Department of Water Resources
CEQA Climate Change Committee
January 2010

Guidance for Quantifying Greenhouse Gas Emissions and Determining the Significance of their Contribution to Global Climate Change for CEQA Purposes

NOTES ON THE USE OF THIS DOCUMENT:
This document is being provided to Integrated Regional Water Management (IRWM) planning agencies as a reference. DWR as the responsible agency from most IRWM grant making activities will be responsible for reviewing and approving CEQA documents done for projects funded through DWR's grant making process. As such, DWR expects that all DWR funded IRWM implementation projects will meet the requirements for climate change analysis in CEQA documents outlined in the CEQA Guideline Amendments approved by the Natural Resources Agency on December 30, 2009. This guidance document describes DWR's interpretation and analysis procedure for complying with the Guideline Amendments, it is provided to help IRWM planning agencies analyze the greenhouse gas emissions associated with their proposed projects and analyze the significance of these emissions for CEQA purposes.

The DWR CEQA Climate Change Committee ("C4") has developed this document for use by DWR staff and consultants on projects for which the Department is involved in the development or support of environmental documentation. This document is to be used as internal guidance for DWR staff and is designed to help DWR provide a consistent approach to climate change analysis in its CEQA documents and to comply with new CEQA Guideline amendments approved by the Natural Resources Agency on December 30, 2009. DWR intends to make periodic updates and addenda to this document as new information and policies on climate change develop. These documents should also be used when working with consultants and other agency staff to prepare climate change analysis for DWR documents. They may also be shared with other interested parties with the understanding that these are internal guidance documents intended to assist DWR staff.

Introduction

Global climate change is becoming an increasingly important and challenging part of the California Environmental Quality Act[1] (CEQA) analysis. CEQA generally requires public agencies to review the environmental impacts of proposed projects, and, if those impacts are determined to be significant, to consider feasible alternatives and mitigation measures that would substantially reduce significant adverse environmental effects. In 2007, the California legislature

[1] The California Environmental Quality Act ("CEQA") is codified at Public Resources Code, §21000, et seq. The Guidelines for the Implementation of CEQA is found at CCR, Title 14, §15000, et seq.

recognized the need for guidance on the analysis of climate change for CEQA purposes and, in SB 97, directed the Natural Resources Agency, in coordination with the Governor's Office of Planning and Research, to address the issues through amendments to the CEQA regulations (also known as "CEQA Guidelines"). As a result of SB 97[2], new CEQA Guideline amendments, adopted January 2010, provide direction to lead agencies about evaluating, quantifying, and mitigating a project's potential GHG emissions. The new regulations are viewable at: http://www.ceres.ca.gov/ceqa/guidelines/.

This DWR white paper outlines a departmental policy consistent with the new guideline amendments for inventorying and assessing the climate change impact of a project for CEQA purposes. Guidance for analyzing the effects of climate change on the project can be found in other Department of Water Resources (DWR) documents and reports.

Because of the evolutionary nature of this subject, the Director has established a DWR CEQA Climate Change Committee to review all climate change analyses in DWR environmental documents and exemption considerations prior to publication or making an exemption determination (or filing of a Notice of Exemption). The committee meets monthly to review and comment on proposed projects, for more information contact CEQAclimatechange@water.ca.gov or 916-651-9274 (Andrew Schwarz).

Adequate consideration of climate change issues is challenging due to the spatial and temporal scales upon which changes occur. In addition, scientific understanding of the effects of greenhouse gas accumulation in the atmosphere is evolving rapidly. Despite these challenges, DWR must provide an inventory and impact assessment of climate change-causing greenhouse gasses (GHG) in its environmental documentation for its projects (Snow, 2009).

Many Environmental Impact Reports (EIR) have been criticized or legally challenged because of alleged deficiencies in the climate change analysis. For projects that face strong opposition, climate change analysis may be especially important. Because of the lack of specific guidance available to lead agencies, this component of CEQA analysis has provided fertile ground for legal challenges.

DWR, as the lead CEQA agency for water supply, flood control, and restoration projects, is continuously developing and improving its tools and methods for analyzing projects' GHG contribution to climate change. In general, DWR's projects involve construction activities, maintenance operations, electricity generation and use, and in some cases carbon sequestration by natural processes. These activities represent sources and sinks of GHG emissions that would have an unquantifiable, though contributory, effect on climate change.

DWR also provides millions of dollars worth of funding annually for local projects through various grant programs. Because DWR is not the lead agency for these projects, the guidance provided here does not specifically apply to them. However, this guidance may be useful for

[2] Senate Bill 97, Chapter 185, Statutes of 2007, codified at Section 21083.05

developing a consistent standard of analysis and reporting protocol for these and other projects where DWR is a responsible agency.

Accounting for GHG sources

Accounting for GHG sources can be done either qualitatively or quantitatively. In the past, numerous agencies have addressed GHG emissions qualitatively in their CEQA documents. Typically, these documents stated that construction or operation of the project would contribute to an increase in GHG emissions, but did not quantify emissions or the impact of the emissions on the environment. This method of accounting is no longer considered adequate for most emissions sources (California Attorney General's Office, 2009)(CEQA Guidelines Amendments, adopted December 2009).

The Attorney General's (AG) office cites the adoption of the California Global Warming Solutions Act of 2006 (AB 32) as evidence that the legislature has clearly identified climate change as a "serious threat to the economic well-being, public health, natural resources, and the *environment* of California". (Emphasis added.) AB 32 directly links anthropogenic emission of GHG's with climate change and lays out a timeline for the reduction of statewide emissions. Both the AG's office and CEQA Guidelines Amendments adopted December 2009 require GHG emissions to be quantified to the extent possible and disclosed as part of the public disclosure requirements of CEQA. Therefore, all DWR environmental documents should quantitatively account for all emissions, except in cases where lack of scientific understanding precludes a quantitative analysis.

Common emissions sources that should be accounted for quantitatively include but are not limited to:

- Operation of construction equipment
- Passenger vehicle trips during construction and operation
- Transportation of construction materials and equipment
- Transportation of material inputs for operation or maintenance
- Generation of electricity used for operation of the project
- Waste generation and disposal of materials during construction and operation

As indicated above, this list is not exhaustive. Any emission that can be accounted for with reasonable certainty and accuracy should be included.

Projects or components of projects that cannot be quantified may include activities such as the carbon sequestration ability of restored habitat or emissions from the surface of reservoirs. In these cases the unknown emissions should be discussed in detail including the current state of scientific understanding, ongoing research, and if available potential ranges for emission or sequestration potential.

Developing an Inventory and Calculating GHG Emissions

A number of methodologies have been published providing guidance on inventorying and quantifying GHG emissions. The United Nations Intergovernmental Panel on Climate Change has published guidelines for national greenhouse gas inventories (IPCC, 2006), which the U.S. Environmental Protection Agency (EPA) has used to develop an inventory for the United States (EPA, 2009). The California Air Resources Board (CARB) also developed an inventory of GHG emissions for California using these guidelines. These inventories provide important information about the scale of national and statewide emissions. However, the methods used to complete them vary significantly from the methods needed to complete a project level inventory.

For project level GHG emissions assessments a more appropriate emissions reporting protocol has been developed by the World Resources Institute (WRI) in cooperation with the World Business Council for Sustainable Development (WRI and WBCSD, n.d). This protocol was used as the basis for the California Climate Action Registry (CCAR) (CCAR, 2009). The WRI and CCAR emissions reporting protocols establish guidelines for voluntary accounting of GHG emissions and provide a peer reviewed and widely accepted methodology for calculating GHG emissions. WRI has also published several calculation tools to simplify and document the procedure. In general, the protocols outline how to estimate emissions from mobile combustion sources, electricity consumption, and industrial processes. The protocol output provides an analysis of all six GHG's as defined by the Kyoto Protocol and California state law (Health &Saf. Code, §38505(g)): carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydro fluorocarbons (HFC's), and perfluorocarbons (PFC's). Emissions are converted to CO_2 equivalents, the common unit for reporting of GHG.

A number of emissions models are available for calculating a wider range of air pollutants. One such model, the Urban Emissions (URBEMIS) model, developed by Environmental Management Software, is one of the most commonly used mobile emissions calculation models and uses the CARB Emfac2007 and Offroad2007 models within its code. It should be noted that URBEMIS and many other emissions models do not calculate emissions of all important GHGs. Projects that have quantifiable emissions of GHGs other than CO_2 should consider using models or other methodologies that capture all important emissions.

The Natural Resource Agency has also adopted CEQA Guidelines Amendments to address the quantification of GHG emissions. CEQA Guideline to Section 15064.4(a)(1), added as part of the new amendments, states that a lead agency has the discretion to determine whether to "use a model or methodology to quantify greenhouse gas emissions resulting from a project, and which model or methodology to use." The WRI/CCAR protocol, URBEMIS, or other similar models are appropriate choices for analysis of GHG emissions for DWR projects. Projects must, however, provide substantial evidence to support the decision to use a specific model or methodology.

Establishment of project boundaries is inherent in using either the WRI/CCAR protocol or a model. The boundary delimits the extent of the project as defined under CEQA (Pub. Resources Code, §21065). All emissions within the boundary are attributable to the project while emissions outside of it are attributable to some other source. Emissions models rarely provide guidance with respect to what emissions should be included. Instead, these decisions are implicit

in what data are inputted to the model. The WRI/CCAR protocol provides guidance on what to include in the inventory. However, this guidance may not be appropriate for the purposes of a CEQA analysis.

The WRI/CCAR protocol is designed to account for the emissions attributable to a specific entity, but does not account for emissions caused by one entity but actually emitted by another entity. For example, DHL, a large international shipping company, outsources much of the long-distance shipping of packages required for its business operations. Under the WRI/CCAR protocol, the emissions generated by the outsourced activities would be considered indirect emissions that are only optionally reported. This convention circumscribes a boundary that is too restrictive to capture the broad range of effects and impacts needed for a CEQA analysis. Section 21065b, subd. (b) of the Pub. Resources Code, defines a "Project" as "an activity undertaken by a person which is supported, in whole or in part through contracts, grants, subsidies, loans… from one or more public agencies." This definition of a project is broader than the definition of an entity used by WRI/CCAR. Thus, DWR projects should carefully consider the project boundaries for CEQA purposes when employing the CCAR/WRI protocol or an emissions model to calculate project GHG emissions. The following section provides additional guidance on establishing project boundaries and determining what emissions sources to include in a CEQA analysis.

Establishing Project Boundaries for CEQA

DWR's environmental documents should establish project boundaries that include the transportation of all materials, labor, and energy required to construct, operate and maintain the project. This typically means placing the boundary of the project for materials at the loading docks of each material supplier. For labor, this would include transportation from the nearest city or town expected to provide workers for construction, operation, and maintenance. For energy this includes all emissions associated with energy supplied from any source. This convention is consistent with settlement agreements made by the California Attorney General's Office.

This boundary convention does not account for the emissions attributable to the manufacture of materials or equipment used by the project. Many projects require the use of large quantities of cement, steel, and other manufactured materials. The manufacturing of these materials may be a substantial source of GHG emissions. Cement specifically requires a large amount of energy to produce and results in substantial GHG emissions. Including these emissions would be more indicative of a "life-cycle" emissions analysis. To date, no court has ruled that such an inclusive analysis is required to meet the requirements of CEQA. A life-cycle analysis also goes beyond the analysis suggested by the California Attorney General's Office, California Climate Action Registry and other GHG monitoring agencies.

Specific Construction and Operation Considerations

- Operation of a wide array of construction equipment: To complete the emissions inventory for the project, construction estimators should provide approximate numbers and types of construction equipment required and the estimated number of day and hours each piece of equipment will be used. Technical reference materials such as the

Caterpillar Performance Handbook and industry experts such as equipment contractors and construction estimators can provide fuel consumption rates for construction equipment. Models may use assumed values for fuel consumption of common construction equipment; these assumed values should be checked to ensure that emissions are not being systematically over or under calculated.

- Emissions associated with trucking construction equipment to the project site: Each project should set a reasonable trucking distance within which all equipment could be acquired, then apply this assumed average travel distance to each piece of equipment to be trucked to the project.

- Labor Force: As with construction equipment, the labor force needed to construct projects may exceed the available local workforce. Or construction sites may be located in relatively remote areas many miles from existing housing or hospitality locations. Each worker will need to be transported to and from housing locations each morning and evening. Each project should set a reasonable distance within which all workers would either come from their permanent residences or would be housed in project related temporary housing. This distance should then be applied to each worker-day required for construction and operation of the project.

- Borrow Areas: Some larger DWR projects may choose to develop soil and rock borrow areas as part of the project. In these cases, the emissions attributable to mining equipment and operations should be included in the emissions inventory. If soil and rock borrow are purchased from a private source, mining and processing emissions need not be included.

- Large scale land use changes: Land use changes may substantially alter the rate at which GHGs are sequestered from the atmosphere or released to it (carbon flux). Quantifying the net change in carbon flux attributable to project implementation would require the measurement of carbon flux under without project conditions and estimation of carbon flux under with project conditions. Both of these quantities involve substantial scientific uncertainty. In some cases, the loss of carbon sequestering flora displaced by the project will be replaced elsewhere as part of habitat mitigation measures, possibly offsetting the loss of carbon sequestration capacity. This topic is likely to gain importance as our understanding of carbon flux from specific land use activities increases. Analysis of this type, however, is likely premature at this point. A qualitative discussion of the emissions/sequestration changes due to project-drive-land-use change may be merited for some projects.

On-Going/Operational Emissions

Operational emissions may vary widely among projects—from no operational emissions from a levee project to very large emissions from a pumping plant project. Some restoration and retrofit projects may even have net negative emissions if the project promotes natural processes that sequester GHGs or improves operational efficiency. For most DWR projects electricity

purchases will be the largest source of operational emissions, but projects should also consider other potential sources of operational emissions attributable to the project.

For purchased electricity, the WRI/CCAR protocol provides the easiest and most reliable method for converting Megawatt-hours (MWh) of electricity consumed to GHG emissions. WRI has developed a calculation tool specifically for this purpose. The tool uses a grid averaged conversion factor appropriate for electricity use throughout each region of the United States. Projects that have specific electricity supply contracts and can more accurately track where their electricity is being generated may wish to use more precise emissions factors.

Hydro-electric power generation by DWR projects does not act as a one to one offset or credit against purchased electricity. Environmental documents should account for all electricity purchased off the grid (and used by the project) and convert this to GHG emissions using the WRI/CCAR factors mentioned above. In order to calculate an emission credit, generated power must be shown to displace other power sources in the no-project scenario. The emissions that would not be released because of the proposed project can then be calculated and reported as a credit against other emissions released by the project.

Projects that improve energy efficiency or alter the peaking demand for electricity should attempt to model how their operations are improvements over the baseline conditions. Reduced overall electricity demand or reduced electricity demand during peak demand periods can reduce overall GHG emissions.

A sample inventory and emissions calculating sheet in .pdf format is included in this document as Appendix X. A fully functional version of the file in Microsoft Excel format is also available through the CEQA Climate Change Committee.

Significance Criteria and Mitigation

Once the emissions from a proposed project have been accounted for, the CEQA lead agency must assess the impacts of these emissions and make a significance determination. This area of climate change analysis is developing and changing rapidly. New guidance and case law are constantly influencing departmental policy. This section outlines the issues with respect to significance criteria and thresholds and outlines the department's current strategy for determining the significance of GHG emissions.

CEQA states that a "significant effect on the environment means a substantial, or potentially substantial, adverse change in the environment" (Pub. Resources Code, §21068) and "the determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data" (CEQA Guidelines, §15064(b)).

The emissions from one project, even a very large project, are miniscule in comparison to worldwide or even statewide GHG emissions. However, the emissions from each project have an incremental contribution to the buildup of GHGs in the atmosphere and may have a

significant environmental impact when analyzed on a cumulative basis. Cumulative impacts are those resulting from the incremental impact of the project when added to other past, present, and reasonably foreseeable probable future projects (CEQA Guidelines, §15355(b)). Therefore, analysis of the significance of GHG emissions should be done as a cumulative impacts analysis (CEQA Guideline Amendments, §15130(f)).

Determining whether the GHG emissions from a project contribute to a significant cumulative impact is complex and evolving. However, a determination of "less than significant" cumulative impacts based on a finding that a project's contribution to a cumulative impact is minute has not withstood legal challenge. Miniscule incremental impacts cannot be ignored as *de minimus* (Communities for a Better Environment v. California Resources Agency (2002) 103 Cal.App.4th 98, 117) nor can the incremental contribution to an environmental impact of a project be trivialized because of the extent to which previous projects have impacted the environment (Kings County Farm Bureau v. City of Hanford(1990) 221 Cal.App.3d 692, 719).

A threshold of significance may be a quantitative, qualitative, or performance level of a particular environmental effect above which impacts will normally be considered significant (CEQA Guidelines, §15064.7(a)). A number of published documents provide a range of strategy guidance for determining thresholds of significance for GHG emissions. These advisory documents come from consulting firms specializing in CEQA work, professional associations, environmental organizations, and OPR. (See Appendix A for a list and links to several of these documents.)

Three basic strategies have been outlined in the technical guidance documents published to date: 1) Establish a significance threshold of net-zero (any increase over baseline conditions is significant); 2) establish a non-zero significance threshold based on compliance with AB 32 or other established GHG reduction strategies; or 3) decline to determine significance. Of these three potential strategies all have complicating issues associated with them.

<u>Establishing a significance threshold of net-zero</u>
Establishing a threshold of net-zero would be difficult because it would require almost all projects, even very small ones that may be exempt, or that would otherwise be subject to a negative declaration to produce full EIRs. This could significantly increase the project cost and the time needed to develop projects, hindering DWR's ability to fulfill its mission. Furthermore, the proposed CEQA Guidelines do not require such a standard. Nor has the AG, in its comment letters and settlement agreements required that projects adopt net-zero significance thresholds. Instead, projects have been encouraged to inventory all emissions and implement all feasible emissions reduction strategies and in some cases pay for off-site carbon mitigation projects.

<u>Establishing a non-zero threshold</u>
A non-zero threshold presents the difficult question of what amount of GHG emissions are less than significant and what substantial evidence can be used to support this level of emissions. In June 2008, guidance published by OPR recognized the lack of established statewide thresholds of significance for GHG emissions and stated that each CEQA lead agency should establish its own approach to analyzing climate change from projects that generate GHG emissions. At the

same time, OPR asked the CARB to recommend a method for setting quantitative thresholds of significance for GHGs that would encourage consistency in CEQA analyses. This effort resulted in a draft proposal in December 2008. The draft proposal elicited a wide range of comments that questioned the underlying assumptions made by CARB. As of January 2010, CARB efforts to develop statewide guidance on setting thresholds of significance are stalled. CARB's difficulty in establishing a defensible methodology highlights the complexity of defining a non-zero level of significance.

Declining to determine significance

Reporting emissions but declining to determine significance was used in a number of analyses in the past, but is now generally considered unacceptable because of the evolution of knowledge in this area. In general, DWR projects should not choose this option. Some projects may employ this strategy if there is evidence to suggest that difficult to quantify processes resulting from the project are likely to result in no net increase of GHGs.

These challenges notwithstanding, a non-zero threshold of significance for GHG emissions is the threshold that best allows DWR to continue to complete its mission while meeting the impact analysis requirements of CEQA. For a number of reasons, no departmental threshold of significance has been established for GHGs. Instead, each past project has developed its own GHG inventory and has determined significance on a project specific basis. Until a Departmental threshold of significance is developed or a statewide threshold is established, projects should continue to determine significance in this way.

Developing Non-Zero Significance Thresholds

As discussed above, non-zero significance thresholds must identify quantitative, qualitative, or performance levels of GHG emissions below which the environmental effects would be considered less than significant. Substantial evidence must be used to support the threshold (CEQA Guidelines, §15064.7(c)). Project managers are encouraged to investigate significance thresholds established by other public agencies or proposed by experts to help develop their own significance thresholds. Non-zero significance thresholds for DWR projects should attempt to employ both qualitative and performance level criteria. In general, DWR projects are not encouraged to establish numeric or quantitative thresholds. The following criteria, developed by DWR, can be used to help projects develop significance thresholds for GHG emissions:

1) Does the project implement or fund its share of a mitigation strategy designed to alleviate climate change? This might be achieved through consistency with AB 32 and the Climate Change Scoping Plan adopted by CARB.
2) How and in what ways does the project move California toward a lower carbon future?
3) How closely does the project's overall GHG emissions balance approach zero?
4) Are there process improvements or efficiencies gained by implementing the project?
5) Is the project inherently energy efficient?

In addition, some projects may also find it useful to discuss how the project contributes to delivering the vital services to the state with the lowest possible GHG emissions. Given that under AB32 or any other international protocol, some level of GHG

> emissions will continue into the future, an especially critical project may be able to establish its emissions as less significant because of the necessity of the project.

The CEQA Guidelines state that a cumulative impact may be considered less than significant if the project implements or funds its fair share of a mitigation strategy designed to alleviate the cumulative impact (CEQA Guidelines, §15130(a)(3)). The Global Warming Solutions Act of 2006 (AB 32) is the definitive state law governing the reduction of GHG emissions. Consistency with AB 32 may meet the CEQA requirements of §15130(a)(3), allowing projects to claim their emissions are less than significant if the project is consistent with the implementation strategies and legislative intent of AB 32.

AB 32 sets aggressive goals aimed at reducing statewide emissions to 1990 levels by 2020 and in the process leading the country and the world forward toward a lower GHG future. CARB finalized its Scoping Plan for implementation of AB 32 in December 2008. The plan lays out six key elements designed to meet the goals of the legislation:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a statewide renewable energy mix of 33 percent;
- Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;
- Establishing targets for transportation-related greenhouse gas emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and
- Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State's long term commitment to AB 32 implementation.

Each of these elements is developed further with specific strategies for implementation in the Climate Change Scoping Plan. Full implementation of the plan is mandated to take place by January 2012.

AB 32 does not call for the elimination of all GHG emissions, nor does it mandate that all new projects be carbon neutral. Instead, AB 32 recognizes that reducing GHG emissions will be a long incremental process to achieve the target emissions rate in 2020 and further reductions in future years. A substantial amount of emissions, 427 million metric tons of CO_2 equivalents, will still be emitted even after the target is achieved. The legislature, in enacting AB 32, understood that many activities would continue to produce GHG emissions.

It is important to note that arguments exist that could draw into question whether compliance with AB 32 is enough to render emissions less than significant. AB 32 calls for a GHG reduction of approximately 15 percent below today's levels. However, the Intergovernmental Panel on Climate Change now estimates that a reduction of 30 to 85 percent below 2000 levels is needed to stabilize global GHG concentrations and avoid the most severe effects of global

warming[3] (IPCC, 2007). Therefore, the argument could be made that AB 32 is an important interim step but is not aggressive enough to reduce remaining emissions to a less than significant level.

Some projects may elect to consider a multi-pronged significance threshold aimed at determining significance based on a larger emissions reduction than that mandated by AB 32. This more stringent threshold would likely include additional measures to reduce and offset remaining emissions. An implicit difficulty in this strategy is that no statewide study has been conducted, such as the Climate Change Scoping Plan, to identify the measures that would be required to further reduce statewide emissions by more than 15 percent.

Whatever threshold of significance is established, projects should attempt to minimize GHG emissions in all phases of the project. Reduction of GHG emissions should be achieved by implementation of all technologically feasible and cost-effective measures. These measures may differ from project to project, however, a number of measures have been proposed by the AG's Office, CARB, and others. Appendix B contains a list of mitigation measures that are likely to apply to DWR projects. Additional on-site or offsite mitigation or offset measures may also be appropriate.

[3] Executive order S-3-05, the order that called for legislation to reduce GHG emissions, also calls for an 80 percent reduction of GHG emissions by 2050. This second tier of emission reductions was not included in AB 32 legislation.

References

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Appendix B. Selected mitigation measures proposed by the Attorney General's Office and California Air Resources Board that could be applied to DWR projects

Mitigation measures proposed by the Attorney General's Office (complete document available at: http://ag.ca.gov/globalwarming/pdf/GW_mitigation_measures.pdf)

Efficiency

1. Design buildings to be energy efficient. Site buildings to take advantage of shade, prevailing winds, landscaping and sun screens to reduce energy use.
2. Install efficient lighting and lighting control systems. Use daylight as an integral part of lighting systems in buildings.
3. Install light colored "cool" roofs, cool pavements, and strategically placed shade trees.
4. Install energy efficient heating and cooling systems, appliances and equipment, and control systems.
5. Install light emitting diodes (LEDs) for street and other outdoor lighting.
6. Limit the hours of operation of outdoor lighting.
7. Provide education on energy efficiency.

Renewable Energy

1. Install solar and wind power systems and energy-efficient heating ventilation and air conditioning.
2. Install solar panels over parking areas.
3. Use combined heat and power in appropriate applications.

Water Conservation and Efficiency

1. Create water-efficient landscapes.
2. Install water-efficient irrigation systems and devices, such as soil moisture-based irrigation controls.
3. Use reclaimed water for landscape irrigation. Install the infrastructure to deliver and use reclaimed water.
4. Design buildings to be water-efficient. Install water-efficient fixtures and appliances.
5. Restrict watering methods (*e.g.*, prohibit systems that apply water to non-vegetated surfaces) and control runoff.
6. Restrict the use of water for cleaning outdoor surfaces and vehicles.
7. Implement low-impact development practices that maintain the existing hydrologic character of the site to manage storm water and protect the environment. (Retaining storm water runoff on-site can drastically reduce the need for energy-intensive imported water at the site.)[15]
8. Devise a comprehensive water conservation strategy appropriate for the project and location. The strategy may include many of the specific items listed above, plus other innovative measures that are appropriate to the specific project.
9. Provide education about water conservation.

Solid Waste Measures

1. Reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).
2. Provide interior and exterior storage areas for recyclables and green waste and adequate recycling containers located in public areas.
3. Recover by-product methane to generate electricity.

Transportation and Motor Vehicles

1. Limit idling time for commercial vehicles, including delivery and construction vehicles.
2. Use low or zero-emission vehicles, including construction vehicles.

3. Promote ride sharing programs *e.g.*, by designating a certain percentage of parking spaces for ride sharing vehicles, designating adequate passenger loading and unloading and waiting areas for ride sharing vehicles, and providing a web site or message board for coordinating rides.
4. Create car sharing programs. Accommodations for such programs include providing parking spaces for the car share vehicles at convenient locations accessible by public transportation.
5. Create local "light vehicle" networks, such as neighborhood electric vehicle (NEV) systems.
6. Provide the necessary facilities and infrastructure to encourage the use of low or zero-emission vehicles (*e.g.*, electric vehicle charging facilities and conveniently located alternative fueling stations).
7. Increase the cost of driving and parking private vehicles by, *e.g.*, imposing tolls and parking fees.
8. Provide shuttle service to public transit/[work sites].
9. Provide information on all options for individuals and businesses to reduce transportation-related emissions.

Carbon Offsets

1. If, after analyzing and requiring all reasonable and feasible on-site mitigation measures for avoiding or reducing greenhouse gas-related impacts, the lead agency determines that additional mitigation is required, the agency may consider additional off-site mitigation. The project proponent could, for example, fund off-site mitigation projects (*e.g.*, alternative energy projects, or energy or water audits for existing projects) that will reduce carbon emissions, conduct an audit of its other existing operations and agree to retrofit, or purchase carbon "credits" from another entity that will undertake mitigation.

2. The topic of offsets can be complicated, and a full discussion is outside the scope of this summary document. Issues that the lead agency should consider include:

    - The location of the off-site mitigation. (If the off-site mitigation is far from the project, any additional, non-climate related benefits of the mitigation will be lost to the local community.)
    - Whether the emissions reductions from off-site mitigation can be quantified and verified.
    - Whether the mitigation ratio should be greater than 1:1 to reflect any uncertainty about the effectiveness of the offset.

Select Early Action Strategies Proposed by the California Air Resources Board (More information available at: http://www.arb.ca.gov/cc/ccea/ccea.htm)

SmartWay Truck Efficiency
The strategy involves requiring existing trucks/trailers to be retrofitted with the best available "SmartWay Transport" and/or ARB approved technology. Technologies that reduce GHG emissions from trucks may include devices that reduce aerodynamic drag and rolling resistance. Aerodynamic drag may be reduced using devices such as cab roof fairings, cab side gap fairings, cab side skirts, and on the trailer side, trailer side skirts, gap fairings, and trailer tail. Rolling resistance may be reduced using single wide tires or low-rolling resistance tires and automatic tire inflation systems on both the tractor and the trailer.

Tire Inflation Program
The strategy involves actions to ensure that vehicle tire pressure is maintained to manufacturer specifications. Specifically, the strategy seeks to ensure that tire pressure in older vehicles is monitored by requiring that tires be checked and inflated at regular service intervals. One potential approach would be to require all vehicle service facilities, such as dealerships, maintenance garages, and Smog Check stations, to check and properly inflate tires. It is also anticipated that signage at fueling stations clearly indicate the availability of compressed air at no charge. Staff also recommends that the feasibility of conducting an extensive outreach program be investigated.

Blended Cements

The strategy to reduce CO2 emissions involves the addition of blending materials such as limestone, fly ash, natural pozzolan and/or slag to replace some of the clinker in the production of Portland Cement. Currently, ASTM cement specifications allow for replacement of up to 5% clinker with limestone. Most manufacturers could in fact replace up to 4% with limestone. Caltrans allows for 2.5% average limestone replacement until testing of the long term performance of the concrete is complete. Caltrans currently has over $1 million in task orders and is devoting considerable staff resources to the evaluation of limestone blending in cement. Caltrans also currently has standards for using flyash and slag in concrete. Other blending practices will be explored.

Anti-idling Enforcement

The strategy guarantees emission reductions as claimed by increasing compliance with anti-idling rules, thereby reducing the amount of fuel burned through unnecessary idling. Measures may include enhanced field enforcement of anti-idling regulations, increased penalties for violations of anti-idling regulations, and restriction on registrations of heavy-duty diesel vehicles with uncorrected idling violations.

Appendix X. Sample Greenhouse Gas Emissions Inventory

Project Name - Greenhouse Gas Emissions Inventory and Calculation

Construction Equipment Emissions

Line	Type of Equipment	Maximum Number per Day	Total Operation Days	Total Operation hours[1]	Fuel Consumption Per Hour[2]	Total Fuel Consumption (gal. diesel)	CO_2e/gal Diesel[3]	Total CO_2 Equivalent Emissions (metric tons)
2	Backhoes			0	3	-	0.010391	-
3	Bobcats			0	2	-	0.010391	-
4	Bulldozers			0	13	-	0.010391	-
5	Compactors			0	18	-	0.010391	-
6	Cranes			0	Varies	#VALUE!	0.010391	#VALUE!
7	Drill Rig			0	Varies	#VALUE!	0.010391	#VALUE!
8	Dump Trucks			0	30	-	0.010391	-
9	Earth Mover			0	57	-	0.010391	-
10	Excavators			0	9	-	0.010391	-
11	Forklifts			0	3	-	0.010391	-
12	Generators			0	Varies	#VALUE!	0.010391	#VALUE!
13	Grader			0	9	-	0.010391	-
14	Loaders			0	10	-	0.010391	-
15	Off-road Trucks			0	28	-	0.010391	-
16	Pavers			0	7	-	0.010391	-
17	Pile Drivers			0	4	-	0.010391	-
18	Roller			0	11	-	0.010391	-
19	Scrapers			0	21	-	0.010391	-
20	Side Boom Pipe Handler Tractor			0	5	-	0.010391	-
21	Highway Truck			0	10	-	0.010391	-
22						-	0.010391	-
23						-	0.010391	-
24						-	0.010391	-
25	TOTAL					-		-

[1] A 8-hour work day is assumed.

[2] Caterpillar Performance Handbook, Edition 36

[3] World Resources Institute-Mobile combustion CO2 emissions tool. June 2003 Version 2

Construction Workforce Transportation Emissions

	Average Number of Workers per Day	Total Number of Workdays	Average Distance Travelled (round trip)	Total Miles Travelled	Average Passenger Vehicle Fuel Efficiency[4]	Total Fuel Consumption (gal. gasoline)	CO_2e/gal Gasoline[3]	Total CO_2 Equivalent Emissions (metric tons)
32				0	20.8	**0.0**	0.00901	**0.0**

[4] United States Environmental Protection Agency. 2008. Light-Duty Automotive

Construction Materials Transportation Emissions

	Trip Type	Total Number of Trips	Average Trip Distance	Total Miles Travelled	Average Semi-truck Fuel Efficiency	Total Fuel Consumption (gal. diesel)	CO_2e/gal Diesel[3]	Total CO_2 Equivalent Emissions (metric tons)
37	Delivery						0.010391	0
38	Spoils						0.010391	0
39	TOTAL							**0**

Operational Emissions

		MWH of electicity	MT $CO2_e$/MWH[5]	CO_2 e emissions
43	Average Annual Electricity Needed		0.329858	

	Greenhouse Gas	Average Annual Production Emissions (MT)	Global Warming Potential[6]	CO_2 e emissions
46	CO2		1	0
47	CH4		23	0
48	N2O		296	0
49	SF6		22000	0
50	*Others as necessary*			0
51	TOTAL			0

[5] eGRID2007 Version 1.1, December 2008 (Year 2005 data) *CAMX-WECC subregion* .

[6] IPCC Third Assessment Report (2001)

55	Construction Equipment Emissions	-	(from line 25 above)
56	Workforce Transportation Emissions	-	(from line 32 above)
57	Construction Materials Emissions	-	(from line 39 above)
58	Operational Emissions	-	(from line 51 above)
59	**Total Greenhouse Gas Emissions**	**-**	**MT CO_2 equivalents**

Equipment Type column contains commonly used construction equipment. Additional equipment can be found in the Caterpillar Performance Manual and other similar equipment operation publications. Alternatively, information regarding specialized equipment can often be obtained through contractors and estimators. (Document all sources.)