

Appendix D

Mitigation Monitoring and Reporting Program

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Appendix D

Mitigation Monitoring and Reporting Program

The proposed project would result in the potential for significant environmental impacts associated with air quality and groundwater resources. Mitigation measures have been incorporated into the Project to reduce impacts to less than significant levels. The mitigation measures for the Project must be adopted by Reclamation and TCCA, in conjunction with adoption of the MND/IS.

Section 21081.6 of the Public Resources Code (PRC) and CEQA Guidelines section 15097 require the Lead Agency for each project that is subject to the CEQA to monitor performance of the mitigation measures included in any environmental document to ensure that implementation does, in fact, take place. The PRC requires the Lead Agency to adopt a monitoring and reporting program for assessing and ensuring the implementation of required mitigation measures.

In accordance with PRC Section 21081.6, TCCA has developed this Mitigation Monitoring and Reporting Program (MMRP) for the Project. The purpose of the MMRP is to ensure activities associated with transferring water comply with all applicable environmental mitigation requirements. Mitigation measures would reduce short-term environmental impacts associated with sellers making water available for transfer through groundwater substitution.

Table D-1 lists the mitigation measures identified in the EA/IS, responsible parties, the time frame for implementation, and the monitoring parties. A column is provided for the monitoring party to sign-off on the implementation of each mitigation measure.

In addition to the mitigation measures, several environmental commitments and minimization measures would be enacted to reduce potential environmental impacts from water transfers to biological and groundwater resources. The groundwater minimization measures are required to monitor and address potential groundwater level changes that could affect third parties or biological resources. The environmental commitments and minimization measures are included in this MMRP to verify compliance as transfers move forward. Table D-2 shows these commitments and measures, the responsible parties, time frame for implementation, and the monitoring parties.

Table D-1. Air Quality and Groundwater Resources Mitigation Measures

Measure No.	Mitigation Measure	Responsible Party	Monitoring Party	Method of Verification	Timing of Verification	Verification of Completion	
						Initials	Date
AQ-1	Selling agency would reduce pumping at diesel wells to reduce emissions to below the thresholds. If an agency is transferring water through cropland idling and groundwater substitution in the same year, the reduction in vehicle emissions can partially offset groundwater substitution pumping at a rate of 4.25 AF of water produced by idling to one acre-foot of groundwater pumped. Agencies may also decide to replace old diesel wells to reduce emission below the thresholds. If a selling agency, through the actions above, can reduce daily emissions below thresholds while operating wells 24 hours per day, then that agency must provide an analysis to Reclamation. This analysis should identify that all wells proposed for participation in a 2015 Water Transfer may be operated on a 24-hour per day basis without exceeding emission thresholds. Alternately, if a selling agency with potentially significant emissions, as determined by this EA/IS, intends to operate wells less than 24 hours per day to reduce emissions below the thresholds, then that agency will be required to maintain daily recordkeeping logs that document the specific engine to be used for groundwater substitution transfers, the power rating (hp), and	Selling agency	Reclamation	Daily recordkeeping logs specifying the engines operated by each selling agency with potentially significant emissions and calculated criteria pollutant emissions	Monthly during transfer		

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	applicable emission factors. Emission calculations will be completed daily for comparison to the significance thresholds determined for each selling agency. The recordkeeping logs will be sent to Reclamation monthly for verification that emissions are within the allowable limits. Reclamation will also work with the water agencies to inform individual growers of incentive funding available through the Natural Resources Conservation Service's Environmental Quality Incentives Program. Funded conservation practices include the replacement of internal combustion engines in irrigation pumps; therefore, the program may be used by growers to further reduce criteria pollutant emissions.						
GW-1	The <i>DRAFT Technical Information for Preparing Water Transfer Proposals</i> (Reclamation and DWR 2014) provides guidance for the development of groundwater substitution water transfer proposals. The technical information informs the development of the monitoring and mitigation program for the range of potential transfer activities evaluated in this EA/IS. The objective of Mitigation Measure GW-1 is to avoid significant adverse environmental effects and ensure prompt corrective action in the event unanticipated effects occur. The measure accomplishes this by monitoring groundwater and/or surface	Participating Sellers	Reclamation	Seller transfer application package	Prior to water transfers		

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	water levels during transfers to avoid potential effects. The objectives of this process are to: (1) minimize potential effects to other legal users of water; (2) provide a process for review and response to reported effects to non-transferring parties; (3) assure that a local mitigation strategy is in place prior to the groundwater transfer; and (4) mitigate significant adverse environmental effects. Reclamation will verify that sellers adopt and implement these mitigation measures to avoid potentially significant adverse effects of transfer-related groundwater extraction. In addition, each entity participating in a groundwater substitution transfer must confirm that the proposed groundwater pumping will be compatible with state and local regulations and Groundwater Management Plans (GMPs). As Groundwater Sustainability Plans (GSPs) are developed by Groundwater Sustainability Agencies, potential sellers must confirm that the proposed pumping is compatible with applicable GSPs.						
GW-1	<u>Well Review Process</u> Potential sellers must submit well data for Reclamation and, where appropriate, DWR review, as part of the transfer approval process. Required information will be detailed in the most current version of the DRAFT Technical Information for Preparing Water Transfer Proposals.	Participating Sellers	Reclamation	Seller transfer application package	Prior to water transfers		
GW-1	<u>Monitoring Program</u> Potential sellers must complete and implement a monitoring program subject	Participating sellers	Reclamation	Seller transfer application package	Prior to, during, and after water transfers		

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	to Reclamation's approval that shall, at a minimum, include the following components:			and monitoring reports			
GW-1	<u>Monitoring Well Network.</u> The monitoring program shall incorporate a sufficient number of monitoring wells, as determined by Reclamation and the sellers in relation to local conditions, to accurately characterize groundwater levels and response in the area before, during, and after transfer pumping takes place. Depending on local conditions, additional groundwater level monitoring may be required near ecological resource areas.	Participating sellers	Reclamation	Seller transfer application package and monitoring data	Plan submitted prior to water transfers; monitoring information submitted during and after transfer.		
GW-1	<u>Groundwater Pumping Measurements.</u> All wells pumping to replace surface water designated for transfer shall be configured with a permanent instantaneous and totalizing flow meter capable of accurately measuring well discharge rates and volumes. Flow meter readings will be recorded just prior to initiation of pumping and at designated times, but no less than monthly and as close as practical to the last day of the month, throughout the duration of the transfer.	Participating sellers	Reclamation	Seller transfer application package with field spot-checks and monitoring data.	Prior to, during, and after water transfers		
GW-1	<u>Groundwater Levels.</u> Sellers will collect measurements of groundwater levels in both participating transfer wells and monitoring wells. Groundwater level monitoring will include measurements before, during and after transfer-related pumping. The	Participating sellers	Reclamation	Regular inspection, monitoring data, and report on effects to deep-rooted vegetation, if necessary	Prior to, during, and after water transfers		

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	seller will measure groundwater levels as follows: • Prior to transfer: Groundwater levels will be measured monthly from March in the year of the proposed transfer-related pumping until the start of the transfer (where possible). • Start of transfer: Groundwater levels will be measured on the same day that the transfer-related pumping begins, prior to the pump being turned on. • During transfer-related pumping: Groundwater levels will be measured weekly throughout the transfer-related pumping period, unless site specific information indicates a different interval should be used. • Post-transfer pumping: Groundwater levels will be measured weekly for one month after the end of transfer-related pumping, after which groundwater levels will be measured monthly through March of the year following the transfer. Sellers thus monitor effects to groundwater levels that may result from the proposed transfer and avoid significant impacts. The primary criteria used to identify potentially significant impacts to groundwater levels are the BMOs set by GMPs. In the Sacramento						

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	Valley, several counties have established GMPs to provide guidance in managing the resource. In areas where quantitative BMOs do not exist, Reclamation, TCCA, and the potential seller(s) will coordinate closely with potentially impacted third parties to collect and monitor groundwater data. If a third party expects that it may be impacted by a proposed transfer, that party should contact Reclamation and the seller with its concern. The burden of collecting groundwater data will not be the responsibility of the third party. If warranted, groundwater level monitoring to address the third-party's concern may be incorporated in the monitoring and mitigation plans required by Mitigation Measure GW-1. Additionally, to avoid significant effects to vegetation and allow sellers to modify actions before significant effects occur, sellers will monitor groundwater depth data to verify that significant adverse effects to deep-rooted vegetation are avoided. If monitoring data indicate that water levels have dropped below root zones (i.e., more than 10 feet where groundwater was 10 to 25 feet below ground surface prior to starting the transfer of surface water made available from groundwater substitution actions), the seller must implement actions set forth in the mitigation plan. If historic data show that groundwater elevations in the area of transfer have typically						

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	varied by more than this amount annually during the proposed transfer period, then the transfer may be allowed to proceed. If there is no deep-rooted vegetation (i.e., oak trees and riparian trees that would have tap roots greater than 10 feet deep) within one-half mile of the transfer wells or the vegetation is located along waterways that will continue to have water during the transfer, the transfer may be allowed to proceed. If no existing monitoring points exist in the shallow aquifer, monitoring would be based on visual observations of the health of these areas of deep-rooted vegetation. If significant adverse impacts to deep-rooted vegetation (that is, loss of a substantial percentage of the deep-rooted vegetation as determined by Reclamation based on site-specific circumstances in consultation with a qualified biologist) occur as a result of the transfer despite the monitoring efforts and implementation of the mitigation plan, the seller will prepare a report documenting the result of the restoration activity to plant, maintain, and monitor restoration of vegetation for 5 years to replace the losses.						
GW-1	<i>Groundwater Quality.</i> For municipal sellers, the comprehensive water quality testing requirements of Title 22 are considered sufficient for the water transfer monitoring program. Agricultural sellers shall measure specific conductance in samples from each participating	Municipal and agricultural sellers	Reclamation	Inspections during transfer period and monitoring data	Prior to, during, and after water transfers		

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	production well. Samples shall be collected when the seller first initiates pumping, monthly during the transfer period, and at the termination of transfer pumping.						
GW-1	<i>Land Subsidence.</i> Subsidence monitoring will be required if groundwater levels could decline below historic low levels during the proposed water transfer. Before a transfer, each seller will examine local groundwater conditions and groundwater level changes based on past pumping events or groundwater substitution transfers. This existing information will be the basis to estimate if groundwater levels are likely to decline below historic low levels, which would trigger land surface elevation measurements (as described below). If the measured groundwater level falls below the historic low level, the seller must confirm the measurement within seven days. If the water level has risen above the historic low level, the seller may continue transfer pumping. If the measured groundwater level remains below the historic low level, the seller will stop transfer-related pumping immediately or begin land surface elevation measurements in strategic locations within and/or near the transfer-related pumping area. Measurements may include (1) extensometer monitoring, (2) continuous GPS monitoring, or (3) extensive land-elevation benchmark surveys conducted	Participating sellers	Reclamation	Regular inspections and monitoring data	Prior to, during, and after water transfers		

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	by a licensed surveyor. This data could be collected by the seller or from other sources (such as public extensometer data). Measurements must be completed on a monthly basis during the transfer. If the land surface elevation survey indicates an elevation decrease between 0.1 foot and 0.2 foot from the initial measurement, the seller could have significant impacts and would need to start the process identified below in the Mitigation Plan. The seller will also work with Reclamation to assess the accuracy of the survey measurements based on current limitations of technology, professional engineering/surveying judgment, and any other data available in or near the transferring area. The threshold of 0.1 foot was chosen as this value is typical of the elastic (i.e., recoverable) portion of subsidence; the threshold of 0.2 foot was selected considering limitations of current land survey technology. This threshold is supported by a review of data from extensometers within the Sacramento Valley.						
GW-1	<i>Coordination Plan.</i> The monitoring program will include a plan to coordinate the collection and organization of monitoring data. This plan will describe how input from third parties will be incorporated into the monitoring program, and will include a	Participating sellers	Reclamation	Seller transfer application package with Coordination Plan.	Prior to water transfers		

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	plan for communication with Reclamation as well as other decision makers and third parties.						
GW-1	<i>Evaluation and Reporting.</i> The proposed monitoring program will describe the method of reporting monitoring data. At a minimum, sellers will provide data summary tables to Reclamation, both during and after transfer-related groundwater pumping. Post-program reporting will continue through March of the year following the transfer. Sellers will provide a final summary report to Reclamation evaluating the effects of the water transfer. The final report will identify transfer-related effects on groundwater and surface water (both during and after pumping), and the extent and significance, if any, of effects on local groundwater users. It shall include groundwater elevation contour maps for the area in which transfer operations are located, showing pre-transfer groundwater elevations, groundwater elevations at the end of the transfer, and recovered groundwater elevations in March of the year following the transfer. The summary report shall also identify the extent and significance, if any, of transfer-related effects to ecological resources such as fish, wildlife, and vegetation resources.	Participating sellers	Reclamation	Seller transfer application package and monitoring data and report.	Plan submitted prior to water transfers; monitoring information submitted during and after transfer.		
GW-1	<u>Mitigation Plan</u> Potential sellers must complete and implement a mitigation plan to avoid potentially significant groundwater impacts and ensure prompt corrective	Participating sellers	Reclamation	Mitigation plan, monitoring data for mitigation activities, and regular	Prior to, during, and after water transfers.		

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	action in the event unanticipated effects occur. Mitigation actions could include: • Curtailment of pumping until natural recharge corrects the issue. • Lowering of pumping bowls in non-transferring wells affected by transfer pumping. • Reimbursement for significant increases in pumping costs due to the additional groundwater pumping to support the transfer. • Curtailment of pumping until water levels rise above historic lows if non-reversible subsidence is detected (based on local data to identify elastic versus inelastic subsidence). • Reimbursement for modifications to infrastructure that may be affected by non-reversible subsidence. • Other appropriate actions based on local conditions, as determined by Reclamation. As summarized above, the purpose of Mitigation Measure GW-1 is to monitor groundwater levels during transfers to avoid potentially significant adverse effects. The mitigation plan will describe how to avoid significant effects and address any significant effects that occur despite the monitoring efforts. The objectives of this process are to: (1) minimize potential effects to other legal			inspections of mitigation activities.			

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	users of water; (2) provide a process for review and response to reported effects; and (3) assure that a local mitigation strategy is in place prior to the groundwater transfer. Accordingly, to ensure that mitigation plans will be feasible, effective, and tailored to local conditions, the plan must include the following elements: • A procedure for the seller to receive reports of purported environmental effects or effects to non-transferring parties; • A procedure for investigating any reported effect; • Development of mitigation options, in cooperation with the affected parties, for legitimate significant effects; and • Assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs. Mitigation to avoid potentially significant subsidence impacts and ensure prompt corrective action in the event that unanticipated effects occur is described by the following stages. <i>Stage 1: Groundwater Levels</i> Irreversible subsidence would not occur if groundwater levels stay above historic low levels for the entire transfer season. As groundwater is pumped from an aquifer, the pore water pressure in the aquifer is reduced. This reduction in pore water pressure increases the						

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	effective stress on the structure of the aquifer itself. This increase in effective stress can cause the aquifer structure to deform, or compress, resulting in the subsidence of the ground surface elevation. Subsidence can be irreversible if the reduced effective stress is lower than the historically low effective stress. Typically this would be the result of groundwater levels reaching levels lower than the historical low level. Before a transfer, each seller will examine local groundwater conditions and groundwater level changes based on past pumping events or groundwater substitution transfers. This existing information will be the basis to estimate if groundwater levels are likely to decline below historic low levels as a result of the proposed transfer. If the pre-transfer assessment indicates that groundwater levels will stay above historic low levels, and this finding is confirmed by monitoring during the transfer-related pumping period, then no additional actions for subsidence monitoring or mitigation are necessary. Sellers would need to proceed to stage 2 for land surface elevation monitoring if the pre-transfer estimates indicate that groundwater levels are anticipated to decline below historic low levels. If monitoring during the transfer-related pumping period (confirmed by two measurements within seven days) indicates that groundwater levels have						

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	fallen below historic low levels, sellers must immediately stop pumping from transfer wells in the area that is affected or proceed to stage 2. <i>Stage 2: Ground Surface Elevations</i> Stage 2 includes monthly ground surface monitoring during transfer-related pumping if pumping could cause groundwater levels to fall below historic low levels, as described above in the Monitoring Plan. If ground surface elevations decrease between 0.1 and 0.2 foot, the seller will evaluate the accuracy of the information based on the current limitations of technology, professional engineering/surveying judgment, and other local data. If the elevations decline more than 0.2 foot, this change could indicate inelastic subsidence, which would trigger a shift to Stage 3. <i>Stage 3: Local Investigation</i> If the threshold of 0.2 foot of ground surface elevation change is exceeded, the seller shall cease groundwater substitution pumping for the transfer until one of the following occurs: (1) groundwater levels recover above historic low groundwater levels; (2) seller completes a more detailed local investigation identifying hydrogeologic conditions that could potentially allow continued transfer-related pumping from a subset of wells (if the seller can provide evidence that this pumping is not expected to cause additional						

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	subsidence); or (3) seller completes an investigation of local infrastructure that could be affected by subsidence (such as water delivery infrastructure, water supply facilities, flood protection facilities, highways, etc.) indicating the local threshold of subsidence that could be experienced before these facilities would be adversely affected. Any option should also consider the effect of non-transfer pumping that may be causing subsidence. <i>Stage 4: Mitigation</i> If subsidence effects to local infrastructure occur despite monitoring efforts, then the sellers must work with the lead agencies to determine whether the measured subsidence may be caused by transfer-related pumping. Any significant adverse subsidence effects caused by transfer pumping activities must be addressed. A contingency plan must be developed in the event that a need for further corrective action is necessary. This contingency plan must be approved by Reclamation before transfer-related pumping could continue after Stage 3. <i>Stage 5: Continued Monitoring</i> The sellers will continue to monitor for subsidence while groundwater levels remain below historic low levels. If the seller has ceased transfer-related pumping but groundwater levels remain below historic lows, subsidence monitoring will need to continue until the						

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	spring following the transfer. The results of subsidence monitoring will be factored into monitoring and mitigation plans for future transfers.						

Table D-2. Environmental Commitments and Minimization Measures for Biological Resources and Groundwater

Environmental Commitments and Minimization Measures	Responsible Party	Monitoring Party	Method of Verification	Timing of Verification	Verification of Completion	
					Initials	Date
In groundwater basins where sellers are in the same groundwater subbasin as protected aquatic habitats, such as giant garter snake (GGS) preserves and conservation banks, groundwater substitution will be allowed as part of the water transfers if the seller can demonstrate that any impacts to water resources needed for special-status species protection have been addressed. In these areas, sellers will be required to address these impacts as part of their mitigation plan.	Participating Sellers	Reclamation	Seller transfer application package	Prior to water transfers		
As part of the approval process for water transfers, Reclamation will have access to the land to verify how the water transfer is being made available and to verify that actions to protect the GGS are being implemented. At the end of the water transfer year, Reclamation will prepare a monitoring report that contains the following: • Maps of all cropland idling actions that occurred within the range of potential transfer activities analyzed in this EA/IS, • Results of any newly available scientific research and monitoring results pertinent to water transfer actions, and • A discussion of conservation measure effectiveness. The report will be submitted to the U.S. Fish and Wildlife Service (USFWS) and shared with California Department of Fish and Wildlife (CDFW) in February, prior to the next year of potential transfers. Reclamation will coordinate with USFWS and CDFW on the contents and findings of the annual report prior to additional transfers.	Participating Sellers	Reclamation	Seller transfer application package with regular inspections of transfer actions. Reclamation will compile and submit annual report to USFWS and CDFW	Access provided prior to and during water transfers; inspections ongoing; report submitted annually to USFWS and CDFW		

Environmental Commitments and Minimization Measures	Responsible Party	Monitoring Party	Method of Verification	Timing of Verification	Verification of Completion	
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Reclamation will establish annual meetings with the USFWS to discuss the contents and findings of the annual report. These meetings will be scheduled following the distribution of the monitoring report and prior to the next transfer season.	Reclamation	Reclamation	Distribution of monitoring report to USFWS and occurrence of annual meeting.	Meeting occurs prior to the next transfer season.		
Reclamation will provide a map(s) to the USFWS in June of each year showing the parcels of rice land that are proposed for the purpose of transferring water for that year. These maps will be prepared to comport to Reclamation's geographic information system (GIS) standards.	Reclamation	Reclamation	Completed mapping package from sellers showing parcels idled. Reclamation will prepare complete package for USFWS.	June of each transfer season		
Movement corridors for aquatic species (including pond turtle and GGS) include major irrigation and drainage canals. The water seller will keep adequate water in major irrigation and drainage canals. Canal water depths should be similar to years when transfers do not occur or, where information on existing water depths is limited, at least two feet of water will be considered sufficient.	Participating Sellers	Reclamation	Seller transfer application package with field spot-checks	Ongoing during transfer season		

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Environmental Commitments and Minimization Measures	Responsible Party	Monitoring Party	Method of Verification	Timing of Verification	Verification of Completion	
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Sellers proposing water transfers made available from idled rice fields will ensure that adequate water is available for priority habitat with a high likelihood of GGS occurrence. The determination of priority habitat will be made through coordination with GGS experts, GIS analysis of proximity to historic tule marsh, and GIS analysis of suitable habitat. The priority habitat areas are indicated on the priority habitat maps for participating water agencies and will be maintained by Reclamation. As new information becomes available, these maps will be updated in coordination with USFWS and CDFW. In addition to mapped priority habitat, fields abutting or immediately adjacent to federal wildlife refuges will be considered priority habitat.	Participating Sellers	Reclamation	Seller transfer application package with field spot-checks. Priority habitat maps reviewed and updated as needed prior to each transfer season.	Field spot checks to occur during the transfer season, priority habitat to be reviewed and update prior to the next transfer season.		
Maintaining water in smaller drains and conveyance infrastructure supports key habitat attributes such as emergent vegetation for GGS for escape cover and foraging habitat. If crop idling/shifting occurs in priority habitat areas, Reclamation will work with contractors to document that adequate water remains in drains and canals in those priority areas. Documentation may include flow records, photo documentation, or other means of documentation agreed to by Reclamation and USFWS.	Participating Sellers	Reclamation	Seller transfer application package with field spot- checks.	Ongoing during transfer season.		
Mapped priority habitat known to be occupied by GGS and priority habitats with a high likelihood for GGS occurrence (60 percent or greater probability) will not be permitted to participate in cropland idling/shifting transfers. Water sellers can request a case-by-case evaluation of whether a specific field would be precluded from participating in water transfers. These areas include lands adjacent to	Participating Sellers	Reclamation	Seller transfer application package, maps of fields to be idled, and field spot-checks of land idled.	Prior to and during water transfers.		

Environmental Commitments and Minimization Measures	Responsible Party	Monitoring Party	Method of Verification	Timing of Verification	Verification of Completion	
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naturalized lands and refuges and corridors between these areas, such as: - Fields abutting or immediately adjacent to Little Butte Creek between Llano Seco and Upper Butte Basin Wildlife Area, Butte Creek between Upper Butte Basin and Gray Lodge Wildlife areas, Colusa Basin drainage canal between Delevan and Colusa National Wildlife Refuges, Gilsizer Slough, Colusa Drainage Canal, the land side of the Toe Drain along the Sutter Bypass, Willow Slough and Willow Slough Bypass in Yolo County, Hunters and Logan Creeks between Sacramento and Delevan National Wildlife Refuges; and - Lands in the Natomas Basin.						
Sellers will perform GGS best management practices, including educating maintenance personnel to recognize and avoid contact with GGS, dredging only one side of a conveyance channel per year, and implementing other measures to enhance habitat for GGS. Implementation of best management practices will be documented by the sellers and verified by Reclamation and will be included in the annual monitoring report.	Participating Sellers	Reclamation	Seller transfer application package with field spot-checks and documented in annual monitoring report.	Ongoing		
In order to limit reduction in the amount of over-winter forage for migratory birds, including greater sandhill crane, cropland idling transfers will be minimized near known wintering areas that support high concentrations of waterfowl and shorebirds, such as wildlife refuges and established wildlife areas.	Participating Sellers	Reclamation	Seller transfer application package, maps of fields to be idled, and field spot-checks	Prior to and during transfer season.		

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Appendix E

Air Quality Emission Calculations

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Table 1. General Conformity Applicability Evaluation (Unmitigated Emissions)

County/ Nonattainment Area	Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5
	Sacramento Metro ¹	Sacramento Metro ¹	Sacramento Area ²	Sacramento ^{3,4}	Sacramento Co.	Sacramento ⁴
Colusa	n/a	n/a	n/a	n/a	n/a	n/a
Glenn	n/a	n/a	n/a	n/a	n/a	n/a
Sacramento	0.1	0.3	2.8	1.0	0.0	0.0
Shasta	n/a	n/a	n/a	n/a	n/a	n/a
Sutter ⁵	1.5	13.3	n/a	2.0	n/a	0.4
Tehama	n/a	n/a	n/a	n/a	n/a	n/a
Yolo	0.1	1.7	1.0	0.3	n/a	0.1
Total	1.7	15.4	3.7	3.3	0.0	0.5
Classification	Severe-15	Severe-15	Maintenance	PM2.5 Precursor	Maintenance	Nonattainment
De Minimis Threshold (tpy)	25	25	100	100	100	100
Exceed?	No	No	No	No	No	No

Note:

¹The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

²The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

³All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

⁴The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

⁵VOC and NOx emissions are excluded from Cranmore Farms, Pelger Mutual Water Company, and Reclamation District 1004 because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

Table 2. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)

Water Agency	County	VOC	NOx
Cranmore Farms	Sutter	All Electric	All Electric
Pelger Mutual Water Company	Sutter	0.0	0.7
Reclamation District 1004	Sutter	No Engines	No Engines
Total		0.0	0.7

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table 3. Daily VOC Emissions (Unmitigated)

Water Agency	Daily VOC Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	2.75							2.75
Conaway Preservation Group							4.24	4.24
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.67							1.67
Glenn-Colusa Irrigation District	64.51	86.02						150.53
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			1.61		All Electric			1.61
Pelger Mutual Water Company					0.99			0.99
Pleasant Grove-Verona Mutual Water Company					30.41			30.41
Princeton-Codora-Glenn Irrigation District	No Engines	30.77						30.77
Provident Irrigation District	No Engines	11.64						11.64
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	34.81	2.95			No Engines			37.76
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	103.74	131.38	1.61	0.00	31.40	0.00	4.24	272.36

Key:

VOC = volatile organic compounds

Table 4. Daily NOx Emissions (Unmitigated)

Water Agency	Daily NOx Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	5.50							5.50
Conaway Preservation Group							80.49	80.49
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	31.65							31.65
Glenn-Colusa Irrigation District	795.46	1,060.61						1,856.07
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			3.39		All Electric			3.39
Pelger Mutual Water Company					18.76			18.76
Pleasant Grove-Verona Mutual Water Company					272.37			272.37
Princeton-Codora-Glenn Irrigation District	No Engines	314.71						314.71
Provident Irrigation District	No Engines	135.66						135.66
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	444.92	36.38			No Engines			481.31
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	1,277.54	1,547.36	3.39	0.00	291.12	0.00	80.49	3,199.90

Key:

NOx = nitrogen oxides

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table 5. Daily CO Emissions (Unmitigated)

Water Agency	Daily CO Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	11.00							11.00
Conaway Preservation Group							44.93	44.93
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	29.15							29.15
Glenn-Colusa Irrigation District	171.41	228.54						399.95
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			29.67		All Electric			29.67
Pelger Mutual Water Company					24.68			24.68
Pleasant Grove-Verona Mutual Water Company					137.77			137.77
Princeton-Codora-Glenn Irrigation District	No Engines	171.88						171.88
Provident Irrigation District	No Engines	45.62						45.62
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	127.07	7.84			No Engines			134.91
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	338.63	453.89	29.67	0.00	162.44	0.00	44.93	1,029.56

Key:

CO = carbon monoxide

Table 6. Daily SOx Emissions (Unmitigated)

Water Agency	Daily SOx Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							16.00	16.00
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	10.38							10.38
Glenn-Colusa Irrigation District	52.60	70.14						122.74
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			10.56		All Electric			10.56
Pelger Mutual Water Company					6.15			6.15
Pleasant Grove-Verona Mutual Water Company					35.49			35.49
Princeton-Codora-Glenn Irrigation District	No Engines	33.73						33.73
Provident Irrigation District	No Engines	13.91						13.91
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	38.74	2.41			No Engines			41.15
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	101.73	120.18	10.56	0.00	41.64	0.00	16.00	290.11

Key:

SOx = sulfur oxides

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table 7. Daily PM10 Emissions (Unmitigated)

Water Agency	Daily PM10 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.03							0.03
Conaway Preservation Group							2.57	2.57
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.67							1.67
Glenn-Colusa Irrigation District	12.45	16.59						29.04
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.17		All Electric			0.17
Pelger Mutual Water Company					1.48			1.48
Pleasant Grove-Verona Mutual Water Company					7.88			7.88
Princeton-Codora-Glenn Irrigation District	No Engines	7.37						7.37
Provident Irrigation District	No Engines	1.51						1.51
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.66	0.39			No Engines			7.05
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	20.81	25.86	0.17	0.00	9.36	0.00	2.57	58.76

Key:

PM10 = inhalable particulate matter

Table 8. Daily PM2.5 Emissions (Unmitigated)

Water Agency	Daily PM2.5 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.03							0.03
Conaway Preservation Group							2.57	2.57
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.67							1.67
Glenn-Colusa Irrigation District	12.15	16.20						28.34
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.17		All Electric			0.17
Pelger Mutual Water Company					1.48			1.48
Pleasant Grove-Verona Mutual Water Company					7.72			7.72
Princeton-Codora-Glenn Irrigation District	No Engines	7.29						7.29
Provident Irrigation District	No Engines	1.47						1.47
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.56	0.38			No Engines			6.94
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	20.41	25.34	0.17	0.00	9.21	0.00	2.57	57.68

Key:

PM2.5 = fine particulate matter

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table 9. Annual VOC Emissions (Unmitigated)

Water Agency	Annual VOC Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.12							0.12
Conaway Preservation Group							0.09	0.09
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.09							0.09
Glenn-Colusa Irrigation District	6.00	8.00						14.00
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.15		All Electric			0.15
Pelger Mutual Water Company					0.03			0.03
Pleasant Grove-Verona Mutual Water Company					1.49			1.49
Princeton-Codora-Glenn Irrigation District	No Engines	2.01						2.01
Provident Irrigation District	No Engines	1.08						1.08
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.42	0.12			No Engines			1.54
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	7.63	11.21	0.15	0.00	1.52	0.00	0.09	20.60

Key:

VOC = volatile organic compounds

Table 10. Annual NOx Emissions (Unmitigated)

Water Agency	Annual NOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.25							0.25
Conaway Preservation Group							1.74	1.74
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.72							1.72
Glenn-Colusa Irrigation District	73.98	98.64						172.61
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.32		All Electric			0.32
Pelger Mutual Water Company					0.66			0.66
Pleasant Grove-Verona Mutual Water Company					13.31			13.31
Princeton-Codora-Glenn Irrigation District	No Engines	20.51						20.51
Provident Irrigation District	No Engines	12.62						12.62
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	18.10	1.48			No Engines			19.58
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	94.05	133.24	0.32	0.00	13.97	0.00	1.74	243.33

Key:

NOx = nitrogen oxides

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table 11. Annual CO Emissions (Unmitigated)

Water Agency	Annual CO Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.50							0.50
Conaway Preservation Group							0.97	0.97
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.59							1.59
Glenn-Colusa Irrigation District	15.94	21.25						37.20
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			2.76		All Electric			2.76
Pelger Mutual Water Company					0.87			0.87
Pleasant Grove-Verona Mutual Water Company					6.73			6.73
Princeton-Codora-Glenn Irrigation District	No Engines	11.20						11.20
Provident Irrigation District	No Engines	4.24						4.24
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	5.17	0.32			No Engines			5.49
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	23.20	37.02	2.76	0.00	7.60	0.00	0.97	71.55

Key:

CO = carbon monoxide

Table 12. Annual SOx Emissions (Unmitigated)

Water Agency	Annual SOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							0.35	0.35
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.57							0.57
Glenn-Colusa Irrigation District	4.89	6.52						11.41
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.98		All Electric			0.98
Pelger Mutual Water Company					0.22			0.22
Pleasant Grove-Verona Mutual Water Company					1.73			1.73
Princeton-Codora-Glenn Irrigation District	No Engines	2.20						2.20
Provident Irrigation District	No Engines	1.29						1.29
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.58	0.10			No Engines			1.67
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	7.03	10.11	0.98	0.00	1.95	0.00	0.35	20.43

Key:

SOx = sulfur oxides

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table 13. Annual PM10 Emissions (Unmitigated)

Water Agency	Annual PM10 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							0.06	0.06
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.09							0.09
Glenn-Colusa Irrigation District	1.16	1.54						2.70
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.02		All Electric			0.02
Pelger Mutual Water Company					0.05			0.05
Pleasant Grove-Verona Mutual Water Company					0.38			0.38
Princeton-Codora-Glenn Irrigation District	No Engines	0.48						0.48
Provident Irrigation District	No Engines	0.14						0.14
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.29
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	1.52	2.18	0.02	0.00	0.44	0.00	0.06	4.21

Key:

PM10 = inhalable particulate matter

Table 14. Annual PM2.5 Emissions (Unmitigated)

Water Agency	Annual PM2.5 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							0.06	0.06
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.09							0.09
Glenn-Colusa Irrigation District	1.13	1.51						2.64
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.02		All Electric			0.02
Pelger Mutual Water Company					0.05			0.05
Pleasant Grove-Verona Mutual Water Company					0.38			0.38
Princeton-Codora-Glenn Irrigation District	No Engines	0.47						0.47
Provident Irrigation District	No Engines	0.14						0.14
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.28
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	1.49	2.13	0.02	0.00	0.43	0.00	0.06	4.12

Key:

PM2.5 = fine particulate matter

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Anderson-Cottonwood Irrigation District		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	2,400 acre-feet	(Apr-Jun)	800 AF/month
	2,400 acre-feet	(Jul-Sep)	800 AF/month
	4,800 acre-feet/year		

Table 15. Anderson-Cottonwood Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Shasta	0	2	0	0	2
Tehama	0	0	0	0	0
Total	0	2	0	0	2

Table 16. Anderson-Cottonwood Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations	
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Barney Street	Shasta	Electric	2012	200	n/a	5,500	85%	677	4,062	22	4,010
Crowley Gulch	Shasta	Electric	2012	50	n/a	1,000	15%	123	738	22	4,010
Total						6,500	100%	800	4,800	43	8,021
Total (Shasta County)						6,500	100%	800	4,800	43	8,021

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

	Shasta	Tehama
PM10	A	A
PM2.5	A	A
O3	A	A

Engines not subject to ATCM if remotely-located.

Peak Month

800 AF/month
5,840 gallons/minute
90% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Burroughs Farms	Peak Pumping by Transfer Period
Transfer Volume	1,000 acre-feet (Apr-Jun)	333 AF/month
	1,000 acre-feet (Jul-Sep)	333 AF/month
	2,000 acre-feet/year	

Table 17. Burroughs Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	1	0	0	1
Total	0	1	0	0	1

Table 18. Burroughs Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations	
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Well #1	Sutter	Electric	2013	200	n/a	4,000	100%	333	2,000	15	2,715
Total						4,000	100%	333	2,000	15	2,715
Total (Sutter County)						4,000	100%	333	2,000	15	2,715

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Sutter

PM10 A

PM2.5 N

O3 N

Engines subject to ATCM.

Peak Month

333 AF/month

2,433 gallons/minute

61% peak pump rate

Conversion Factors

1 lb = 453.6 g

1 ton = 2,000 lbs

1 kW = 1.34 hp

1 day = 24 hours

1 month = 31 days

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Canal Farms		Peak Pumping by Transfer Period
Transfer Volume	575 acre-feet	(Apr-Jun)	342 AF/month
	425 acre-feet	(Jul-Sep)	162 AF/month
	1,000 acre-feet/year		

Table 19. Canal Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	1	3
Total	0	2	0	1	3

Table 20. Canal Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(MMBtu/yr)	(g/hp-hr)			(lb/MMBtu)			VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
													VOC	NOx	CO	SOx	PM10	PM2.5												
Dennis Well North	Colusa	E	unknown	125	n/a	3,500	29%	100	292	5	453	n/a																		
Dennis Well South	Colusa	E	unknown	125	n/a	3,500	29%	100	292	5	453	n/a																		
East Well	Colusa	Propane	unknown	250	n/a	5,000	42%	142	417	5	453	288	1.0	2.0	4.0	0.00059	0.00999	0.00999	2.75	5.50	11.00	0.00	0.03	0.03	0.12	0.25	0.50	0.000085	0.0014	0.0014
Total						12,000	100%	342	1,000	15	1,358	288							2.75	5.50	11.00	0.00	0.03	0.03	0.12	0.25	0.50	0.000085	0.0014	0.0014
Total (Colusa County)						12,000	100%	342	1,000	15	1,358	288							2.75	5.50	11.00	0.00	0.03	0.03	0.12	0.25	0.50	0.000085	0.0014	0.0014

Note: Natural gas emission factors used for propane.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Colusa

PM10 A

PM2.5 A

O3 A

Engines not subject to ATCM if remotely-located.

Peak Month

342 AF/month

2,496 gallons/minute

21% peak pump rate

Legend

	Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 bhp-hr =	2,542.5 Btu
1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Conaway Preservation Group		<u>Peak Pumping by Transfer Period</u>	
Transfer Volume	5,368 acre-feet	(Apr-Jun)	0 AF/month	
	0 acre-feet	(Jul-Sep)	2,822 AF/month	
	5,368 acre-feet/year			

Table 21. Conaway Preservation Group Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	2	12	0	0	14
Total	2	12	0	0	14

Table 22. Conaway Preservation Group Criteria Pollutant Emissions

	Well Location			Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
Well	(County)	Fuel Type	Model Year	(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(gal/yr)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
1W3	Yolo	Electric	unknown	250	n/a	4,700	11%	419	690	16	797	n/a																		
5W2	Yolo	Electric	unknown	250	n/a	4,500	11%	0	380	0	459	n/a																		
7W1	Yolo	Electric	unknown	75	n/a	1,800	4%	179	414	18	1,248	n/a																		
7W2	Yolo	Electric	unknown	250	n/a	2,700	6%	269	605	18	1,217	n/a																		
7W4S	Yolo	Electric	unknown	200	n/a	3,500	8%	35	212	2	329	n/a																		
12W1	Yolo	Electric	unknown	250	n/a	4,500	11%	425	633	17	763	n/a																		
13W3	Yolo	Electric	unknown	200	n/a	2,900	7%	335	488	21	914	n/a																		
16W2	Yolo	Diesel	2005	227	T2	1,600	4%	167	231	19	785	9,993	0.2	4.7	2.6	0.93	0.15	0.15	2.33	44.23	24.69	8.79	1.41	1.41	0.05	0.92	0.51	0.18	0.03	0.03
17W3	Yolo	Diesel	2005	227	T2	1,700	4%	145	220	15	702	8,944	0.2	4.7	2.6	0.93	0.15	0.15	1.91	36.26	20.24	7.21	1.16	1.16	0.04	0.82	0.46	0.16	0.03	0.03
20W1	Yolo	Electric	unknown	100	n/a	2,500	6%	154	203	11	441	n/a																		
21W3	Yolo	Electric	unknown	100	n/a	2,500	6%	269	332	19	721	n/a																		
31W1	Yolo	Electric	unknown	100	n/a	2,300	5%	0	28	0	66	n/a																		
32NW1	Yolo	Electric	unknown	100	n/a	3,300	8%	0	107	0	177	n/a																		
32NW2	Yolo	Electric	unknown	250	n/a	4,200	10%	424	824	18	1,066	n/a																		
Total						42,700	100%	2,822	5,368	175	9,686	18,937							4.24	80.49	44.93	16.00	2.57	2.57	0.09	1.74	0.97	0.35	0.06	0.06
Total (Yolo County)						42,700	100%	2,822	5,368	175	9,686	18,937							4.24	80.49	44.93	16.00	2.57	2.57	0.09	1.74	0.97	0.35	0.06	0.06

Key:

AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Yolo
PM10 A
PM2.5 N
O3 N
Engines subject to ATCM.

Peak Month
425 AF/month
3,204 gallons/minute
8% peak pump rate

Legend

	Transfer volume data based on transfer plan developed by Conaway PG for May and June 2015
	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
	Emission factors based on NMHC+NOx standard

Conversion Factors

1 lb =	453.6 g	
1 ton =	2,000 lbs	
1 kW =	1.34 hp	
1 day =	24 hours	
1 month =	30 days	<--peak pumping in June
1 hour =	60 minutes	
1 acre-foot =	325,851 gallons	

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Cranmore Farms		Peak Pumping by Transfer Period
Transfer Volume	1,700 acre-feet	(Apr-Jun)	567 AF/month
	1,700 acre-feet	(Jul-Sep)	567 AF/month
	3,400 acre-feet/year		

Table 23. Cranmore Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	2	0	0	2
Total	0	2	0	0	2

Table 24. Cranmore Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations	
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
North Well	Sutter	Electric	unknown	125	n/a	3,500	54%	305	1,831	15	2,841
South Well	Sutter	Electric	unknown	125	n/a	3,000	46%	262	1,569	15	2,841
Total						6,500	100%	567	3,400	31	5,682
Total (Sutter County)						6,500	100%	567	3,400	31	5,682

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Sutter

PM10 A

PM2.5 N

O3 N

Engines subject to ATCM.

Peak Month

567 AF/month

4,136 gallons/minute

64% peak pump rate

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)

0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)

7.13 lb/gal

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Eastside Mutual Water Company		Peak Pumping by Transfer Period
Transfer Volume	1,067 acre-feet	(Apr-Jun)	634 AF/month
	1,163 acre-feet	(Jul-Sep)	443 AF/month
	2,230 acre-feet/year		

Table 25. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	1	0	0	0	1
Total	1	0	0	0	1

Table 26. Eastside Mutual Water Company Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(gal/yr)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
7631T	Colusa	Diesel	2006	215	T3	4,720	100%	634	2,230	24	2,566	30,948	0.1	2.8	2.6	0.93	0.14925	0.15	1.67	31.65	29.15	10.38	1.67	1.67	0.09	1.72	1.59	0.57	0.09	0.09
Total						4,720	100%	634	2,230	24	2,566	30,948							1.67	31.65	29.15	10.38	1.67	1.67	0.09	1.72	1.59	0.57	0.09	0.09
Total (Colusa County)						4,720	100%	634	2,230	24	2,566	30,948							1.67	31.65	29.15	10.38	1.67	1.67	0.09	1.72	1.59	0.57	0.09	0.09

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Colusa
PM10 A
PM2.5 A
O3 A
Engines not subject to ATCM if remotely-located.

Peak Month
634 AF/month
4,631 gallons/minute
98% peak pump rate

Legend

Emission factors based on NMHC+NOx standard

Conversion Factors

1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Glenn-Colusa Irrigation District		<u>Peak Pumping by Transfer Period</u>	
Transfer Volume	5,000 acre-feet	(Apr-Jun)	1,667 AF/month	
	5,000 acre-feet	(Jul-Sep)	1,667 AF/month	
	10,000 acre-feet/year			

Table 27. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	12	0	0	0	12
Colusa	9	0	0	0	9
Total	21	0	0	0	21

Table 28. Glenn-Colusa Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Well1	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well2	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well3	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well4	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well5	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well6	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well7	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well8	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well9	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well10	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well11	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well12	Glenn	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well13	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well14	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well15	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well16	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well17	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well18	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well19	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well20	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Well21	Colusa	Diesel	unknown	121	T0	590	5%	79	476	24	4,383	29,751	1.1	14.1	3.0	0.93	0.22	0.21	7.17	88.38	19.05	5.84	1.38	1.35	0.67	8.22	1.77	0.54	0.13	0.13
Total						12,392	100%	1,667	10,000	495	92,037	624,765							150.53	1,856.07	399.95	122.74	29.04	28.34	14.00	172.61	37.20	11.41	2.70	2.64
Total (Glenn County)						7,081	57%	952	5,714	283	52,592	357,008							86.02	1,060.61	228.54	70.14	16.59	16.20	8.00	98.64	21.25	6.52	1.54	1.51
Total (Colusa County)						5,311	43%	714	4,286	212	39,444	267,756							64.51	795.46	171.41	52.60	12.45	12.15	6.00	73.98	15.94	4.89	1.16	1.13

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

	Glenn	Colusa
PM10	A	A
PM2.5	A	A
O3	A	A

Engines not subject to ATCM if remotely-located.

Peak Month

1,667 AF/month
12,166 gallons/minute
98% peak pump rate

Legend

Engine power rating equal to average horsepower of all wells in GCID's well database

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Maxwell Irrigation District	<u>Peak Pumping by Transfer Period</u>
Transfer Volume	1,330 acre-feet (Apr-Jun)	791 AF/month
	2,270 acre-feet (Jul-Sep)	865 AF/month
	3,600 acre-feet/year	

Table 29. Maxwell Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	0	2
Total	0	2	0	0	2

Table 30. Maxwell Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations	
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
MainWell	Colusa	Electric	unknown	125	n/a	3,800	50%	432	1,800	20	2,573
TuttleWell	Colusa	Electric	unknown	125	n/a	3,800	50%	432	1,800	20	2,573
Total						7,600	100%	865	3,600	40	5,145
Total (Colusa County)						7,600	100%	865	3,600	40	5,145

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Colusa

PM10 A

PM2.5 A

O3 A

Engines not subject to ATCM if remotely-located.

Peak Month

865 AF/month

6,312 gallons/minute

83% peak pump rate

Legend

 Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g

1 ton = 2,000 lbs

1 kW = 1.34 hp

1 day = 24 hours

1 month = 31 days

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Natomas Central Mutual Water Company	Peak Pumping by Transfer Period
Transfer Volume	10,000 acre-feet (Apr-Jun)	3,333 AF/month
	10,000 acre-feet (Jul-Sep)	3,333 AF/month
	20,000 acre-feet/year	

Table 31. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sacramento	1	6	0	0	7
Sutter	0	7	0	0	7
Total	1	13	0	0	14

Table 32. Natomas Central Mutual Water Company Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Frazer	Sutter	Electric	unknown	50	n/a	2,000	8%	261	1,569	23	4,259	n/a																		
Lucich North	Sutter	Electric	unknown	75	n/a	2,500	10%	327	1,961	23	4,259	n/a																		
Bennett North	Sutter	Electric	unknown	150	n/a	2,000	8%	261	1,569	23	4,259	n/a																		
Atkinson	Sutter	Electric	unknown	60	n/a	1,800	7%	235	1,412	23	4,259	n/a																		
L-2	Sutter	Electric	unknown	100	n/a	1,900	7%	248	1,490	23	4,259	n/a																		
L-12	Sutter	Electric	unknown	50	n/a	1,500	6%	196	1,176	23	4,259	n/a																		
Spangler	Sutter	Electric	unknown	60	n/a	2,400	9%	314	1,882	23	4,259	n/a																		
Natomas Farms	Sacramento	Electric	unknown	60	n/a	1,500	6%	196	1,176	23	4,259	n/a																		
Silva	Sacramento	Electric	unknown	150	n/a	1,000	4%	131	784	23	4,259	n/a																		
Betts	Sacramento	Electric	unknown	150	n/a	1,500	6%	196	1,176	23	4,259	n/a																		
MAP	Sacramento	Electric	unknown	150	n/a	2,000	8%	261	1,569	23	4,259	n/a																		
Ose-1	Sacramento	Diesel	2013	225	T4I	1,800	7%	235	1,412	23	4,259	53,766	0.14	0.3	2.6	0.93	0.01	0.01	1.61	3.39	29.67	10.56	0.17	0.17	0.15	0.32	2.76	0.98	0.02	0.02
Ose-2	Sacramento	Electric	unknown	150	n/a	1,600	6%	209	1,255	23	4,259	n/a																		
Perry	Sacramento	Electric	unknown	135	n/a	2,000	8%	261	1,569	23	4,259	n/a																		
Total						25,500	100%	3,333	20,000	321	59,633	53,766							1.61	3.39	29.67	10.56	0.17	0.17	0.15	0.32	2.76	0.98	0.02	0.02
Total (Sacramento County)						11,400	45%	1,490	8,941	160	29,816	53,766							1.61	3.39	29.67	10.56	0.17	0.17	0.15	0.32	2.76	0.98	0.02	0.02
Total (Sutter County)						14,100	55%	1,843	11,059	160	29,816	0							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

	Sacramento	Sutter
PM10	M	A
PM2.5	N	N
O3	N	N

Engines subject to ATCM.

Peak Month

3,333 AF/month
24,332 gallons/minute
95% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pelger Mutual Water Company		Peak Pumping by Transfer Period
Transfer Volume	2,000 acre-feet	(Apr-Jun)	1,189 AF/month
	2,670 acre-feet	(Jul-Sep)	1,017 AF/month
	4,670 acre-feet/year		

Table 33. Pelger Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	1	2	0	0	3
Total	1	2	0	0	3

Table 34. Pelger Mutual Water Company Criteria Pollutant Emissions

	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel Consumption	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
Well				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(gal/yr)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
PMWC#1	Sutter	Electric	unknown	150	n/a	5,000	25%	293	1,149	24	1,248	n/a																		
Well 1 Tucker	Sutter	Electric	unknown	75	n/a	2,800	25%	293	1,149	24	2,229	n/a																		
Well 2 Flopet	Sutter	Diesel	2008	125	T3	2,500	17%	198	778	24	1,690	11,852	0.1	2.8	3.7	0.93	0.22	0.22	0.99	18.76	24.68	6.15	1.48	1.48	0.03	0.66	0.87	0.22	0.05	0.05
Well 3 Klein	Sutter	Electric	unknown	150	n/a	4,300	34%	406	1,594	24	2,013	n/a																		
Total						14,600	100%	1,190	4,670	96	7,180	11,852							0.99	18.76	24.68	6.15	1.48	1.48	0.03	0.66	0.87	0.22	0.05	0.05
Total (Sutter County)						14,600	100%	1,190	4,670	96	7,180	11,852							0.99	18.76	24.68	6.15	1.48	1.48	0.03	0.66	0.87	0.22	0.05	0.05

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status
Sutter
PM10 A
PM2.5 N
O3 N
Engines subject to ATCM.

Peak Month
1,189 AF/month
8,681 gallons/minute
59% peak pump rate

Legend

Emission factors based on NMHC+NOx standard

Conversion Factors

1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pleasant Grove-Verona Mutual Water Company		Peak Pumping by Transfer Period	
Transfer Volume	8,000 acre-feet	(Apr-Jun)	4,757 AF/month	
	7,000 acre-feet	(Jul-Sep)	2,667 AF/month	
	15,000 acre-feet/year			

Table 35. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	13	20	0	2	35
Total	13	20	0	2	35

Table 36. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

Well	Location	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Consumption (gal/yr) - diesel (MMBtu/yr) - propane	Emission Factors (g/bhp-hr) - diesel and VOC, NOx, and CO for propane (lb/MMBtu) - SOx, PM10, and PM2.5 for propane						Daily Emissions						Annual Emissions					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	(pounds per day)						(tons per year)					
																			VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	10	951	n/a																		
Kelly Windmill Field Well #2	Sutter	Electric	2002	62.1	n/a	2,000	2%	111	350	10	951	n/a																		
Kelly Windmill North Field Well	Sutter	Propane	2014	133	T2	1,750	2%	97	306	10	951	321	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	2.85	5.70	11.40	0.00	0.03	0.03	0.14	0.28	0.56	0.00	0.00	0.00
Kelly306	Sutter	Electric	unknown	60	n/a	2,600	3%	144	455	10	951	n/a																		
MLF Clubhouse B Well	Sutter	Electric	unknown	300	n/a	3,700	4%	205	648	10	951	n/a																		
MLF Marsh Well	Sutter	Electric	unknown	300	n/a	3,700	4%	205	648	10	951	n/a																		
MLF Monster Well	Sutter	Electric	unknown	60	n/a	3,100	4%	172	543	10	951	n/a																		
MLF Well #1	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	10	951	n/a																		
MLF Well #16	Sutter	Electric	unknown	50	n/a	1,700	2%	94	298	10	951	n/a																		
MLF Well#11	Sutter	Diesel	2004	250	T2	4,200	5%	233	735	10	951	13,332	0.2	4.7	2.6	0.93	0.15	0.15	1.32	25.08	14.00	4.98	0.80	0.80	0.06	1.23	0.68	0.24	0.04	0.04
MLF Well#12/17	Sutter	Electric	unknown	50	n/a	1,500	2%	83	263	10	951	n/a																		
MLF Well#13	Sutter	Electric	2000	215	n/a	4,800	6%	266	840	10	951	n/a																		
MLF Well#2B	Sutter	Electric	2000	300	n/a	3,700	4%	205	648	10	951	n/a																		
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	10	951	n/a																		
Nicholas 72-Acree Field South	Sutter	Diesel	2002	62.1	T1	2,000	2%	111	350	10	951	3,312	1.1	6.9	3.0	0.93	0.30	0.29	1.52	9.14	4.03	1.24	0.40	0.39	0.07	0.45	0.20	0.06	0.02	0.02
Nicholas BBC Well	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	10	951	n/a																		
Nicholas Filipino Camp South	Sutter	Diesel	2002	62.1	T1	2,000	2%	111	350	10	951	3,312	1.1	6.9	3.0	0.93	0.30	0.29	1.52	9.14	4.03	1.24	0.40	0.39	0.07	0.45	0.20	0.06	0.02	0.02
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	10	951	n/a																		
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	10	951	n/a																		
Nicholas Sand Field Well	Sutter	Diesel	2002	62.1	T2	2,000	2%	111	350	10	951	3,312	0.3	5.3	3.7	0.93	0.30	0.29	0.37	7.08	4.97	1.24	0.40	0.39	0.02	0.35	0.24	0.06	0.02	0.02
RiverRanch#19	Sutter	Diesel	2008	99	T3	2,000	2%	111	350	10	951	5,279	0.2	3.3	3.7	0.93	0.30	0.29	0.37	7.07	7.92	1.97	0.64	0.62	0.02	0.35	0.39	0.10	0.03	0.03
S&O#16	Sutter	Electric	2014	159	n/a	3,000	4%	167	525	10	951	n/a																		
S&O#17	Sutter	Diesel	1999	101	T0	2,250	3%	125	394	10	951	5,386	1.1	14.1	3.0	0.93	0.22	0.21	2.47	30.45	6.56	2.01	0.48	0.46	0.12	1.49	0.32	0.10	0.02	0.02
S&O#18A	Sutter	Diesel	1999	101	T0	1,800	2%	100	315	10	951	5,386	1.1	14.1	3.0	0.93	0.22	0.21	2.47	30.45	6.56	2.01	0.48	0.46	0.12	1.49	0.32	0.10	0.02	0.02
S&O#19	Sutter	Diesel	2007	215	T3	2,150	3%	119	376	10	951	11,465	0.1	2.8	2.6	0.93	0.15	0.15	0.69	13.07	12.04	4.29	0.69	0.69	0.03	0.64	0.59	0.21	0.03	0.03
S&O#20	Sutter	Propane	2014	154	n/a	2,250	3%	125	394	10	951	372	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	3.30	6.60	13.21	0.00	0.04	0.04	0.16	0.32	0.65	0.00	0.00	0.00
Willey#1	Sutter	Diesel	2000	168	T1	3,000	4%	167	525	10	951	8,959	1.1	6.9	3.0	0.93	0.22	0.21	4.11	24.73	10.91	3.35	0.79	0.77	0.20	1.21	0.53	0.16	0.04	0.04
Willey#2	Sutter	Diesel	unknown	250	T2	3,000	4%	167	525	10	951	13,332	0.2	4.7	2.6	0.93	0.15	0.15	1.32	25.08	14.00	4.98	0.80	0.78	0.06	1.23	0.68	0.24	0.04	0.04
Willey#3	Sutter	Electric	unknown	75	n/a	2,000	2%	111	350	10	951	n/a																		
Willey#4	Sutter	Diesel	1974	150	T0	2,000	2%	111	350	10	951	7,999	1.1	14.1	3.0	0.93	0.22	0.21	3.67	45.22	9.74	2.99	0.71	0.69	0.18	2.21	0.48	0.15	0.03	0.03
Will-Lee Well#30	Sutter	Diesel	2000	100	T2	2,500	3%	139	438	10	951	5,333	0.2	4.7	3.7	0.93	0.22	0.21	0.53	10.03	8.00	1.99	0.47	0.46	0.03	0.49	0.39	0.10	0.02	0.02
Will-Lee Well#31	Sutter	Electric	unknown	50	n/a	2,500	3%	139	438	10	951	n/a																		
Will-Lee Well#32	Sutter	Electric	unknown	300	n/a	2,500	3%	139	438	10	951	n/a																		
Will-Lee Well#33	Sutter	Electric	unknown	75	n/a	2,500	3%	139	438	10	951	n/a																		
Will-Lee Well#4A	Sutter	Diesel	2000	160	T1	1,500	2%	83	263	10	951	8,532	1.1	6.9	3.0	0.93	0.22	0.21	3.91	23.55	10.39	3.19	0.75	0.74	0.19	1.15	0.51	0.16	0.04	0.04
Total						85,700	100%	4,757	15,000	340	33,270	95,632							30.41	272.37	137.77	35.49	7.88	7.72	1.49	13.31	6.73	1.73	0.38	0.38
Total (Sutter County)						85,700	100%	4,757	15,000	340	33,270	95,632							30.41	272.37	137.77	35.49	7.88	7.72	1.49	13.31	6.73	1.73	0.38	0.38

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

Sutter
PM10 A
PM2.5 N
O3 N

Engines subject to ATCM.

Peak Month

4,757 AF/month
34,722 gallons/minute
41% peak pump rate

Legend

	Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
	Emission factors based on NMHC+NOx standard
	Emission factor from AP-42 because emission standards for pollutant not available for emissions tier

Conversion Factors

1 bhp-hr = 2,542.5 Btu
1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Princeton-Codora-Glenn Irrigation District		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	2,000 acre-feet	(Apr-Jun)	1,189 AF/month
	3,000 acre-feet	(Jul-Sep)	1,143 AF/month
	5,000 acre-feet/year		

Table 37. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	4	0	0	0	4
Colusa	0	0	0	0	0
Total	4	0	0	0	4

Table 38. Princeton-Codora-Glenn Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Joel Mann	Glenn	D	1995	150	T0	3,000	34%	405	1,705	24	3,086	25,967	1.1	14.1	3.0	0.93	0.22	0.21	8.93	110.08	23.72	7.28	1.72	1.68	0.58	7.17	1.55	0.47	0.11	0.11
D.Withrow	Glenn	D	1992	180	T0	1,200	14%	162	682	24	3,086	31,160	1.1	14.1	3.0	0.93	0.15	0.15	10.71	132.10	28.47	8.74	1.41	1.38	0.70	8.61	1.86	0.57	0.09	0.09
Chrisman	Glenn	D	1998	195	T1	1,600	18%	216	909	24	3,086	33,757	1.0	6.9	8.5	0.93	0.40	0.40	9.87	69.87	86.58	9.46	4.10	4.10	0.64	4.55	5.64	0.62	0.27	0.27
D.Schmidt	Glenn	D	2013	170	T4I	3,000	34%	405	1,705	24	3,086	29,429	0.14	0.3	3.7	0.93	0.01	0.01	1.26	2.65	33.11	8.25	0.13	0.13	0.08	0.17	2.16	0.54	0.01	0.01
Total						8,800	100%	1,189	5,000	95	12,343	120,312							30.77	314.71	171.88	33.73	7.37	7.29	2.01	20.51	11.20	2.20	0.48	0.47
Total (Glenn County)						8,800	100%	1,189	5,000	95	12,343	120,312							30.77	314.71	171.88	33.73	7.37	7.29	2.01	20.51	11.20	2.20	0.48	0.47
Total (Colusa County)						0	0%	0	0	0	0	0							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status		
	Glenn	Colusa
PM10	A	A
PM2.5	A	A
O3	A	A

Engines not subject to ATCM if remotely-located.

Peak Month	
	1,189 AF/month
	8,681 gallons/minute
	99% peak pump rate

Legend
 Tier 4 Exhaust Emission Standards, Phase-In (100<=hp<=175, 2012-2014 model year)

Conversion Factors
1 lb = 453.6 g
1 ton = 2,000 lbs
1 kW = 1.34 hp
1 day = 24 hours
1 month = 31 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Provident Irrigation District		Peak Pumping by Transfer Period
Transfer Volume	3,000 acre-feet	(Apr-Jun)	1,000 AF/month
	3,000 acre-feet	(Jul-Sep)	1,000 AF/month
	6,000 acre-feet/year		

Table 39. Provident Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	5	2	0	0	7
Colusa	0	0	0	0	0
Total	5	2	0	0	7

Table 40. Provident Irrigation District Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Weller62V	Glenn	Diesel	2014	190	T4	3,000	13%	128	766	7	1,387	14,780	0.14	0.3	2.6	0.93	0.01	0.01	0.44	0.93	8.16	2.90	0.05	0.05	0.04	0.09	0.76	0.27	0.00	0.00
L Hansen#1	Glenn	Diesel	1991	210	T0	4,000	17%	170	1,021	7	1,387	16,336	1.1	14.1	3.0	0.93	0.15	0.15	3.94	48.53	10.46	3.21	0.52	0.51	0.37	4.51	0.97	0.30	0.05	0.05
L Hansen#2	Glenn	Diesel	2013	140	T4I	4,500	19%	191	1,149	7	1,387	10,891	0.14	0.3	3.7	0.93	0.01	0.01	0.33	0.69	8.59	2.14	0.03	0.03	0.03	0.06	0.80	0.20	0.00	0.00
K Hansen#1	Glenn	Diesel	1992	185	T0	2,500	11%	106	638	7	1,387	14,391	1.1	14.1	3.0	0.93	0.15	0.15	3.47	42.75	9.21	2.83	0.46	0.45	0.32	3.98	0.86	0.26	0.04	0.04
K Hansen#2	Glenn	Electric	n/a	170	n/a	3,500	15%	149	894	7	1,387	n/a																		
E Weller	Glenn	Diesel	1993	185	T0	3,000	13%	128	766	7	1,387	14,391	1.1	14.1	3.0	0.93	0.15	0.15	3.47	42.75	9.21	2.83	0.46	0.45	0.32	3.98	0.86	0.26	0.04	0.04
Weller#4	Glenn	Electric	n/a	170	n/a	3,000	13%	128	766	7	1,387	n/a																		
Total						23,500	100%	1,000	6,000	52	9,706	70,789							11.64	135.66	45.62	13.91	1.51	1.47	1.08	12.62	4.24	1.29	0.14	0.14
Total (Glenn County)						23,500	100%	1,000	6,000	52	9,706	70,789							11.64	135.66	45.62	13.91	1.51	1.47	1.08	12.62	4.24	1.29	0.14	0.14
Total (Colusa County)						0	0%	0	0	0	0	0							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status		
	Glenn	Colusa
PM10	A	A
PM2.5	A	A
O3	A	A
Engines not subject to ATCM if remotely-located.		
Peak Month		
	1,000 AF/month	
	7,300 gallons/minute	
	31% peak pump rate	

Legend	
	Emission factors based on NMHC+NOx standard
	Information on engine not available; therefore, engine assumed to be diesel as worst-case.
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors	
1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf	

Diesel Engine Fuel Consumption		
0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)	
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)	
7.13 lb/gal		

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Reclamation District 108	<u>Peak Pumping by Transfer Period</u>
Transfer Volume	7,500 acre-feet (Apr-Jun)	2,500 AF/month
	7,500 acre-feet (Jul-Sep)	2,500 AF/month
	15,000 acre-feet/year	

Table 41. Reclamation District 108 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	4	0	0	4
Yolo	0	1	0	0	1
Total	0	5	0	0	5

Table 42. Reclamation District 108 Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations	
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Well #4 Huff	Colusa	Electric	unknown	250	n/a	4,000	21%	524	3,141	23	4,265
Well #5 RiggsRanch	Colusa	Electric	unknown	150	n/a	1,700	9%	223	1,335	23	4,265
Well #6 CountyLine	Colusa	Electric	unknown	250	n/a	5,900	31%	772	4,634	23	4,265
Well#1 Heidrick	Colusa	Electric	unknown	100	n/a	3,500	18%	458	2,749	23	4,265
Well#7 Tract 6	Yolo	Electric	unknown	250	n/a	4,000	21%	524	3,141	23	4,265
Total						19,100	100%	2,500	15,000	115	21,325
Total (Colusa County)						15,100	79%	1,976	11,859	92	17,060
Total (Yolo County)						4,000	21%	524	3,141	23	4,265

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

	Colusa	Yolo
PM10	A	A
PM2.5	A	N
O3	A	N

Engines subject to ATCM.

Peak Month

2,500 AF/month

18,249 gallons/minute

96% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Reclamation District 1004		Peak Pumping by Transfer Period	
Transfer Volume	0 acre-feet (Apr-Jun)		0 AF/month	
	7,175 acre-feet (Jul-Sep)		2,733 AF/month	
	7,175 acre-feet/year			

Table 43. Reclamation District 1004 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	5	0	0	6
Colusa	17	5	0	0	22
Sutter	0	0	0	0	0
Total	18	10	0	0	28

Table 44. Reclamation District 1004 Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gall/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Barale Well	Colusa	Diesel	TBD	225	T0	4,000	4%	119	313	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Behring Ranch 10 Field Well No. 496441	Colusa	Diesel	2008	225	T3	5,800	6%	173	453	5	424	5,358	0.1	2.8	2.6	0.93	0.15	0.15	0.39	7.34	6.76	2.41	0.39	0.39	0.02	0.30	0.27	0.10	0.02	0.02
Behring Ranch Club House Well No.496461	Colusa	Electric	unknown	125	n/a	3,400	4%	101	266	5	424	n/a																		
Behring Ranch Nursery Well No. 17N1W10H1	Colusa	Diesel	TBD	225	T0	1,000	1%	30	78	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Behring Ranch Pearl Well No. 20094	Colusa	Diesel	TBD	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Behring Ranch West Well No.97863	Colusa	Electric	unknown	125	n/a	2,300	3%	68	180	5	424	n/a																		
Drumheller Well No.7	Colusa	Diesel	TBD	225	T0	4,000	4%	119	313	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
East Morgan Well #1 No. 374667 17N01W14N001M	Colusa	Diesel	TBD	225	T0	2,600	3%	77	203	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
East Morgan Well#2 No. 498195 17N01W15Q001M	Colusa	Diesel	TBD	225	T0	1,300	1%	39	102	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Gardener No. 374672	Colusa	Diesel	2008	215	T3	3,500	4%	104	274	5	424	5,120	0.1	2.8	2.6	0.93	0.15	0.15	0.37	7.01	6.46	2.30	0.37	0.37	0.02	0.29	0.26	0.09	0.02	0.02
Gardener No. 498178	Colusa	Diesel	2009	215	T3	3,500	4%	104	274	5	424	5,120	0.1	2.8	2.6	0.93	0.15	0.15	0.37	7.01	6.46	2.30	0.37	0.37	0.02	0.29	0.26	0.09	0.02	0.02
Hall Well No. X	Glenn	Electric	TBD	125	n/a	4,500	5%	134	352	5	424	n/a																		
Hall Well No.369428	Glenn	Electric	2011	125	n/a	4,500	5%	134	352	5	424	n/a																		
Mohammad No.e0084085 17N01W02D001M	Colusa	Electric	TBD	125	n/a	4,500	5%	134	352	5	424	n/a																		
Myers Well #1 No.3457	Glenn	Electric	2006	40	n/a	2,200	2%	66	172	5	424	n/a																		
Myers Well #2 No. 340884	Glenn	Electric	1982	100	n/a	4,100	4%	122	320	5	424	n/a																		
Rancho Caleta No. 726883	Colusa	Diesel	2004	170	T2	4,500	5%	134	352	5	424	4,048	0.2	4.7	3.7	0.93	0.22	0.22	0.48	9.15	7.29	1.82	0.44	0.44	0.02	0.37	0.30	0.07	0.02	0.02

Table 44. Reclamation District 1004 Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate		Transfer Volume		Operations		Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr)						Daily Emissions (pounds per day)						Annual Emissions (tons per year)					
						(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)		VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Sikes & Parachini Well #1 WS No.93124	Colusa	Diesel	2006	173	T2	4,000	4%	119	313	5	424	4,120	0.2	4.7	3.7	0.93	0.22	0.22	0.49	9.31	7.42	1.85	0.45	0.45	0.02	0.38	0.30	0.08	0.02	0.02
Sikes & Parachini Well #2 WS No. 374682	Colusa	Diesel	2008	150	T3	4,000	4%	119	313	5	424	3,572	0.1	2.8	3.7	0.93	0.22	0.22	0.26	4.89	6.44	1.60	0.39	0.39	0.01	0.20	0.26	0.07	0.02	0.02
Southam Sartain Well 18N01W26D001M	Glenn	Diesel	TBD	225	T0	4,800	5%	143	375	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Stone Well #6 No.11334	Colusa	Electric	2006	40	n/a	1,800	2%	54	141	5	424	n/a																		
Wilder Farms Well	Glenn	Electric	unknown	125	n/a	2,500	3%	74	195	5	424	n/a																		
Dan Charter Well#1	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Dan Charter Well#2	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
GVL Well#1	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Behring Ranch Well	Colusa	Electric	unknown	125	n/a	4,000	4%	119	313	5	424	n/a																		
Claudia Charter	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
GVL Well#2	Colusa	Diesel	unknown	225	T0	2,500	3%	74	195	5	424	5,358	1.1	14.1	3.0	0.93	0.15	0.15	2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Total						91,800	100%	2,733	7,175	146	11,885	91,633							37.76	481.31	134.91	41.15	7.05	6.94	1.54	19.58	5.49	1.67	0.29	0.28
Total (Glenn County)						22,600	25%	673	1,766	31	2,547	5,358							2.95	36.38	7.84	2.41	0.39	0.38	0.12	1.48	0.32	0.10	0.02	0.02
Total (Colusa County)						69,200	75%	2,060	5,409	115	9,338	86,275							34.81	444.92	127.07	38.74	6.66	6.56	1.42	18.10	5.17	1.58	0.27	0.27
Total (Sutter County)						0	0%	0	0	0	0	0							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status			
	Glenn	Colusa	Sutter
PM10	A	A	A
PM2.5	A	A	N
O3	A	A	N
Engines subject to ATCM.			
Peak Month			
	2,733 AF/month		
	19,952 gallons/minute		
	22% peak pump rate		

Legend	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
	Emission factors based on NMHC+NOx standard

Conversion Factors	
1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf	

Diesel Engine Fuel Consumption	
0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	River Garden Farms		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	4,000 acre-feet	(Apr-Jun)	2,378 AF/month
	5,000 acre-feet	(Jul-Sep)	1,905 AF/month
	9,000 acre-feet/year		

Table 45. River Garden Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	8	0	0	8
Total	0	8	0	0	8

Table 46. River Garden Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations	
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Field 65 PW	Yolo	Electric	2008	125	n/a	2,500	12%	292	1,103	20	2,397
Field 71 PW	Yolo	Electric	2001	125	n/a	1,700	8%	198	750	20	2,397
Field 98 PW	Yolo	Electric	1963	125	n/a	2,900	14%	338	1,280	20	2,397
Field 104 PW	Yolo	Electric	2008	125	n/a	2,500	12%	292	1,103	20	2,397
Field 104-09 PW	Yolo	Electric	2009	125	n/a	2,990	15%	349	1,319	20	2,397
Field 91-09 PW	Yolo	Electric	2009	125	n/a	2,840	14%	331	1,253	20	2,397
Field 117 PW	Yolo	Electric	2009	125	n/a	1,965	10%	229	867	20	2,397
Shop PW	Yolo	Electric	2009	125	n/a	3,000	15%	350	1,324	20	2,397
Total						20,395	100%	2,378	9,000	163	19,172
Total (Yolo County)						20,395	100%	2,378	9,000	163	19,172

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Yolo

PM10 A

PM2.5 N

O3 N

Engines subject to ATCM.

Peak Month

2,378 AF/month

17,361 gallons/minute

85% peak pump rate

Legend

	Information on engine not available; engine assumed to be electric based on other engines used by water agency.
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Sycamore Mutual Water Company		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	5,000 acre-feet	(Apr-Jun)	2,973 AF/month
	6,300 acre-feet	(Jul-Sep)	2,400 AF/month
	11,300 acre-feet/year		

Table 47. Sycamore Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	5	0	0	5
Total	0	5	0	0	5

Table 48. Sycamore Mutual Water Company Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations	
				(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
Well #15	Colusa	electric	n/a	125	n/a	3,270	15%	440	1,672	24	2,776
Well #14	Colusa	electric	n/a	125	n/a	3,270	15%	440	1,672	24	2,776
Well #11	Colusa	electric	n/a	125	n/a	6,409	29%	862	3,276	24	2,776
Well #2b	Colusa	electric	n/a	125	n/a	4,578	21%	616	2,340	24	2,776
Well #2a	Colusa	electric	n/a	125	n/a	4,578	21%	616	2,340	24	2,776
Total						22,104	100%	2,973	11,300	118	13,882
Total (Colusa County)						22,104	100%	2,973	11,300	118	13,882

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Colusa

PM10 A

PM2.5 A

O3 A

Engines not subject to ATCM if remotely-located.

Peak Month

2,973 AF/month

21,701 gallons/minute

98% peak pump rate

Legend

 Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g

1 ton = 2,000 lbs

1 kW = 1.34 hp

1 day = 24 hours

1 month = 31 days

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	T&P Farms		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	650 acre-feet	(Apr-Jun)	386 AF/month
	550 acre-feet	(Jul-Sep)	210 AF/month
	1,200 acre-feet/year		

Table 49. T&P Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	0	2
Total	0	2	0	0	2

Table 50. T&P Farms Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations	
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
NW-3	Colusa	E	unknown	125	n/a	3,500	47%	180	560	9	869
NW-4	Colusa	E	unknown	125	n/a	4,000	53%	206	640	9	869
Total						7,500	100%	386	1,200	18	1,738
Total (Colusa County)						7,500	100%	386	1,200	18	1,738

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Colusa

PM10 A

PM2.5 A

O3 A

Engines not subject to ATCM if remotely-located.

Peak Month

386 AF/month

2,821 gallons/minute

38% peak pump rate

Legend

 Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Te Velde Revocable Family Trust		<u>Peak Pumping by Transfer Period</u>
Transfer Volume	2,700 acre-feet	(Apr-Jun)	1,605 AF/month
	4,394 acre-feet	(Jul-Sep)	1,674 AF/month
	7,094 acre-feet/year		

Table 51. Te Velde Revocable Family Trust Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	5	0	0	5
Total	0	5	0	0	5

Table 52. Te Velde Revocable Family Trust Criteria Pollutant Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Emission Tier	Pump Rate		Transfer Volume		Operations	
				(hp)		(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)
GW1	Yolo	Electric	N/A	127	n/a	4,656	29%	493	2,090	19	2,438
GW10	Yolo	Electric	N/A	143	n/a	2,833	18%	300	1,272	19	2,438
GW9	Yolo	Electric	N/A	104	n/a	2,400	15%	254	1,077	19	2,438
GW3	Yolo	Electric	N/A	52	n/a	3,715	24%	393	1,668	19	2,438
GW4	Yolo	Electric	N/A	125	n/a	2,200	14%	233	988	19	2,438
Total						15,804	100%	1,674	7,094	93	12,189
Total (Yolo County)						15,804	100%	1,674	7,094	93	12,189

Note: All wells are electric; therefore, no local criteria pollutant emissions.

Key:

AF = acre-feet

CO = carbon monoxide

g/bhp-hr = grams per brake-horsepower hour

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

NOx = nitrogen oxides

PM10 = inhalable particulate matter

PM2.5 = fine particulate matter

SOx = sulfur oxides

VOC = volatile organic compound

Federal Attainment Status

Yolo

PM10 A

PM2.5 N

O3 N

Engines subject to ATCM.

Peak Month

1,674 AF/month

12,219 gallons/minute

77% peak pump rate

Conversion Factors

1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Table 53. General Conformity Applicability Evaluation (Mitigated Emissions)

County/ Nonattainment Area	Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5
	Sacramento Metro ¹	Sacramento Metro ¹	Sacramento Area ²	Sacramento ^{3,4}	Sacramento Co.	Sacramento ⁴
Colusa	n/a	n/a	n/a	n/a	n/a	n/a
Glenn	n/a	n/a	n/a	n/a	n/a	n/a
Sacramento	0.1	0.3	2.8	1.0	0.0	0.0
Shasta	n/a	n/a	n/a	n/a	n/a	n/a
Sutter ⁵	0.6	1.8	n/a	2.0	n/a	0.1
Tehama	n/a	n/a	n/a	n/a	n/a	n/a
Yolo	0.1	1.7	1.0	0.3	n/a	0.1
Total	0.8	3.8	3.7	3.3	0.0	0.2
Classification	Severe-15	Severe-15	Maintenance	PM2.5 Precursor	Maintenance	Nonattainment
De Minimis Threshold (tpy)	25	25	100	100	100	100
Exceed?	No	No	No	No	No	No

Note:

¹The Sacramento Metro 8-hour O3 nonattainment area consist of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

²The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

³All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

⁴The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

⁵VOC and NOx emissions are excluded from Cranmore Farms, Pelger Mutual Water Company, and Reclamation District 1004 because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

Table 54. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)

Water Agency	County	VOC	NOx
Cranmore Farms	Sutter	All Electric	All Electric
Pelger Mutual Water Company	Sutter	0.0	0.7
Reclamation District 1004	Sutter	No Engines	No Engines
Total		0.0	0.7

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table 55. Daily VOC Emissions (Mitigated)

Water Agency	Daily VOC Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	2.75							2.75
Conaway Preservation Group							4.24	4.24
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.67							1.67
Glenn-Colusa Irrigation District	64.51	86.02						150.53
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			1.61		All Electric			1.61
Pelger Mutual Water Company					0.99			0.99
Pleasant Grove-Verona Mutual Water Company					8.71			8.71
Princeton-Codora-Glenn Irrigation District	No Engines	30.77						30.77
Provident Irrigation District	No Engines	11.64						11.64
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	34.81	2.95			No Engines			37.76
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	103.74	131.38	1.61	0.00	9.69	0.00	4.24	250.66

Key:

VOC = volatile organic compounds

Table 56. Daily NOx Emissions (Mitigated)

Water Agency	Daily NOx Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	5.50							5.50
Conaway Preservation Group							80.49	80.49
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	31.65							31.65
Glenn-Colusa Irrigation District	795.46	1,060.61						1,856.07
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			3.39		All Electric			3.39
Pelger Mutual Water Company					18.76			18.76
Pleasant Grove-Verona Mutual Water Company					25.00			25.00
Princeton-Codora-Glenn Irrigation District	No Engines	314.71						314.71
Provident Irrigation District	No Engines	135.66						135.66
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	444.92	36.38			No Engines			481.31
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	1,277.54	1,547.36	3.39	0.00	43.76	0.00	80.49	2,952.53

Key:

NOx = nitrogen oxides

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table 57. Daily CO Emissions (Mitigated)

Water Agency	Daily CO Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	11.00							11.00
Conaway Preservation Group							44.93	44.93
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	29.15							29.15
Glenn-Colusa Irrigation District	171.41	228.54						399.95
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			29.67		All Electric			29.67
Pelger Mutual Water Company					24.68			24.68
Pleasant Grove-Verona Mutual Water Company					191.15			191.15
Princeton-Codora-Glenn Irrigation District	No Engines	171.88						171.88
Provident Irrigation District	No Engines	45.62						45.62
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	127.07	7.84			No Engines			134.91
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	338.63	453.89	29.67	0.00	215.83	0.00	44.93	1,082.94

Key:

CO = carbon monoxide

Table 58. Daily SOx Emissions (Mitigated)

Water Agency	Daily SOx Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							16.00	16.00
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	10.38							10.38
Glenn-Colusa Irrigation District	52.60	70.14						122.74
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			10.56		All Electric			10.56
Pelger Mutual Water Company					6.15			6.15
Pleasant Grove-Verona Mutual Water Company					53.59			53.59
Princeton-Codora-Glenn Irrigation District	No Engines	33.73						33.73
Provident Irrigation District	No Engines	13.91						13.91
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	38.74	2.41			No Engines			41.15
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	101.73	120.18	10.56	0.00	59.74	0.00	16.00	308.20

Key:

SOx = sulfur oxides

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table 59. Daily PM10 Emissions (Mitigated)

Water Agency	Daily PM10 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.03							0.03
Conaway Preservation Group							2.57	2.57
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.67							1.67
Glenn-Colusa Irrigation District	12.45	16.59						29.04
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.17		All Electric			0.17
Pelger Mutual Water Company					1.48			1.48
Pleasant Grove-Verona Mutual Water Company					1.34			1.34
Princeton-Codora-Glenn Irrigation District	No Engines	7.37						7.37
Provident Irrigation District	No Engines	1.51						1.51
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.66	0.39			No Engines			7.05
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	20.81	25.86	0.17	0.00	2.82	0.00	2.57	52.22

Key:

PM10 = inhalable particulate matter

Table 60. Daily PM2.5 Emissions (Mitigated)

Water Agency	Daily PM2.5 Emissions (pounds per day)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.03							0.03
Conaway Preservation Group							2.57	2.57
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.67							1.67
Glenn-Colusa Irrigation District	12.15	16.20						28.34
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.17		All Electric			0.17
Pelger Mutual Water Company					1.48			1.48
Pleasant Grove-Verona Mutual Water Company					1.34			1.34
Princeton-Codora-Glenn Irrigation District	No Engines	7.29						7.29
Provident Irrigation District	No Engines	1.47						1.47
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	6.56	0.38			No Engines			6.94
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	20.41	25.34	0.17	0.00	2.82	0.00	2.57	51.29

Key:

PM2.5 = fine particulate matter

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table 61. Annual VOC Emissions (Mitigated)

Water Agency	Annual VOC Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.12							0.12
Conaway Preservation Group							0.09	0.09
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.09							0.09
Glenn-Colusa Irrigation District	6.00	8.00						14.00
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.15		All Electric			0.15
Pelger Mutual Water Company					0.03			0.03
Pleasant Grove-Verona Mutual Water Company					0.57			0.57
Princeton-Codora-Glenn Irrigation District	No Engines	2.01						2.01
Provident Irrigation District	No Engines	1.08						1.08
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.42	0.12			No Engines			1.54
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	7.63	11.21	0.15	0.00	0.61	0.00	0.09	19.69

Key:

VOC = volatile organic compounds

Table 62. Annual NOx Emissions (Mitigated)

Water Agency	Annual NOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.25							0.25
Conaway Preservation Group							1.74	1.74
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.72							1.72
Glenn-Colusa Irrigation District	73.98	98.64						172.61
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.32		All Electric			0.32
Pelger Mutual Water Company					0.66			0.66
Pleasant Grove-Verona Mutual Water Company					1.75			1.75
Princeton-Codora-Glenn Irrigation District	No Engines	20.51						20.51
Provident Irrigation District	No Engines	12.62						12.62
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	18.10	1.48			No Engines			19.58
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	94.05	133.24	0.32	0.00	2.41	0.00	1.74	231.76

Key:

NOx = nitrogen oxides

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table 63. Annual CO Emissions (Mitigated)

Water Agency	Annual CO Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.50							0.50
Conaway Preservation Group							0.97	0.97
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	1.59							1.59
Glenn-Colusa Irrigation District	15.94	21.25						37.20
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			2.76		All Electric			2.76
Pelger Mutual Water Company					0.87			0.87
Pleasant Grove-Verona Mutual Water Company					7.32			7.32
Princeton-Codora-Glenn Irrigation District	No Engines	11.20						11.20
Provident Irrigation District	No Engines	4.24						4.24
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	5.17	0.32			No Engines			5.49
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	23.20	37.02	2.76	0.00	8.19	0.00	0.97	72.14

Key:

CO = carbon monoxide

Table 64. Annual SOx Emissions (Mitigated)

Water Agency	Annual SOx Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							0.35	0.35
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.57							0.57
Glenn-Colusa Irrigation District	4.89	6.52						11.41
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.98		All Electric			0.98
Pelger Mutual Water Company					0.22			0.22
Pleasant Grove-Verona Mutual Water Company					1.73			1.73
Princeton-Codora-Glenn Irrigation District	No Engines	2.20						2.20
Provident Irrigation District	No Engines	1.29						1.29
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	1.58	0.10			No Engines			1.67
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	7.03	10.11	0.98	0.00	1.95	0.00	0.35	20.43

Key:

SOx = sulfur oxides

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table 65. Annual PM10 Emissions (Mitigated)

Water Agency	Annual PM10 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							0.06	0.06
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.09							0.09
Glenn-Colusa Irrigation District	1.16	1.54						2.70
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.02		All Electric			0.02
Pelger Mutual Water Company					0.05			0.05
Pleasant Grove-Verona Mutual Water Company					0.07			0.07
Princeton-Codora-Glenn Irrigation District	No Engines	0.48						0.48
Provident Irrigation District	No Engines	0.14						0.14
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.29
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	1.52	2.18	0.02	0.00	0.12	0.00	0.06	3.90

Key:

PM10 = inhalable particulate matter

Table 66. Annual PM2.5 Emissions (Mitigated)

Water Agency	Annual PM2.5 Emissions (tons per year)							Total
	Colusa	Glenn	Sacramento	Shasta	Sutter	Tehama	Yolo	
Anderson-Cottonwood Irrigation District				All Electric		No Engines		0.00
Burroughs Farms					All Electric			0.00
Canal Farms	0.00							0.00
Conaway Preservation Group							0.06	0.06
Cranmore Farms					All Electric			0.00
Eastside Mutual Water Company	0.09							0.09
Glenn-Colusa Irrigation District	1.13	1.51						2.64
Maxwell Irrigation District	All Electric							0.00
Natomas Central Mutual Water Company			0.02		All Electric			0.02
Pelger Mutual Water Company					0.05			0.05
Pleasant Grove-Verona Mutual Water Company					0.07			0.07
Princeton-Codora-Glenn Irrigation District	No Engines	0.47						0.47
Provident Irrigation District	No Engines	0.14						0.14
Reclamation District 108	All Electric						All Electric	0.00
Reclamation District 1004	0.27	0.02			No Engines			0.28
River Garden Farms							All Electric	0.00
Sutter Mutual Water Company	No Groundwater Substitution							0.00
Sycamore Mutual Water Company	All Electric							0.00
T&P Farms	All Electric							0.00
Te Velde Revocable Family Trust							All Electric	0.00
Total	1.49	2.13	0.02	0.00	0.12	0.00	0.06	3.82

Key:

PM2.5 = fine particulate matter

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Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pleasant Grove-Verona Mutual Water Company		Peak Pumping by Transfer Period
Transfer Volume	8,000 acre-feet	(Apr-Jun)	4,757 AF/month
	7,000 acre-feet	(Jul-Sep)	2,667 AF/month
	15,000 acre-feet/year		

Table 67. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	13	20	0	2	35
Total	13	20	0	2	35

Table 68. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

Well	Well	Fuel Type	Model Year	Power Rating	Emission	Pump Rate		Transfer Volume		Operations		Fuel	Emission Factors						Daily Emissions						Annual Emissions					
	Location					Consumption (gal/yr) - diesel (MMBtu/yr) - propane	(g/bhp-hr) - diesel and VOC, NOx, and CO for propane (lb/MMBtu) - SOx, PM10, and PM2.5 for propane						(pounds per day)						(tons per year)											
							VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5						
Well	(County)			(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)																			
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	19	951	n/a																		
Kelly Windmill Field Well #2	Sutter	Electric	2002	62.1	n/a	2,000	2%	111	350	19	951	n/a																		
Kelly Windmill North Field Well	Sutter	Propane	2014	133	n/a	1,750	2%	97	306	2	951	321	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	0.46	0.92	1.84	0.00	0.01	0.01	0.14	0.28	0.56	0.00	0.00	0.00
Kelly306	Sutter	Electric	unknown	60	n/a	2,600	3%	144	455	19	951	n/a																		
MLF Clubhouse B Well	Sutter	Electric	unknown	300	n/a	3,700	4%	205	648	19	951	n/a																		
MLF Marsh Well	Sutter	Electric	unknown	300	n/a	3,700	4%	205	648	19	951	n/a																		
MLF Monster Well	Sutter	Electric	unknown	60	n/a	3,100	4%	172	543	19	951	n/a																		
MLF Well #1	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	19	951	n/a																		
MLF Well #16	Sutter	Electric	unknown	50	n/a	1,700	2%	94	298	19	951	n/a																		
MLF Well#11	Sutter	Diesel	2011	250	T4I	4,200	5%	233	735	14	951	13,332	0.14	0.30	2.61	0.93	0.01	0.01	1.12	2.36	20.68	7.36	0.12	0.12	0.04	0.08	0.68	0.24	0.00	0.00
MLF Well#12/17	Sutter	Electric	unknown	50	n/a	1,500	2%	83	263	19	951	n/a																		
MLF Well#13	Sutter	Electric	2000	215	n/a	4,800	6%	266	840	19	951	n/a																		
MLF Well#2B	Sutter	Electric	2000	300	n/a	3,700	4%	205	648	19	951	n/a																		
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas 72-Acree Field South	Sutter	Diesel	2008	62.1	T4I	2,000	2%	111	350	6	951	3,312	0.18	3.33	3.73	0.93	0.22	0.22	0.13	2.52	2.82	0.70	0.17	0.17	0.01	0.22	0.24	0.06	0.01	0.01
Nicholas BBC Well	Sutter	Electric	unknown	30	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas Filipino Camp South	Sutter	Diesel	2008	62.1	T4I	2,000	2%	111	350	6	951	3,312	0.18	3.33	3.73	0.93	0.22	0.22	0.13	2.52	2.82	0.70	0.17	0.17	0.01	0.22	0.24	0.06	0.01	0.01
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	n/a	2,000	2%	111	350	19	951	n/a																		
Nicholas Sand Field Well	Sutter	Diesel	2008	62.1	T4I	2,000	2%	111	350	6	951	3,312	0.18	3.33	3.73	0.93	0.22	0.22	0.13	2.52	2.82	0.70	0.17	0.17	0.01	0.22	0.24	0.06	0.01	0.01
RiverRanch#19	Sutter	Diesel	2012	99	T4I	2,000	2%	111	350	17	951	5,279	0.14	0.30	3.73	0.93	0.01	0.01	0.54	1.13	14.15	3.53	0.06	0.06	0.01	0.03	0.39	0.10	0.00	0.00
S&O#16	Sutter	Electric	2014	159	n/a	3,000	4%	167	525	19	951	n/a																		
S&O#17	Sutter	Diesel	2012	101	T4I	2,250	3%	125	394	17	951	5,386	0.14	0.30	3.73	0.93	0.01	0.01	0.55	1.15	14.41	3.59	0.06	0.06	0.02	0.03	0.39	0.10	0.00	0.00
S&O#18A	Sutter	Diesel	2012	101	T4I	1,800	2%	100	315	17	951	5,386	0.14	0.30	3.73	0.93	0.01	0.01	0.55	1.15	14.41	3.59	0.06	0.06	0.02	0.03	0.39	0.10	0.00	0.00
S&O#19	Sutter	Diesel	2011	215	T4I	2,150	3%	119	376	15	951	11,465	0.14	0.30	2.61	0.93	0.01	0.01	1.01	2.13	18.65	6.64	0.11	0.11	0.03	0.07	0.59	0.21	0.00	0.00
S&O#20	Sutter	Propane	2014	154	n/a	2,250	3%	125	394	0	951	372	1.0	2.0	4.0	5.88E-04	9.99E-03	9.99E-03	0.00	0.00	0.00	0.00	0.00	0.16	0.32	0.65	0.00	0.00	0.00	
Wiley#11	Sutter	Diesel	2012	168	T4I	3,000	4%	167	525	16	951	8,959	0.14	0.30	3.73	0.93	0.01	0.01	0.84	1.77	22.12	5.51	0.09	0.09	0.02	0.05	0.66	0.16	0.00	0.00
Wiley#2	Sutter	Diesel	2011	250	T4I	3,000	4%	167	525	14	951	13,332	0.14	0.30	2.61	0.93	0.01	0.01	1.12	2.36	20.68	7.36	0.12	0.12	0.04	0.08	0.68	0.24	0.00	0.00
Wiley#3	Sutter	Electric	unknown	75	n/a	2,000	2%	111	350	19	951	n/a																		
Wiley#4	Sutter	Diesel	2012	150	T4I	2,000	2%	111	350	16	951	7,999	0.14	0.30	3.73	0.93	0.01	0.01	0.77	1.62	20.19	5.03	0.08	0.08	0.02	0.05	0.59	0.15	0.00	0.00
Will-Lee Well#30	Sutter	Diesel	2012	100	T4I	2,500	3%	139	438	17	951	5,333	0.14	0.30	3.73	0.93	0.01	0.01	0.54	1.14	14.28	3.56	0.06	0.06	0.01	0.03	0.39	0.10	0.00	0.00
Will-Lee Well#31	Sutter	Electric	unknown	50	n/a	2,500	3%	139	438	19	951	n/a																		
Will-Lee Well#32	Sutter	Electric	unknown	300	n/a	2,500	3%	139	438	19	951	n/a																		
Will-Lee Well#33	Sutter	Electric	unknown	75	n/a	2,500	3%	139	438	19	951	n/a																		
Will-Lee Well#4A	Sutter	Diesel	2012	160	T4I	1,500	2%	83	263	16	951	8,532	0.14	0.30	3.73	0.93	0.01	0.01	0.81	1.70	21.27	5.30	0.09	0.09	0.02	0.05	0.63	0.16	0.00	0.00
Total						85,700	100%	4,757	15,000	567	33,270	95,632							8.71	25.00	191.15	53.59	1.34	1.34	0.57	1.75	7.32	1.73	0.07	0.07
Total (Sutter County)						85,700	100%	4,757	15,000	567	33,270	95,632							8.71	25.00	191.15	53.59	1.34	1.34	0.57	1.75	7.32	1.73	0.07	0.07

Key:
AF = acre-feet
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
NOx = nitrogen oxides
PM10 = inhalable particulate matter
PM2.5 = fine particulate matter
SOx = sulfur oxides
VOC = volatile organic compound

Federal Attainment Status

Sutter
PM10 A
PM2.5 N
O3 N
Engines subject to ATCM.

Peak Month

4,757 AF/month
34,722 gallons/minute
41% peak pump rate

Legend

	Emission factors from 40 CFR 60, Subpart JJJJ, Table 1 for Non-Emergency SI Lean Burn LPG engines, 100<=HP<500, manufactured after 7/1/2008
	Mitigation requirement

Conversion Factors

1 bhp-hr =	2,542.5 Btu
1 lb =	453.6 g
1 ton =	2,000 lbs
1 kW =	1.34 hp
1 day =	24 hours
1 month =	31 days
1 hour =	60 minutes
1 acre-foot =	325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

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CARB Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines

Table 69. Summary of the Emission Standards for New Stationary Diesel-Fueled CI Engines > 50 BHP used in Agricultural Operations

Horsepower Range	Diesel PM [1] (g/bhp-hr)	HC (g/bhp-hr)	NOx (g/bhp-hr)	NMHC+NOx (g/bhp-hr)	CO (g/bhp-hr)
50<HP<100	0.3				
100<=HP<175	0.22				
175<=HP	0.15				

Source: See Section 93115.8(a)

Notes:

[1] Less than or equal to the emission standard OR Off-Road CI Engine Certification Standard for an off-road engine of the maximum rated power, whichever is more stringent.

[2] Off-Road CI Engine Certification Standard for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard, or Tier 1 standards.

[3] Prior to January 1, 2008, these limits shall not apply to engines sold from one agricultural operation to another and funded under State or federal incentive.

Table 70. Emission Standards for Noncertified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower (HP) Range	Compliance Date [1]	PM (g/bhp-hr)	HC [2,3] (g/bhp-hr)	NOx [2,3] (g/bhp-hr)	NMHC+NOx [2,3] (g/bhp-hr)	CO [2,3] (g/bhp-hr)
50<HP<75	2011	0.3				
75<=HP<100	2011	0.3				
100<=HP<175	2010	0.22				
175<=HP<=750	2010	0.15				
750<HP	2014	0.075				

Source: See Sections 93115.8(b) (2) and (4)

Note:

[1] Compliance date on or after December 31

[2] Engine Certification Standards for off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in Title 13.

Table 71. Emission Standards Tier 1- and Tier 2-Certified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower Range (hp)	Compliance Date	PM (g/bhp-hr)	HC [2,3] (g/bhp-hr)	NOx [2,3] (g/bhp-hr)	NMHC+NOx [2,3] (g/bhp-hr)	CO [2,3] (g/bhp-hr)
50<HP<75	2015	0.02				
75<=HP<175	2015	0.01				
175<=hp<=750	2014	0.01				
750<HP	2014	0.075				

Source: See Sections 93115.8(b)(3) and (4)

Notes:

[1] Compliance date on or after December 31 or 12 years after the date of initial installation, whichever is later.

[2] Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in agricultural operation shall not exceed Tier 1 standards in Tier 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

Table 72. Tier 1, Tier 2, and Tier 3 Exhaust Emission Standards

Maximum Rated Power	Tier	Model Year	(g/kW-hr)					(g/hp-hr)				
			NOx	HC	NMHC+NOx	CO	PM	NOx	HC	NMHC+NOx	CO	PM
kW<8 hp <11	T1	2000-2004	-	-	10.5	8.0	1	-	-	7.8	6.0	0.7
	T2	2005 -2007	-	-	7.5	8.0	0.8	-	-	5.6	6.0	0.6
8≤kW<19 11≤hp<25	T1	2000-2004	-	-	9.5	6.6	0.8	-	-	7.1	4.9	0.6
	T2	2005 -2007	-	-	7.5	6.6	0.8	-	-	5.6	4.9	0.6
19≤kW<37 25≤hp<50	T1	2000-2003	-	-	9.5	5.5	0.8	-	-	7.1	4.1	0.6
	T2	2004 -2007	-	-	7.5	5.5	0.6	-	-	5.6	4.1	0.4
37≤kW<56 50≤hp<75	T1	2000-2003	9.2	-	-	-	-	6.9	-	-	-	-
	T2	2004-2007	-	-	7.5	5.0	0.4	-	-	5.6	3.7	0.3
	T3	2008 -2011	-	-	4.7	5.0	0.4	-	-	3.5	3.7	0.3
56≤kW<75 75≤hp<100	T1	2000-2003	9.2	-	-	-	-	6.9	-	-	-	-
	T2	2004-2007	-	-	7.5	5.0	0.4	-	-	5.6	3.7	0.3
	T3	2008-2011	-	-	4.7	5.0	0.4	-	-	3.5	3.7	0.3
75≤kW<130 100≤hp<175	T1	2000-2002	9.2	-	-	-	-	6.9	-	-	-	-
	T2	2003-2006	-	-	6.6	5.0	0.3	-	-	4.9	3.7	0.2
	T3	2007 -2011	-	-	4.0	5.0	0.3	-	-	3.0	3.7	0.2
130≤kW<225 175≤hp<300	T1	1996-2002	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2003-2005	-	-	6.6	3.5	0.2	-	-	4.9	2.6	0.1
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.1
225≤kW<450 300≤hp<600	T1	1996-2000	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2001-2005	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.1
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.1
450≤kW≤560 600≤hp<750	T1	1996-2001	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2002-2005	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.1
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.1
kW>560 hp>750	T1	2000-2005	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.4
	T2	2006 -2010	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.1

Source: Title 13, California Code of Regulations, Division 3, Chapter 9, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."

NOx and NMHC fraction - Table B-26

NOx 95%
NMHC 5%

http://www.arb.ca.gov/msprog/moyer/guidelines/cmp_guidelines_part4.pdf

PM Size Fractions

PM10 0.96
PM2.5 0.937
Ratio 0.98

CARB PMSIZE Profile No. 116 (STAT. I.C. ENGINE-DIESEL)

Table 73. Tier 4 Exhaust Emission Standards

MAXIMUM ENGINE POWER	MODEL YEAR	TYPE	PM	NMHC+NOx	NMHC	NOx	CO
			grams per horsepower-hour				
hp<11	2008 and later	FINAL	0.30	5.6	-	-	6.0
11<=hp<25							4.9
25<=hp<50	2008-2012	INTERIM	0.22	5.6	-	-	4.1
	2013 and later	FINAL	0.02	3.5			
50<=hp<75	2008-2012	INTERIM	0.22	3.5	-	-	3.7
	2013 and later	FINAL	0.02				
75<=hp<100	2012-2014	PHASE-IN	0.01	-	0.14	0.3	3.7
		PHASE-OUT		3.5	-	-	
		or/ ALT NOx			0.14	2.5	
	2015 and later	FINAL		-		0.3	
100<=hp<175	2012-2014	PHASE-IN	0.01	-	0.14	0.3	3.7
		PHASE-OUT		3.0	-	-	
		or/ ALT NOx		-	0.14	2.5	
	2015 and later	FINAL			0.14	0.3	
175<=hp<=750	2011-2013	PHASE-IN	0.01	-	0.14	0.3	2.6
	2014 and later	PHASE-OUT		3.0	-	-	
		or/ ALT NOx		-	0.14	1.5	
		FINAL				0.3	
750 hp<GEN<=1205 hp	2011-2014	INTERIM	0.07	-	0.30	2.6	2.6
	2015 and later	FINAL	0.02		0.14	0.5	
GEN>1205 hp	2011-2014	INTERIM	0.07	-	0.30		2.6
	2015 and later	FINAL	0.02		0.14	0.5	
ELSE>750 hp	2011-2014	INTERIM	0.07	-	0.30	2.6	2.6
	2015 and later	FINAL	0.03	-	0.14		

Source: Title 13, California Code of Regulations, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."

Table 74. Engine Tier Matrix

HP Range	Year																			
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
hp <11	T0	T0	T0	T0	T1	T1	T1	T1	T1	T2	T2	T2	T4	T4	T4	T4	T4	T4	T4	T4
11<=hp<25	T0	T0	T0	T0	T1	T1	T1	T1	T1	T2	T2	T2	T4	T4	T4	T4	T4	T4	T4	T4
25<=hp<50	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4I	T4	T4	T4
50<=hp<75	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4I	T4	T4	T4
75<=hp<100	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T4I	T4I	T4I	T4
100<=hp<175	T0	T0	T0	T0	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4
175<=hp<300	T1	T1	T1	T1	T1	T1	T1	T2	T2	T2	T3	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4
300<=hp<600	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T3	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4
600<=hp<750	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4
hp>750	T0	T0	T0	T0	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T2	T4I	T4I	T4I	T4

Key:

T0 = Tier 0 (Noncertified)
T1 = Tier 1
T2 = Tier 2
T3 = Tier 3
T4 = Tier 4
T4I = Tier 4 Interim

AP-42 Emission Factors

Table 75. Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines [a]

Pollutant	Gasoline Fuel		Diesel Fuel		Emission Factor Rating
	Emission Factor		Emission Factor		
	(lb/hp-hr) (power output)	(lb/MMBtu) (fuel input)	(lb/hp-hr) (power output)	(lb/MMBtu) (fuel input)	
NOx	0.011	1.63	0.031	4.41	D
CO	6.96E-03 [d]	0.99 [d]	6.68E-03	0.95	D
SOx	5.91E-04	0.084	2.05E-03	0.29	D
PM-10 [b]	7.21E-04	0.1	2.20E-03	0.31	D
CO2 [c]	1.08	154	1.15	164	B
Aldehydes	4.85E-04	0.07	4.63E-04	0.07	D
TOC					
Exhaust	0.015	2.1	2.47E-03	0.35	D
Evaporative	6.61E-04	0.09	0.00	0.00	E
Crankcase	4.85E-03	0.69	4.41E-05	0.01	E
Refueling	1.08E-03	0.15	0.00	0.00	E

Source: U.S. Environmental Protection Agency. 1996. *Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.3: Gasoline and Diesel Industrial Engines.*

Notes:

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kwhr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 :m aerodynamic diameter. All particulate is assumed to be 10 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

[d] Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009

For large stationary diesel engines (greater than 600 horsepower [hp]) see Chapter 3.4: Large Stationary Diesel and All Stationary Dual-Fuel Engines.

Table 76. Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines [a]

Pollutant	Emission Factor (lb/MMBtu) [b] (fuel input)	Emission Factor Rating
NOx [c] 90 - 105% Load	4.08E+00	B
NOx [c] <90% Load	8.47E-01	B
CO [c] 90 - 105% Load	3.17E-01	C
CO [c] <90% Load	5.57E-01	B
CO2 [d]	1.10E+02	A
SO2 [e]	5.88E-04	A
TOC [f]	1.47E+00	A
Methane[g]	1.25E+00	C
VOC [h]	1.18E-01	C
PM10 (filterable) [i]	7.71E-05	D
PM2.5 (filterable) [i]	7.71E-05	D
PM Condensable [j]	9.91E-03	D

Source: U.S. Environmental Protection Agency. 2000. *Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.2: Natural Gas-Fired Reciprocating Engines. July.*
Notes:

[a] Reference 7. Factors represent uncontrolled levels. For NOx, CO, and PM10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, the data set may include units with control techniques used for NOx control, such as PCC"uncontrolled" means no oxidation control; and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter ≤ 10 microns (μ) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10⁶ scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$\text{lb/hp-hr} = (\text{lb/MMBtu}) (\text{heat input, MMBtu/hr}) (1/\text{operating HP, 1/hp})$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO2. $\text{CO}_2 [\text{lb/MMBtu}] = (3.67)(\% \text{CON})(C)(D)(1/h)$, where %CON = percent conversion of fuel carbon to CO2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10⁶ scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60EF).

[e] Based on 100% conversion of fuel sulfur to SO2. Assumes sulfur content in natural gas of 2,000 gr/10⁶scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered ≤ 1 μ in aerodynamic diameter. Therefore, for filterable PM emissions, $\text{PM}_{10}(\text{filterable}) = \text{PM}_{2.5}(\text{filterable})$.

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

Engine Size Summary

Table 77. Engine Power Rating Summary by Fuel Type

Fuel Type	No. Engines	Avg. HP	Max HP	Min HP
Diesel	23	170	250	60
Electric	47	125	300	30
Natural Gas	0	n/a	0	0
Propane	3	180	250	135

Summary of Crop Idling Emissions by Air District

Table 78. Reduced Exhaust Emissions from Cropland Idling

Air District	Peak Daily Emissions (lbs/day)						Annual Project Emissions (tpy)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Colusa County APCD												
Canal Farms	(0)	(5)	(6)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Eastside Mutual Water Company	(1)	(14)	(18)	(4)	(1)	(1)	(0)	(0)	(1)	(0)	(0)	(0)
Glenn-Colusa Irrigation District	(13)	(244)	(321)	(80)	(19)	(19)	(0)	(9)	(11)	(3)	(1)	(1)
Maxwell Irrigation District	(1)	(18)	(23)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Princeton-Codora-Glenn Irrigation District	(1)	(11)	(15)	(4)	(1)	(1)	(0)	(0)	(1)	(0)	(0)	(0)
Provident Irrigation District	(1)	(11)	(15)	(4)	(1)	(1)	(0)	(0)	(1)	(0)	(0)	(0)
Reclamation District 108	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(3)	(1)	(0)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Sycamore Mutual Water Company	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(3)	(1)	(0)	(0)
T&P Farms	(0)	(7)	(9)	(2)	(1)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
Colusa County APCD Subtotal	(26)	(487)	(641)	(160)	(38)	(38)	(1)	(17)	(23)	(6)	(1)	(1)
Glenn County APCD												
Glenn-Colusa Irrigation District	(13)	(244)	(321)	(80)	(19)	(19)	(0)	(9)	(11)	(3)	(1)	(1)
Princeton-Codora-Glenn Irrigation District	(1)	(11)	(15)	(4)	(1)	(1)	(0)	(0)	(1)	(0)	(0)	(0)
Provident Irrigation District	(1)	(11)	(15)	(4)	(1)	(1)	(0)	(0)	(1)	(0)	(0)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Glenn County APCD Subtotal	(16)	(297)	(391)	(97)	(23)	(23)	(1)	(10)	(14)	(3)	(1)	(1)
Feather River AQMD												
Burroughs Farms	0	0	0	0	0	0	0	0	0	0	0	0
Cranmore Farms	0	0	0	0	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(1)	(19)	(25)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Pleasant Grove-Verona Mutual Water Company	(4)	(67)	(88)	(22)	(5)	(5)	(0)	(2)	(3)	(1)	(0)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Sutter Mutual Water Company	(7)	(133)	(175)	(44)	(11)	(11)	(0)	(5)	(6)	(2)	(0)	(0)
Feather River AQMD Subtotal	(13)	(249)	(328)	(82)	(20)	(20)	(0)	(9)	(12)	(3)	(1)	(1)
Yolo-Solano AQMD												
Conaway Preservation Group	(8)	(158)	(208)	(52)	(12)	(12)	(0)	(6)	(7)	(2)	(0)	(0)
Reclamation District 108	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(3)	(1)	(0)	(0)
River Garden Farms	(1)	(26)	(34)	(8)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Te Velde Revocable Family Trust	(3)	(52)	(68)	(17)	(4)	(4)	(0)	(2)	(2)	(1)	(0)	(0)
Yolo-Solano AQMD Subtotal	(16)	(309)	(407)	(101)	(24)	(24)	(1)	(11)	(14)	(4)	(1)	(1)
GRAND TOTAL	(71)	(1,343)	(1,767)	(440)	(106)	(106)	(2)	(47)	(62)	(16)	(4)	(4)

Note:

No cropland idling would occur in Sacramento, Shasta, and Tehama Counties.

Table 79. Reduced Peak Daily Fugitive Dust Emissions from Cropland Idling

Air District	Peak Daily PM10 Emissions (lbs/day)				Peak Daily PM2.5 Emissions (lbs/day)			
	Land Prep	Harvest	Wind Erosion	Total	Land Prep	Harvest	Wind Erosion	Total
Colusa County APCD								
Canal Farms	(11)	(1)	2	(9)	(2)	(0)	0	(1)
Eastside Mutual Water Company	(31)	(3)	7	(26)	(5)	(0)	1	(4)
Glenn-Colusa Irrigation District	(548)	(46)	132	(462)	(82)	(7)	26	(63)
Maxwell Irrigation District	(40)	(3)	9	(34)	(6)	(1)	2	(5)
Princeton-Codora-Glenn Irrigation District	(25)	(2)	6	(21)	(4)	(0)	1	(3)
Provident Irrigation District	(25)	(2)	6	(21)	(4)	(0)	1	(3)
Reclamation District 108	(166)	(14)	22	(158)	(25)	(2)	4	(23)
Reclamation District 1004	(69)	(6)	12	(63)	(10)	(1)	2	(9)
Sycamore Mutual Water Company	(166)	(14)	39	(141)	(25)	(2)	8	(19)
T&P Farms	(15)	(1)	3	(13)	(2)	(0)	1	(2)
Colusa County APCD Subtotal	(1,095)	(92)	240	(947)	(164)	(14)	48	(130)
Glenn County APCD								
Glenn-Colusa Irrigation District	(548)	(46)	132	(462)	(82)	(7)	26	(63)
Princeton-Codora-Glenn Irrigation District	(25)	(2)	6	(21)	(4)	(0)	1	(3)
Provident Irrigation District	(25)	(2)	6	(21)	(4)	(0)	1	(3)
Reclamation District 1004	(69)	(6)	12	(63)	(10)	(1)	2	(9)
Glenn County APCD Subtotal	(667)	(56)	156	(567)	(100)	(8)	31	(77)
Feather River AQMD								
Burroughs Farms	0	0	0	0	0	0	0	0
Cranmore Farms	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(42)	(4)	1	(45)	(6)	(1)	0	(7)
Pleasant Grove-Verona Mutual Water Company	(149)	(13)	3	(159)	(22)	(2)	1	(24)
Reclamation District 1004	(69)	(6)	12	(63)	(10)	(1)	2	(9)
Sutter Mutual Water Company	(299)	(25)	6	(318)	(45)	(4)	1	(47)
Feather River AQMD Subtotal	(518)	(43)	20	(541)	(78)	(7)	4	(80)
Yolo-Solano AQMD								
Conaway Preservation Group	(355)	(30)	11	(373)	(53)	(4)	2	(55)
Reclamation District 108	(166)	(14)	22	(158)	(25)	(2)	4	(23)
River Garden Farms	(58)	(5)	2	(61)	(9)	(1)	0	(9)
Te Velde Revocable Family Trust	(116)	(10)	4	(122)	(17)	(1)	1	(18)
Yolo-Solano AQMD Subtotal	(694)	(58)	38	(714)	(104)	(9)	8	(105)
GRAND TOTAL	(2,974)	(250)	454	(2,770)	(446)	(37)	91	(392)

Note:

No cropland idling would occur in Sacramento, Shasta, and Tehama Counties.

Table 80. Reduced Annual Fugitive Dust Emissions from Cropland Idling

Air District	Annual PM10 Emissions (tpy)				Annual PM2.5 Emissions (tpy)			
	Land Prep	Harvest	Wind Erosion	Total	Land Prep	Harvest	Wind Erosion	Total
Colusa County APCD								
Canal Farms	(1)	(0)	0	(1)	(0)	(0)	0	(0)
Eastside Mutual Water Company	(3)	(0)	1	(2)	(0)	(0)	0	(0)
Glenn-Colusa Irrigation District	(49)	(4)	12	(42)	(7)	(1)	2	(6)
Maxwell Irrigation District	(4)	(0)	1	(3)	(1)	(0)	0	(0)
Princeton-Codora-Glenn Irrigation District	(2)	(0)	1	(2)	(0)	(0)	0	(0)
Provident Irrigation District	(2)	(0)	1	(2)	(0)	(0)	0	(0)
Reclamation District 108	(15)	(1)	2	(14)	(2)	(0)	0	(2)
Reclamation District 1004	(6)	(1)	1	(6)	(1)	(0)	0	(1)
Sycamore Mutual Water Company	(15)	(1)	4	(13)	(2)	(0)	1	(2)
T&P Farms	(1)	(0)	0	(1)	(0)	(0)	0	(0)
Colusa County APCD Subtotal	(99)	(8)	22	(85)	(15)	(1)	4	(12)
Glenn County APCD								
Glenn-Colusa Irrigation District	(49)	(4)	12	(42)	(7)	(1)	2	(6)
Princeton-Codora-Glenn Irrigation District	(2)	(0)	1	(2)	(0)	(0)	0	(0)
Provident Irrigation District	(2)	(0)	1	(2)	(0)	(0)	0	(0)
Reclamation District 1004	(6)	(1)	1	(6)	(1)	(0)	0	(1)
Glenn County APCD Subtotal	(60)	(5)	14	(51)	(9)	(1)	3	(7)
Feather River AQMD								
Burroughs Farms	0	0	0	0	0	0	0	0
Cranmore Farms	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(4)	(0)	0	(4)	(1)	(0)	0	(1)
Pleasant Grove-Verona Mutual Water Company	(13)	(1)	0	(14)	(2)	(0)	0	(2)
Reclamation District 1004	(6)	(1)	1	(6)	(1)	(0)	0	(1)
Sutter Mutual Water Company	(27)	(2)	0	(29)	(4)	(0)	0	(4)
Feather River AQMD Subtotal	(47)	(4)	2	(49)	(7)	(1)	0	(7)
Yolo-Solano AQMD								
Conaway Preservation Group	(32)	(3)	1	(34)	(5)	(0)	0	(5)
Reclamation District 108	(15)	(1)	2	(14)	(2)	(0)	0	(2)
River Garden Farms	(5)	(0)	0	(6)	(1)	(0)	0	(1)
Te Velde Revocable Family Trust	(10)	(1)	0	(11)	(2)	(0)	0	(2)
Yolo-Solano AQMD Subtotal	(63)	(5)	3	(64)	(9)	(1)	1	(9)
GRAND TOTAL	(268)	(22)	41	(249)	(40)	(3)	8	(35)

Note:

No cropland idling would occur in Sacramento, Shasta, and Tehama Counties.

Table 81. Combined Emissions by Air District

Air District	Peak Daily Emissions (lbs/day)						Annual Project Emissions (tpy)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Colusa County APCD												
Canal Farms	(0)	(5)	(6)	(2)	(9)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Eastside Mutual Water Company	(1)	(14)	(18)	(4)	(27)	(5)	(0)	(0)	(1)	(0)	(2)	(0)
Glenn-Colusa Irrigation District	(13)	(244)	(321)	(80)	(481)	(82)	(0)	(9)	(11)	(3)	(42)	(6)
Maxwell Irrigation District	(1)	(18)	(23)	(6)	(35)	(6)	(0)	(1)	(1)	(0)	(3)	(0)
Princeton-Codora-Glenn Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Provident Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(3)	(1)	(14)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Sycamore Mutual Water Company	(4)	(74)	(97)	(24)	(147)	(25)	(0)	(3)	(3)	(1)	(13)	(2)
T&P Farms	(0)	(7)	(9)	(2)	(13)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Colusa County APCD Subtotal	(26)	(487)	(641)	(160)	(986)	(168)	(1)	(17)	(23)	(6)	(87)	(13)
Glenn County APCD												
Glenn-Colusa Irrigation District	(13)	(244)	(321)	(80)	(481)	(82)	(0)	(9)	(11)	(3)	(42)	(6)
Princeton-Codora-Glenn Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Provident Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Glenn County APCD Subtotal	(16)	(297)	(391)	(97)	(590)	(101)	(1)	(10)	(14)	(3)	(52)	(8)
Feather River AQMD												
Burroughs Farms	0	0	0	0	0	0	0	0	0	0	0	0
Cranmore Farms	0	0	0	0	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(1)	(19)	(25)	(6)	(46)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Pleasant Grove-Verona Mutual Water Company	(4)	(67)	(88)	(22)	(164)	(29)	(0)	(2)	(3)	(1)	(15)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Sutter Mutual Water Company	(7)	(133)	(175)	(44)	(329)	(58)	(0)	(5)	(6)	(2)	(29)	(5)
Feather River AQMD Subtotal	(12)	(230)	(303)	(76)	(559)	(98)	(0)	(8)	(11)	(3)	(49)	(8)
Yolo-Solano AQMD												
Conaway Preservation Group	(8)	(158)	(208)	(52)	(386)	(68)	(0)	(6)	(7)	(2)	(34)	(5)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(3)	(1)	(14)	(2)
River Garden Farms	(1)	(26)	(34)	(8)	(63)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Te Velde Revocable Family Trust	(3)	(52)	(68)	(17)	(126)	(22)	(0)	(2)	(2)	(1)	(11)	(2)
Yolo-Solano AQMD Subtotal	(16)	(309)	(407)	(101)	(739)	(130)	(1)	(11)	(14)	(4)	(65)	(10)
GRAND TOTAL	(70)	(1,324)	(1,742)	(434)	(2,874)	(497)	(2)	(47)	(61)	(15)	(253)	(39)

Table 82. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Anderson-Cottonwood Irrigation District												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	--
Anderson-Cottonwood Irrigation District Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Burroughs Farms												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	--
Burroughs Farms Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Canal Farms												
Exhaust Emissions	(0)	(5)	(6)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(11)	(2)	--	--	--	--	(1)	(0)
Harvesting	--	--	--	--	(1)	(0)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	2	0	--	--	--	--	0	0
Canal Farms Subtotal	(0)	(5)	(6)	(2)	(9)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Conaway Preservation Group												
Exhaust Emissions	(8)	(158)	(208)	(52)	(12)	(12)	(0)	(6)	(7)	(2)	(0)	(0)
Land Preparation	--	--	--	--	(355)	(53)	--	--	--	--	(32)	(5)
Harvesting	--	--	--	--	(30)	(4)	--	--	--	--	(3)	(0)
Wind Erosion	--	--	--	--	11	2	--	--	--	--	1	0
Conaway Preservation Group Subtotal	(8)	(158)	(208)	(52)	(386)	(68)	(0)	(6)	(7)	(2)	(34)	(5)
Cranmore Farms												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	--
Cranmore Farms Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Eastside Mutual Water Company												
Exhaust Emissions	(1)	(14)	(18)	(4)	(1)	(1)	(0)	(0)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(31)	(5)	--	--	--	--	(3)	(0)
Harvesting	--	--	--	--	(3)	(0)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	7	1	--	--	--	--	1	0
Eastside Mutual Water Company Subtotal	(1)	(14)	(18)	(4)	(27)	(5)	(0)	(0)	(1)	(0)	(2)	(0)
Glenn-Colusa Irrigation District												
Exhaust Emissions	(26)	(488)	(642)	(160)	(39)	(39)	(1)	(17)	(23)	(6)	(1)	(1)
Land Preparation	--	--	--	--	(1,096)	(164)	--	--	--	--	(99)	(15)
Harvesting	--	--	--	--	(92)	(14)	--	--	--	--	(8)	(1)
Wind Erosion	--	--	--	--	265	53	--	--	--	--	24	5
Glenn-Colusa Irrigation District Subtotal	(26)	(488)	(642)	(160)	(962)	(164)	(1)	(17)	(23)	(6)	(84)	(13)

Table 82. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Maxwell Irrigation District												
Exhaust Emissions	(1)	(18)	(23)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(40)	(6)	--	--	--	--	(4)	(1)
Harvesting	--	--	--	--	(3)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	9	2	--	--	--	--	1	0
Maxwell Irrigation District Subtotal	(1)	(18)	(23)	(6)	(35)	(6)	(0)	(1)	(1)	(0)	(3)	(0)
Natomas Central Mutual Water Company												
Exhaust Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Land Preparation	--	--	--	--	0	0	--	--	--	--	0	0
Harvesting	--	--	--	--	0	0	--	--	--	--	0	0
Wind Erosion	--	--	--	--	--	--	--	--	--	--	--	--
Natomas Central Mutual Water Company Subtotal	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company												
Exhaust Emissions	(1)	(19)	(25)	(6)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(42)	(6)	--	--	--	--	(4)	(1)
Harvesting	--	--	--	--	(4)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	1	0	--	--	--	--	0	0
Pelger Mutual Water Company Subtotal	(1)	(19)	(25)	(6)	(46)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Pleasant Grove-Verona Mutual Water Company												
Exhaust Emissions	(4)	(67)	(88)	(22)	(5)	(5)	(0)	(2)	(3)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(149)	(22)	--	--	--	--	(13)	(2)
Harvesting	--	--	--	--	(13)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	3	1	--	--	--	--	0	0
Pleasant Grove-Verona Mutual Water Company Subtotal	(4)	(67)	(88)	(22)	(164)	(29)	(0)	(2)	(3)	(1)	(15)	(2)
Princeton-Codora-Glenn Irrigation District												
Exhaust Emissions	(1)	(22)	(29)	(7)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(50)	(7)	--	--	--	--	(4)	(1)
Harvesting	--	--	--	--	(4)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	12	2	--	--	--	--	1	0
Princeton-Codora-Glenn Irrigation District Subtotal	(1)	(22)	(29)	(7)	(44)	(7)	(0)	(1)	(1)	(0)	(4)	(1)
Provident Irrigation District												
Exhaust Emissions	(1)	(22)	(29)	(7)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(50)	(7)	--	--	--	--	(4)	(1)
Harvesting	--	--	--	--	(4)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	12	2	--	--	--	--	1	0
Provident Irrigation District Subtotal	(1)	(22)	(29)	(7)	(44)	(7)	(0)	(1)	(1)	(0)	(4)	(1)
Reclamation District 108												
Exhaust Emissions	(8)	(148)	(195)	(48)	(12)	(12)	(0)	(5)	(7)	(2)	(0)	(0)
Land Preparation	--	--	--	--	(332)	(50)	--	--	--	--	(30)	(4)
Harvesting	--	--	--	--	(28)	(4)	--	--	--	--	(3)	(0)
Wind Erosion	--	--	--	--	44	9	--	--	--	--	4	1
Reclamation District 108 Subtotal	(8)	(148)	(195)	(48)	(327)	(57)	(0)	(5)	(7)	(2)	(29)	(4)

Table 82. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Reclamation District 1004												
Exhaust Emissions	(5)	(92)	(122)	(30)	(7)	(7)	(0)	(3)	(4)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(208)	(31)	--	--	--	--	(19)	(3)
Harvesting	--	--	--	--	(17)	(3)	--	--	--	--	(2)	(0)
Wind Erosion	--	--	--	--	35	7	--	--	--	--	3	1
Reclamation District 1004 Subtotal	(5)	(92)	(122)	(30)	(198)	(34)	(0)	(3)	(4)	(1)	(17)	(3)
River Garden Farms												
Exhaust Emissions	(1)	(26)	(34)	(8)	(2)	(2)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(58)	(9)	--	--	--	--	(5)	(1)
Harvesting	--	--	--	--	(5)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	2	0	--	--	--	--	0	0
River Garden Farms Subtotal	(1)	(26)	(34)	(8)	(63)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Sutter Mutual Water Company												
Exhaust Emissions	(7)	(133)	(175)	(44)	(11)	(11)	(0)	(5)	(6)	(2)	(0)	(0)
Land Preparation	--	--	--	--	(299)	(45)	--	--	--	--	(27)	(4)
Harvesting	--	--	--	--	(25)	(4)	--	--	--	--	(2)	(0)
Wind Erosion	--	--	--	--	6	1	--	--	--	--	0	0
Sutter Mutual Water Company Subtotal	(7)	(133)	(175)	(44)	(329)	(58)	(0)	(5)	(6)	(2)	(29)	(5)
Sycamore Mutual Water Company												
Exhaust Emissions	(4)	(74)	(97)	(24)	(6)	(6)	(0)	(3)	(3)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(166)	(25)	--	--	--	--	(15)	(2)
Harvesting	--	--	--	--	(14)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	39	8	--	--	--	--	4	1
Sycamore Mutual Water Company Subtotal	(4)	(74)	(97)	(24)	(147)	(25)	(0)	(3)	(3)	(1)	(13)	(2)
T&P Farms												
Exhaust Emissions	(0)	(7)	(9)	(2)	(1)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(15)	(2)	--	--	--	--	(1)	(0)
Harvesting	--	--	--	--	(1)	(0)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	3	1	--	--	--	--	0	0
T&P Farms Subtotal	(0)	(7)	(9)	(2)	(13)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Te Velde Revocable Family Trust												
Exhaust Emissions	(3)	(52)	(68)	(17)	(4)	(4)	(0)	(2)	(2)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(116)	(17)	--	--	--	--	(10)	(2)
Harvesting	--	--	--	--	(10)	(1)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	4	1	--	--	--	--	0	0
Te Velde Revocable Family Trust Subtotal	(3)	(52)	(68)	(17)	(126)	(22)	(0)	(2)	(2)	(1)	(11)	(2)
Exhaust Emissions Total	(71)	(1,343)	(1,767)	(440)	(106)	(106)	(2)	(47)	(62)	(16)	(4)	(4)
Land Preparation Total	0	0	0	0	(3,016)	(452)	0	0	0	0	(271)	(41)
Harvesting Total	0	0	0	0	(253)	(38)	0	0	0	0	(23)	(3)
Wind Erosion Total	0	0	0	0	455	91	0	0	0	0	41	8
GRAND TOTAL	(71)	(1,343)	(1,767)	(440)	(2,921)	(505)	(2)	(47)	(62)	(16)	(257)	(40)

Table 83. Summary of Cropland Idling Emissions by County

County	Daily Emissions (lbs/day)						Annual Emissions (tons/yr)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Colusa												
Canal Farms	(0)	(5)	(6)	(2)	(9)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Eastside Mutual Water Company	(1)	(14)	(18)	(4)	(27)	(5)	(0)	(0)	(1)	(0)	(2)	(0)
Glenn-Colusa Irrigation District	(13)	(244)	(321)	(80)	(481)	(82)	(0)	(9)	(11)	(3)	(42)	(6)
Maxwell Irrigation District	(1)	(18)	(23)	(6)	(35)	(6)	(0)	(1)	(1)	(0)	(3)	(0)
Princeton-Codora-Glenn Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Provident Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(3)	(1)	(14)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Sycamore Mutual Water Company	(4)	(74)	(97)	(24)	(147)	(25)	(0)	(3)	(3)	(1)	(13)	(2)
T&P Farms	(0)	(7)	(9)	(2)	(13)	(2)	(0)	(0)	(0)	(0)	(1)	(0)
Colusa Subtotal	(26)	(487)	(641)	(160)	(986)	(168)	(1)	(17)	(23)	(6)	(87)	(13)
Glenn												
Glenn-Colusa Irrigation District	(13)	(244)	(321)	(80)	(481)	(82)	(0)	(9)	(11)	(3)	(42)	(6)
Princeton-Codora-Glenn Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Provident Irrigation District	(1)	(11)	(15)	(4)	(22)	(4)	(0)	(0)	(1)	(0)	(2)	(0)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Glenn Subtotal	(16)	(297)	(391)	(97)	(590)	(101)	(1)	(10)	(14)	(3)	(52)	(8)
Sutter												
Burroughs Farms	0	0	0	0	0	0	0	0	0	0	0	0
Cranmore Farms	0	0	0	0	0	0	0	0	0	0	0	0
Natomas Central Mutual Water Company	0	0	0	0	0	0	0	0	0	0	0	0
Pelger Mutual Water Company	(1)	(19)	(25)	(6)	(46)	(8)	(0)	(1)	(1)	(0)	(4)	(1)
Pleasant Grove-Verona Mutual Water Company	(4)	(67)	(88)	(22)	(164)	(29)	(0)	(2)	(3)	(1)	(15)	(2)
Reclamation District 1004	(2)	(31)	(41)	(10)	(66)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Sutter Mutual Water Company	(7)	(133)	(175)	(44)	(329)	(58)	(0)	(5)	(6)	(2)	(29)	(5)
Sutter Subtotal	(13)	(249)	(328)	(82)	(606)	(106)	(0)	(9)	(12)	(3)	(53)	(9)
Yolo												
Conaway Preservation Group	(8)	(158)	(208)	(52)	(386)	(68)	(0)	(6)	(7)	(2)	(34)	(5)
Reclamation District 108	(4)	(74)	(97)	(24)	(164)	(28)	(0)	(3)	(3)	(1)	(14)	(2)
River Garden Farms	(1)	(26)	(34)	(8)	(63)	(11)	(0)	(1)	(1)	(0)	(6)	(1)
Te Velde Revocable Family Trust	(3)	(52)	(68)	(17)	(126)	(22)	(0)	(2)	(2)	(1)	(11)	(2)
Yolo Subtotal	(16)	(309)	(407)	(101)	(739)	(130)	(1)	(11)	(14)	(4)	(65)	(10)
GRAND TOTAL	(71)	(1,343)	(1,767)	(440)	(2,921)	(505)	(2)	(47)	(62)	(16)	(257)	(40)

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Table 84. Reduced Exhaust Emissions from Cropland Idling

Water Agency	Groundwater Substitution (acre-feet/year)	Cropland Idling/ Crop Shifting (acre-feet/year)	GW Pumping Equivalent (acre-feet/year)	Reduced Daily Emissions (lbs/day)						Reduced Annual Emissions (tons/year)					
				VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Anderson-Cottonwood Irrigation District	4,800	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burroughs Farms	2,000	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Canal Farms	1,000	635	149	0.25	4.68	6.16	1.53	0.37	0.37	0.01	0.16	0.22	0.05	0.01	0.01
Conaway Preservation Group	5,368	21,350	5,024	8.31	157.83	207.68	51.75	12.46	12.46	0.29	5.56	7.31	1.82	0.44	0.44
Cranmore Farms	3,400	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eastside Mutual Water Company	2,230	1,846	434	0.72	13.63	17.94	4.47	1.08	1.08	0.03	0.48	0.63	0.16	0.04	0.04
Glenn-Colusa Irrigation District	10,000	66,000	15,529	25.68	487.86	641.92	159.97	38.52	38.52	0.90	17.18	22.60	5.63	1.36	1.36
Maxwell Irrigation District	3,600	2,400	565	0.93	17.75	23.36	5.82	1.40	1.40	0.03	0.62	0.82	0.20	0.05	0.05
Natomas Central Mutual Water Company	20,000	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pelger Mutual Water Company	4,670	2,538	597	0.99	18.76	24.68	6.15	1.48	1.48	0.03	0.66	0.87	0.22	0.05	0.05
Pleasant Grove-Verona Mutual Water Company	15,000	9,000	2,118	3.50	66.54	87.55	21.82	5.25	5.25	0.12	2.34	3.08	0.77	0.18	0.18
Princeton-Codora-Glenn Irrigation District	5,000	3,000	706	1.17	22.18	29.18	7.27	1.75	1.75	0.04	0.78	1.03	0.26	0.06	0.06
Provident Irrigation District	6,000	3,000	706	1.17	22.18	29.18	7.27	1.75	1.75	0.04	0.78	1.03	0.26	0.06	0.06
Reclamation District 108	15,000	20,000	4,706	7.78	147.84	194.53	48.48	11.67	11.67	0.27	5.21	6.85	1.71	0.41	0.41
Reclamation District 1004	7,175	12,500	2,941	4.86	92.39	121.57	30.30	7.29	7.29	0.17	3.25	4.28	1.07	0.26	0.26
River Garden Farms	9,000	3,500	824	1.36	25.89	34.06	8.49	2.04	2.04	0.05	0.91	1.20	0.30	0.07	0.07
Sutter Mutual Water Company	0	18,000	4,235	7.00	133.05	175.06	43.63	10.50	10.50	0.25	4.68	6.16	1.54	0.37	0.37
Sycamore Mutual Water Company	11,300	10,000	2,353	3.89	73.92	97.27	24.24	5.84	5.84	0.14	2.60	3.42	0.85	0.21	0.21
T&P Farms	1,200	890	209	0.35	6.57	8.64	2.15	0.52	0.52	0.01	0.23	0.30	0.08	0.02	0.02
Te Velde Revocable Family Trust	7,094	6,975	1,641	2.71	51.55	67.83	16.90	4.07	4.07	0.10	1.82	2.39	0.60	0.14	0.14
Total	133,837	181,634	42,737	70.66	1,342.63	1,766.62	440.26	106.00	106.00	2.49	47.27	62.20	15.50	3.73	3.73

Notes:
Pelger Mutual Water District used to estimate emissions for other water agencies.
Engine power rating equal to 250 hp for Pelger Mutual Water District engines.
The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).
Pelger Mutual Water District engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing
Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."

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Fugitive Dust Emissions from Cropland Idling

Table 85. Land Preparation (Reduced Emissions)

District	County	Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
		Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	0	0
Burroughs Farms	Sutter	0	0	0
Canal Farms	Colusa	192	11	1
Conaway Preservation Group	Yolo	6,470	355	32
Cranmore Farms	Sutter	0	0	0
Eastside Mutual Water Company	Colusa	559	31	3
Glenn-Colusa Irrigation District	Glenn/Colusa	20,000	1,096	99
Maxwell Irrigation District	Colusa	727	40	4
Natomas Central Mutual Water Company	Sacramento/Sutter	0	0	0
Pelger Mutual Water Company	Sutter	769	42	4
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	149	13
Princeton-Codora-Glenn Irrigation District	Glenn/Colusa	909	50	4
Provident Irrigation District	Glenn/Colusa	909	50	4
Reclamation District 108	Colusa/Yolo	6,061	332	30
Reclamation District 1004	Glenn/Colusa/Sutter	3,788	208	19
River Garden Farms	Yolo	1,061	58	5
Sutter Mutual Water Company	Sutter	5,455	299	27
Sycamore Mutual Water Company	Colusa	3,030	166	15
T&P Farms	Colusa	270	15	1
Te Velde Revocable Family Trust	Yolo	2,114	116	10
Total		55,041	3,016	271

Table 86. Harvesting (Reduced Emissions)

District	County	Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
		Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	0	0
Burroughs Farms	Sutter	0	0	0
Canal Farms	Colusa	192	1	0
Conaway Preservation Group	Yolo	6,470	30	3
Cranmore Farms	Sutter	0	0	0
Eastside Mutual Water Company	Colusa	559	3	0
Glenn-Colusa Irrigation District	Glenn/Colusa	20,000	92	8
Maxwell Irrigation District	Colusa	727	3	0
Natomas Central Mutual Water Company	Sacramento/Sutter	0	0	0
Pelger Mutual Water Company	Sutter	769	4	0
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	13	1
Princeton-Codora-Glenn Irrigation District	Glenn/Colusa	909	4	0
Provident Irrigation District	Glenn/Colusa	909	4	0
Reclamation District 108	Colusa/Yolo	6,061	28	3
Reclamation District 1004	Glenn/Colusa/Sutter	3,788	17	2
River Garden Farms	Yolo	1,061	5	0
Sutter Mutual Water Company	Sutter	5,455	25	2
Sycamore Mutual Water Company	Colusa	3,030	14	1
T&P Farms	Colusa	270	1	0
Te Velde Revocable Family Trust	Yolo	2,114	10	1
Total		55,041	253	23

Table 87. Windblown Dust (Increased Emissions)

		Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
District	County	Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	--	--
Burroughs Farms	Sutter	0	--	--
Canal Farms	Colusa	192	2	0
Conaway Preservation Group	Yolo	6,470	11	1
Cranmore Farms	Sutter	0	--	--
Eastside Mutual Water Company	Colusa	559	7	1
Glenn-Colusa Irrigation District	Glenn/Colusa	20,000	265	24
Maxwell Irrigation District	Colusa	727	9	1
Natomas Central Mutual Water Company	Sacramento/Sutter	0	--	--
Pelger Mutual Water Company	Sutter	769	1	0
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	3	0
Princeton-Codora-Glenn Irrigation District	Glenn/Colusa	909	12	1
Provident Irrigation District	Glenn/Colusa	909	12	1
Reclamation District 108	Colusa/Yolo	6,061	44	4
Reclamation District 1004	Glenn/Colusa/Sutter	3,788	35	3
River Garden Farms	Yolo	1,061	2	0
Sutter Mutual Water Company	Sutter	5,455	6	0
Sycamore Mutual Water Company	Colusa	3,030	39	4
T&P Farms	Colusa	270	3	0
Te Velde Revocable Family Trust	Yolo	2,114	4	0
Total		55,041	455	41

Note:

Fraction of PM10 (FRPM10) from wind erosion: 0.50

(PM10 Emissions = PM x FRPM10)

Conversions

1 ton =	2,000 pounds	
1 year =	365 days	
Project duration =	180 days	(assumes 6-month crop idling season)

Legend

	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available.
	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Yolo County only).
	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Sutter County only).

Agricultural Land Preparation

Table 88. Summary of Crop Profile, Acre-Pass, and Emission Factor

Crop profile	Land Preparation Operations	Category	Acre-Pass	Emission Factor	
				Operation (lbs/Acre-pass)	Crop (lbs/Acre/year)
Alfalfa	Unspecified	Discing	1.25	1.2	4
	Land Maintenance	Land Planing	0.2	12.5	
Almonds	Float	Land Planing	0.25	12.5	3.13
Citrus	Unspecified	Discing	0.06	1.2	0.07
Corn	List & Fertilize	Weeding	1	0.8	6.9
	Mulch Beds	Discing	1	1.2	
	Finish Disc	Discing	1	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	
Cotton	Land Preparation	Discing	4	1.2	8.9
	Land Maintenance	Land Planing	0.2	12.5	
	Seed Bed Preparation	Weeding	2	0.8	
DryBeans	Land Maintenance	Land Planing	0.2	12.5	7.7
	Chisel	Discing	1	1.2	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Listing	Weeding	1	0.8	
Garbanzo	Chisel	Discing	1	1.2	7.7
	Listing	Weeding	1	0.8	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
Garlic	Land Maintenance	Land Planing	0.2	12.5	6.5
	Disc & Roll	Discing	1	1.2	
	Chisel	Discing	1	1.2	
	List	Weeding	1	0.8	
	Shape Beds	Weeding	1	0.8	
Grapes-Raisin	Terrace	Weeding	1	0.8	2.6
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	1	1.2	
	Level (new vineyard)	Land Planing	0.02	12.5	
Grapes-Table	Subsoil	Ripping	0.05	4.6	0.83
	Disc & Furrow-out	Discing	0.5	1.2	
Grapes-Wine	Level (new vineyard)	Land Planing	0.02	12.5	1.5
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	0.75	1.2	
Lettuce*	Land Maintenance	Land Planing	0.2	12.5	12.75
	Disc & Roll	Discing	2/2	1.2	
	Chisel	Discing	2/2	1.2	
	List	Weeding	2/2	0.8	
	Plane	Land Planing	½	12.5	
	Shape Beds & Roll	Weeding	2/2	0.8	
Melon	Plow	Discing	1	1.2	5.7
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Disc	Discing	1	1.2	
No Land Prep.	Unspecified	Discing	0	1.2	0
Onions	List	Weeding	1	0.8	6.5
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Chisel	Discing	1	1.2	
	Disc & Roll	Discing	1	1.2	

Agricultural Land Preparation

Table 88. Summary of Crop Profile, Acre-Pass, and Emission Factor

Crop profile	Land Preparation Operations	Category	Acre-Pass	Emission Factor	
				Operation (lbs/Acre-pass)	Crop (lbs/Acre/year)
Rice	Chisel	Discing	1	1.2	20
	Land Maintenance	Land Planing	0.2	12.5	
	Post Burn/Harvest Disc	Discing	0.5	1.2	
	Roll	Weeding	1	0.8	
	3 Wheel Plane	Land Planing	1	12.5	
	Harrow Disc	Discing	1	1.2	
	Stubble Disc	Discing	1	1.2	
Safflower	List	Weeding	1	0.8	4.5
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	
Sugar Beets	Disc	Discing	1	1.2	22.8
	Land Plane	Land Planing	1	12.5	
	Subsoil-deep chisel	Ripping	1	4.6	
	Stubble Disc	Discing	1	1.2	
	List	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
Tomatoes	Bed Preparation	Weeding	2	0.8	10.1
	Land Preparation	Discing	5	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
Vegetables	Land Maintenance	Land Planing	0.2	12.5	8.5
	Unspecified	Discing	5	1.2	
Wheat	Stubble Disc	Discing	1	1.2	3.7
	Land Maintenance	Land Planing	0.2	12.5	

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.4: Agricultural Land Preparation. January.

Accessed on: January 21, 2015. Available at: <http://www.arb.ca.gov/ei/areasrc/arbmiscproccresfarmop.htm>.

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
101999	WHEAT ALL	Wheat	Wheat/1	5.8
104999	RYE FOR GRAIN	Wheat	Wheat/1	5.8
106199	RICE, FOR MILLING	Rice	Cotton/2	1.68
106269	FIELD CROP BY PRODUCTS	Cotton	Cotton/20	0.17
108999	FOOD GRAINS, MISC	Corn	Cotton/2	1.68
111559	CORN, WHITE	Corn	Cotton/40	0.08
111991	CORN FOR GRAIN	Corn	Cotton/2	1.68
111992	CORN FOR SILAGE	Corn	Cotton/20	0.17
112999	OATS FOR GRAIN	Wheat	Wheat/1	5.8
113994	BARLEY, MALTING	Wheat	Wheat/1	5.8
113995	BARLEY, FEED	Wheat	Wheat/1	5.8
113999	BARLEY, UNSPECIFIED	Wheat	Wheat/1	5.8
114991	SORGHUM, GRAIN	Wheat	Wheat/1	5.8
121219	COTTON LINT, UPLAND	Cotton	Cotton/1	3.37
121229	COTTON LINT, PIMA	Cotton	Cotton/1	3.37
121299	COTTON LINT, UNSPEC	Cotton	Cotton/1	3.37
132999	SUGAR BEETS	Sugar Beets	Cotton/2	1.68
151999	COTTONSEED	Cotton	Cotton/1	3.37
153999	PEANUTS, ALL	Safflower	Cotton/2	1.68
158269	SAFFLOWER	Safflower	Wheat/1	5.8
158316	SUNFLOWER SEED, PLANTING	Corn	Wheat/1	5.8
158319	SUNFLOWER SEED	Corn	Wheat/1	5.8
158499	JOJOBA	Melon	Cotton/40	0.08
161131	BEANS, LIMAS, LG. DRY	DryBeans	Cotton/2	1.68
161132	BEANS, LIMAS, BABY DRY	DryBeans	Cotton/2	1.68
161199	LIMA BEANS, UNSPECIFIED	DryBeans	Cotton/2	1.68
161717	BEANS, RED KIDNEY	DryBeans	Cotton/2	1.68
161721	BEANS, PINK	DryBeans	Cotton/2	1.68
161741	BEANS, BLACK EYE (PEAS)	DryBeans	Cotton/2	1.68
161742	BEANS, GARBANZO	Garbanzo	Cotton/2	1.68
162399	BEANS, FAVA	DryBeans	Cotton/2	1.68
163999	PEAS, DRY EDIBLE	DryBeans	Cotton/20	0.17
169999	BEANS, UNSPEC. DRY EDIBLE	DryBeans	Cotton/2	1.68
171019	SEED WHEAT	Wheat	Wheat/1	5.8
171049	SEED RYE	Wheat	Wheat/1	5.8
171069	SEED RICE	Rice	Cotton/2	1.68
171129	SEED OATS	Wheat	Wheat/1	5.8
171139	SEED BARLEY	Wheat	Wheat/1	5.8
171519	SEED, COTTON FOR PLANTING	Cotton	Cotton/1	3.37
171582	SEED, SAFFLOWER, PLANTING	Safflower	Wheat/1	5.8
171619	SEED BEANS	DryBeans	Cotton/2	1.68
171639	SEED PEAS	DryBeans	Cotton/20	0.17
171949	SEED, MISC FIELD CROP	Corn	Cotton/20	0.17
171959	SEED, VEG & VINECROP	Vegetables	Cotton/20	0.17
172119	SEED, ALFALFA	Alfalfa	Zero/1	0
172289	CLOVER, UNSPECIFIED SEED	Alfalfa	Zero/1	0
173079	SEED, BERMUDA GRASS	Alfalfa	Zero/1	0
173669	SEED, SUDAN GRASS	Alfalfa	Zero/1	0
173999	SEED, GRASS, UNSPECIFIED	Alfalfa	Zero/1	0
178999	SEED, OTHER (NO FLOWERS)	Alfalfa	Cotton/20	0.17
181999	HAY, ALFALFA	Alfalfa	Zero/1	0
188499	HAY, GRAIN	Alfalfa	Cotton/2	1.68

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
188799	HAY, WILD	Alfalfa	Cotton/2	1.68
188899	HAY, SUDAN	Alfalfa	Zero/1	0
188999	HAY, OTHER UNSPECIFIED	Alfalfa	Cotton/2	1.68
194599	PASTURE, IRRIGATED	No Land	Zero/1	0
194699	PASTURE, RANGE	No Land	Zero/1	0
194799	PASTURE, MISC. FORAGE	No Land	Zero/1	0
195199	SILAGE	Wheat	Cotton/20	0.17
195299	HAY, GREEN CHOP	Alfalfa	Zero/1	0
195399	STRAW	Alfalfa	Wheat/1	5.8
198199	RICE, WILD	Rice	Cotton/2	1.68
198999	FIELD CROPS, UNSPEC.	Corn	Cotton/20	0.17
201119	ORANGES, NAVEL	Citrus	Cotton/40	0.08
201519	ORANGES, VALENCIAS	Citrus	Cotton/40	0.08
201999	ORANGES, UNSPECIFIED	Citrus	Cotton/40	0.08
202999	GRAPEFRUIT, ALL	Citrus	Cotton/40	0.08
203999	TANGERINES & MANDARINS	Citrus	Cotton/40	0.08
204999	LEMONS, ALL	Citrus	Cotton/40	0.08
205999	LIMES, ALL	Citrus	Cotton/40	0.08
206999	TANGELOS	Citrus	Cotton/40	0.08
207999	KUMQUATS	Citrus	Cotton/40	0.08
208059	CITRUS, MISC BY-PROD	Citrus	Cotton/40	0.08
209999	CITRUS, UNSPECIFIED	Citrus	Cotton/40	0.08
211999	APPLES, ALL	Citrus	Cotton/40	0.08
212199	PEACHES, FREESTONE	Citrus	Cotton/40	0.08
212399	PEACHES, CLINGSTONE	Citrus	Cotton/40	0.08
212999	PEACHES, UNSPECIFIED	Citrus	Cotton/40	0.08
213199	CHERRIES, SWEET	Citrus	Cotton/40	0.08
214199	PEARS, BARLETT	Citrus	Cotton/40	0.08
214899	PEARS, ASIAN	Citrus	Cotton/40	0.08
214999	PEARS, UNSPECIFIED	Citrus	Cotton/40	0.08
215199	PLUMS	Citrus	Cotton/40	0.08
215399	PLUMCOTS	Citrus	Cotton/40	0.08
215999	PRUNES, DRIED	Citrus	Cotton/40	0.08
216199	GRAPES, TABLE	Grapes-Table	Cotton/20	0.17
216299	GRAPES, WINE	Grapes-Wine	Cotton/20	0.17
216399	GRAPES, RAISIN	Grapes-Raisin	Cotton/20	0.17
216999	GRAPES, UNSPECIFIED	Grapes-Wine	Cotton/20	0.17
217999	APRICOTS, ALL	Citrus	Cotton/40	0.08
218199	NECTARINES	Citrus	Cotton/40	0.08
218299	PERSIMMONS	Citrus	Cotton/40	0.08
218399	POMEGRANATES	Citrus	Cotton/40	0.08
218499	QUINCE	Citrus	Cotton/40	0.08
218839	CHERIMOYAS	Citrus	Cotton/40	0.08
218889	ORCHARD BIOMASS	Almonds	Cotton/40	0.08
218899	FRUITS & NUTS, UNSPEC.	Citrus	Cotton/40	0.08
221999	AVOCADOS, ALL	Citrus	Cotton/40	0.08
224999	DATES	Citrus	Almonds/20	2.04
225999	FIGS, DRIED	Citrus	Almonds/20	2.04
226999	OLIVES	Citrus	Cotton/40	0.08
228019	GUAVAS	Citrus	Cotton/40	0.08
229999	KIWIFRUIT	Citrus	Cotton/40	0.08
230639	BERRIES, BLACKBERRIES	Grapes-Table	Cotton/40	0.08

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
230869	BERRIES, BOYSENBERRIES	Grapes-Table	Cotton/40	0.08
234799	BERRIES, LOGANBERRIES	Grapes-Table	Cotton/40	0.08
236199	BERRIES, RASPBERRIES	Grapes-Table	Cotton/40	0.08
237199	STRAWBERRIES, FRESH MKT	Melon	Cotton/40	0.08
237299	STRAWBERRIES, PROC	Melon	Cotton/40	0.08
237999	STRAWBERRIES, UNSPECIFIED	Melon	Cotton/40	0.08
239999	BERRIES, BUSH, UNSPECIFIED	Grapes-Table	Cotton/40	0.08
261999	ALMONDS, ALL	Almonds	Almonds/1	40.77
263999	WALNUTS, ENGLISH	Almonds	Almonds/1	40.77
264999	PECANS	Almonds	Almonds/10	4.08
265999	WALNUTS, BLACK	Almonds	Almonds/1	40.77
266999	CHESTNUTS	Almonds	Almonds/10	4.08
267999	MACADAMIA NUT	Almonds	Almonds/10	4.08
268079	PISTACHIOS	Almonds	Almonds/10	4.08
268099	ALMOND HULLS	Almonds	Almonds/1	40.77
301999	ARTICHOKES	Melon	Cotton/40	0.08
302199	ASPARAGUS, FRESH MKT	Melon	Cotton/2	1.68
302299	ASPARAGUS, PROC	Melon	Cotton/2	1.68
302999	ASPARAGUS, UNSPECIFIED	Melon	Cotton/2	1.68
303999	BEANS, GREEN LIMAS	DryBeans	Cotton/2	1.68
304199	BEANS, SNAP FR MKT	DryBeans	Cotton/20	0.17
304299	BEANS, SNAP PROC	DryBeans	Cotton/20	0.17
304399	BEANS FRESH UNSPECIFIED	DryBeans	Cotton/20	0.17
304999	BEANS, UNSPECIFIED SNAP	DryBeans	Cotton/20	0.17
305999	BEETS, GARDEN	Sugar Beets	Cotton/2	1.68
306999	RAPINI	Sugar Beets	Cotton/40	0.08
307189	BROCCOLI, FOOD SERV	Vegetables	Cotton/40	0.08
307199	BROCCOLI, FR MKT	Vegetables	Cotton/40	0.08
307299	BROCCOLI, PROC	Vegetables	Cotton/40	0.08
307919	BROCCOLI, UNSPECIFIED	Vegetables	Cotton/40	0.08
308999	BRUSSELS SPROUTS	Melon	Cotton/40	0.08
309999	CABBAGE, CH. & SPECIALTY	Lettuce	Cotton/40	0.08
310999	CABBAGE, HEAD	Lettuce	Cotton/40	0.08
313189	CARROTS, FOOD SERV	Sugar Beets	Cotton/20	0.17
313199	CARROTS, FR MKT	Sugar Beets	Cotton/20	0.17
313299	CARROTS, PROC	Sugar Beets	Cotton/20	0.17
313999	CARROTS, UNSPECIFIED	Sugar Beets	Cotton/20	0.17
314189	CAULIFLOWER, FOOD SERV	Vegetables	Cotton/40	0.08
314199	CAULIFLOWER, FR MKT	Vegetables	Cotton/40	0.08
314299	CAULIFLOWER, PROC	Vegetables	Cotton/40	0.08
314999	CAULIFLOWER, UNSPECIFIED	Vegetables	Cotton/40	0.08
316189	CELERY, FOOD SERV	Lettuce	Cotton/40	0.08
316199	CELERY, FR MKT	Lettuce	Cotton/40	0.08
316299	CELERY, PROC	Lettuce	Cotton/40	0.08
316999	CELERY, UNSPECIFIED	Lettuce	Cotton/40	0.08
318999	RADICCHIO	Lettuce	Cotton/40	0.08
320999	CHIVES	Lettuce	Cotton/40	0.08
322999	COLLARD GREENS	Lettuce	Cotton/40	0.08
323999	CORN, SWEET ALL	Corn	Cotton/40	0.08
325999	CUCUMBERS	Vegetables	Cotton/40	0.08
330999	EGGPLANT, ALL	Vegetables	Cotton/40	0.08
331999	ENDIVE, ALL	Lettuce	Cotton/40	0.08

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
332999	ESCAROLE, ALL	Lettuce	Cotton/40	0.08
333999	ANISE (FENNEL)	Lettuce	Cotton/2	1.68
335999	GARLIC, ALL	Garlic	Cotton/2	1.68
337999	KALE	Lettuce	Cotton/40	0.08
338999	KOHLRABI	Lettuce	Cotton/40	0.08
339196	LETTUCE, BULK SALAD PRODS.	Lettuce	Cotton/40	0.08
339999	LETTUCE, UNSPECIFIED	Lettuce	Cotton/40	0.08
340999	LETTUCE, HEAD	Lettuce	Cotton/40	0.08
341999	LETTUCE, ROMAINE	Lettuce	Cotton/40	0.08
342999	LETTUCE, LEAF	Lettuce	Cotton/40	0.08
343999	MELON, CANTALOUPE	Melon	Cotton/40	0.08
348999	MELON, HONEYDEW	Melon	Cotton/40	0.08
354299	MELON, UNSPECIFIED	Melon	Cotton/40	0.08
354999	MELON, WATER MELONS	Melon	Cotton/40	0.08
355999	MUSHROOMS	No Land Prep.	Zero/1	0
356999	MUSTARD	Lettuce	Cotton/40	0.08
357999	OKRA	Lettuce	Cotton/40	0.08
358999	ONIONS	Onions	Cotton/2	1.68
359999	PARSLEY	Lettuce	Cotton/40	0.08
361299	PEAS, GREEN, PROCESSING	DryBeans	Cotton/20	0.17
361999	PEAS, GREEN, UNSPECIFIED	DryBeans	Cotton/20	0.17
363999	PEPPERS, BELL	Tomatoes	Cotton/40	0.08
364999	PEPPERS, CHILI, HOT	Tomatoes	Cotton/40	0.08
366999	PUMPKINS	Melon	Cotton/20	0.17
367999	RADISHES	Sugar Beets	Cotton/40	0.08
368999	RHUBARB	Lettuce	Cotton/40	0.08
370999	RUTABAGAS	Sugar Beets	Cotton/2	1.68
372999	ONIONS, GREEN & SHALLOTS	Onions	Cotton/40	0.08
374189	SPINACH, FOOD SERV	Lettuce	Cotton/40	0.08
374199	SPINACH, FR MKT	Lettuce	Cotton/40	0.08
374299	SPINACH, PROC	Lettuce	Cotton/40	0.08
374999	SPINACH UNSPECIFIED	Lettuce	Cotton/40	0.08
375999	SQUASH	Melon	Cotton/20	0.17
376999	SWISSCHARD	Lettuce	Cotton/40	0.08
378199	TOMATOES, FRESH MARKET	Tomatoes	Cotton/40	0.08
378299	TOMATOES, PROCESSING	Tomatoes	Cotton/20	0.17
378999	TOMATOES, UNSPECIFIED	Tomatoes	Cotton/20	0.17
380999	TURNIPS, ALL	Sugar Beets	Cotton/2	1.68
381999	GREENS, TURNIP & MUSTARD	Lettuce	Cotton/40	0.08
387999	LEEKs	Onions	Cotton/40	0.08
391999	POTATOES, IRISH ALL	Sugar Beets	Cotton/2	1.68
392999	SWEET POTATOES	Sugar Beets	Cotton/2	1.68
393999	HORSERADISH	Onions	Cotton/40	0.08
394199	SALAD GREENS NEC	Lettuce	Cotton/40	0.08
394999	PEAS, EDIBLE POD (SNOW)	DryBeans	Cotton/20	0.17
395999	VEGETABLES, ORIENTAL, ALL	Vegetables	Cotton/40	0.08
396999	SPROUTS, ALFALFA & BEAN	Lettuce	Cotton/40	0.08
398199	CUCUMBERS, GREENHOUSE	No Land Prep.	Zero/1	0
398299	TOMATOES, GREENHOUSE	No Land Prep.	Zero/1	0
398399	TOMATOES, CHERRY	Tomatoes	Cotton/40	0.08
398499	TOMATILLO	Tomatoes	Cotton/40	0.08
398559	CILANTRO	Lettuce	Cotton/40	0.08

Agricultural Harvest Operations

Table 89. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
398599	SPICES AND HERBS	Lettuce	Cotton/40	0.08
398899	VEGETABLES, BABY	Vegetables	Cotton/40	0.08
398999	VEGETABLES, UNSPECIFIED	Vegetables	Cotton/20	0.17
832919	POTATOES SEED	Sugar Beets	Cotton/2	1.68
892999	NURSERY TURF	No Land Prep.	Zero 1	0

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.5: Agricultural Harvest Operations. January.

Accessed on: January 21, 2015. Available at: <http://www.arb.ca.gov/ei/areasrc/arbmiscproccresfarmop.htm>.

Windblown Dust - Agricultural Lands

Table 90. Windblown Dust - Agricultural Lands

Air Basin Code	County Name	Emission Factor (tons/acre/yr)	Process Rate (acres)	PM Emissions (tons/year)
NCC	Monterey	0.020478	279,178.00	5,717.07
	San Benito	0.015936	50,009.00	796.96
	Santa Cruz	0.002485	14,873.00	36.97
SCC	San Luis Obispo	0.006876	109,694.00	754.2
	Santa Barbara	0.00319	80,732.00	257.56
	Ventura	0.018418	54,568.00	1,005.02
SED	Imperial	0.141666	490,409.00	69,474.43
SV	Fresno	0.013761	864,164.00	11,891.35
	Kern	0.008662	408,313.48	3,536.73
	Kings	0.012856	473,817.00	6,091.62
	Madera	0.008032	141,617.00	1,137.47
	Merced	0.013659	364,804.00	4,982.86
	San Joaquin	0.003527	387,278.00	1,365.96
	Stanislaus	0.009052	229,805.00	2,080.26
	Tulare	0.004693	471,664.00	2,213.29
SV	Butte	0.001154	116,869.00	134.87
	Colusa	0.004702	229,747.00	1,080.31
	Glenn	0.004957	186,067.00	922.39
	Placer	0.002172	6,962.90	15.12
	Sacramento	0.002479	117,770.00	291.92

Note:

Fraction of PM10 (FRPM10): 0.50

(PM10 Emissions = PM x FRPM10)

Table 91. Windblown Dust - Pasture Lands

Air Basin Code	County Name	Emission Factor (tons/acre/yr)	Process Rate (acres)	PM Emissions (tons/year)
NCC	Monterey	0.00110562	1,108,000	1,225.03
	San Benito	0.00109336	512,000	559.8
	Santa Cruz	0.0001605	8,000	1.28
SCC	Santa Barbara	0.00021801	602,913	131.44
	San Luis Obispo	0.00046964	1,102,500	517.78
	Ventura	0.00050356	210,918	106.21
SED	Imperial	0.00867346	158,449	1,374.30
SVJ	Fresno	0.00149089	907,300	1,352.69
	Kern	0.00082834	1,527,603	1,265.37
	Kings	0.00146875	142,777	209.7
	Madera	0.00116178	421,000	489.11
	Merced	0.00155578	642,700	999.9
	San Joaquin	0.0005228	167,700	87.67
	Stanislaus	0.00107875	434,300	468.5
	Tulare	0.00063424	713,400	452.47
SV	Butte	0.00014292	288,500	41.23
	Colusa	0.00046444	181,900	84.48
	Glenn	0.00048846	256,575	125.33
	Placer	0.00026499	65,656	17.4
	Sacramento	0.00019538	118,000	23.05
	Shasta	0.00034146	459,000	156.73
	Solano	0.00039453	131,360	51.83
	Sutter	0.00037084	71,500	26.51
	Tehama	0.00035146	955,350	335.76
	Yolo	0.00061919	136,870	84.75
	Yuba	0.00023892	207,600	49.6

Note:

Fraction of PM10 (FRPM10): 0.50

(PM10 Emissions = PM x FRPM10)

Table 92. County Size

County	Area (acres)	
	Non-Pasture	Pasture
Butte	n/a	n/a
Colusa	n/a	n/a
Fresno	n/a	n/a
Glenn	n/a	n/a
Imperial	n/a	n/a
Kern	n/a	n/a
Kings	n/a	n/a
Madera	n/a	n/a
Merced	n/a	n/a
Monterey	n/a	n/a
Placer	n/a	n/a
Sacramento	n/a	n/a
San Benito	n/a	n/a
San Joaquin	n/a	n/a
San Luis Obispo	n/a	n/a
Santa Barbara	n/a	n/a
Santa Cruz	n/a	n/a
Shasta	n/a	n/a
Solano	n/a	n/a
Stanislaus	n/a	n/a
Sutter	n/a	n/a
Tehama	n/a	n/a
Tulare	n/a	n/a
Ventura	n/a	n/a
Yolo	n/a	n/a
Yuba	n/a	n/a
Total	0	0

Source:

CARB. 1997. *Emission Inventory Documentation, Section 7.12: Windblown Dust - Agricultural Lands*. July.

Accessed on: January 21, 2015. Available at: <http://www.arb.ca.gov/ei/areasrc/arbmiscproc/fugwbdst.htm>.

Appendix F

Special Status Wildlife Species with Potential to Occur

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Appendix F
Special Status Wildlife Species with Potential to Occur

Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Invertebrates						
Conservancy fairy shrimp <i>Branchinecta conservation</i>	E, X	--	Northern two-thirds of the Central Valley. It ranges from Vina Plains of Tehama County; Sacramento NWR in Glenn County; Jepson Prairie Preserve and surrounding area east of Travis Air Force Base, Solano County; Mapes Ranch west of Modesto, Stanislaus County.	Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grass or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands.	Has been collected from early December to early May.	None. Occurrences have been documented within the Seller Service Area. Suitable habitat occurs within the project area. No impacts to vernal pool or other habitats occupied by this species are anticipated. The species is not likely to occur to occur in rice fields and canals due to predators (i.e. fish).
Mid-valley fairy shrimp <i>Branchinecta mesoallensis</i>	Under review	--	Counties within the Great Central Valley, including Sacramento, Solano, Merced, Madera, San Joaquin, Fresno, and Contra Costa Counties.	Found in vernal pools, seasonal wetlands that fill with water during fall and winter rains	Has been collected from early December to early May.	Suitable habitat may occur within the project area. Low potential for occurrence due to predators (i.e. fish).
Valley elderberry longhorn beetle <i>Desmocerus californicus dimorphus</i>	T, X	--	Central Valley and surrounding foothills below 3,000 feet elevation.	Dependent on elderberry shrubs (host plant) as a food source. Potential habitat is shrubs with stems 1 inch in diameter within Central Valley.	Year round for host plant and exit holes; March-June for adults	Elderberry shrubs will not be impacted, therefore no impact to beetles will occur.
Vernal pool fairy shrimp <i>Branchinecta lynchi</i>	T, X	--	Endemic to the Central Valley, Central Coast Mountains, and South Coast Mountains of California. It ranges from the Vina Plains in Tehama County, through the Central Valley, and south along the Central Coast to northern Santa Barbara County.	Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grassed or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands.	Has been collected from early December to early May.	None. Occurrences have been documented in both the Buyer and the Seller Service areas. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish), therefore no impacts are anticipated to the species. The project is not expected to impact vernal pools or natural wetlands.
Vernal pool tadpole shrimp <i>Lepidurus packardii</i>	E, X	--	Endemic to the northern portion of the Central Valley of California. This species occurs from the Millville Plains and Stillwater Plains in Shasta County south throughout the Central Valley to Merced County.	Found in a variety of natural and artificial seasonally ponded habitat types including: vernal pools, swales, ephemeral drainages, stock ponds, reservoirs, ditches, backhoe pits, and ruts caused by vehicular activities.	Has been collected from early December to early May.	None. Occurrences have been documented in both the Buyer and the Seller Service area. Suitable habitat is present in the project area. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish),therefore there is a low potential for impacts to the species. The project is not expected to impact vernal pools or natural wetlands. No impacts to the species are expected.

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Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Amphibians						
California tiger salamander <i>Ambystoma californiense</i>	T ¹ , E ² , X	CE, SSC	Found in annual grassland habitat, grassy understories of valley-foothill hardwood habitats, and uncommonly along stream courses in valley-foothill riparian habitats. Occurs from near Petaluma, Sonoma Co., east through the Central Valley to Yolo and Sacramento Counties and south to Tulare Co.; and from the vicinity of San Francisco Bay south to Santa Barbara Co.	Lives in vacant or mammal-occupied burrows, occasionally other underground retreats, throughout most of the year, in grassland, savanna, or open woodland habitats. Lays eggs on submerged stems and leaves, usually in shallow ephemeral or semi permanent pools and ponds that fill during heavy winter rains, sometimes in permanent ponds; breeding takes place in fish free pools and ponds.	Migrates up to about 2 km between terrestrial habitat and breeding pond. Migrations may occur from November through April.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat may occur within the project area, but will not be impacted by the project. This species is not expected to occur in rice fields due to predatory fish.
Foothill yellow-legged frog <i>Rana boylei</i>	SC	SSC	This species is known from the Pacific drainages from Oregon to the upper San Gabriel River, Los Angeles County, California, including the coast ranges and Sierra Nevada foothills in the United States.	This species inhabits partially shaded, rocky streams at low to moderate elevations, in areas of chaparral, open woodland, and forest.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat is present within the project area. However the project is not expected to impact any suitable rocky stream and woodland habitats. No impact to the species is expected.
Western spadefoot toad <i>Spea hammondi</i>	--	SSC	This species occurs in the Central Valley and bordering foothills of California and along the Coast Ranges into northwestern Baja California, Mexico.	Lowlands to foothills, grasslands, open chaparral, pine-oak woodlands. Prefers shortgrass plains, sandy or gravelly soil. It is fossorial and breeds in temporary rain pools and slow-moving streams that do not contain bullfrogs, fish, or crayfish.	Year round. Usually in underground burrows most of year, but will travel several meters on rainy nights. Movement is rarely extensive.	None. Occurrences have been documented from both the Buyer and Seller Service Areas. Suitable habitat is present in the project area. The project will not impact suitable upland habitat types. The species is not likely to occur in rice fields due to the
Reptiles						
Giant garter snake <i>Thamnophis gigas</i>	T	T	Sacramento and San Joaquin Valleys from Butte County in the north to Kern County in the south.	Primarily associated with marshes, sloughs, and irrigation ditches. Generally absent in larger rivers.	Year round	High. Suitable habitat is present within the Buyer and Seller Service Areas. Suitable habitat in the Seller Service Area is intermittent based on normal variation in cropping. Direct impacts may include reduction in suitable aquatic habitat within the Seller Service Area. The greatest impact would occur during the breeding season. Conservation measures are in place to maintain aquatic habitat corridors within irrigation ditches.
Western pond turtle <i>Actinemys marmorata</i>	Under review	SSC	Ranged from extreme western Washington and British Columbia to northern Baja California, mostly to the west of the Cascade-Sierra crest.	The western pond turtle occupies a wide variety of wetland habitats including rivers and streams (both permanent and intermittent), lakes, ponds, reservoirs, permanent and ephemeral shallow wetlands, abandoned gravel pits, stock ponds, and sewage treatment.	Year round	High. Suitable habitat occurs within the project area. Pond turtles may occur in ditches, canals, rice fields, etc.

Appendix F
Special Status Wildlife Species with Potential to Occur

Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Birds						
Aleutian Canada goose <i>Branta canadensis leucopareia</i>	D	--	Alaska to California	Found grazing in golf courses, agricultural lands, and any open ground adjacent to water. Nests in grasses and marshes.	Year round	Suitable habitat is present in project area. Low impact will occur. Can relocate to other habitats within the area.
American peregrine falcon <i>Falco peregrinus anatum</i>	D, NMBMC	E, FP	Throughout California.	Breeds in woodland, forest and coastal habitats on protected cliffs and ledges. Riparian areas and coastal and inland wetlands are important habitats yearlong especially during the non-breeding season.	Year round	None. Rice fields may provide suitable foraging habitat for the species, but birds could relocate to other habitat areas in the vicinity. No nesting habitat will be affected by the project.
Bald eagle <i>Haliaeetus leucocephalus</i>	D	E	Throughout California.	Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area and both areas provide suitable habitat. No impacts to suitable nesting habitat are anticipated. Rice fields represent marginal foraging habitat. Birds would be able to relocate to other suitable habitat areas in the vicinity if fields were fallowed. Environmental commitments limit the amount of land that can be fallowed in a given county.
Bank swallow <i>Riparia riparia</i>	--	T, SSC	A neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. Breeding population in California occurs along banks of the Sacramento and Feather rivers in the northern Central Valley.	Requires vertical banks and cliffs with fine-textured or sandy soils near streams, rivers, ponds, lakes, and the ocean for nesting. Feeds primarily over grassland, shrub land, savannah, and open riparian areas during breeding season and over grassland, brushland, wetlands, and cropland during migration.	March-mid-September	None. Known from both the Buyer and Seller Service Areas. No suitable nesting habitat (i.e. cliffs) will be affected. There is potential that the project would reduce the area of cropland habitat used for foraging during migration (wetlands and croplands) due to changes in water application. However, fallow cropland would still providing suitable foraging habitat, and birds could forage at other croplands in the vicinity. Environmental commitments limit the amount of cropland idling that would

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Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Black tern <i>Chlidonias niger</i>	--	SSC	Common spring and summer visitor to fresh emergent wetlands of California.	Uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields. In migration, some take coastal routes and forage offshore.	April-September	Suitable habitat is present within the project area (i.e. rice fields) and a high potential to occur. Conservation strategies are in place for this species. High. No occurrences have been documented within either the Buyer or Seller Service Areas. However, suitable habitat (i.e. rice fields) is present, and the project area is within the known range for the species. Therefore it has moderate potential to occur. Water transfers could reduce suitable habitat for the species within the Seller Service Area. Conservation strategies are in place that would make potential impacts to this species to negligible.
Black-crowned night heron <i>Nycticorax nycticorax</i>	SC	--	Resident in lowlands and foothills throughout most of California, including the Salton Sea and Colorado River areas, and very common locally in large nesting colonies.	Feeds along the margins of lacustrine, large riverine, and fresh and saline emergent habitats. Nests and roosts in dense-foliaged trees and dense emergent wetlands.	Year round	None. No occurrences of black-crowned night heron have been documented within either the Buyer or Seller Service Areas. Suitable habitat is present in project area, however no nesting or roosting habitats will be affected.
California yellow warbler <i>Dendroica petechia brewsteri</i>	--	SSC	Throughout California	Frequents open to medium-density woodlands and forests with a heavy brush understory in breeding season. In migration, found in a variety of sparse to dense woodland and forest habitats.	April-October	None. No occurrences have been documented in the project area. The species is not likely to occur in rice fields, and no suitable habitat will be impacted (i.e. dense woodland and forest habitats).
Cooper's hawk <i>Accipiter cooperii</i>	--	WL	Throughout California	Frequents landscapes where wooded areas occur in patches and groves. Often uses patchy woodlands and edges with snags for perching. Dense stands with moderate crown-depths used for nesting.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. No potential impacts to preferred foraging or nesting habitat are anticipated.
Double-crested cormorant <i>Phalacrocorax pelagicus</i>	--	WL	Along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters.	Open water with offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or even transmission lines. Requires undisturbed nest-sites beside water, on islands or mainland. Uses wide rock ledges on cliffs; rugged slopes; and live or dead trees, especially tall ones.	Year round	None. No occurrences have been documented within the project area, but the species could occur at reservoirs and inland ponds. No negative impacts to foraging or breeding habitat are expected.
Golden eagle <i>Aquila chrysaetos</i>	T	E	Throughout California	Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat occurs within the project area. No impacts to nesting habitat are expected.

Appendix F
Special Status Wildlife Species with Potential to Occur

Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Great blue heron <i>Ardea herodias</i>	--	--	Throughout California	Found in shallow estuaries, fresh and saline emergent wetlands, along riverine and rocky marine shores, in croplands, pastures, salt ponds, and in mountains above foothills. Nests roosts in large trees.	Year round	None. Rookeries have been documented within the Buyer and Seller Service Areas. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Great egret <i>Ardea alba</i>	--	--	Throughout California	Feeds and rests in fresh, and saline emergent wetlands, along the margins of estuaries, lakes, and slow-moving streams, on mudflats and salt ponds, and in irrigated croplands and pastures. Nests roosts in large trees.	Year round	None. Occurrences have been documented in the Seller Service Area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Greater sandhill crane <i>Grus canadensis tabida</i>	--	T, FP	Breeds only in Siskiyou, Modoc and Lassen counties and in Sierra Valley, Plumas and Sierra counties. Winters primarily in the Sacramento and San Joaquin valleys from Tehama south to Kings Counties.	In summer, this race occurs in and near wet meadow, shallow lacustrine, and fresh emergent wetland habitats. Frequents annual and perennial grassland habitats, moist croplands with rice or corn stubble, and open, emergent wetlands. It prefers relatively treeless plains.	Migration southward is September-October and northward is March-April.	High. No occurrences have been documented within the project area, but occurrences have been recorded in Butte and Sutter Counties. Suitable foraging and winter roosting habitat is present within the project area (i.e. rice fields). Conservation strategies are in place for this species and birds will have other suitable nesting sites available.
Least bell's vireo <i>Vireo bellii pusillus</i>	E	E	California to northern Baja.	Inhabits low, dense riparian growth along water or along dry parts of intermittent streams. Typically associated with willow, cottonwood, baccharis, wild blackberry, or mesquite in desert localities.	March-August	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat may occur within the project action area. The project is not expected to impact any suitable willow or dense riparian habitat, therefore no impacts to the species are anticipated.
Little willow flycatcher <i>Empidonax traillii brewsteri</i>	--	E	Migrant at lower elevations, primarily in riparian habitats throughout California	Most numerous where extensive thickets of low, dense willows edge on wet meadows, ponds, or backwaters.	Spring (mid-May to early June) and fall (mid-August to early September)	None. This species has not been documented within the project area according to CNDDB. Suitable habitat may be present within the project area (i.e. dense willows), but will not be impacted by the project.

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Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Long-billed curlew <i>Numenius americanus</i>	SC	WL	Along the California coast, and in the Central and Imperial valleys.	Upland shortgrass prairies and wet meadows are used for nesting; coastal estuaries, open grasslands, and croplands are used in winter.	Winter migrant from July-April	Low. No CNDDB occurrences have been documented within the project area, but the species is known to occur within the action area during winter migration. There is potential for impacts to suitable foraging habitat (i.e. cropland), although this may be reduced by environmental commitments, which protect winter foraging habitat in Butte Sink, and other wildlife management areas downstream. Birds can relocate to other suitable habitats within the area.
Long-eared owl <i>Asio otus</i>	--	SSC	Throughout California	Frequents dense, riparian and live oak thickets near meadow edges, and nearby woodland and forest habitats. Also found in dense conifer stands at higher elevations.	Year round	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the project area. The project is not expected to impact any suitable habitat (i.e. forest and woodland habitats).
Northern harrier <i>Circus cyaneus</i>	--	SSC	Throughout lowland California, concentrated in the Central Valley and coastal valleys.	Breeds in annual grasslands and wetlands. Prefers marshes and grasslands for foraging and nesting. Also uses agricultural fields for nesting and foraging, although nests may be destroyed by agricultural activities.	Year round	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in project area. Foraging and breeding habitat may be affected, but fallow fields would still represent suitable habitat. Birds can relocate to other habitats within the area.
Osprey <i>Pandion haliaetus</i>	--	WL	Northern California from Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County.	Associated strictly with large, fish-bearing waters, primarily in ponderosa pine through mixed conifer habitats.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. Water transfers would be subject to flow requirements. Therefore no impacts to foraging area expected. No impacts to nesting sites are anticipated.
Short-eared owl <i>Asio flammeus</i>	--	SSC	Endemic to marshes bordering the San Francisco, San Pablo Bays and Suisun Bay .	Open country, including grasslands, wet meadows and cleared forests. Occasionally in estuaries during breeding season.	Year round	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the project area. No impacts to breeding habitat will occur. Fallow rice fields would still represent suitable foraging habitat for the species.

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Special Status Wildlife Species with Potential to Occur

Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Snowy egret <i>Egretta thula</i>	--	--	Throughout California	Found along shores of coastal estuaries, fresh and saline emergent wetlands, ponds, slow-moving rivers, irrigation ditches, and wet fields.	Year round	None. Occurrences have been documented in the Buyer Service Area, however suitable habitat is present in both the Buyer and Seller Service area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Swainson's hawk <i>Buteo swainsoni</i>	SC, MNBMC	T	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley.	Nests in mature trees, including valley oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain and row crop fields.	Spring and Summer; small wintering population in the Delta	None. CNDDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. The project may alter the composition of foraging habitat in the Buyer and Seller Service Areas, but these areas would still be suitable for the species, and additional habitats in the vicinity would be available. No impacts to breeding habitat are expected.
Tricolored blackbird <i>Agelaius tricolor</i>	--	SSC	A resident in California found throughout the Central Valley and in coastal districts from Sonoma Co. south.	Breeds near fresh water, preferably in emergent wetlands with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, tall herbs. Feeds in grassland and cropland habitats.	Year round	Low. CNDDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. Foraging habitat may be affected by the project. Environmental commitments limit cropland idling and birds can relocate to other adjacent foraging habitats within the area.
Western burrowing owl <i>Athene cunicularia hypugaea</i>	--	SSC	Central and southern coastal habitats, Central Valley, Great Basin, and deserts.	Open annual grasslands or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Dependent upon burrowing mammals (especially California ground squirrel) for burrows.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. Agricultural ditches may be suitable habitat for burrowing owl burrow and nesting activity. Water transfers would not affect the suitability of habitat for burrowing owl in the project area.

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Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Western yellow-billed cuckoo <i>Coccyzus americanus</i>	SC, C	E	Uncommon to rare summer resident in scattered locations throughout California.	Deciduous riparian thickets or forests with dense, low-level or understory foliage, and which abut on slow-moving watercourses, backwaters, or seeps. Willow almost always a dominant component of the vegetation. In Sacramento Valley, also utilizes adjacent orchards, especially of walnut. Nests in sites with some willows, dense low-level or understory foliage, high humidity, and wooded foraging spaces.	Summer migration is from June-September.	None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present within the project area. However this species is not likely to occur in rice fields due to lack of suitable foraging and roosting habitat (i.e. dense riparian thickets). No impacts are anticipated.
White-faced ibis <i>Plegadis chihi</i>	--	WL	Uncommon summer resident in sections of southern California, a rare visitor in the Central Valley, and is more widespread in migration.	Feeds in fresh emergent wetlands, shallow lacustrine waters, muddy grounds of wet meadows, and irrigated or flooded pastures and croplands. Nests in dense, fresh emergent wetlands.	Present in California from April-October.	Low. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. Low potential impact to foraging habitat in the Seller Service Area. No potential impacts are expected to roosting habitat. Can relocate to other habitats within the area. Environmental commitments would limit acreage of allowable cropland idling.
White-tailed kite <i>Elanus leucurus</i>	SC, MNBMC	FP	Central Valley, coastal valleys, San Francisco Bay area, and low foothills of Sierra Nevada.	Savanna, open woodlands, marshes, partially cleared lands and cultivated fields, mostly in lowland situations (Tropical to Temperate zones).	Year round	None. CNDDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. Foraging habitat may be altered, but will still be suitable for the species. No potential impacts to breeding habitat are anticipated.
Mammals						
California wolverine <i>Gulo gulo</i>	SC	T, FP	A scarce resident of North Coast mountains and Sierra Nevada. Sightings range from Del Norte and Trinity cos. east through Siskiyou and Shasta cos., and south through Tulare Co. A few possible sightings occur in the north coastal region as far south as Lake Co. Habitat distribution in California is poorly known for the North Coast and northern Sierra Nevada.	In north coastal areas, has been observed in Douglas-fir and mixed conifer habitats. In the northern Sierra Nevada, have been found in mixed conifer, red fir, and lodgepole habitats, and probably use subalpine conifer, alpine dwarf-shrub, wet meadow, and montane riparian habitats. In the southern Sierra Nevada occur in red fir, mixed conifer, lodgepole, subalpine conifer, alpine dwarf-shrub, barren, and probably wet meadows, montane chaparral, and Jeffrey pine.	Year round (largely nocturnal)	None. Suitable habitat may occur within the project area, however no CNDDDB occurrences have been documented in the Buyer or Seller Service area. The species is not likely to occur in agriculture fields. No impacts are anticipated.
Greater western mastiff bat <i>Eumops perotis californicus</i>	SC	SSC	Uncommon resident in southeastern San Joaquin Valley and Coastal Ranges from Monterey Co. southward through southern California, from the coast eastward to the Colorado Desert.	Occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban areas. Crevices in cliff faces, high buildings, trees, and tunnels are required for roosting.	Year round (nocturnal activity)	None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area, but no project impacts are anticipated.

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Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Ring-tailed cat <i>Brassariscus astutus</i>	SC	FP	Ringtails are found in a variety of habitats centered around the semi-arid to arid climates of the west and southwest. Little information available on distribution and relative abundance among habitats.	Occurs in various riparian habitats, and in brush stands of most forest and shrub habitats, at low to middle elevations. Uses hollow trees, logs, snags, cavities in talus and other rocky areas, and other recesses are for cover.	Year round (nocturnal)	None. No CNDDB records of this species have been documented in the project area. Suitable habitat is present in project area, but the species is not likely to occur in rice fields. No potential impact to suitable habitat are expected.
Riparian brush rabbit <i>Sylvilagus bachmani riparius</i>	E	E	Isolated populations on Caswell Memorial State Park on the Stanislaus River and along an overflow channel of the San Joaquin River.	Riparian thickets	Year round	None. No CNDDB records of this species have been documented in the project area. Suitable habitat is present in the project area, however, no potential impacts are expected to suitable habitat (i.e. riparian thickets).

¹Central CA DPS

²Santa Barbara and Sonoma Counties

Green Shading: potential to be affected, further evaluated in Chapter 3

*** Status explanations:**

Federal

E = listed as endangered under the federal Endangered Species Act

T = listed as threatened under the federal Endangered Species Act

MNBMC = Fish and Wildlife Service: Migratory Nongame Birds of Management Concern

SC = species of concern; formerly Category 2 candidate for federal listing

C = Candidate for listing as threatened or endangered

-- = no designations

X = critical habitat

PX = potential critical habitat

D = delisted

State

E = listed as endangered under the California Endangered Species Act

T = listed as threatened under the California Endangered Species Act

CE = candidate endangered under the California Endangered Species Act

FP = fully protected under the California Fish and Game Code

SSC = species of special concern

WL = Watch List

-- = no designations

Appendix G

Special-Status Plants Species with Potential to Occur

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Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Ahart's dwarf rush <i>Juncus leiospermus</i> var. <i>ahartii</i>	-/-/ 1B	Butte, Calaveras, Placer, Sacramento, Tehama, and Yuba Counties.	Valley and foothill grassland (mesic).	March-May	Not likely to occur in rice fields, no suitable habitat present.
Ahart's paronychia <i>Paronychia ahartii</i>	-/-/ 1B	Butte, Shasta, and Tehama Counties.	Cismontane woodland, valley and foothill grassland, and vernal pools.	March-June	Not likely to occur in rice fields, no suitable habitat present.
Alkali milk-vetch <i>Astragalus tener</i> var. <i>tener</i>	-/-/ 1B	Central western California including Yolo County.	Subalkaline flats and areas around vernal pools.	March-June	Not likely to occur in rice fields, no suitable habitat present (i.e. subalkali flats).
Antioch Dunes evening-primrose <i>Oenothera deltoides</i> ssp. <i>howellii</i>	E/E/ 1B	Found only in Contra Costa and Sacramento Counties.	Occurs in inland dunes.	March-September	Not likely to occur in rice fields, no suitable habitat present. Located outside of the project area.
Brittlescale <i>Atriplex depressa</i>	-/-/1B	Western Central Valley and valleys of adjacent foothills.	Alkali grassland, alkali meadow, alkali scrub, and vernal pools.	April-October	There is a CNDDDB occurrence within Glenn, Colusa, and Yolo counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali and vernal pools).
Boggs Lake hedge- hyssop <i>Gratiola hetersepela</i>	-/-/1B	Dispersed throughout the Sacramento and Central Valley. Also in Oregon.	Marsh's, swamps, and vernal pools (clay).	April-August	There is a CNDDDB occurrence within Sacramento County. Suitable habitat is present but has low potential to occur.
Butte County meadowfoam <i>Limnanthes floccosa</i> ssp. <i>californica</i>	E/E/1B	Only located in Butte County.	Valley and foothill grassland (mesic), and vernal pools.	March-May	Not likely to occur in rice fields, no suitable habitat present.

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Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Contra Costa goldfields <i>Lasthenia conjugens</i>	E/SSC/1B	San Francisco Bay Delta Regions, and scattered coastal areas.	Cismontane woodlands, playas, valley and foothill grasslands, and vernal pools.	March-June	No CNDDDB occurrences; not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools, playas).
Colusa grass <i>Neostapfia colusana</i>	T/E/1B	Southern Sacramento Valley, and northern San Joaquin Valley.	Vernal pools.	May-July	There is a CNDDDB occurrence within Glenn and Colusa counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Crampton's tuctoria (Solano grass) <i>Tuctoria mucronata</i>	E/E/1B	Located only in Yolo and Solano Counties.	Valley and foothill grassland (mesic), and vernal pools.	April-August	Not likely to occur in rice fields, no suitable habitat present.
Ferris' milk-vetch <i>Astragalus tener</i> var. <i>ferrisae</i>	-/-/1B	Sacramento Valley.	Subalkaline flats and areas around vernal pools.	March-June	Not likely to occur in rice fields, no suitable habitat present.
Fox sedge <i>Carex vulpinoidea</i>	-/-/2	Northern Sacramento Valley, including Butte County, isolated populations in San Joaquin County.	Riparian woodland, marshes and swamps.	May-June	Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields.
Greene's tuctoria <i>Tuctoria greeni</i>	E/SSC/1B	Butte, Colusa, Fresno, Glenn, Madera, Merced, Modoc, Shasta, San Joaquin, Stanislaus, Tehama, and Tulare Counties.	Vernal pools.	May-July	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Hairy Orcutt grass <i>Orcuttia pilosa</i>	E/E/1B	Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento counties.	Vernal pools.	May-September	There is a CNDDDB occurrence within Butte and Glenn counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Hartweg's golden sunburst <i>Pseudobahia bahiifolia</i>	E/E/1B	Found in El Dorado, Fresno, Madera, Merced, Stanislaus, Tuolumne, and Yuba Counties.	Cismontane woodland, valley and foothill grassland, often acidic.	April-May	There is a CNDDDB occurrence within Yolo County, however this species is not likely to occur in rice fields due to lack of suitable habitat
Heartscale <i>Atriplex cordulata</i>	-/-/1B	Western Central Valley and valleys of adjacent foothills.	Alkali grasslands, alkali meadows, and alkali scrub.	May-October	There is a CNDDDB occurrence within Butte, Colusa, Yolo, and Glenn counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali areas).
Heckard's pepper-grass <i>Lepidium latipes</i> var. <i>heckardii</i>	-/-/1B	Glenn, Solano, and Yolo Counties.	Valley and foothill grassland alkaline flats.	March-May	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali flats).
Henderson's bent grass <i>Agrostis hendersonii</i>	- /- / 3	Found in Butte, Calaveras, Merced, Placer, Shasta, and Tehama counties. Also found in Oregon.	Vernal pools.	March- June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

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Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Hoover's spurge <i>Chamaesyce hooveri</i>	T/-/1B	Scattered in Glenn, Butte, Colusa, Merced, Stanislaus, Tehama, and Tulare Counties.	Vernal pools.	July-September	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Indian valley brodiaea <i>Brodiaea coronaria</i> ssp. <i>rosea</i>	-/E/1B	Scattered in Glenn, Lake, Colusa, and Tehama Counties.	Closed cone coniferous forest, chaparral, valley and foothill grasslands (serpentinite).	May-June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat.
Jepson's milk-vetch <i>Astragalus rattanii</i> var. <i>jepsonianus</i>	-/-/1B	Colusa, Glenn, Lake, Napa, Tehama, and Yolo counties.	Chaparral, cismontane woodland, valley and foothill grassland, often serpentinite.	April-June	There is a CNDDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat.
Keck's checkerbloom <i>Sidalcea keckii</i>	E/-/1B	Colusa, Fresno, Merced, Napa, Solano, Tulare, and Yolo counties.	Cismontane woodlands, foothill and valley grasslands (serpentinite).	April-May	There is a CNDDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat.
Layne's ragwort <i>Packera layneae</i>	T/-/1B	Butte, El Dorado, Tuolumne, and Yuba Counties.	Chaparral and cismontane woodland, rocky and often serpentinite.	April-August	There is a CNDDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat.
Legenere <i>Legenere limosa</i>	SC/-/1B	Sacramento Valley and south of the North Coast Ranges.	Vernal pools.	May-June	Not likely to occur in rice fields, no suitable habitat present (i.e. vernal pools)
Lesser saltscale <i>Atriplex minuscula</i>	-/-/1B	Found in Butte, Fresno, Kern, Madera, Merced, Stanislaus, and Tulare Counties.	Chenopod scrub, playas, valley and foothill grasslands (alkali and sandy).	May-October	Not likely to occur in rice fields, no suitable habitat present (i.e. alkali, sandy)

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Lone buckwheat <i>Eriogonum apricum</i> var. <i>apricum</i>	E/E/1B	Found in Amador and Sacramento Counties.	Chaparral.	July-October	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (chaparral).
Marsh checkerbloom <i>Sidalcea oregana</i> ssp. <i>hydrophila</i>	-/-/1B	Glenn, Lake, Mendocino, and Napa Counties.	Meadows and seeps, and riparian forest.	June-August	Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields.
Milo Baker's lupine <i>Lupinus milo-bakeri</i>	-/T/1B	Glenn and Mendocino Counties.	Cismontane woodlands, foothill and valley grasslands.	June-September	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat.
Palmate-bracted bird's-beak <i>Cordylanthus palmatus</i>	E/E/1B	Found in Glenn and Colusa Counties and within the Central Valley.	Alkali meadow, alkali scrub, valley and grasslands.	May-October	Not likely to occur in rice fields, no suitable habitat present (i.e. alkali).
Pincushion navarretia <i>Navarretia myersii</i> ssp. <i>myersii</i>	-/-/1B	Alamador, Calaveras, Merced, Placer, and Sacramento Counties.	Vernal pools (often acidic).	May	No CNDDDB occurrences; not likely to occur due to lack of suitable habitat (i.e. vernal pools).
Recurved larkspur <i>Delphinium recurvatum</i>	-/-/1B	Disbursed throughout the Sacramento and Central Valley.	Chenopod scrub, cismontane, valley and foothill grasslands (alkali).	March-June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali).
Red mountain catchfly <i>Silene campanulata</i> ssp. <i>campanulata</i>	-/E/1B	Found in Colusa, Glenn, Mendocino, Shasta, Tehama, and Trinity Counties.	Chaparral and lower montane coniferous forest, usually serpentine and rocky.	April-July	There is a CNDDDB occurrence in Colusa County, however this species is not likely to occur in rice fields due to lack of suitable habitat.

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Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Rose-mallow <i>Hibiscus laiocarpus</i>	-/-/2	Northern Sacramento County.	Marshes and swamps.	June-September	Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields.
Sacramento orcutt grass <i>Orcuttia viscida</i>	E/E/1B	Valley grasslands and freshwater wetlands.	Vernal pools.	May-June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
San Joaquin spearscale <i>Atriplex joaquiniana</i>	-/-/1B	Western Central Valley and valleys of adjacent foothills.	Alkali grasslands, and alkali scrub.	April-September	Not likely to occur in rice fields, no suitable habitat present (i.e. alkali).
Sanford's arrowhead <i>Sagittaria sanfordii</i>	-/-/1B	Central Valley.	Freshwater marshes, shallow streams, and ditches.	May-August	Suitable habitat on present in ditches; not yet detected. Not likely to establish in rice fields.
Silky cryptantha <i>Cryptantha crinita</i>	-/-/1B	Shasta and Tehama Counties.	Cismontane woodland, lower montane coniferous forest, riparian forest and woodland, valley foothill and grasslands.	April-May	Not likely to occur in rice fields, no suitable habitat present. Located outside of the project area.
Slender Orcutt grass <i>Orcuttia tenuis</i>	T/E/1B	Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento Counties	Vernal pools.	May-July	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Soft bird's beak <i>Cordylanthus mollis</i> ssp. <i>mollis</i>	E/SSC/1B	Located in Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma Counties.	Coastal salt marshes and swamps.	July-November	There is a CNDDDB occurrence in Sacramento County, however this species is not likely to occur in rice fields due to lack of suitable habitat.

***Status explanations:**

F=Federal

E=Endangered

T=Threatened

SC= Special Concern

S=State

E=Endangered

T=Threatened

SSC=Species of Special Concern

CNPS=California Native Plant Society

1B=Rare, threatened, or endangered in California and elsewhere

2=Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere

3=Plants about which we need more information - A review list

Summary of Annual Greenhouse Gas Emissions

Table 1. GHG Emissions from Groundwater Substitution

Water Agency	Emissions (MTCO ₂ e/year)			
	CO ₂	CH ₄	N ₂ O	Total
Anderson-Cottonwood Irrigation District	151	0	1	152
Burroughs Farms	82	0	0	82
Canal Farms	35	0	0	35
Conaway Preservation Group	428	1	1	430
Cranmore Farms	107	0	0	107
Eastside Mutual Water Company	316	0	1	317
Glenn-Colusa Irrigation District	6,379	6	15	6,401
Maxwell Irrigation District	97	0	0	97
Natomas Central Mutual Water Company	1,496	2	5	1,503
Pelger Mutual Water Company	222	0	1	223
Pleasant Grove-Verona Mutual Water Company	1,336	2	4	1,341
Princeton-Cordora-Glenn Irrigation District	1,228	1	3	1,233
Provident Irrigation District	794	1	2	797
Reclamation District 108	642	1	3	646
Reclamation District 1004	1,003	1	3	1,007
River Garden Farms	361	1	1	363
Sutter Mutual Water Company	No Groundwater Substitution			0
Sycamore Mutual Water Company	261	0	1	263
T&P Farms	33	0	0	33
Te Velde Revocable Family Trust	202	0	1	203
Total	15,172	17	42	15,232

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Anderson-Cottonwood Irrigation District
Transfer Volume 4,800 acre-feet/year

Table 2. Anderson-Cottonwood Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Shasta	0	2	0	0	2
Tehama	0	0	0	0	0
Total	0	2	0	0	2

Table 3. Anderson-Cottonwood Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Barney Street	Shasta	Electric	2012	200	5,500	85%	4,062	4,010	598,578	n/a	121	0.0077	0.0016	121	0.19	0.49	121
Crowley Gulch	Shasta	Electric	2012	50	1,000	15%	738	4,010	149,645	n/a	30	0.0019	0.0004	30	0.05	0.12	30
Total					6,500	100%	4,800	8,021	748,223	0	151	0.0097	0.0020	151	0.24	0.61	152

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Burroughs Farms
Transfer Volume 2,000 acre-feet/year

Table 4. Burroughs Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	1	0	0	1
Total	0	1	0	0	1

Table 5. Burroughs Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #1	Sutter	Electric	2013	200	4,000	100%	2,000	2,715	405,287	n/a	82	0.0052	0.0011	82	0.13	0.33	82
Total					4,000	100%	2,000	2,715	405,287	0	82	0.0052	0.0011	82	0.13	0.33	82

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Canal Farms
Transfer Volume 1,000 acre-feet/year

Table 6. Canal Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	1	3
Total	0	2	0	1	3

Table 7. Canal Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(MMBtu/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Dennis Well North	Colusa	E	unknown	125	3,500	29%	292	453	42,217	n/a	9	0.0005	0.0001	9	0.01	0.03	9
Dennis Well South	Colusa	E	unknown	125	3,500	29%	292	453	42,217	n/a	9	0.0005	0.0001	9	0.01	0.03	9
East Well	Colusa	Propane	unknown	250	5,000	42%	417	453	n/a	288	18	0.0009	0.0002	18	0.02	0.05	18
Total					12,000	100%	1,000	1,358	84,435	288	35	0.0020	0.0004	35	0.05	0.12	35

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 bhp-hr = 2,542.5 Btu
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Conaway Preservation Group
Transfer Volume 5,368 acre-feet/year

Table 8. Conaway Preservation Group Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	2	12	0	0	14
Total	2	12	0	0	14

Table 9. Conaway Preservation Group GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
1W3	Yolo	Electric	unknown	250	4,700	11%	690	797	148,780	n/a	30	0.0019	0.0004	30	0.05	0.12	30
5W2	Yolo	Electric	unknown	250	4,500	11%	380	459	85,593	n/a	17	0.0011	0.0002	17	0.03	0.07	17
7W1	Yolo	Electric	unknown	75	1,800	4%	414	1,248	69,859	n/a	14	0.0009	0.0002	14	0.02	0.06	14
7W2	Yolo	Electric	unknown	250	2,700	6%	605	1,217	227,135	n/a	46	0.0029	0.0006	46	0.07	0.19	46
7W4S	Yolo	Electric	unknown	200	3,500	8%	212	329	49,034	n/a	10	0.0006	0.0001	10	0.02	0.04	10
12W1	Yolo	Electric	unknown	250	4,500	11%	633	763	142,444	n/a	29	0.0018	0.0004	29	0.05	0.12	29
13W3	Yolo	Electric	unknown	200	2,900	7%	488	914	136,439	n/a	28	0.0018	0.0004	28	0.04	0.11	28
16W2	Yolo	Diesel	2,005	227	1,600	4%	231	785	n/a	9,993	102	0.0041	0.0008	102	0.10	0.25	102
17W3	Yolo	Diesel	2,005	227	1,700	4%	220	702	n/a	8,944	91	0.0037	0.0007	91	0.09	0.22	92
20W1	Yolo	Electric	unknown	100	2,500	6%	203	441	32,920	n/a	7	0.0004	0.0001	7	0.01	0.03	7
21W3	Yolo	Electric	unknown	100	2,500	6%	332	721	53,815	n/a	11	0.0007	0.0001	11	0.02	0.04	11
31W1	Yolo	Electric	unknown	100	2,300	5%	28	66	4,948	n/a	1	0.0001	0.0000	1	0.00	0.00	1
32NW1	Yolo	Electric	unknown	100	3,300	8%	107	177	13,189	n/a	3	0.0002	0.0000	3	0.00	0.01	3
32NW2	Yolo	Electric	unknown	250	4,200	10%	824	1,066	198,888	n/a	40	0.0026	0.0005	40	0.06	0.16	40
Total					42,700	100%	5,368	9,686	1,163,044	18,937	428	0.0229	0.0047	428	0.57	1.42	430

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Cranmore Farms
Transfer Volume 3,400 acre-feet/year

Table 10. Cranmore Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	2	0	0	2
Total	0	2	0	0	2

Table 11. Cranmore Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
North Well	Sutter	Electric	unknown	125	3,500	54%	1,831	2,841	264,996	n/a	53	0.0034	0.0007	53	0.09	0.22	54
South Well	Sutter	Electric	unknown	125	3,000	46%	1,569	2,841	264,996	n/a	53	0.0034	0.0007	53	0.09	0.22	54
Total					6,500	100%	3,400	5,682	529,991	0	107	0.0068	0.0014	107	0.17	0.43	107

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Eastside Mutual Water Company
Transfer Volume 2,230 acre-feet/year

Table 12. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	1	0	0	0	1
Total	1	0	0	0	1

Table 13. Eastside Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
7631T	Colusa	Diesel	2006	215	4,720	100%	2,230	2,566	n/a	30,948	316	0.0128	0.0026	316	0.32	0.76	317
Total					4,720	100%	2,230	2,566	0	30,948	316	0.0128	0.0026	316	0.32	0.76	317

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Glenn-Colusa Irrigation District
Transfer Volume 10,000 acre-feet/year

Table 14. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	12	0	0	0	12
Colusa	9	0	0	0	9
Total	21	0	0	0	21

Table 15. Glenn-Colusa Irrigation District GHG Emissions

	Well										GHG Emissions						
	Location			Power Rating	Pump Rate		Transfer	Operation		Fuel	(tonnes per year)			(MTCO2e per year)			
Well	(County)	Fuel Type	Model Year	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	Consumption	CO2	CH4	N2O	CO2	CH4	N2O	Total
Well1	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well2	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well3	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well4	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well5	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well6	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well7	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well8	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well9	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well10	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well11	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well12	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well13	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well14	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well15	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well16	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well17	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well18	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well19	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well20	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well21	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Total				12,392	100%	10,000	92,037	0	624,765	6,379	0.2587	0.0517	6,379	6.47	15.42	6,401	

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr	(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL	(Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal	

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Maxwell Irrigation District
Transfer Volume 3,600 acre-feet/year

Table 16. Maxwell Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	0	2
Total	0	2	0	0	2

Table 17. Maxwell Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
MainWell	Colusa	Electric	unknown	125	3,800	50%	1,800	2,573	239,973	n/a	48	0.0031	0.0007	48	0.08	0.20	49
TuttleWell	Colusa	Electric	unknown	125	3,800	50%	1,800	2,573	239,973	n/a	48	0.0031	0.0007	48	0.08	0.20	49
Total					7,600	100%	3,600	5,145	479,946	0	97	0.0062	0.0013	97	0.16	0.39	97

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential
CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption
0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Natomas Central Mutual Water Company
Transfer Volume 20,000 acre-feet/year

Table 18. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sacramento	1	6	0	0	7
Sutter	0	7	0	0	7
Total	1	13	0	0	14

Table 19. Natomas Central Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions									
					(hp)	(gpm)					(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	(tonnes per year)			(MTCO2e per year)	
								CO2	CH4							N2O	CO2	CH4	N2O	Total
Frazer	Sutter	Electric	unknown	50	2,000	8%	1,569	4,259	158,936	n/a	32	0.0021	0.0004	32	0.05	0.13	32			
Lucich North	Sutter	Electric	unknown	75	2,500	10%	1,961	4,259	238,404	n/a	48	0.0031	0.0007	48	0.08	0.19	48			
Bennett North	Sutter	Electric	unknown	150	2,000	8%	1,569	4,259	476,809	n/a	96	0.0062	0.0013	96	0.15	0.39	97			
Atkinson	Sutter	Electric	unknown	60	1,800	7%	1,412	4,259	190,723	n/a	38	0.0025	0.0005	38	0.06	0.16	39			
L-2	Sutter	Electric	unknown	100	1,900	7%	1,490	4,259	317,872	n/a	64	0.0041	0.0009	64	0.10	0.26	64			
L-12	Sutter	Electric	unknown	50	1,500	6%	1,176	4,259	158,936	n/a	32	0.0021	0.0004	32	0.05	0.13	32			
Spangler	Sutter	Electric	unknown	60	2,400	9%	1,882	4,259	190,723	n/a	38	0.0025	0.0005	38	0.06	0.16	39			
Natomas Farms	Sacramento	Electric	unknown	60	1,500	6%	1,176	4,259	190,723	n/a	45	0.0025	0.0005	45	0.06	0.16	45			
Silva	Sacramento	Electric	unknown	150	1,000	4%	784	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
Betts	Sacramento	Electric	unknown	150	1,500	6%	1,176	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
MAP	Sacramento	Electric	unknown	150	2,000	8%	1,569	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
Ose-1	Sacramento	Diesel	2013	225	1,800	7%	1,412	4,259	n/a	53,766	549	0.0223	0.0045	549	0.56	1.33	551			
Ose-2	Sacramento	Electric	unknown	150	1,600	6%	1,255	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
Perry	Sacramento	Electric	unknown	135	2,000	8%	1,569	4,259	429,128	n/a	102	0.0055	0.0012	102	0.14	0.35	102			
Total					25,500	100%	20,000	59,633	4,259,490	53,766	1,496	0.0773	0.0161	1,496	1.93	4.80	1,503			

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Pelger Mutual Water Company
Transfer Volume 4,670 acre-feet/year

Table 20. Pelger Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	1	3	0	0	4
Total	1	3	0	0	4

Table 21. Pelger Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
PMWC#1	Sutter	Electric	unknown	150	5,000	34%	1,599	1,737	194,455	n/a	39	0.0025	0.0005	39	0.06	0.16	39
Well 1 Tucker	Sutter	Electric	unknown	75	2,800	19%	896	1,737	97,227	n/a	20	0.0013	0.0003	20	0.03	0.08	20
Well 2 Flopet	Sutter	Diesel	2008	125	2,500	17%	800	1,737	n/a	12,182	124	0.0050	0.0010	124	0.13	0.30	125
Well 3 Klein	Sutter	Electric	unknown	150	4,300	29%	1,375	1,737	194,455	n/a	39	0.0025	0.0005	39	0.06	0.16	39
Total					14,600	100%	4,670	6,949	486,137	12,182	222	0.0113	0.0023	222	0.28	0.70	223

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

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Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Pleasant Grove-Verona Mutual Water Company
Transfer Volume 15,000 acre-feet/year

Table 22. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	13	20	0	2	35
Total	13	20	0	2	35

Table 23. Pleasant Grove-Verona Mutual Water Company GHG Emissions

Well	Well Location	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
	(County)			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gall/yr) - diesel (MMBtu/yr) - propane	(tonnes per year)			(MTCO2e per year)			
											CO2	CH4	N2O	CO2	CH4	N2O	Total
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	2,000	2%	350	951	21,281	n/a	4	0.0003	0.0001	4	0.01	0.02	4
Kelly Windmill Field Well #2	Sutter	Electric	2002	62.1	2,000	2%	350	951	44,052	n/a	9	0.0006	0.0001	9	0.01	0.04	9
Kelly Windmill North Field Well	Sutter	Propane	2014	133	1,750	2%	306	951	n/a	321	20	0.0010	0.0002	20	0.02	0.06	20
Kelly306	Sutter	Electric	unknown	60	2,600	3%	455	951	42,562	n/a	9	0.0006	0.0001	9	0.01	0.03	9
MLF Clubhouse B Well	Sutter	Electric	unknown	300	3,700	4%	648	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
MLF Marsh Well	Sutter	Electric	unknown	300	3,700	4%	648	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
MLF Monster Well	Sutter	Electric	unknown	60	3,100	4%	543	951	42,562	n/a	9	0.0006	0.0001	9	0.01	0.03	9
MLF Well #1	Sutter	Electric	unknown	30	2,000	2%	350	951	21,281	n/a	4	0.0003	0.0001	4	0.01	0.02	4
MLF Well #16	Sutter	Electric	unknown	50	1,700	2%	298	951	35,469	n/a	7	0.0005	0.0001	7	0.01	0.03	7
MLF Well#11	Sutter	Diesel	2004	250	4,200	5%	735	951	n/a	13,332	136	0.0055	0.0011	136	0.14	0.33	137
MLF Well#12/17	Sutter	Electric	unknown	50	1,500	2%	263	951	35,469	n/a	7	0.0005	0.0001	7	0.01	0.03	7
MLF Well#13	Sutter	Electric	2000	215	4,800	6%	840	951	152,515	n/a	31	0.0020	0.0004	31	0.05	0.12	31
MLF Well#2B	Sutter	Electric	2000	300	3,700	4%	648	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	2,000	2%	350	951	28,375	n/a	6	0.0004	0.0001	6	0.01	0.02	6
Nicholas 72-Acree Field South	Sutter	Diesel	2002	62.1	2,000	2%	350	951	n/a	3,312	34	0.0014	0.0003	34	0.03	0.08	34
Nicholas BBC Well	Sutter	Electric	unknown	30	2,000	2%	350	951	21,281	n/a	4	0.0003	0.0001	4	0.01	0.02	4
Nicholas Filipino Camp South	Sutter	Diesel	2002	62.1	2,000	2%	350	951	n/a	3,312	34	0.0014	0.0003	34	0.03	0.08	34
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	2,000	2%	350	951	28,375	n/a	6	0.0004	0.0001	6	0.01	0.02	6
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	2,000	2%	350	951	28,375	n/a	6	0.0004	0.0001	6	0.01	0.02	6
Nicholas Sand Field Well	Sutter	Diesel	2002	62.1	2,000	2%	350	951	n/a	3,312	34	0.0014	0.0003	34	0.03	0.08	34
RiverRanch#19	Sutter	Diesel	2008	99	2,000	2%	350	951	n/a	5,279	54	0.0022	0.0004	54	0.05	0.13	54
S&O#16	Sutter	Electric	2014	159	3,000	4%	525	951	112,790	n/a	23	0.0015	0.0003	23	0.04	0.09	23
S&O#17	Sutter	Diesel	1999	101	2,250	3%	394	951	n/a	5,386	55	0.0022	0.0004	55	0.06	0.13	55
S&O#18A	Sutter	Diesel	1999	101	1,800	2%	315	951	n/a	5,386	55	0.0022	0.0004	55	0.06	0.13	55
S&O#19	Sutter	Diesel	2007	215	2,150	3%	376	951	n/a	11,465	117	0.0047	0.0009	117	0.12	0.28	117
S&O#20	Sutter	Propane	2014	154	2,250	3%	394	951	n/a	372	23	0.0011	0.0002	23	0.03	0.07	23
Willey#1	Sutter	Diesel	2000	168	3,000	4%	525	951	n/a	8,959	91	0.0037	0.0007	91	0.09	0.22	92
Willey#2	Sutter	Diesel	unknown	250	3,000	4%	525	951	n/a	13,332	136	0.0055	0.0011	136	0.14	0.33	137
Willey#3	Sutter	Electric	unknown	75	2,000	2%	350	951	53,203	n/a	11	0.0007	0.0001	11	0.02	0.04	11
Willey#4	Sutter	Diesel	1974	150	2,000	2%	350	951	n/a	7,999	82	0.0033	0.0007	82	0.08	0.20	82
Will-Lee Well#30	Sutter	Diesel	2000	100	2,500	3%	438	951	n/a	5,333	54	0.0022	0.0004	54	0.06	0.13	55
Will-Lee Well#31	Sutter	Electric	unknown	50	2,500	3%	438	951	35,469	n/a	7	0.0005	0.0001	7	0.01	0.03	7
Will-Lee Well#32	Sutter	Electric	unknown	300	2,500	3%	438	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
Will-Lee Well#33	Sutter	Electric	unknown	75	2,500	3%	438	951	53,203	n/a	11	0.0007	0.0001	11	0.02	0.04	11
Will-Lee Well#4A	Sutter	Diesel	2000	160	1,500	2%	263	951	n/a	8,532	87	0.0035	0.0007	87	0.09	0.21	87
Total				85,700	100%		15,000	33,270	1,607,506	n/a	1,336	0.0622	0.0127	1,336	1.55	3.78	1,341

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 bhp-hr = 2,542.5 Btu
1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency

Princeton-Codora-Glenn Irrigation District

Transfer Volume

5,000 acre-feet/year

Table 24. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	4	0	0	0	4
Colusa	0	0	0	0	0
Total	4	0	0	0	4

Table 25. Princeton-Codora-Glenn Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Joel Mann	Glenn	D	1995	150	3,000	34%	1,705	3,086	n/a	25,967	265	0.0108	0.0022	265	0.27	0.64	266
D.Withrow	Glenn	D	1992	180	1,200	14%	682	3,086	n/a	31,160	318	0.0129	0.0026	318	0.32	0.77	319
Chrisman	Glenn	D	1998	195	1,600	18%	909	3,086	n/a	33,757	345	0.0140	0.0028	345	0.35	0.83	346
D.Schmidt	Glenn	D	2013	170	3,000	34%	1,705	3,086	n/a	29,429	300	0.0122	0.0024	300	0.30	0.73	302
Total					8,800	100%	5,000	12,343	0	120,312	1,228	0.0498	0.0100	1,228	1.25	2.97	1,233

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g

1 tonne = 1,000 kg

1 tonne = 1,000,000 g

1 MWh = 1,000 kWh

1 GWh = 1,000,000 kWh

1 kW = 1.34 hp

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO21

CH425

N2O298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr

0.855 g/mL

7.13 lb/gal

(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)

(Based on MSDS for Hess Diesel Fuel All Types)

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Provident Irrigation District
Transfer Volume 6,000 acre-feet/year

Table 26. Provident Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	5	2	0	0	7
Colusa	0	0	0	0	0
Total	5	2	0	0	7

Table 27. Provident Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Weller62V	Glenn	Diesel	2014	190	3,000	13%	766	1,387	n/a	14,780	151	0.0061	0.0012	151	0.15	0.36	151
L Hansen#1	Glenn	Diesel	1991	210	4,000	17%	1,021	1,387	n/a	16,336	167	0.0068	0.0014	167	0.17	0.40	167
L Hansen#2	Glenn	Diesel	2013	140	4,500	19%	1,149	1,387	n/a	10,891	111	0.0045	0.0009	111	0.11	0.27	112
K Hansen#1	Glenn	Diesel	1992	185	2,500	11%	638	1,387	n/a	14,391	147	0.0060	0.0012	147	0.15	0.36	147
K Hansen#2	Glenn	Electric	n/a	170	3,500	15%	894	1,387	175,912	n/a	35	0.0023	0.0005	35	0.06	0.14	36
E Weller	Glenn	Diesel	1993	185	3,000	13%	766	1,387	n/a	14,391	147	0.0060	0.0012	147	0.15	0.36	147
Weller#4	Glenn	Electric	n/a	170	3,000	13%	766	1,387	175,912	n/a	35	0.0023	0.0005	35	0.06	0.14	36
Total					23,500	100%	6,000	9,706	351,824	70,789	794	0.0339	0.0068	794	0.85	2.03	797

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency

Reclamation District 108

Transfer Volume

15,000 acre-feet/year

Table 28. Reclamation District 108 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	4	0	0	4
Yolo	0	1	0	0	1
Total	0	5	0	0	5

Table 29. Reclamation District 108 GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #4 Huff	Colusa	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
Well #5 RiggsRanch	Colusa	Electric	unknown	150	1,700	9%	1,335	4,265	477,433	n/a	96	0.0062	0.0013	96	0.15	0.39	97
Well #6 CountyLine	Colusa	Electric	unknown	250	5,900	31%	4,634	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
Well#1 Heidrick	Colusa	Electric	unknown	100	3,500	18%	2,749	4,265	318,288	n/a	64	0.0041	0.0009	64	0.10	0.26	65
Well#7 Tract 6	Yolo	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
				Total	19,100	100%	15,000	21,325	3,182,885	0	642	0.0411	0.0087	642	1.03	2.59	646

Key:

AF = acre-feet

CH4 = methane

CO2 = carbon dioxide

gal/yr = gallons per year

gpm = gallons per minute

hp = horsepower

kW/yr = kilowatt hours per year

MTCO2e = metric tons carbon dioxide equivalent

N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g

1 tonne = 1,000 kg

1 tonne = 1,000,000 g

1 MWh = 1,000 kWh

1 GWh = 1,000,000 kWh

1 kW = 1.34 hp

1 hour = 60 minutes

1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2

1

CH4

25

N2O

298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Reclamation District 1004
Transfer Volume 7,175 acre-feet/year

Table 30. Reclamation District 1004 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	5	0	0	6
Colusa	17	5	0	0	22
Sutter	0	0	0	0	0
Total	18	10	0	0	28

Table 31. Reclamation District 1004 GHG Emissions

Well	Location	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer	Operation		Fuel	GHG Emissions						
	Location				Volume	Operation	Consumption	(tonnes per year)			(MTCO2e per year)						
	(County)							(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O
Barale Well	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch 10 Field Well No. 496441	Colusa	Diesel	2008	225	5,800	6%	453	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch Club House Well No.496461	Colusa	Electric	unknown	125	3,400	4%	266	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Behring Ranch Nursery Well No. 17N1W10H1	Colusa	Diesel	TBD	225	1,000	1%	78	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch Pearl Well No. 20094	Colusa	Diesel	TBD	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch West Well No.97863	Colusa	Electric	unknown	125	2,300	3%	180	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Drumheller Well No.7	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
East Morgan Well #1 No. 374667 17N01W14N001M	Colusa	Diesel	TBD	225	2,600	3%	203	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
East Morgan Well#2 No. 498195 17N01W15Q001M	Colusa	Diesel	TBD	225	1,300	1%	102	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Gardener No. 374672	Colusa	Diesel	2008	215	3,500	4%	274	424	n/a	5,120	52	0.0021	0.0004	52	0.05	0.13	52
Gardener No. 498178	Colusa	Diesel	2009	215	3,500	4%	274	424	n/a	5,120	52	0.0021	0.0004	52	0.05	0.13	52
Hall Well No. X	Glenn	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Hall Well No.369428	Glenn	Electric	2011	125	4,500	5%	352	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Mohammad No.e0084085 17N01W02D001M	Colusa	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Myers Well #1 No.3457	Glenn	Electric	2006	40	2,200	2%	172	424	12,671	n/a	3	0.0002	0.0000	3	0.00	0.01	3
Myers Well #2 No. 340884	Glenn	Electric	1982	100	4,100	4%	320	424	31,677	n/a	6	0.0004	0.0001	6	0.01	0.03	6
Rancho Caleta No. 726883	Colusa	Diesel	2004	170	4,500	5%	352	424	n/a	4,048	41	0.0017	0.0003	41	0.04	0.10	41
Sikes & Parachini Well #1 WS No.93124	Colusa	Diesel	2006	173	4,000	4%	313	424	n/a	4,120	42	0.0017	0.0003	42	0.04	0.10	42
Sikes & Parachini Well #2 WS No. 374682	Colusa	Diesel	2008	150	4,000	4%	313	424	n/a	3,572	36	0.0015	0.0003	36	0.04	0.09	37
Southam Sartain Well 18N01W26D001M	Glenn	Diesel	TBD	225	4,800	5%	375	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Stone Well #6 No.11334	Colusa	Electric	2006	40	1,800	2%	141	424	12,671	n/a	3	0.0002	0.0000	3	0.00	0.01	3
Wilder Farms Well	Glenn	Electric	unknown	125	2,500	3%	195	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Dan Charter Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Dan Charter Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
GVL Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Behring Ranch Well	Colusa	Electric	unknown	125	4,000	4%	313	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Claudia Charter	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
GVL Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55
Total					91,800	100%	7,175	11,885	334,191	91,633	1,003	0.0423	0.0085	1,003	1.06	2.53	1,007

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr (Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)
0.855 g/mL (Based on MSDS for Hess Diesel Fuel All Types)
7.13 lb/gal

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency River Garden Farms
Transfer Volume 9,000 acre-feet/year

Table 32. River Garden Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	8	0	0	8
Total	0	8	0	0	8

Table 33. River Garden Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Field 65 PW	Yolo	Electric	2008	125	2500	12%	1,103	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 71 PW	Yolo	Electric	2001	125	1700	8%	750	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 98 PW	Yolo	Electric	1963	125	2900	14%	1,280	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 104 PW	Yolo	Electric	2008	125	2500	12%	1,103	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 104-09 PW	Yolo	Electric	2009	125	2990	15%	1,319	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 91-09 PW	Yolo	Electric	2009	125	2840	14%	1,253	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 117 PW	Yolo	Electric	2009	125	1965	10%	867	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Shop PW	Yolo	Electric	2009	125	3000	15%	1,324	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Total					20,395	100%	9,000	19,172	1,788,471	0	361	0.0231	0.0049	361	0.58	1.46	363

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend	
	Information on engine not available; engine assumed to be electric based on other engines used by water agency.
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Sycamore Mutual Water Company
Transfer Volume 11,300 acre-feet/year

Table 34. Sycamore Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	5	0	0	5
Total	0	5	0	0	5

Table 35. Sycamore Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #15	Colusa	electric	n/a		3,270	15%	1,672	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #14	Colusa	electric	n/a		3,270	15%	1,672	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #11	Colusa	electric	n/a		6,409	29%	3,276	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #2b	Colusa	electric	n/a		4,578	21%	2,340	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #2a	Colusa	electric	n/a		4,578	21%	2,340	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Total					22,104	100%	11,300	13,882	1,294,949	0	261	0.0167	0.0035	261	0.42	1.06	263

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency T&P Farms
Transfer Volume 1,200 acre-feet/year

Table 36. T&P Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	0	2
Total	0	2	0	0	2

Table 37. T&P Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
NW-3	Colusa	E	unknown	125	3,500	47%	560	869	81,057	n/a	16	0.0010	0.0002	16	0.03	0.07	16
NW-4	Colusa	E	unknown	125	4,000	53%	640	869	81,057	n/a	16	0.0010	0.0002	16	0.03	0.07	16
				Total	7,500	100%	1,200	1,738	162,115	0	33	0.0021	0.0004	33	0.05	0.13	33

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Te Velde Revocable Family Trust
Transfer Volume 7,094 acre-feet/year

Table 38. Te Velde Revocable Family Trust Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	5	0	0	5
Total	0	5	0	0	5

Table 39. Te Velde Revocable Family Trust GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
GW1	Yolo	Electric	N/A	127	4,656	29%	2,090	2,438	231,042	n/a	47	0.0030	0.0006	47	0.07	0.19	47
GW10	Yolo	Electric	N/A	143	2,833	18%	1,272	2,438	260,150	n/a	52	0.0034	0.0007	52	0.08	0.21	53
GW9	Yolo	Electric	N/A	104	2,400	15%	1,077	2,438	189,200	n/a	38	0.0024	0.0005	38	0.06	0.15	38
GW3	Yolo	Electric	N/A	52	3,715	24%	1,668	2,438	94,600	n/a	19	0.0012	0.0003	19	0.03	0.08	19
GW4	Yolo	Electric	N/A	125	2,200	14%	988	2,438	227,404	n/a	46	0.0029	0.0006	46	0.07	0.19	46
Total					15,804	100%	7,094	12,189	1,002,395	0	202	0.0130	0.0027	202	0.32	0.82	203

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 lb = 453.6 g
1 tonne = 1,000 kg
1 tonne = 1,000,000 g
1 MWh = 1,000 kWh
1 GWh = 1,000,000 kWh
1 kW = 1.34 hp
1 hour = 60 minutes
1 acre-foot = 325,851 gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2 1
CH4 25
N2O 298

Engine Size Summary

Table 40. Engine Power Rating Summary by Fuel Type

Fuel Type	No. Engines	Avg. HP	Max HP	Min HP
Diesel	23	170	250	60
Electric	47	125	300	30
Natural Gas	0	n/a	0	0
Propane	3	180	250	135

GHG Emission Factors

Table 41. GHG Emission Factors for Electric Pumps

County	Utility Company	Emission Factors		
		CO2 (lbs/MWh)	CH4 (lbs/GWh)	N2O (lbs/GWh)
Colusa	Pacific Gas & Electric	444.62	28.49	6.03
Glenn	Pacific Gas & Electric	444.62	28.49	6.03
Sacramento	Sacramento Municipal Utility District	521.73	28.49	6.03
Shasta	Pacific Gas & Electric	444.62	28.49	6.03
Sutter	Pacific Gas & Electric	444.62	28.49	6.03
Tehama	Pacific Gas & Electric	444.62	28.49	6.03
Yolo	Pacific Gas & Electric	444.62	28.49	6.03

Table 42. Utility-Specific CO2 Emission Factors

2012 Emission Rates		
Utility	Factor Type	Emission Factor (lbs CO ₂ /MWh)
City of Vernon, Light and Power	System Average	765.97
Pacific Gas & Electric	System Average	444.62
Sacramento Municipal Utility District	Retail Power	521.73
	Special Power	0.00
	Wholesale Power	799.77
Seattle City Light	Retail Power	25.62
	Special Power	0.00
	Wholesale Power	362.85
Metropolitan Water District of Southern California	Wholesale Power	658.73
	Self-consumed Power	157.87

Source:

The Climate Registry. 2015. Utility-Specific Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/resources/protocols/general-reporting-protocol/#jump3>.

Table 43. Diesel Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	10.21	kg/gallon	Table 12.1, Distillate Fuel Oil No. 2
CH4	0.003	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
Heat Content	0.138	MMBtu/gallon	Table 12.1, Distillate Fuel Oil No. 2

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/downloads/2014/04/2014-Climae-Registry-Default-Emissions-Factors.pdf>.

Table 44. Natural Gas Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	53.02	kg/MMBtu	Table 12.1, US Weighted Average
CH4	0.001	kg/MMBtu	Table 12.9, Natural Gas, Industrial
N2O	0.0001	kg/MMBtu	Table 12.9, Natural Gas, Industrial
Heat Content	1,028	Btu/scf	Table 12.1, US Weighted Average

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/downloads/2014/04/2014-Climae-Registry-Default-Emissions-Factors.pdf>.

Table 45. Propane Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	61.46	kg/MMBtu	Table 12.1, Propane (liquid)
CH4	0.003	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
Heat Content	0.091	MMBtu/gal	Table 12.1, Propane (liquid)

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/downloads/2014/04/2014-Climae-Registry-Default-Emissions-Factors.pdf>.

Table 46. Year 2010 eGRID Subregion Emissions - Greenhouse Gases

eGRID subregion acronym	eGRID subregion name	Carbon dioxide (CO ₂)		Methane (CH ₄)		Nitrous oxide (N ₂ O)		Carbon dioxide equivalent (CO ₂ e)	
		Emissions (tons)	Total output emission rate (lb/MWh)	Emissions (tons)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/MWh)
AKGD	ASCC Alaska Grid	3,350,817.0	1,256.87	139,035.5	26.08	38,279.9	7.18	3,358,210.3	1,259.64
AKMS	ASCC Miscellaneous	317,398.6	448.57	26,527.0	18.74	5,208.6	3.68	318,484.5	450.1
AZNM	WECC Southwest	104,967,483.8	1,177.61	3,424,005.1	19.21	2,802,975.8	15.72	105,437,897.1	1,182.89
CAMX	WECC California	64,799,260.4	610.82	6,044,809.1	28.49	1,278,773.3	6.03	65,060,940.8	613.28
ERCT	ERCOT All	210,366,837.2	1,218.17	5,820,108.3	16.85	4,859,884.0	14.07	211,181,230.4	1,222.88
FRCC	FRCC All	130,376,587.7	1,196.71	8,478,102.7	38.91	2,995,217.6	13.75	130,929,866.5	1,201.79
HIMS	HICC Miscellaneous	1,963,642.7	1,330.16	218,438.7	73.98	40,985.9	13.88	1,972,289.1	1,336.02
HIOA	HICC Oahu	6,393,027.4	1,621.86	782,825.4	99.3	176,679.8	22.41	6,428,632.4	1,630.90
MROE	MRO East	26,009,237.7	1,610.80	784,331.9	24.29	888,770.5	27.52	26,155,232.6	1,619.84
MROW	MRO West	156,444,752.4	1,536.36	5,809,874.5	28.53	5,354,351.3	26.29	157,335,680.5	1,545.11
NEWE	NPCC New England New England	46,905,984.7	722.07	9,322,707.0	71.76	1,685,853.4	12.98	47,265,180.4	727.6
NWPP	WECC Northwest	112,891,853.5	842.58	4,300,901.6	16.05	3,502,980.9	13.07	113,479,975.1	846.97
NYCW	NPCC NYC/Westchester	12,733,660.7	622.42	974,161.1	23.81	114,582.6	2.8	12,761,649.6	623.78
NYLI	NPCC Long Island	8,115,858.7	1,336.11	989,929.6	81.49	124,943.6	10.28	8,145,619.2	1,341.01
NYUP	NPCC Upstate NY	24,165,154.6	545.79	1,443,157.6	16.3	641,283.5	7.24	24,279,706.7	548.37
RFCE	RFC East	137,558,868.7	1,001.72	7,434,984.1	27.07	4,210,267.5	15.33	138,289,527.5	1,007.04
RFCM	RFC Michigan	74,602,328.8	1,629.38	2,789,651.5	30.46	2,457,844.2	26.84	75,012,586.0	1,638.34
RFCW	RFC West	449,994,271.4	1,503.47	10,897,168.6	18.2	14,813,680.5	24.75	452,404,812.2	1,511.52
RMPA	WECC Rockies	61,839,528.9	1,896.74	1,477,560.7	22.66	1,904,448.4	29.21	62,150,232.8	1,906.27
SPNO	SPP North	62,457,258.2	1,799.45	1,444,401.4	20.81	1,986,994.1	28.62	62,780,408.5	1,808.76
SPSO	SPP South	117,325,297.0	1,580.60	3,444,187.9	23.2	3,095,469.5	20.85	117,841,258.7	1,587.55
SRMV	SERC Mississippi Valley	90,967,299.2	1,029.82	3,650,522.7	20.66	1,900,187.0	10.76	91,300,158.7	1,033.58
SRMW	SERC Midwest	123,042,911.4	1,810.83	2,783,643.6	20.48	4,019,051.2	29.57	123,695,092.6	1,820.43
SRSO	SERC South	183,236,856.9	1,354.09	6,176,437.4	22.82	5,653,138.2	20.89	184,177,945.9	1,361.05
SRTV	SERC Tennessee Valley	163,960,526.8	1,389.20	4,177,202.5	17.7	5,290,412.2	22.41	164,824,401.3	1,396.52
SRVC	SERC Virginia/Carolina	167,452,188.6	1,073.65	6,766,296.6	21.69	5,502,582.8	17.64	168,376,135.0	1,079.57

Source: U.S. Environmental Protection Agency. 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available online at: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID_9th_edition_V1-0_year_2010_Summary_Tables.pdf [Accessed on January 20, 2015].

Table 47. Reduced Exhaust Emissions from Cropland Idling

Water Agency	Groundwater Substitution	Cropland Idling/ Crop Shifting	GW Pumping Equivalent	Annual Emission (MT/year)			Annual Emissions (MTCO2e/year)			
	(acre-feet/year)	(acre-feet/year)	(acre-feet/year)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Canal Farms	1,000	635	149	56	0.00283	0.00058	56	0.071	0.174	56
Conaway Preservation Group	5,368	21,350	5,024	1,872	0.095	0.0197	1,872	2.38	5.9	1,880
Eastside Mutual Water Company	2,230	1,846	434	162	0.0082	0.00170	162	0.206	0.51	162
Glenn-Colusa Irrigation District	10,000	66,000	15,529	5,786	0.295	0.061	5,786	7.4	18.1	5,811
Maxwell Irrigation District	3,600	2,400	565	210	0.0107	0.00221	210	0.268	0.66	211
Pelger Mutual Water Company	4,670	2,538	597	222	0	0	222	0	1	223
Pleasant Grove-Verona Mutual Water Company	15,000	9,000	2,118	789	0.0402	0.0083	789	1.00	2.47	793
Princeton-Codora-Glenn Irrigation District	5,000	3,000	706	263	0.0134	0.00277	263	0.335	0.82	264
Provident Irrigation District	6,000	3,000	706	263	0.0134	0.00277	263	0.335	0.82	264
Reclamation District 108	15,000	20,000	4,706	1,753	0.089	0.0184	1,753	2.23	5.5	1,761
Reclamation District 1004	7,175	12,500	2,941	1,096	0.056	0.0115	1,096	1.39	3.43	1,101
River Garden Farms	9,000	3,500	824	307	0.0156	0.00323	307	0.391	0.96	308
Sutter Mutual Water Company	--	18,000	4,235	1,578	0.080	0.0166	1,578	2.01	4.94	1,585
Sycamore Mutual Water Company	11,300	10,000	2,353	877	0.0446	0.0092	877	1.12	2.75	881
T&P Farms	1,200	890	209	78	0.00396	0.00082	78	0.099	0.244	78
Te Velde Revocable Family Trust	7,094	6,975	1,641	611	0.0311	0.0064	611	0.78	1.92	614
Total	133,837	181,634	42,737	15,922	0.81	0.167	15,922	20.3	49.9	15,992

Notes:

Reclamation District 108 used to estimate emissions for other water agencies.

Engine power rating equal to 140 hp for RD-108 engines.

The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).

RD-108 engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing
Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."