Encinitas-Solana Beach Coastal Storm Damage Reduction Project

San Diego County, California

Appendix I

Air Quality Analysis

U.S. Army Corps of Engineers
Los Angeles District

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1 Introduction

This technical appendix includes additional details on ambient air quality and existing air quality conditions not presented in **Section 4.5** of the Integrated Report. **Section 4.5** includes federal and State Greenhouse House Gas (GHG) regulations that are applicable to the proposed action. This appendix includes additional details on regulations that address GHG emissions, but might not be directly applicable to the proposed action. In addition, modeling assumptions and outputs for the proposed action and alternatives are included in this appendix.

2 Air Quality

2.1 Ambient Air Quality

The California Air Resources Board (ARB) and the U.S. Environmental Protection Agency (EPA) focus on the following air pollutants as indicators of ambient air quality: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less (PM_{10}), fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less ($PM_{2.5}$), and lead (Pb). Because these are the most prevalent air pollutants known to be deleterious to human health and extensive health-effects criteria documentation is available for these pollutants, they are commonly referred to as "criteria air pollutants."

Health-based air quality standards have been established for these pollutants by ARB at the state level and by EPA at the national level. These standards were established to protect the public with a margin of safety from adverse health impacts due to exposure to air pollution. California has also established standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. A brief description of each criteria air pollutant including source types and impacts to health is provided below along with the most current monitoring station data and attainment designations for the project study areas. **Table 2.1-1** presents the California Ambient Air Quality Standards (CAAQS) and the National Ambient Air Quality Standards (NAAQS).

2.1.1 Ozone (O_3)

O_3 is a colorless, odorless gas that primarily exists in the upper atmosphere (stratosphere) as the ozone layer and in the lower atmosphere (troposphere) as a pollutant. Tropospheric O_3 is a principal cause of lung and eye irritation in the urban environment. It is the principal component of smog, which is formed in the troposphere through a series of reactions involving reactive organic gases (ROG) and oxides of nitrogen (NO_X) in the presence of sunlight. Therefore, ROG and NO_X are precursors of O_3. ROG and NO_X emissions are both considered critical in O_3formation. Control strategies for ozone have focused on reducing these emissions from vehicles, industrial processes using solvents and coatings, and consumer products. O_3 concentrations are generally greatest in the summer, when atmospheric inversions are greatest and the presence of sunlight and heat is high.

1 **Table 2.1-1 National and California Ambient Air Quality Standards**

Pollutant	Averaging Time	National[a]		California[b]
		Primary[c, d]	Secondary[c, e]	Concentration[c]
Ozone	1 hour	—	Same as primary standard	0.09 ppm (180 µg/m^3)
	8 hour	0.075 ppm (147 µg/m^3)		0.07 ppm (137 µg/m^3)
Respirable particulate matter	24 hour	150 µg/m^3	Same as primary standard	50 µg/m^3
	Annual arithmetic mean	—		20 µg/m^3
Fine particulate matter	24 hour	35 µg/m^3	Same as primary standard	No separate state standard
	Annual arithmetic mean	15 µg/m^3		12 µg/m^3
Carbon monoxide	8 hour	9 ppm (10 mg/m^3)	None	9 ppm (10 mg/m^3)
	1 hour	35 ppm (40 mg/m^3)		20 ppm (23 mg/m^3)
	8 hour (Lake Tahoe)	—	—	6 ppm (7 mg/m^3)
Nitrogen dioxide	Annual Arithmetic Mean	0.053 ppm (100 µg/m^3)	Same as primary standard	0.03 ppm (57 µg/m^3)
	1 hour	0.100 ppm	None	0.18 ppm (339 µg/m^3)
Sulfur dioxide	Annual Arithmetic Mean	0.03 ppm (for certain areas)	—	—
	24 hour	0.14 ppm (for certain areas)	—	0.04 ppm (105 µg/m^3)
	3 hour	—	0.5 ppm (1,300 µg/m^3)[h]	—
	1 hour	75 ppb	—	0.25 ppm (655 µg/m^3)
Lead[f]	30-day average	—	—	1.5 µg/m^3
	Calendar quarter	1.5 µg/m^3	Same as primary standard	—
	Rolling 3-month average[g]	0.15 µg/m^3		—
Visibility-reducing particles	8 hour	No national standards		Extinction coefficient of 0.23 per kilometer —visibility of 10 miles or more (0.07 to 30 miles for Lake Tahoe) because of particles when the relative humidity is less than 70%. Method: Beta attenuation and transmittance through filter tape.
Sulfates	24 hour			25 µg/m^3
Hydrogen sulfide	1 hour			0.03 ppm (42 µg/m^3)
Vinyl chloride[f]	24 hour			0.01 ppm (26 µg/m^3)

Notes: mg/m^3 = milligrams per cubic meter; $PM_{2.5}$ = fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less; PM_{10} = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less; ppm = parts per million; µg/m^3 = micrograms per cubic meter.

[a] National standards (other than those for ozone and particulate matter and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m^3 is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact U.S. Environmental Protection Agency for further clarification and current federal policies.

[b] California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, suspended particulate matter—PM_{10}, $PM_{2.5}$, and visibility-reducing particles—are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[c] Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based on a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[d] National primary standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

[e] National secondary standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[f] The California Air Resources Board has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[g] National lead standard, rolling 3-month average: final rule signed October 15, 2008.

[h] On June 2, 2010, a new 1-hour SO2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain ineffect until implementation plans to attain or maintain the 2010 standards are approved. Note that the 1-hour national standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

Source: ARB 2012a.

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2.1.2 Particulate Matter (PM)

PM is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. Natural sources of particulates include windblown dust and ocean spray. Some particles are emitted directly into the atmosphere. Others, referred to as secondary particles, result from gases that are transformed into particles through physical and chemical processes in the atmosphere.

The size of PM is directly linked to the potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects such as aggravation of respiratory and cardiovascular disease, lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and irregular heartbeat. Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children. EPA groups PM into two categories, coarse PM or PM_{10}, and fine PM or $PM_{2.5}$, as described below.

Inhalable coarse particles (PM_{10}), such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter. Sources of coarse particles include crushing or grinding operations and dust from paved or unpaved roads. Control of PM_{10} is primarily achieved through the control of dust at construction and industrial sites, the cleaning of paved roads, and the wetting or paving of frequently used unpaved roads.

PM_{10} includes the subgroup of finer particles ($PM_{2.5}$), such as those found in smoke and haze, with an aerodynamic diameter of 2.5 microns or smaller. These finer particles pose an increased health risk because they can deposit deep in the lungs and contain substances that are particularly harmful to human health. Sources of fine particles include all types of combustion activities such as motor vehicles, power plants, wood burning, and certain industrial processes. $PM_{2.5}$ is the major cause of reduced visibility (haze) in California.

2.1.3 Carbon Monoxide (CO)

CO is a colorless and odorless gas that, in the urban environment, is associated primarily with the incomplete combustion of fossil fuels in motor vehicles. Relatively high concentrations are typically found near crowded intersections and along heavily used roadways carrying slow-moving traffic. Even under the most severe meteorological and traffic conditions, high concentrations of CO are limited to locations within a relatively short distance (300 to 600 feet) of heavily traveled roadways. Overall, CO emissions are decreasing because of the Federal Motor Vehicle Control Program, which has mandated increasingly lower emission levels for vehicles manufactured since 1973. CO concentrations are typically higher in the winter; therefore, California has required the use of oxygenated gasoline in the winter months to reduce CO emissions.

In addition to regional CO emissions, localized CO emissions can be of concern. Vehicle traffic emissions can cause localized CO impacts and severe vehicle congestion at major signalized intersections can generate elevated CO levels, called “hotspots,” that can be hazardous to human receptors adjacent to the intersections.

2.1.4 Nitrogen Dioxide (NO_2)

NO_2 is a gas that is a product of the combustion of fossil fuels generated from vehicles and stationary sources, such as power plants and boilers. NO_2 can cause lung damage. As noted above, NO_2 is a type of NO_X and is a principal contributor to ozone and smog production.

2.1.5 Sulfur Dioxide (SO_2)

SO_2 is a gas that is a product of the combustion of fossil fuels, with the primary source being power plants and heavy industry that utilize coal or oil as fuel. SO_2 is also a product of diesel engine emissions. The human health effects of SO_2 include lung disease and breathing problems for asthmatics. SO_2 in the atmosphere contributes to the formation of acid rain. In the Basin, there is relatively little combustion of coal and oil; therefore, SO_2 is less of a concern than in other parts of the country.

2.1.6 Lead (Pb)

Lead is a highly toxic metal that may cause a range of human health effects. Lead anti-knock additives in gasoline represent a major source of Lead emissions to the atmosphere. However, Lead emissions have significantly decreased due to the near elimination of leaded gasoline use. Lead-based paint, banned or limited by EPA in the 1980s, is a health hazard when it deteriorates by peeling, chipping, or cracking; or generates lead dust when scraped, sanded, or heated.

2.2 Existing Air Quality

Ambient air pollutant concentrations in the SDAB are measured at 10 air quality monitoring stations operated by the SDAPCD. The closest and most representative SDAPCD air quality monitoring station to the project site is the Del Mar monitoring station, located at 215 9th St in Del Mar, CA. However, that monitoring station only collects data on concentrations of O_3. The closest monitoring station with complete data is the Escondido monitoring station, located at 600 East Valley Parkway in Escondido, California. The Escondido station is in an urbanized area located inland, and therefore, may not completely represent the existing conditions at the project site, especially for CO, PM_{10}, and $PM_{2.5,}$ which are pollutants attributable to local emission sources. Table 2 presents the most recent data over the past four years from the Del Mar and Escondido monitoring stations as summaries of the exceedances of standards and the highest pollutant levels recorded for years 2008 through 2010 as show in **Table 2.2-1**.

Table 2.2-1 Ambient Air Quality Summary – Del Mar and Escondido Monitoring Stations

Pollutant Standards		2008	2009	2010
Carbon Monoxide (CO)				
National maximum 8-hour concentration (ppm)		2.81	3.24	2.46
State maximum 8-hour concentration (ppm)		2.81	3.54	2.46
State maximum 1-hour concentration (ppm)		5.7	5.2	4.6
Number of Days Standard Exceeded				
NAAQS 8-hour (>9.0 ppm)		0	0	0
CAAQS 8-hour (>9.0 ppm)		0	0	0
CAAQS 1-hour (>20.0 ppm)		0	0	0
Nitrogen Dioxide (NO_2)				
State maximum 1-hour concentration (ppm)		0.081	0.073	0.064
Annual Average (ppm)		0.018	0.016	0.014
Number of Days Standard Exceeded				
CAAQS 1-hour		0	0	0
Ozone				
State max 1-hour concentration (ppm)		0.117	0.097	0.085
National maximum 8-hour concentration (ppm)		0.078	0.084	0.072
Number of Days Standard Exceeded				
CAAQS 1-hour (>0.09 ppm)		2	1	0
CAAQS 8- hour (>0.070 ppm)/ NAAQS 8-hour (>0.075 ppm)		11/3	3/1	2/0
Particulate Matter (PM_{10})				
National maximum 24-hour concentration ($\mu g/m^3$)		82.0	73.0	42.0
State maximum 24-hour concentration ($\mu g/m^3$)		84.0	74.0	43.0
State annual average concentration ($\mu g/m^3$)		*	24.6	21.0
Estimated Number of Days Standard Exceeded				
NAAQS 24-hour (>150 $\mu g/m^3$)		0	0	0
CAAQS 24-hour (>50 $\mu g/m^3$)		1	1	0
Particulate Matter ($PM_{2.5}$				
National maximum 24-hour concentration ($\mu g/m^3$)		44.0	78.3	48.4
State maximum 24-hour concentration ($\mu g/m^3$)		44.0	78.4	52.2
National annual average concentration ($\mu g/m^3$)		*	13.4	12.2
State annual average concentration ($\mu g/m^3$)		12.4	*	*
Estimated Number of Days Standard Exceeded				
NAAQS 24-hour (>65 $\mu g/m^3$)		3	2	2

Notes:
* Data unavailable
ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter
Source: ARB 2011

3 Greenhouse Gases

This section describes the existing regulatory framework surrounding GHG emissions.

3.1 Federal Plans, Policies, Regulations, and Laws

3.1.1 Proposed Endangerment and Cause or Contribute Findings for GHG under the CAA

On December 7, 2009, USEPA signed two distinct findings regarding greenhouse gases under section 202(a) of the Clean Air Act:

- **Endangerment Finding:** The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations.
- **Cause or Contribute Finding:** The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, this action is a prerequisite to finalizing USEPA's proposed GHG emission standards for light-duty vehicles, which USEPA proposed in a joint proposal including the Department of Transportation's (DOT) proposed Corporate Average Fuel Economy (CAFE) standards on September 15, 2009. In April 2010, the DOT and USEPA established greenhouse gas emission and fuel economy standards for model year 2012-2016 light-duty cars and trucks. On November 16, 2011, the DOT and USEPA proposed stringent federal greenhouse gas and fuel economy standards for model year 2017-2025 passenger cars and light-duty trucks. In addition to the standards for light-duty vehicles, the DOT and USEPA announced standards to reduce GHG emissions and improve the fuel efficiency of heavy-duty trucks and buses on August 9, 2011.

3.1.2 Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, USEPA published the Final Mandatory Greenhouse Gas Reporting Rule (Reporting Rule) in the Federal Register. The Reporting Rule requires reporting of GHG data and other relevant information from fossil fuel and industrial GHG suppliers, vehicle and engine manufacturers, and all facilities that would emit 25,000 MT or more of CO_2e per year. Facility owners are required to submit an annual report with detailed calculations of facility GHG emissions due on March 31 for emissions in the previous calendar year. The Reporting Rule would also mandate recordkeeping and administrative requirements to enable USEPA to verify the annual GHG emissions reports. Owners of existing facilities that commenced operation prior to January 1, 2011, are required to submit an annual report for calendar year 2011.

3.2 State Plans, Policies, Regulations, and Laws

ARB is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA).

3.2.1 Assembly Bill (AB) 1493

AB 1493, signed in 2002, required that ARB develop and adopt by January 1, 2005, regulations that achieve "the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty trucks and other vehicles determined by ARB to be vehicles whose primary use is noncommercial personal transportation in the state."

In 2004, ARB adopted standards requiring automobile manufacturers to meet fleet-average GHG emissions limits for all passenger cars, light-duty trucks within various weight criteria, and medium-duty passenger vehicle weight classes (i.e., any medium-duty vehicle with a gross vehicle weight rating less than 10,000 pounds that is designed primarily for the transportation of persons), and beginning with the 2009 model year. For passenger cars and light-duty trucks, the GHG emission limits for the 2016 model year are approximately 37 percent lower than the limits for the first year of the regulations, the 2009 model year. Before the regulations could go into effect, US EPA had to grant California a waiver under the CAA, allowing California to regulate GHG emissions from motor vehicles within the state. USEPA granted the waiver in 2009.

In the fall of 2010, California accepted compliance with the federal GHG standards as meeting similar state standards as adopted in 2004, resulting in the first coordinated national program.

3.2.2 Executive Order S-3-05

Executive Order S-3-05, signed in June 2005, proclaimed that the State of California is vulnerable to the impacts of climate change. Executive Order S-3-05 declared that increased temperatures could reduce the Sierra Nevada's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80percent below the 1990 level by 2050.

Executive Order S-3-05 directed the Secretary of Cal/EPA to coordinate a multi-agency effort to reduce GHG emissions to the target levels and to submit biannual reports to the Governor and the State Legislature describing progress made toward reaching the emission targets, impacts of global warming on California's resources, and mitigation and adaptation plans to combat these impacts. The Secretary of Cal/EPA created the California Climate Action Team (CCAT), made up of members from various state agencies and commissions, which responsible for implementing global warming emissions reduction programs. CCAT is also responsible for reporting on the progress made toward meeting the statewide GHG targets.

3.2.3 Executive Order S-1-07

Executive Order S-1-07, signed in 2007, establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10percent by 2020. ARB identified this Low Carbon Fuel Standard (LCFS) as a discrete early action item under AB 32, and the final ARB resolution (No. 09-31) was issued on April 23, 2009.

Attachment I1 Alternative EN-1A Emissions

Attachment I2 Alternative EN-1B Emissions

Attachment I3 Alternative EN-2A Emissions

Attachment I4 Alternative EN-2B Emissions

Attachment I5 Alternative SB-1A Emissions

Attachment I6 Alternative SB-1B Emissions

Attachment I7 Alternative SB-1C Emissions

Attachment I8 Alternative SB-2A Emissions

Attachment I9 Alternative SB-2B Emissions

Attachment I0 Reef Construction Emission Estimates