# Appendices

### 2 Introduction

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3 The appendices to the Salton Sea Species Conservation Habitat Project (SCH Project) Environmental 4 Impact Statement/Environmental Impact Report (EIS/EIR) include information directly needed to assist 5 agencies and the general public in their review of the EIS/EIR. These appendices document that 6 appropriate procedures were followed to develop the scope and contents of the EIS/EIR (Appendices A 7 and B); provide technical information specifically used to support the Project description or provide 8 additional detail regarding Project operations (Appendices C, D, E, and F); and provide substantial 9 evidence that supports the conclusions reached in the EIS/EIR (Appendices G, H, I, J, and K). The list of 10 appendices provided below is followed by a brief description of the purpose of each:

- 11 A Scoping Process
- 12 B Alternatives Development Process
- 13 C Geotechnical Investigations
- 14 D Project Operations
- 15 E Monitoring and Adaptive Management Framework
- 16 F Mosquito Control Plan
- 17 G Air Quality Documentation
- 18 H Special-Status Species Evaluated but not Affected by the SCH Project
- 19 I Selenium Management Strategies
- 20 J Summary of Special Studies Supporting the EIS/EIR Impact Analysis
- 21 K Corps Section 404 Permit Projects in the HUC 8 Watershed
- 22 L Tribal Consultation and Coordination

#### 23 Appendix A Scoping Process

This appendix includes the Notice of Intent and Notice of Preparation prepared by the United States Army Corps of Engineers (Corps) and California Department of Natural Resources, respectively. These notices provided information regarding the SCH Project's nature and its anticipated impacts, and they informed interested agencies, Stakeholders, and members of the general public of the intent to prepare a joint EIS/EIR assessing the Project impacts. These notices also described the procedures to be followed to submit comments on the scope and contents of the EIS/EIR, either in writing or verbally at four public meetings. This appendix also includes a scoping report that summarizes the comments that were received.

Salton Sea SCH Project Draft EIS/EIR

### 1 Appendix B Alternatives Development Process

2 This appendix outlines the procedures that were followed in developing the alternatives that are analyzed

3 in this EIS/EIR. It includes a description of the potential sites and Project components that originally were

4 considered, as well as reasons that some of them were eliminated.

# 5 Appendix C Geotechnical Investigations

6 This report presents the results of the preliminary geotechnical investigation for the SCH Project. The 7 preliminary investigation was intended to provide a general characterization of on-site soil conditions and 8 to provide geotechnical engineering criteria for preliminary design, which is the basis for the Project 9 description in the EIS/EIR. The findings and conclusions presented in this report are not intended for final 10 design. A more detailed investigation would be conducted for the final berm alignment, berm 11 configurations, borrow sources, and anticipated construction methodologies.

### 12 Appendix D Project Operations

13 The SCH ponds are intended to be operated in a manner that would both provide in-kind replacement for 14 some of the near-term habitat losses at the Salton Sea and answer key questions regarding shallow water 15 habitat development and management as part of a long-term Salton Sea restoration program. Operations 16 would have to balance habitat requirements necessary to achieve desired objectives against environmental 17 constraints (physical, water quality, and climatological conditions), potential impacts (e.g., toxicity, 18 disease vectors), and compatibility with adjacent land uses, other habitat values, and applicable 19 regulations. This appendix provides an overview of several operations scenarios that could be used to 20 provide suitable habitat and to test different scenarios as part of the SCH Project's "proof-of-concept" 21 aspect.

#### 22 Appendix E Monitoring and Adaptive Management Framework

23 The two goals of the SCH Project are (1) to provide aquatic habitat to support fish and wildlife species 24 dependent on the Salton Sea and (2) to develop and refine information needed to successfully manage the 25 SCH Project. The SCH Project is intended to serve as a proof of concept for the long-term restoration 26 envisioned for the Salton Sea and, therefore, would be developed and operated consistent with the 27 principles of adaptive management. The purpose of this appendix is to present a monitoring and adaptive 28 management framework to guide evaluation and improved management of the newly created habitat, as 29 well as to inform future restoration. Because the SCH Project has not reached final design or construction, 30 this document does not include the detailed protocols and site-specific sampling design necessary for 31 actual implementation. A more detailed monitoring plan and decision-making process would be 32 developed should the SCH Project be constructed.

# 33 Appendix G Air Quality/Greenhouse Gases Documentation

This appendix includes the Imperial County Air Pollution Control District, Regulation VIII, Fugitive Dust Control Measures, which are required to be implemented to minimize impacts from fugitive dust emissions. It also includes the emissions calculations used to support both the air quality and greenhouse gas emissions/climate change analyses.

#### 38 Appendix H Special-Status Species Evaluated but not Affected by the SCH Project

39 This appendix explains why a number of special-status species that were evaluated would not be affected

40 if the SCH Project were implemented.

# 1 Appendix I Selenium Management Strategies

2 Selenium, a naturally occurring element, is present in the water, sediments, and biota of the Salton Sea 3 ecosystem. Selenium can cause adverse effects when present at elevated concentrations in the food web, 4 especially on the reproduction of birds and fish. One uncertainty is whether the SCH Project could 5 increase the probability and magnitude of selenium impacts relative to existing and expected future 6 conditions. This appendix evaluates the potential selenium exposure and risks from the SCH Project on 7 ecological receptors (primarily aquatic and benthic invertebrates, fish, and birds); identifies measures to 8 avoid, reduce, and mitigate potential impacts; and outlines monitoring that would support adaptive 9 management of selenium risk at the SCH Project.

### 10 Appendix J Special Studies Summary

The SCH Project is being designed to support wildlife dependent on the Salton Sea and to minimize negative impacts on wildlife or humans. The Sea's environmental conditions are often extreme and can be challenging for building habitat and maintaining fish and wildlife populations. The State of California contracted for specialized studies to address key uncertainties for the SCH Project's design, impact analysis, and operation. This appendix summarizes various studies including:

- Hydrologic modeling explored how different potential pond depths and configurations, source waters, and water operations could affect saltwater balance in ponds and expected water quality conditions (temperature, dissolved oxygen).
- Fish tolerance study A laboratory experiment exposed different tilapia species to various
   combinations of salinity and temperature to look at survival tolerances to inform design of operational
   scenarios and selection of fish species for stocking.
- Contaminants in water and sediments Another issue is potential toxicity impacts from contaminants
   in sediments or water at the proposed SCH ponds. Sediment and water samples were collected from
   the alternative SCH sites and concentrations measured for selenium, arsenic, boron, and pesticides.
- Selenium ecorisk modeling Selenium in the sediment and water could contribute to toxicity risks to the ecosystem and humans through accumulation in the sediment and cycling through the food web.
   Ecorisk modeling was conducted to evaluate the potential risk of transfer and bioaccumulation in the food web.
- Selenium treatment Pilot studies are underway to evaluate the potential for using vegetation in constructed wetlands to help remove selenium from water that could supply the SCH ponds.

# 31 Appendix K Corps Section 404 Permit Projects in the HUC 8 Watershed

This appendix includes a list of section 404 permits issued by the Corps in the Salton Sea watershed where the SCH Project would be located.

# 34 Appendix L Tribal Consultation and Coordination

As part of its Section 106 consultation process, the Corps requested information regarding cultural and Native American resources in the SCH Project area from the Torres Martinez Desert Cahuilla Indians, Quechan Indian Nation, Manzanita Band of the Kumeyaay Nation, La Posta Band of Mission Indians, Kwaaymii Laguna Band of Mission Indians, Kumeyaay Cultural Heritage Preservation, Fort Yuma Quechan Nation, Ewiiaapyaap Tribal Office, Cocopah Museum, Campo Kumeyaay Nation, Augustine Band of Cahuilla Mission Indians, and the Ah-Mut-Pipa Foundation. Appendix L contains copies of the

41 consultation letters sent by the Corps and responses from the tribes received to date.

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APPENDIX A

# **Scoping Process**

ATTACHMENT A

# **Notice of Intent**



# **PUBLIC NOTICE**

# US Army Corps of Engineers®

# RECEIPT OF APPLICATION FOR A CORPS PERMIT, NOTICE OF INTENT TO PREPARE A DRAFT EIS/EIR AND HOLD A PUBLIC SCOPING MEETING

LOS ANGELES DISTRICT

**Public Notice/Application No.:** SPL-2010-00142-LLC **Comment Period:** June 21, 2010 through July 24, 2010 **Project Manager:** Lanika Cervantes; 760.602.4838; Lanika.L.Cervantes@usace.army.mil

Applicant and Contact Kim Nicol California Department of Fish and Game 78078 Country Club Drive, Suite 109, Bermuda Dunes, CA 92203 (760) 200-9178

#### **Location**

The proposed project would be located within the Salton Sea in Imperial and Riverside County, California.

#### <u>Activity</u>

The U.S. Army Corps of Engineers (Corps), in conjunction with the California Natural Resources Agency, is preparing an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the construction of the Salton Sea Species Conservation Habitat (SCH) Project. The SCH project consists of the creation of a shallow habitat pond complex that would be constructed in phases depending on funding and land availability. Habitat would be constructed over multiple years, as the Sea recedes, until the targeted acreage of habitat was reached. It is currently anticipated that about 2,400 acres of habitat would be created as part of the SCH Project, although the actual amount may vary depending on the outcome of the alternatives development process. For more information, see page 3 of this notice.

Interested parties are hereby notified that an application has been received for a Department of the Army permit for the activity described herein and shown on the attached drawings. Interested parties are invited to provide their views on the proposed work, which will become a part of the record and will be considered in the decision. This permit will be issued or denied under Section 404 of the Clean Water Act (33 U.S.C. 1344). Written comments should be mailed to:

Comments should be mailed to:

U.S. Army Corps of Engineers, Los Angeles District Regulatory Division ATTN: 2010-00142-LLC 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

Alternatively, comments can be sent electronically to: Lanika.L.Cervantes@usace.army.mil

#### **Evaluation Factors**

The decision whether to issue a permit will be based on an evaluation of the probable impact including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit that reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors that may be relevant to the proposal will be considered including the cumulative effects thereof. Factors that will be considered include conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food production and, in general, the needs and welfare of the people. In addition, because the proposed action would discharge dredged or fill material into waters of the U.S., the evaluation of the activity will include application of the U.S. Environmental Protection Agency's Section 404(b)(1) Guidelines (40 C.F.R. Part 230) as required by Section 404 (b)(1) of the Clean Water Act.

The Corps of Engineers is soliciting comments from the public; Federal, state, and local agencies and officials; Indian tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition, or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. In this case, comments will be used in the preparation of an Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act. Comments are also used to determine the overall public interest of the proposed activity.

#### **Preliminary Review of Selected Factors**

**EIS Determination**- A determination has been made that an environmental impact statement (EIS) is required for the proposed activities, based on the Corps's independent determination that the proposed action could result in potentially significant impacts. It is expected that a Draft EIS will be prepared and published by early-2011.

<u>Water Quality</u>- The applicant is required to obtain water quality certification, under Section 401 of the Clean Water Act, from the California Regional Water Quality Control Board (RWQCB). Section 401 requires that any applicant for an individual Section 404 permit provide proof of water quality certification to the Corps of Engineers prior to permit issuance. For any proposed activity on Tribal land that is subject to Section 404 jurisdiction, the applicant will be required to obtain water quality certification from the U.S. Environmental Protection Agency.

<u>Coastal Zone Management</u>- For those projects in or affecting the coastal zone, the Federal Coastal Zone Management Act requires that prior to issuing the Corps authorization for the project, the applicant must obtain concurrence from the California Coastal Commission that the project is consistent with the State's Coastal Zone Management Plan. This project is located outside the coastal zone and is not expected to affect coastal zone resources.

<u>Cultural Resources</u>- The Corps and the Applicant are still in the process of collecting information of the potential sites and will continue to evaluate potential effects on cultural resources. Consultation with the State Historic Preservation Officer, pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, will occur for any anticipated effects of the proposed activities on cultural resources eligible for listing or listed on the National Register of Historic Places.

Endangered/Threatened Species- Preliminary determinations indicate that the proposed activities may affect federally listed endangered or threatened species, or their critical habitat. Federally listed species known or having high potential to occur in the areas selected around the Salton Sea, based on previous survey results, include least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii extimus*), desert pupfish (*Cyprinodon macularius*), Yuma Clapper rail (*Rallus longirostris yumanensis*), and California Least tern (*Sterna antillarum browni*). Additional on-site surveys for federally listed species are being conducted at this time to provide current information. Thus, formal consultation under Section 7 of the Endangered Species Act appears to be required.

**Public Meeting/Hearing-** The Corps and the Natural Resources Agency will jointly conduct a series of public scoping meetings to receive public comments regarding the appropriate scope and content of the SCH Project DEIS/DEIR and to assess public concerns. Parties interested in being added to the electronic mail notification list for any projects associated with the Salton Sea can register at: http://www.spl.usace.army.mil/regulatory/ under the Public Notice tab, Distribution List registration. This list will be used in the future to notify the public about scheduled hearings and availability of future public notices. Parties interested in obtaining additional information about the SCH Project can also visit the Natural Resources Agency website at http://resources.ca.gov/restoring the salton sea.html.

The scoping meetings will be held at:

- 1. Palm Desert—**July 7, 2010 at 1:00 P.M.** at University of California, 75-080 Frank Sinatra Drive, Room B200, Palm Desert, CA 92211.
- 2. Thermal—**July 7, 2010 at 6:30 P.M.** at Torrez-Martinez Tribal Administration Building, 66-725 Martinez Road, Thermal, CA 92274.
- 3. Calipatria **July 8, 2010 at 1:00 P.M.** at Calipatria Inn and Suites, 700 North Sorenson Avenue, Calipatria, CA 92233.
- 4. Brawley **July 8, 2010 at 6:30 P.M.** at Elks Lodge #1420, 161 South Plaza, Brawley, CA 92227.

During these public scoping meetings, anyone wishing to make a statement will be allocated a certain amount of time to provide information on the proposed project. The amount of time each person is allowed will be directly dependent on the number of people who wish to make verbal

comments. At this time, we estimate that individuals will be given 2 or 3 minutes to provide their comments verbally. We would like to encourage interest groups to designate an official spokesperson to present the group's views. We will allocate a larger amount of time to official representatives of such groups upon request.

Groups wishing to designate an official representative must notify the Corps in writing prior to, but no later than **July 1, 2010**. The determination of this extended speaking time will be based on the number of responses received by the Corps. This rule will be strictly enforced at the discretion of the Corps' hearing officer.

The public scoping meetings will provide the opportunity for the public to provide comments on the proposal that will be entered into the administrative record. In addition, the Corps will be receiving written comments into the record from anyone who wishes to provide them until **July 24**, **2010** (i.e., the close of the comment period for this public notice).

The Corps also anticipates holding a public hearing to obtain input on the Draft EIS/EIR when it becomes available and is circulated to the public (expected by early-2011).

#### **Proposed Activity for Which a Permit is Required**

CDFG, as the project applicant, proposes to construct, operate, and maintain the SCH project; approximately 2,400 acres of exposed playa of the Salton Sea will be converted to shallow pond and wetland complexes. The SCH project would impact areas within the Ordinary High Water Mark of the Salton Sea and adjacent wetlands.

<u>Basic Project Purpose</u>- The basic project purpose comprises the fundamental, essential, or irreducible purpose of the proposed project, and is used by the Corps to determine whether the applicant's project is water dependent. The basic purpose of the proposed SCH Project is to create aquatic habitat to protect the fish and wildlife species dependent on the Salton Sea in accordance with California Fish and Game Code, Section 2932. This project is a water dependent activity.

<u>Overall Project Purpose</u>- The overall project purpose serves as the basis for the Corps' Section 404(b)(1) alternatives analysis and is determined by further defining the basic project purpose in a manner that more specifically describes the applicant's goals for the project, and which allows a reasonable range of alternatives to be analyzed. The overall project purpose is to develop a range of aquatic habitats that will support fish and wildlife species dependent on the Salton Sea.

#### **Additional Project Information**

**Background information-** The Salton Sea is located in both Imperial and Riverside counties in southeastern California, approximately 35 miles north of the U.S. Mexico border and 50 miles west of the Colorado River. Preliminary evaluations of potential sites indicate that SCH ponds could be constructed at either the north end of the Salton Sea near the Whitewater River, or the south end of the Salton Sea near the New and Alamo rivers, or in both areas.

As the Sea recedes and becomes more saline, fish species will not be able to survive. Simultaneously, the fish-eating birds, including several species of special concern, will lose their forage base and begin to disappear. As the Sea continues to become more saline, current invertebrate species will become less diverse and be replaced by species tolerant of hyper-saline environments (e.g., brine flies and brine shrimp).

The SCH Project would provide habitat for both fish and invertebrate species, which in turn would provide forage for the numerous bird species dependent on the Salton Sea ecosystem. Salinity would be managed to support various assemblages of invertebrates and fish to diversify the prey base for as wide a variety of bird species as possible. The SCH ponds would be designed to serve those piscivorous bird species that are expected to experience significant declines as functional Salton Sea habitat is lost due to increasing salinity.. For many of these species, a significant proportion of their population uses the Salton Sea.

**Project description**- The SCH Project is being developed as a proof-of-concept project for future restoration to verify that the core ideas are functional and feasible prior to attempting a full scale restoration of the Salton Sea. The SCH Project would help establish viability, technical issues, and overall direction, as well as providing feedback for costs and requirements of construction, operations and management. The SCH Project would be created in phases as the Sea recedes by constructing dikes below the elevation of -228 feet mean sea level (msl) using material excavated from the sea bed. Rivers, which have better water quality than agricultural drain water, would provide the primary source of water for the ponds.

Habitat ponds would vary in size, and several ponds could be constructed in each phase depending on funding and land availability. Habitat would continue to be constructed in subsequent years as the Sea continues to recede until the targeted acreage of habitat was reached. It is currently anticipated that about 2,400 acres of habitat would be created as part of the SCH Project, although the actual amount may vary depending on the outcome of the alternatives development process. The SCH would be designed with varying ranges of salinity in order to maximize biological productivity and minimize adverse effects associated with water quality. Ponds would be designed to optimize fish habitat and maximize fish productivity to provide a sustainable prey base for piscivorous birds. Ponds could also be managed to optimize invertebrate production to enhance the prey base for shorebirds and wading birds.

The depth of water in the ponds is dependent on the slope of the sea bed, but could range up to approximately 6 feet, depending on the areas available for development as the surface water elevation declines. Deeper areas could be created by excavating materials from within the ponds for construction of the dikes or islands. The dike separating adjacent ponds at similar elevations could also be modified to form larger ponds in the future, with portions of the original dike left intact to form islands.

A sedimentation basin could be constructed on lands above elevation -228 msl, or the first SCH pond could function as a sedimentation basin in addition to providing habitat. The first pond may need to be drained periodically for vegetation management and sediment removal; triggers for such actions will be developed as part of the adaptive management plan. Water discharged from the first pond would flow into other ponds, and from there into further ponds and/or into the Salton Sea.

A variety of methods for managing salinity will be thoroughly evaluated in the EIR/EIS. Several methods are currently under consideration, although additional methods may be identified as part of the scoping process and as a result of special studies that are underway. The method currently being considered is evapo-concentration of salts, which would result in higher salinity in each subsequent pond until the maximum salinity suitable for optimal biological productivity was achieved. Once the maximum desired salinity was achieved, the next series of ponds could again initially be supplied by

river water. Saline water from the earlier ponds could be blended with river water to obtain targeted salinities in some of the newer ponds. If not needed for blending in the next phase of ponds, saline water from the ponds would discharge to the Salton Sea. This process would result in a mix of salinities throughout the SCH complex, with salinities being managed by balancing river inflow, evaporation, and discharge. Higher salinities in the initial ponds, if needed, could be achieved by temporarily blending diverted river water with saline water pumped from the Salton Sea. If necessary, temporary pumping could also be used to initially achieve the targeted salinities in subsequent series of ponds, but longer-term salinity management would be maintained by balancing inflows, evaporation, and discharge. If additional salt water were needed in future years to maintain salinity, saline water from the higher salinity ponds could be recirculated to the lower salinity ponds.

Siting SCH ponds adjacent to the confluence of the New, Alamo, or Whitewater rivers and the Salton Sea would minimize the need for conveyance facilities to transport freshwater from these rivers to the ponds. Water flow from the rivers and between the ponds could be controlled with valves to be able to respond to varying evaporation or seepage rates and to allow changes in operations to modify salinity or water depth goals. The precise method of conveying water will be evaluated as part of the engineering design and environmental review process.

Monitoring and evaluation would commence upon completion of the ponds in the first year and would continue thereafter. A monitoring and adaptive management plan would be implemented to monitor and evaluate biological and water quality parameters, habitat function, and engineering performance of the SCH Project. Information obtained from monitoring and evaluation would be used to refine the engineering design, wildlife management criteria, and adaptive strategies for continued development of subsequent phases of the SCH Project. Adaptive and flexible strategies would reduce the risks and uncertainties associated with operating larger complexes and facilitate managing or mitigating observed issues and problems.

Through the EIS/EIR process, feasible environmental mitigation measures will be developed to reduce potential environmental impacts. Measures to reduce construction impacts would be implemented through construction contract specifications and permit requirements.

<u>Issues-</u> There are several potential environmental issues that will be addressed in the Draft EIS/EIR. Additional issues may be identified during the scoping process. Issues initially identified for evaluation in the Draft EIS/EIR as potentially significant or that are believed to be of local concern include:

- 1. Agricultural Resources: impacts from conversion of farmland to non-agricultural use, and dust due to construction.
- 2. Air Quality: impacts during construction, operations, and maintenance, and also the beneficial impact on fugitive dust from covering exposed playa with water.
- 3. Biological Resources: impacts on fish and wildlife during construction, operations, and maintenance.
- 4. Cultural Resources: potential impacts to archaeological resources, human remains, and sacred sites activities.
- 5. Environmental Justice: potential effects on the Torres Martinez Desert Cahuilla Indian Tribe and other local communities from construction, operations, and maintenance activities.

- 6. Geology and Soils: impacts during construction, operations, and maintenance
- 7. Greenhouse Gas Emissions/Climate Change: impacts during construction, operations, and maintenance.
- 8. Hazards and Hazardous Materials: impacts during construction, maintenance, and operations.
- 9. Hydrology and Water Quality: impacts during construction, operations, and maintenance.
- 10. Indian Trust Assets: effects on Torres Martinez Tribe's trust assets from development of the sites near the Whitewater River.
- 11. Land Use: potential conflicts with other existing or planned land uses and local plans, policies, and ordinances.
- 12. Noise: impacts during construction, operations, and maintenance.
- 13. Paleontological Resources: potential impacts from ground-disturbing activities.
- 14. Transportation and Traffic: impacts during construction, operations, and maintenance.

<u>Alternatives</u>- Several alternatives are being considered for the proposed action. The EIS/EIR may include a co-equal analysis of the project alternatives considered. Alternatives initially being considered for the SCH Project include: (a) alternative locations (at the confluence of the New, Alamo, or Whitewater rivers and the Salton Sea, or a combination of sites); (b) different acreages of created habitat; (c) different pond sizes and configurations; (d) different ranges of salinity within the ponds; and (e) no action. The range and characteristics of the alternatives addressed in the EIS/EIR will be further developed based on input from the scoping process and special studies that are underway.

**Proposed Mitigation** – The proposed mitigation may change as a result of comments received in response to this public notice, the applicant's response to those comments, and/or the need for the project to comply with the Section 404(b)(1) Guidelines. In consideration of the above, the proposed mitigation sequence (avoidance/minimization/compensation), as applied to the proposed project is summarized below:

<u>Avoidance/minimization</u>: The Applicant is still in the conceptual design phase of their project and will be working closely with the Corps and other permitting Agencies to develop designs that will avoid and minimize potentially negative impacts to aquatic resources to the highest extent practicable.

<u>Compensation</u>: The applicant is proposing to compensate for the impacts to waters/wetlands of the U.S. through the creation of wetlands as part of the project design.

For additional information please call Ms. Lanika Cervantes of my staff at (760) 602-4838 or via e-mail at Lanika.L.Cervantes@usace.army.mil. This public notice is issued by the Chief, Regulatory Division.



ATTACHMENT B

# **Notice of Preparation**

#### **Notice of Completion & Environmental Document Transmittal**

*Mail to:* State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613 *For Hand Delivery/Street Address:* 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Salton Sea Spe	cies Conservation Habitat (S	CH) Project			
Lead Agency: Natural Resources Agency			Contact Person: Kimberly Nicol/DFG Program Mgr		
Mailing Address: 78078 Country		Phone: (760) 200-9	9178		
City: Bermuda Dunes		Zip: 92203	County: Riverside		
Project Location: County: Imp	erial and Riverside counties	City/Nearest Com	munity: Calipatria, N	iland, & Oasis	
Cross Streets: See Figure1, Ger	neral SCH Site Locations			Zip Code: Multiple	
Longitude/Latitude (degrees, minu	ites and seconds):°	<u>′                                    </u>	'' W Tota	al Acres: approximately 2,400	
Assessor's Parcel No.: Multiple		Section: Multiple Twp.: Multiple Range: Multiple Base: Multiple			
Within 2 Miles: State Hwy #: 8	36 and 111	Waterways: New River, Alamo River, and Whitewater River			
Airports: Non	е	Railways: Union Pacific Schools: Oasis Elem. School &			
				– – Saul Martinez School	
Document Type:					
CEQA:           Image: CEQA:       Image: NoP       Image: Ceqa: Image: Image: Ceqa: Image: Ceqa: Image: Ceq	Draft EIR Supplement/Subsequent EIR Prior SCH No.)	NEPA:	NOI Other: EA Draft EIS FONSI	<ul> <li>Joint Document</li> <li>Final Document</li> <li>Other:</li> </ul>	
Local Action Type:			And a second	an an ann an Anna an An Anna an Anna an	
General Plan Update     General Plan Amendment     General Plan Element     Community Plan	<ul> <li>Specific Plan</li> <li>Master Plan</li> <li>Planned Unit Developmen</li> <li>Site Plan</li> </ul>	L Rezone Prezone Use Permi Land Divi	t sion (Subdivision, etc.	Annexation     Redevelopment     Coastal Permit     Other:	
Development Type:			an tar al ne an 181 an an Antenin in dhaonna an	יסיר שיני אין איז	
Residential: Units	Acres				
Office: Sq.ft.	Acres Employees	Transpor	rtation: Type		
Commercial:Sq.ft.	Acres Employees	Mining:	Mineral		
Industrial: Sq.ft.	Acres Employees	Power:	Туре	MW	
Educational:		Waste Ti	reatment: Type	MGD	
Recreational:		Hazardous Waste: Type			
Water Facilities: Type	MGD	[✓] Other: <u>H</u>	abitat Restoration		
Project Issues Discussed in I		an a	and a contraction of the second s	ของสามสารางที่สารางไม่ได้ของเงิมีมีสารางได้มีขณะมีได้มีขณะที่มีที่สารางที่มีที่สารางได้มีการสำคัญการไม่ได้	
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Activity Visual	Elood Plain/Flooding	Schools/Univ	uns	Water Quality	
Air Quality	Forest L and/Fire Hazard	Sentic System	ne	Water Supply/Groundwater	
Archeological/Historical	Geologic/Seismic	Sewer Canac	itx	Wetland/Rinarian	
✓ Archeological/Historical     ✓ Geologic/Seismic       ✓ Biological Resources     ✓ Minerals		Soil Erosion/Compaction/Grading Crowth Inducer		Growth Inducement	
Coastal Zone		Solid Waste	Compaction/Orading	I and Use	
Drainage/Absorption	Denulation/Housing Dalan	Torrio/Harard	long	Cumulativa Effects	
Fconomic/Jobs	Public Services/Facilities	Traffic/Circu	lation	Other	
<u> </u>					

Present Land Use/Zoning/General Plan Designation:

Salton Sea is a repository for agricultural drainage; surrounding areas are predominantly used for agriculture.

**Project Description:** (please use a separate page if necessary)

The SCH Project would construct habitat configured in a series of interconnected shallow ponds at either the north or south ends of the Salton Sea, or in both areas. The Project size at total build-out is currently expected to be approximately 2,400 acres, which may be constructed over a period of several years. The actual total Project size may vary, and SCH ponds would vary in size. The Project's ponds would be created by constructing dikes below the elevation of -228' msl using material excavated from the Sea bed. Rivers would provide the primary source of water for the ponds. The SCH would be designed with varying ranges of salinity to maximize biological productivity and minimize adverse effects from water quality.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

#### **Reviewing Agencies Checklist**

x	Ale Deserves Desert	X Office (T		
	Air Resources Board	X Office of Emergency Serv	vices	
~	Boating & Waterways, Department of	X Office of Historic Preserv	ation	
~	_ California Highway Patrol	Office of Public School C	Construction	
<u>~</u>	Caltrans District #	X Parks & Recreation, Depa	urtment of	
	_ Caltrans Division of Aeronautics	Pesticide Regulation, Dep	partment of	
	_ Caltrans Planning	Public Utilities Commiss	on	
	Central Valley Flood Protection Board	$\times$ Regional WQCB # /	_	
X	Coachella Valley Mtns. Conservancy	X Resources Agency		
	_ Coastal Commission	S.F. Bay Conservation &	Development Comm.	
Х	Colorado River Board	San Gabriel & Lower L.A	. Rivers & Mtns. Conservancy	
Х	Conservation, Department of	San Joaquin River Conser	rvancy	
	_ Corrections, Department of	Santa Monica Mtns. Cons	servancy	
	Delta Protection Commission	X State Lands Commission		
	Education, Department of	SWRCB: Clean Water Gr	ants	
Х	Energy Commission	X SWRCB: Water Quality		
Х	Fish & Game Region # 6	X SWRCB: Water Rights		
X	Food & Agriculture, Department of	Tahoe Regional Planning	Agency	
X	Forestry and Fire Protection, Department of	X Toxic Substances Control	, Department of	
	General Services, Department of	X Water Resources, Departi	nent of	
Х	Health Services. Department of			
	Housing & Community Development	Other:		
	Integrated Waste Management Board	Other:		
X	Native American Heritage Commission			
Loca	I Public Review Period (to be filled in by lead age	су)	•	
Starting Date June 23, 2010		Ending Date July 22, 2010		
Lead	Agency (Complete if applicable):		<b>N. 27. 190 N. N. M. M. M. N. N. N.</b>	
Cons	ulting Firm:	Applicant:		
Addr	ess:	Address:		
City/State/Zip:		City/State/Zip:		
Cont	act:	Phone:		
Phon	e:	_		

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

То:	Distribution List
From:	State of California, Natural Resources Agency
Date:	June 21, 2010
Re:	Notice of Preparation (NOP) of a Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR)
Project:	Proposed Salton Sea Species Conservation Habitat (SCH) Project Riverside and Imperial Counties, California

The California Natural Resources Agency is the Lead Agency for preparation of the Salton Sea SCH Project EIR in accordance with the California Environmental Quality Act (CEQA). Because the SCH Project (Project) involves both State and Federal actions, a joint EIS/EIR will be prepared by DFG, under the direction of the Natural Resources Agency, and the U.S. Army Corps of Engineers (Corps) pursuant to CEQA and the National Environmental Policy Act (NEPA). The joint document is being prepared to optimize efficiency and avoid duplication and is intended to be sufficient in scope to address both the Federal and State requirements. A summary of the SCH Project is included as Attachment A.

For the purposes of the EIS/EIR, the State actions are the implementation of conservation measures necessary to protect the fish and wildlife species dependent on the Salton Sea in accordance with California Fish and Game Code, Section 2932, and the potential issuance of incidental take authorization under the California Endangered Species Act (CESA) California, Section 2081, and a Streambed Alteration Agreement under California Fish and Game Code, Section 1602. The primary Federal action is the potential issuance of a permit under Section 404 of the Clean Water Act, which regulates the discharge of dredged, excavated, or fill material in wetlands, streams, rivers, and other U.S. waters.

We request the views of interested parties as to the scope and content of the environmental documentation, including issues that are of interest to an agency's statutory responsibilities in connection with the SCH Project. Agencies may need to use the EIS/EIR when considering permit(s) or other approval(s) for the Project. An Initial Study was not prepared because the Natural Resources Agency has already determined that a joint EIS/EIR is required (CEQA Guidelines, Section 15063(a)).

Due to time limits mandated by State law, your response must be sent at the earliest possible date, but not later than 30 days after receipt of this notice. Please send responses to Ms. Kimberly Nicol, DFG Program Manager, at 78078 Country Club Drive, Suite 109, Bermuda Dunes, CA 92203, or at <u>knicol@dfg.ca.gov</u>; alternatively, they can be sent to U.S. Army Corps of Engineers, Los Angeles District, Regulatory Division, San Diego Field Office, ATTN: CESPL-RG-SS-2010-00142-LLC, 6010 Hidden Valley Road, Suite 105, Carlsbad, CA 92011, or <u>lanika.l.cervantes@usace.army.mil</u>. If you have questions, please contact Ms. Nicol at (760) 200-9178 or Ms. Lanika Cervantes, Corps Project Manager, at (760) 602-4838. Comment letters sent via electronic mail should include the commenter's name and physical mailing

address, and the Project title, "Species Conservation Habitat Project" should be included in the electronic mail's subject line.

Scoping meetings will be held to obtain input to the Draft EIS/EIR, and a public hearing will be held during the public comment period once the Draft EIS/EIR is released. Parties interested in being added to the electronic mail notification list for the SCH Project can register at: <a href="http://www.spl.usace.army.mil/regulatory/">http://www.spl.usace.army.mil/regulatory/</a> under the Public Notice tab, Distribution List registration. This list will be used in the future to notify the public about scheduled hearings and availability of future public notices. Parties interested in obtaining additional information about the SCH Project can also visit the Natural Resources Agency website at <a href="http://resources.ca.gov/restoring\_the\_salton\_sea.html">http://resources.ca.gov/restoring\_the\_salton\_sea.html</a>.

The Natural Resources Agency and the Corps will jointly conduct public scoping meetings at the following locations to receive public comment and assess public concerns regarding the appropriate scope of the Draft EIS/EIR.

Community	Location/Address	Date	Time
Palm Desert	University of California at Riverside, Room B200 75-080 Frank Sinatra Drive	July 07, 2010	1:00 P.M.
Thermal	Torrez Martinez, Tribal Administration Building 66-725 Martinez St.	July 07, 2010	6:30 PM
Calipatria	Calipatria Inn and Suites 700 North Sorenson Avenue	July 08, 2010	1:00 P.M.
Brawley	Elks Lodge #1420, 161 South Plaza	July 08, 2010	6:30 PM

# Attachment A

#### **1.0** Description of the Project

#### Overview

The SCH Project would construct habitat configured in a series of interconnected shallow ponds within the current footprint of the Salton Sea. The Project size at total build-out is currently expected to be approximately 2,400 acres, which may be constructed over a period of several years depending on land availability and cost. The actual total project size may vary depending on the outcome of the alternatives development process. The Project's ponds would be created as the Sea recedes by constructing dikes below the elevation of -228 feet mean sea level (msl) using material excavated from the sea bed. Rivers, which have better water quality than agricultural drain water, would provide the primary source of water for the ponds. Habitat ponds would vary in size, and several ponds could be constructed in each phase depending on land availability. Habitat would continue to be constructed in subsequent years as the Sea continues to recede until the targeted acreage of habitat was reached. Preliminary evaluations of potential siting areas indicate that ponds could be constructed at either the north or south ends of the Salton Sea, or in both areas. Figure 1 shows generalized locations of where the SCH Project could be constructed. The habitat would be designed with varying ranges of salinity in order to maximize biological productivity and minimize adverse effects associated with water quality. Ponds would be designed to optimize fish habitat and maximize fish productivity to provide a sustainable prev base for fish-eating birds. Ponds could also be managed to optimize invertebrate production to enhance the prey base for shorebirds and wading birds. The Project is being developed as a proof-of-concept project with construction planned beginning in late 2011 or early 2012.

#### Project Purpose, Goals, and Objectives

The SCH Project is being developed as a conservation measure for the protection of the fish and wildlife species dependent on the Salton Sea in accordance with California Fish and Game Code, Section 2932. As the Sea recedes and becomes more saline, fish species will not be able to survive. Simultaneously, the fish-eating birds, including several species of special concern, will lose their forage base and begin to disappear. As the Sea continues to become more saline, current invertebrate species will become less diverse and be replaced by species tolerant of hyper-saline environments (e.g., brine flies and brine shrimp).

Goal 1	Develop a range of aquatic habitats that will support fish and wildlife species dependent on the Salton Sea
Objectives	Provide adequate foraging habitat for piscivorous (fish-eating) bird species
	Develop habitats required to support piscivorous bird species
	Support a sustainable, productive aquatic community
	Provide suitable water quality for fish
	Minimize adverse effects to desert pupfish
	Minimize risk of selenium
	Minimize risk of disease/toxicity impacts

The Project goals and the objectives are as follows:



Goal 2	Develop and refine information needed to successfully manage the SCH Project habitat through an adaptive management process
Objectives	Identify uncertainties in achieving the objectives
	Design science-based means to test alternatives and reduce uncertainty
	Develop and implement a monitoring plan
	Develop a decision-making framework
	Provide proof of concept for future restoration

The SCH Project would provide habitat for both fish and invertebrate species, which in turn would provide forage for the numerous bird species dependent on the Salton Sea ecosystem. Salinity would be managed to support various assemblages of invertebrates and fish to diversify the prey base for as wide a variety of bird species as possible. The SCH ponds would be designed to serve those piscivorous bird species that would experience significant declines if the amount of Salton Sea habitat were substantially reduced. For many of these species, a significant proportion of their population uses the Salton Sea. Examples of those focal species that the SCH ponds would support are American white pelican, black skimmer, Caspian tern, and double-crested cormorant. If the amount of habitat used by these species at the Sea were substantially reduced, some individuals could use other habitats in the region up to their capacity, but it is unlikely that all of the piscivorous birds using the Salton Sea could find suitable habitat elsewhere.

The SCH ponds would also benefit other bird species, such as the eared grebe, gull-billed tern, western snowy plover, ruddy duck, black tern, and California brown pelican. These species are either not piscivorous (i.e., invertebrate prey is easier to support than fish) and/or only a small proportion of their population depends on the Salton Sea. There are also some subspecies or population segments that would likely use the created habitats as well, such as the least tern (interior subspecies of the California least tern or Mexican least tern, whichever is present at the Salton Sea) and Baja population of the California brown pelican which uses the Salton Sea as a post-breeding site. While the SCH ponds would provide ancillary benefits for these species, they are not the principal species served by the SCH Project, and therefore, their habitat needs would not be criteria for design.

Fish currently existing in the Salton Sea or tributaries are the likely candidates for establishment in the SCH ponds. The ponds would not likely provide suitable habitat for the marine species (orangemouth corvina, gulf croaker, and sargo) previously found in the Salton Sea. Tilapia are currently found in large numbers in the Sea, and would likely be the species providing the primary forage base in the ponds for fish eating birds. Since a primary purpose of the ponds is to provide habitat for fish as forage for birds, the ponds would be managed to maximize fish productivity. However, it is likely that desert pupfish would also become established in the ponds, and management implications would be addressed through consultation with appropriate jurisdictional agencies.

#### **Key Project Components**

Depth of water in the ponds is dependent on the slope of the sea bed, but could range up to approximately 6 feet, depending on the areas available for development as the surface water elevation declines. Deeper areas could be created by excavating materials from within the ponds for construction of the dikes or islands. The dike separating adjacent ponds at similar

elevations could also be modified to form larger ponds in the future, with portions of the original dike left intact to form islands.

A sedimentation basin could be constructed on lands above elevation -228 msl, or the first SCH pond could function as a sedimentation basin in addition to providing habitat. The first pond may need to be drained periodically for vegetation management and sediment removal; triggers for such actions will be developed as part of the adaptive management plan. Water discharged from the first pond would flow into other ponds, and from there into further ponds.

A variety of methods for managing salinity will be thoroughly evaluated in the EIS/EIR. Several methods are currently under consideration, although additional methods may be identified as part of the scoping process and as a result of special studies that are underway. The methods currently being considered include evapo-concentration of salts, which would result in higher salinity in each subsequent pond, until the maximum salinity suitable for optimal biological productivity was achieved. Once the maximum desired salinity was achieved, the next phase of ponds could again initially be supplied by river water. Saline water from the earlier ponds could be blended with river water to obtain targeted salinities in some of the newer ponds. If not needed for blending in the next phase of ponds, saline water from the ponds would discharge to the much more saline Salton Sea. This process would result in a mix of salinities throughout the SCH complex, with salinities being managed by balancing river inflow, evaporation, and discharge. Interspersing ponds with freshwater amongst the more saline ponds would provide a drinking water source for birds, especially young birds unable to fly. Higher salinities in the initial ponds, if needed, also could be achieved by temporarily blending diverted river water with saline water pumped from the Salton Sea. If necessary, temporary pumping could also be used to initially achieve the targeted salinities in the subsequent phases of ponds, but longer-term salinity management would be maintained by balancing inflows, evaporation, and discharge. If additional salt water were needed in future years to maintain salinity, saline water from the higher salinity ponds could be recirculated to the lower salinity ponds.

Siting ponds adjacent to the confluence of the New, Alamo, or Whitewater rivers and the Salton Sea would minimize the need for conveyance facilities to transport freshwater from these rivers to the ponds. Water flow from the rivers and between the ponds could be controlled with valves to be able to respond to varying evaporation or seepage rates and to allow changes in operations to modify salinity or water depth goals. The precise method of conveying water will be evaluated as part of the engineering design and environmental review process.

Monitoring and evaluation would commence upon completion of the ponds in the first year and would continue thereafter. A monitoring and adaptive management plan would be implemented to monitor and evaluate biological and water quality parameters, habitat function, and engineering performance of the SCH Project. Information obtained from monitoring and evaluation would be used to refine the engineering design, wildlife management criteria, and adaptive strategies for continued development of the SCH Project. Adaptive and flexible strategies would reduce the risks and uncertainties associated with operating larger complexes and facilitate managing or mitigating observed issues and problems.

#### 2.0 Other Involved Agencies

The Natural Resources Agency and the Corps are developing the SCH Project in close coordination with other agencies, including the Department of Water Resources, DFG, the State Air Resources Board, and the State Water Resources Control Board. The following permits, approvals, and consultations are expected to be required: Clean Water Act section 404

permit/section 401 water quality certification; Endangered Species Act section 7 consultation; National Historic Preservation Act section 106 consultation; CESA section 2081 incidental take authorization; California Fish and Game Code section 1602, Streambed Alteration Agreement; and air quality permits.

#### 3.0 **Project Alternatives**

Alternatives initially being considered for the SCH Project include the following: (a) alternative locations (at the confluence of the New, Alamo, or Whitewater rivers and the Salton Sea, or a combination of sites); (b) different acreages of created habitat; (c) different pond sizes and configurations; (d) different ranges of salinity; and (e) no project. The range and characteristics of the alternatives addressed in the EIS/EIR will be further developed based on input from the scoping process and special studies that are underway.

#### 4.0 Probable Environmental Effects of the Project

The Draft EIS/EIR will evaluate the full spectrum of resources potentially affected by the SCH Project. Although additional issues may be identified during the scoping process, issues initially identified as probable environmental effects include:

#### Agricultural Resources

- Potential conversion of farmland to non-agricultural use.
- Dust from construction.
- Potential zoning conflicts if the Project were implemented on lands zoned for agricultural use.

#### Air Quality

- Potential exceedance of emissions thresholds from equipment, vehicle traffic, and soil disturbance during construction, operations, and maintenance.
- Beneficial impact on fugitive dust from covering exposed playa with water.
- Potential odors emanating from the ponds, fish kills in the ponds, or bird die-offs.

#### **Biological Resources**

- Potential effects on fish and wildlife during construction, operations, and maintenance, such as disruptions from noise and human activity, mortality, effects on nesting birds, and risks to avian and aquatic species and habitat due to selenium and other water quality constituents.
- Potential effects on desert pupfish and other special status species during construction, operations, and maintenance, including mortality, water quality effects, disturbance effects, and effects on movement corridors.
- Removal or degradation of habitat, including riparian vegetation, mudflats, and section 404 and State jurisdictional wetlands.
- Potential for disease (e.g., avian botulism and cholera) and toxicity effects (e.g., from selenium, algal toxins).

#### **Cultural Resources**

Potential for destruction or disturbance of archaeological resources, human remains, and sacred sites activities.

#### **Environmental Justice**

Potential effects on the Torres Martinez Desert Cahuilla Indian Tribe and other local communities from construction, operations, and maintenance activities.

#### **Geology and Soils**

- Increased erosion and sedimentation during construction, operations, and maintenance.
- Potential collapse of berms from seismic events, flooding surrounding areas.

#### **Greenhouse Gas Emissions/Climate Change**

Generation of greenhouse gas emissions from equipment and worker vehicles during construction, operations, and maintenance.

#### **Hazards and Hazardous Materials**

- Potential accidental release of hazardous materials (e.g., diesel fuel, lubricants) during construction, maintenance, and operations.
- Potential exposure of workers and the public (if public access is allowed) to unexploded ordnance.
- Potential increase in mosquito vectors from standing water.

#### Hydrology and Water Quality

- Increased erosion and sedimentation in the Salton Sea, nearby rivers, and canals during construction, operations, and maintenance.
- Inadvertent release of hazardous materials into water during construction, construction, operations, and maintenance.
- Changes in water quality of the ponds, including resuspension or dissolution of salts and selenium, seasonal increases or decreases in water temperature, reduced levels of dissolved oxygen, and high concentrations of nutrients.
- Potential reduced freshwater inflow into the Salton Sea, resulting in decreased surface water elevation and increased rate of salination.
- Reduced downstream river flows due to water diversion for ponds.

#### Indian Trust Assets

Effects on Torres Martinez Tribe's trust assets from development of the sites near the Whitewater River.

#### Land Use

Potential conflicts with other existing or planned land uses and local plans, policies, and ordinances.

#### Noise

 $\ensuremath{\boxtimes}$  Noise increases during construction, operations, and maintenance.

#### **Paleontological Resources**

Destruction or alteration of paleontological resources from ground-disturbing activities.

### Transportation and Traffic

☑ Increased traffic during construction, operations, and maintenance.

#### 5.0 Schedule

The joint lead agencies expect the Draft EIS/EIR to be made available to the public by early 2011.

ATTACHMENT C

# **Scoping Report**

# Salton Sea Species Conservation Habitat Scoping Report

# SUMMARY OF SCOPING MEETING COMMENTS AND RESPONSES TO THE NOTICE OF INTENT AND NOTICE OF PREPARATION

The U.S. Army Corps of Engineers (Corps) and the California Department of Fish and Game (DFG), acting on behalf of the California Natural Resources Agency, have been charged with preparing a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Salton Sea Species Conservation Habitat (SCH) Project. The SCH Project would restore approximately 2,400 acres of habitat for piscivorous (fish-eating) birds that are dependent on the Salton Sea. In compliance with the National Environmental Policy Act (NEPA), the Corps issued a Notice of Intent (NOI) for the preparation of the EIS/EIR on June 23, 2010. In compliance with the California Environmental Policy Act (CEQA), the Natural Resources Agency issued a Notice of Preparation (NOP) for the EIS/EIR on June 21, 2010. The NOI and NOP were sent to over 1,300 responsible and involved agencies and interested organizations and individuals. To solicit additional comments on the scope and content of the EIS/EIR, the co-lead agencies held four public scoping meetings in the vicinity of the Salton Sea on July 7 and 8, 2010. The following table lists the logical details for each public meeting.

Community	Location/Address	Date	Time	Approximate Attendance
Palm Desert	University of California at Riverside, Room B200 75-080 Frank Sinatra Drive	July 07	1:00 P.M.	32
Thermal	Torrez Martinez, Tribal Administration Building 66-725 Martinez St.	July 07	6:30 PM	8
Calipatria	Calipatria Inn and Suites 700 North Sorenson Avenue Elks Lodge #1420, 161 South Plaza	July 08	1:00 P.M.	11
Brawley	Elks Lodge #1420, 161 South Plaza	July 08	6:30 PM	2

This report summarizes the written responses to the NOI and NOP and the major themes and/or comments from various scoping meetings. The four scoping meetings attracted over 50 people, some of whom provided oral comments on the scope and content of the EIS/EIR, including project design and impacts.

Twelve written responses to the NOI and NOP were received during the comment period which ended on June 24<sup>1</sup>. The written comments received are attached as an appendix to this report. Table 1 is a listing of those agencies and organizations that submitted written comments.

# Table 1Agencies, organizations, and individuals that submitted written<br/>comments on the NOI and NOP

Federal Agencies (5)
U.S. Bureau of Reclamation (Reclamation)
U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA), Region IX
U.S. Geological Survey (USGS)
U.S. Environmental Protection Agency (EPA)
U.S. Navy
State of California Agencies (2)
Department of Toxic Substances Control (DTSC)
State Lands Commission
Regional and Local Agencies (4)
Coachella Valley Mosquito and Vector Control District
County of Imperial Public Health Department
Imperial Irrigation District (IID)
San Diego County Water Authority
Organizations (6) <sup>a</sup>
Audubon California
California Outdoor Heritage Alliance
Defenders of Wildlife
Desert Protective Council
Pacific Institute
Sierra Club California
Individuals (1)
Patrick Maloney (on behalf of agricultural landowners in the Imperial Valley)

Note:

a. These organizations submitted a single, joint letter.

The major themes and/or issue areas expressed as part of written and oral comments on the NOI and NOP are summarized below under "Scope and Content of the EIS/EIR—Major Themes or Topics." More specific comments on the scope and content of the NOI and NOP are categorized under "Scope and Content of the EIS/EIR—Specific Comments." Finally, comments or

<sup>&</sup>lt;sup>1</sup> The organizations listed in Table 1 submitted a single, joint letter.

statements not directly pertinent to the scope and content of the EIS/EIR are summarized under "Other Comments."

# SCOPE AND CONTENT OF THE EIS/EIR—MAJOR THEMES OR TOPICS

Several of the written and oral comments on the NOI and NOP can be summarized or grouped into major themes or topics, including expanding the range of species that would be benefited by the SCH Project, addressing issues associated with selenium exposure, and the need to address the potential creation of breeding habitat for mosquitoes, which are disease vectors. Additionally, a number of commenters, including the EPA, Reclamation, SDCWA, and the non-governmental organizations listed above, expressed overall support for the SCH Project.

# Range of Targeted Species

The SCH Project is encouraged to develop as much habitat as practical for species other than the targeted bird species that also use the Salton Sea. To maximize biological productivity of the SCH ponds, they should be designed to optimize invertebrate production to enhance the prey base for shorebirds and wading birds, in addition to optimizing production for fish-eating birds. Accordingly, the ponds should be managed to include a greater range of salinities than tolerable by fish, ranging from the roughly 2-3 gallons per liter (g/L) total dissolved solids (TDS) of the rivers to 140+ g/L TDS. This broad range of salinity would greatly increase the diversity of species residing in and visiting the SCH, improving the resilience of the system as a whole. Ponds managed for salinities around 130 g/L TDS could produce a large number of brine flies and brine shrimp, complementing the invertebrate good base found in the other ponds and in the Sea itself. Managing ponds at these higher salinities would also provide valuable monitoring data and experience for the future.

# Selenium Exposure

- The SCH plan calls for use of evapo-concentrated, high-salinity water from one pond to provide saline water for another series of salinity gradient ponds. There may be a selenium risk associated with this practice. The EIS/EIR should include an assessment of effects of using waters (including selenium and pesticides) that have been evapo-concentrated for mixing.
- SCH would create habitats that do not currently exist at the Salton Sea; the increased exposure risk related to selenium in this new habitat relative to existing Salton Sea habitat should be assessed.
- A robust ecological analysis of selenium remediation and avoidance technologies (including a definition of specific endpoints for measuring effects and target action levels) should be included.

# Mosquito/Vector Control

Concerns were raised that restoration efforts would provide breeding habitat for mosquitoes, leading to a possible increase of mosquito populations at the north and south ends of the Salton Sea. The mosquito, *Culex tarsalis* Coquilett, is a known vector of the West Nile, Saint Louis encephalitis, and western equine encephalomyelitis viruses, which are active in the Coachella and Imperial valleys. According to the University of California Davis Center for Vector-borne Disease Research data, shoreline habitats along the Salton Sea are the focus of yearly virus amplifications, and the breeding habitat of *Culex tarsalis* covers a wide range of water quality

(from fresh up to 35 parts per thousand). Moreover, the Salton Sea provides a year-round habitat for breeding due to the climate.

Habitats usually do not support mosquitoes if they have running water, deeper water, and no sloped edges. After several years, many man-made wetlands become overgrown with vegetation, the water settles, and water quality changes; the type of emerging submerged and floating vegetation promotes mosquito breeding. There are considerable costs associated with mosquito control. Using specific types of fish to control mosquitoes is challenging because the birds will feed on the fish. Desert pupfish feed on mosquito larvae more aggressively than mosquitofish. The Coachella Valley Mosquito and Vector Control District has facilities where they could be raised, but this would require a permit from DFG.

The following concerns need to be evaluated:

- Who will be responsible for monitoring and treating mosquito populations? What thresholds will be established?
- What jurisdictions will be encountered and what permitting will be needed to control any vector problems that may result? Will the DFG and/or the Corps have the ultimate authority regarding vector operations in relation to endangered species?
- Is there funding for mosquito control with respect to maintaining and monitoring the facility?
- Will a mosquito abatement plant be developed for the project?
- Will the project have a dedicated vector biologist and supporting staff?
- Will a designated party serve as the contact point with the authority to act in the event of unforeseen circumstances during and after construction?

It is suggested that local health and vector control agencies should be further consulted regarding best management practices to address mosquito vectors.

# SCOPE AND CONTENT OF THE EIS/EIR—SPECIFIC COMMENTS

The following comments were provided by individual commenters. They focus primarily on the project design, adaptive management and monitoring program, siting criteria, the appropriate baseline condition to use, and project impacts and mitigation measures.

# **Project Design**

- The proposed location of the initial ponds should be clarified.
- The EIS/EIR should include a discussion of fish species proposed to be the principal project focus (natives, invasives, a combination of both?) This is critical when considering a variety of issues including potential depths of ponds.
- The EIS/EIR should include a discussion of what habitat attributes will be built into SCH to provide for desert pupfish.
- The draft plans call for SCH to create deep holes from borrow pits. Steep-sided pits should be avoided since they may promote stratification and anoxia of the deep water. (Construction equipment tends to make steep sides when excavating.) USGS has observed that traps placed in the deeper holes captured no fish. When placed in the exact same area, but at the surface, the trap came back loaded. Unless adequate mixing of the deep water can be ensured, the holes may not sustain habitat.

4
- A review and citation of literature justifying proposed depths of ponds in SCH should be conducted.
- Design of the SCH Project should include a variety of substrates to increase invertebrate productivity.
- Standards to which berms will be built will need to be clarified.
- The EIS/EIR should assess the potential use of geothermal energy resources to selectively supplement heating of ponds for temperature-sensitive fish.
- The project should evaluate the potential to harvest shallow groundwater for use in the cells.
- The rationale for use of freshwater for SCH (if proposed to be used) to replace saline water habitat at the Salton Sea should be included.
- Specific information such as number of acres of each specific salinity regime that would be created and size of anticipated freshwater area should be included (freshwater being the river water quality).
- The 2008 Flood Insurance Rate Maps (FIRM) for the project area should be reviewed. All buildings within a riverine floodplain (i.e., Flood Zones A, AO, AH, AE, and A1 through A30 as delineated on the FIRM) must be elevated so that the lowest floor is at or above the Base Flood Elevation level in accordance with the effective FIRM.
- If the area of construction is located within a Regulatory Floodway as delineated on the FIRM, any development must not increase base flood elevation levels. The term "development" means any man-made change to improved or unimproved real estate, including but not limited to, buildings, other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, and storage of equipment and materials. A hydrologic and hydraulic analysis must be performed prior to the start of development and must demonstrate that the development would not cause any rise in base flood levels. No rise is permitted within regulatory floodways.
- The project, including its water conveyance systems, should be designed to minimize impacts on the water delivery and drainage infrastructure in place around the rivers, drains, and other agricultural facilities. Any increase in water surface elevations of the drains or rivers would affect field irrigation infrastructure and drainage. Impounded areas such as the SCH ponds may raise water table elevations in the surrounding areas and affect the tile drainage systems in the farm fields.
- The SCH Project alternatives should not conflict with the goals and objectives of the QSA and pursuant to Fish and Game Code section 2932(b) should be consistent with the Salton Sea Restoration study requirements found in Fish and Game Code section 2081.7.
- Any construction or operation on IID property or within its existing and proposed rights of way or easements will require an encroachment permit. No foundations or buildings will be allowed within the right of way.

## Water Supplies

- The EIS/EIR should acknowledge that water in the Alamo, New, and Whitewater rivers is not fresh water, but rather composed primarily of agricultural drainage.
- The EIS/EIR should acknowledge that water from the Colorado River is not available for direct delivery to the SCH Project. The lack of available Colorado River supplies is

documented on page 2-8 of the October 2006 Draft Salton Sea Ecosystem Restoration Programmatic EIR.

- Landowners in the Imperial Valley are entitled to continued water service by virtue of the easements predating governmental intrusion into the waters of the Colorado River. The discussion of water rights in the NOI/NOP and scoping documents fail to reflect such unique rights.
- Any discussion of the cause of the Sea's historic size a potential factor in assessing fiscal liability is also absent from the notices and analysis documents thus far.
- The fundamental facts about what the documents refer to as "water rights" (e.g., Section 1.1.2 of the document describing the screening process) are wrong; i.e., much of the water use in the Imperial Valley is not under the jurisdiction of the State Water Resources Control Board since such rights are of the pre-1941 variety (Arizona v. California (2006) 547 US 150, 175 (recognizing 2.6 million acre-feet of present perfected rights as of 1901). Any review of "water rights" involved would necessarily include the public statements of water diversion filed by those who use Colorado River water in Imperial County.

## Adaptive Management and Monitoring

- This "proof-of-concept" project relies on adaptive management to make improvements. Detailed information on monitoring plans should be included.
- Science from the literature and recently completed and ongoing studies should be used in establishing the goals, objectives, and triggers included in the adaptive management plan. Adaptive management is not the same as trial and error.
- The SCH Project may benefit by drawing on science published and available from the USGS/Reclamation shallow habitat project as part of the proof of concept.

## Siting Criteria

- To the extent practical, habitat should be located in a manner that maximizes mitigation of dust emissions from the playa.
- The project should be compatible with the mitigation planned for the Quantification Settlement Agreement water transfer and other projects.
- The project should be designed to accommodate other land uses such as alternative energy development, agricultural use, and recreational use.
- The extent to which the SCH Project would conflict with or preclude other existing, planned or proposed habitat construction or air quality management projects at and around the Salton Sea should be a factor in determining the location of the shallow habitat pond complexes. Siting the proposed ponds in locations where other parties would otherwise construct habitat would be a waste of limited resources and dramatically reduce the net habitat value of the proposed project. The SCH Project should be sited at locations whether no other habitat or air quality projects are currently planned or proposed.

## **Baseline Conditions**

• The "current" level of the Salton Sea changes daily, and as of July 22, 2010, is ranging about 0.10 foot above and below -231.20 ft.

- A key factor the Corps should use to determine whether to issue a permit for the SCH Project is the benefit of the project relative to no project. Current conditions are not an appropriate baseline for determining the condition of the Salton Sea in the future, nor are they appropriate for determining the relative benefits of the SCH Project.
- The EIS/EIR should include a detailed, comprehensive list and description of every planned and proposed habitat and air quality project at and around the Salton Sea. These constitute a reasonable baseline against which the SCH Project should be measured.
- The EIS/EIR should include a clear demonstration of compliance with the Clean Water Act section 404(b)(1) guidelines. The existing condition of wetlands and waterways should be described in detail. The effects analysis and assessment of existing conditions should use the California Rapid Assessment Methodology (CRAM) or another applicable assessment method.

## **Project Impacts and Mitigation Measures**

• The EIS/EIR should address all of the issues listed in the NOI and NOP, with particular attention to potential effects on existing Quantification Settlement Agreement agreements, land use policies and plans, water use/quality, biological resources, and air quality.

#### Agricultural Resources

• The project should be planned and implemented to avoid impacts on area farmers and productive agricultural land.

### **Biological Resources**

- Potential environmental consequences of establishing a sedimentation basin should be addressed (for example, components of SCH may develop into habitat capable of supporting Yuma clapper rails [YCR]). An evaluation of selenium exposure risk to YCR should be included.
- Impacts of diversions from the rivers on threatened and endangered species (in the rivers at the diversion points) should be assessed.
- The EIS/EIR should evaluate desert pupfish interactions with non-natives that are being encouraged as a forage base. The role of invasive species, termed "novel species" in the SCH summary documents, should be evaluated to understand interactions of anticipated invasive or exotic species in SCH.
- Potential impacts of invasive species should be analyzed.
- The EIS/EIR should describe proposed mitigation for aquatic, wetland, and habitat impacts, and demonstrate compliance with the Corps' IEPA Wetlands Compensatory Mitigation Rule issued in April 2008 (40 CFR Part 230, page 195941).
- The EIS/EIR should evaluate the direct habitat benefits of the SCH Project.
- The EIS/EIR should evaluate water quality effects on current bird diseases such as botulism.

### Air Quality

• The EIS/EIR should evaluate the direct and indirect air quality benefits generated by flooding exposed Salton Sea playa and interrupting wind fetch.

• EPA has a strong interest in ensuring restoration practices are consistent with air quality emission mandates.

## Greenhouse Gas Emissions/Climate Change

- Regarding the effects of SCH development on greenhouse gases uptake and emissions relative to existing area of the Salton Sea it is suggested that an assessment of uptake, including positive or negative rate, be included.
- The climate change section should analyze what may occur during the life of the project and any projected impacts from global warming on the Salton Sea and the SCH areas.

#### Hazards and Hazardous Materials

- The EIS/EIR should evaluate the potential for the SCH Project to attract and increase local bird populations and thus cause an increase in the potential for bird strikes by aircraft from the Naval Air Facility El Centro training ranges. Both project-specific and cumulative impacts should be evaluated.
- Regarding selenium and public access and recreational activities relative to public health threshold levels would the SCH Project cause a public health risk to humans consuming fishes or birds from the SCH site? The EIS/EIR should evaluate public access and recreation.
- The EIS/EIR should evaluate whether conditions within the project area may pose a threat to human health or the environment, using the EPA's National Priorities List, Resource Conservation and Recovery Information System, and Comprehensive Environmental Response Compensation and Liability Information System; Envirostor (accessible through DTSC's website), Solid Waste Information System provided by the California Integrated Waste Management Board (currently the Department of Resources Recycling and Recovery); GeoTracker (maintained by the Regional Water Quality Control Boards); lists of hazardous substances cleanup sits and leaking underground storage tanks maintained by local counties and cities; and the Corps' list of Formerly Used Defense Sites.
- The EIS/EIR should identify the mechanism to initiate any required investigation and/or remediation for any site within the proposed Project area that may be contaminated, and the government agency to provide appropriate regulatory oversight. If necessary, DTSC would require an oversight agreement to review such documents.
- Any environment investigations, sampling, and/or remediation should be conducted under a work plan approved and overseen by a regulatory agency that has jurisdiction to oversee hazardous substance cleanup. The findings of any investigations, including any Phase I or II Environmental Site Assessment investigations should be summarized in the document. All sampling results in which hazardous substances were found above regulatory standards should be clearly summarized in a table. All closure, certification, or remediation approval reports by regulatory agencies should be included in the EIS/EIR.
- If buildings, other structures, asphalts or concrete-paved surface areas are being planned to be demolished, an investigation should be conducted for the presence of hazardous materials (chemicals, mercury, asbestos-containing materials), and proper precautions should be taken as needed. Contaminants should be remediated in compliance with California environmental regulations and policies.
- Sampling may be required if construction requires soil excavation or filling. Contaminated soils must be properly disposed of, not relocated onsite. Land Disposal Restrictions may be applicable. Imported soil, if any, should be sampled for contamination.

- Human health and the environment of sensitive receptors should be protected during construction/demolition. If necessary, a health risk assessment overseen and approved by the appropriate government agency should be conducted by a qualified health risk assessor to determine if there have been or will be any releases of hazardous materials that may pose a risk to human health or the environment.
- At sites used for agricultural, livestock, or related activities, onsite soils and groundwater might contain pesticides, agricultural chemical, organic waste, or other related residue. Proper investigation, and remedial actions, if necessary, should be conducted prior to construction.
- If hazardous wastes would be generated by SCH operations, they must be managed in accordance with the California Hazardous Waste Control Law (California Health and Safety Code, Division 20, Chapter 6.5) and the Hazardous Waste Control Regulations (California Code of Regulations, Title 22, Division 4.5). Additionally, the facility should obtain an EPA Identification Number. Certain hazardous waste treatment processes or hazardous materials, handling, storage, or uses may require authorization from the local Certified Unified Program Agency.

## Hydrology/Water Quality

- Water quality effects to evaluate include nutrient loading, oxygen depletion, temperature fluctuations, pesticide, selenium, and DDT residues; discharges of agricultural chemicals; effects on total management demand loads (TMDLs), water quality standards, and Coachella and Torres Martinez Tribal water quality goals; effects on current bird diseases such as botulism; and the impact of a sudden release of high salinity water into less saline water if a berm fails. EPA has a strong interest in ensuring restoration practices are consistent with TMDL requirements and water quality standards.
- The EIS/EIR should evaluate the potential to restore seeps, creeks, springs, and the river deltas of the Salton Sea.
- The EIS/EIR should evaluate changes in the surface water elevation of the Salton Sea.

## **Cumulative Impacts**

- The Corps should consider the role of a sustainably restored Salton Sea as a vital part of a thriving, healthy Lower Colorado River watershed. The Lower Colorado River Basin, including the Salton Sea and Colorado River Delta, should be considered in its entirety, especially in regards to preserving at-risk migratory birds, because actions taken in one part of the Lower Colorado River Basin could have significant cumulative impacts on other parts of the Basin. It is questionable whether the entire watershed would remain ecologically viable without a comprehensive approach to its restoration. It is recommended that the EIS/EIR describe the proposed project's impacts and benefits within the regional context of the Lower Colorado River Multi-species Conservation Program and past and current Salton Sea restoration efforts.
- Several other projects would contribute to a cumulative impact associated with bird air strikes. IID is constructing several thousand acres of managed marsh near the Salton Sea, which is intended to attract and provide habitat for avian species affected by decreased Salton Sea levels resulting from agricultural/urban water transfers. Also, a planned development, the Desert Springs Resort, is proposed for construction on the west side of Imperial Valley less than 4 miles from the perimeter of Naval Air Facility El Centro and directly adjacent to their parachute drop range. This project would include over 100 acres of lakes and associated landscaping (golf course), which the Navy believes would attract large numbers of birds.

## Other Issues

- If the Draft EIS/EIR does not contain a preferred alternative, it should describe the eventual selection criteria and processes for selection of the preferred alternative in the Final EIS/EIR.
- The SCH Project should reflect the extensive research already conducted on biotic and abiotic elements of the Salton Sea ecosystem.
- Other issues that should be addressed in the EIS/EIR include funding, project management, and engineering questions such as seismic stability of the constructed berms.
- "Special studies" are cited on pages 5 and 7 of the Public Notice. Some additional information on the goals, objectives, scope, and anticipated contributions of special studies should be included.

## **OTHER COMMENTS**

- Water rights and access to water (paper and wet water) should be addressed and secured prior to construction.
- Additional Stakeholder group meetings should be held to discuss the project as the design progresses.
- IID should be notified once specific sites are located.
- Reclamation requests Cooperating Agency status.
- DTSC can provide cleanup oversight through an Environmental Oversight Agreement for government agencies that are not responsible parties, or a Voluntary Cleanup Agreement for private parties.
- A detailed map or site plan showing exactly where the SCH Project improvements would occur should be provided to the State Lands Commission to enable them to determine the State's interest in these locations.
- Upon completion of any development that changes existing Special Flood Hazard Areas, the National Flood Insurance Program directs all participating communities to submit the appropriate hydrologic and hydraulic data to FEMA for a FIRM revision.
- It is recommended that the wetland assessment data be entered into California's Wetland portal.
- The recovery of the Salton Sea as a whole needs to be funded.
- The focus appears to be wholly piecemeal and likely will not garner support from the public. It is essential that an integrated approach be taken that guarantees a rapid solution and involves the parties directed affected.
- The need for an environmental review may not be necessary or advised under the law. Based on the principles announced in the Nacimiento Regional Water Management Advisory Committee v. Monterey County Water Resources Agency (1993) 15 Cal.App.4<sup>th</sup> 200 and Reclamation's recommendations for IID's improvement of its management of diversions from the Colorado River (presented in a Decision resulting from a Part 417 process initiated by Reclamation against IID), the Imperial Valley landowners have no obligation to maintain the Salton Sink as a sea, and no EIR or environmental mitigation is required if the landowners choose to reduce the flow of water into the Salton Sea.

• The notice and scoping documents all lack a critical event since the prior review: the water transfer that is at the heart of all Sea discussion was decreed invalid after a lengthy trial in 2009. Thus, the implicit assumptions about water flow, the availability of money under legislation associated with the transfer, the responsibilities of specific parties (e.g., the Metropolitan Water District of Southern California) for liability all remain unresolved. Given the scope of the trial court's decision, the results on appeal – affirming or reversing – may fundamentally alter the status of the Sea, especially what parties may be liable for any cost of remediation thereof.

## Appendix

## Written Comments Received in Response to the NOI and NOP

Written comments are available on the California Department of Water Resources' website at: <u>http://www.saltonsea.water.ca.gov</u>.

APPENDIX B

# **Alternatives Development Process**

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# Appendix B Salton Sea Species Conservation Habitat Alternatives Development Process

## 4 **B.1** Introduction

5 The goals and objectives/purpose for a project could be met in a variety of ways. However, these 6 alternative ways of implementation would likely differ in how well they achieved the project 7 objectives/purpose, their feasibility, and their impacts. The approach and requirements for alternatives 8 analysis are slightly different under Federal and state law.

9 Both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act 10 (CEOA) require that an Environmental Impact Statement (EIS) or Environmental Impact Report (EIR), respectively, analyze the impacts of alternative ways of implementing a project. NEPA's requirements for 11 12 an alternatives analysis are found in the Council on Environmental Quality's NEPA Regulations (40 Code of Federal Regulations [CFR] 1502.14), and CEQA's are found in CEQA Guidelines section 15126.6. 13 14 Under NEPA, the range of alternatives required to be evaluated by an EIS is governed by the rule of 15 reason, which requires an EIS to set forth only those alternatives necessary to permit a reasoned choice. An EIS must rigorously explore and objectively evaluate a reasonable range of alternatives as defined by 16 the specific facts and circumstances of the proposed action. Alternatives must be feasible and consistent 17 with the statement of purpose and need. Feasible alternatives are those that can be carried out based on 18 technical, economic, and environmental factors, as well as common sense (40 CFR 1502.14; Forty Most 19 20 Asked Questions Concerning CEO's NEPA Regulations No. 2a). If alternatives have been eliminated 21 from detailed study, the EIS must briefly discuss the reasons for their elimination. In addition, under 22 NEPA, the alternatives analysis should present the environmental impacts of the proposed project and the 23 alternatives "in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public" (40 CFR section 1502.14). The "No Federal 24 Action" alternative (no permit issued) must be included among the alternatives analyzed. The Federal 25 26 lead agency also should identify its preferred alternative.

27 In addition to the NEPA alternatives analysis, the United States (U.S.) Army Corps of Engineers (Corps) 28 is required to analyze alternatives pursuant to the Clean Water Act section 404(b)(1) Guidelines (40 CFR 29 Part 230). Under those guidelines, the Corps is required to identify and determine the "least environmentally damaging practicable alternative." A Draft Section 404(b)(1) Alternatives Analysis for 30 31 the proposed project will be prepared pursuant to the Guidelines and included in the Final EIS/EIR. The 32 Draft Section 404(b)(1) Alternatives Analysis is intended to assist the Corps in complying with the 33 guidelines in connection with its decision whether to issue a Clean Water Act section 404 permit for the proposed project or an alternative to the proposed project. Pursuant to the Section 404(b)(1) Guidelines 34 and Corps regulations (33 CFR 320-332), the Corps can issue a permit only for a project that is the least 35 36 environmentally damaging practicable alternative (focusing primarily on impacts on aquatic resources) and is not contrary to the public interest. 37

CEQA requires that EIRs examine a reasonable range of alternatives that would feasibly achieve most of the basic project objectives, but would avoid or substantially lessen one or more of a project's significant environmental impacts. Project alternatives must be feasible based on specific economic, social, legal, and technical considerations. The EIR must explain the rationale for selecting the alternatives to be discussed, identify those that were eliminated as infeasible, and briefly explain why they were eliminated. The range of alternatives required in an EIR is governed by a "rule of reason," which requires the EIR to set forth only those alternatives necessary to permit a reasoned choice. The EIR need examine in detail only the alternatives that the lead agency determines could feasibly attain most of the project objectives (CEQA Guidelines section 15126.6[f]). An EIR need not consider an alternative whose effects cannot be reasonably ascertained and whose implementation is remote and speculative (CEQA Guidelines section 15126.6[f][3]).

8 CEQA Guidelines section 15126.6[e][1] indicates that the no project alternative (referred to as the "No 9 Action Alternative" in this document) is not the baseline for determining whether the proposed project's 10 environmental impacts may be significant unless it is identical to the existing environmental setting. 11 CEQA Guidelines section 15126.6[e][2] further indicates that the no action analysis should discuss the 12 existing conditions at the time the Notice of Preparation is published, as well as what would be 13 reasonably expected to occur in the foreseeable future if the action were not approved, based on current 14 plans and consistent with available infrastructure and community services.

15 The initial concept for the Salton Sea Species Conservation Habitat (SCH) Project was to restore approximately 2,400 acres of saline habitat, based on available funds. The habitat would be configured in 16 a series of interconnected shallow ponds located within the Sea's current footprint, consistent with the 17 18 characteristics of the Early Start Habitat identified in the Programmatic Environmental Impact Report for 19 the Salton Sea Ecosystem Restoration Program (California Department of Water Resources [DWR] and California Department of Fish and Game [DFG] 2007). This appendix describes the process used for 20 developing this initial concept and refining the list of alternatives to be evaluated in the SCH Project 21 22 EIS/EIR. This process has occurred in a systematic, incremental manner, involving the development of 23 Project goals and objectives/purpose; identification of potential site locations, configurations, and Project 24 components; and the application of exclusionary and evaluative criteria to the potential sites and Project 25 components with the intent of eliminating those that either did not meet the goals and objectives/purpose or were not viable due to cost, technical, or environmental considerations. Additional refinements to the 26 27 Project alternatives included in the EIS/EIR occurred after this initial analysis, based on information 28 included in the geotechnical analysis, special studies and workshops, land use compatibility issues, 29 budgetary considerations, and input from Stakeholders.

## 30 B.1.1 SCH Project Goals and Objectives/Purpose

Feasible alternatives must, at a minimum, meet the Project goals and objectives/purpose, which were developed after consideration of the existing and projected conditions of the Salton Sea ecosystem.

The Salton Sea currently supports a wide variety of bird species and a limited aquatic community. Over many decades, the components of the aquatic-dependent community have shifted in response to receding water levels and increasing salinity. The Salton Sea currently is a hypersaline ecosystem (about 51 parts per thousand [ppt]) (C. Holdren, Reclamation, unpublished data). Without restoration, declining inflows in future years will result in the Sea's ecosystem collapse due to increasing salinity (expected to exceed 60 ppt by 2018, which is too saline to support fish) and other water quality stresses, such as temperature extremes, eutrophication, and related anoxia due to algal productivity.

The most serious and immediate threat to the Salton Sea ecosystem is the loss of fishery resources that support piscivorous birds. The birds that feed on invertebrates have more options and resources, because the invertebrate fauna has a wider range of salinity tolerances. Piscivorous birds, on the other hand, are at risk of decline. To address this immediate need, the California Legislature appropriated funds for the purpose of implementing "conservation measures necessary to protect the fish and wildlife species dependent on the Salton Sea, including adaptive management measurements" (California Fish and Game

- 1 Code section 2932(b)). Therefore, under CEQA the SCH Project's goals are two-fold: (1) develop a range
- 2 of aquatic habitats that will support fish and wildlife species dependent on the Salton Sea; and (2) develop
- and refine information needed to successfully manage the SCH Project habitat through an adaptive
- 4 management process. Specific objectives under each goal are described in detail in Section 1 of this
- 5 EIS/EIR.

#### 6 GOAL 1. DEVELOP A RANGE OF AQUATIC HABITATS THAT WILL SUPPORT FISH AND WILDLIFE SPECIES DEPENDENT ON THE 7 SALTON SEA.

- 8 The SCH Project's purpose is to provide in-kind replacement for near-term habitat losses. The Project's
- 9 target species are those piscivorous bird species use the Salton Sea and that are dependent on shallow
- 10 saline habitat for essential habitat requirements and the viability of a significant portion of their
- 11 population.

#### 12 **OBJECTIVES FOR GOAL 1:**

- 13 1. Provide appropriate foraging habitat for piscivorous bird species.
- 14 2. Develop habitats required to support piscivorous bird species.
- 15 3. Support a sustainable, productive aquatic community.
- 16 4. Provide suitable water quality for fish.
- 17 5. Minimize adverse effects on desert pupfish.
- 18 6. Minimize risk of selenium.
- 19 7. Minimize risk of disease/toxicity impacts.

## 20GOAL 2. DEVELOP AND REFINE INFORMATION NEEDED TO SUCCESSFULLY MANAGE THE SCH PROJECT HABITAT THROUGH21AN ADAPTIVE MANAGEMENT PROCESS.

- 22 The SCH Project's second goal would be to serve as a proof of concept for the restoration of shallow-
- water habitat that supports fish and wildlife currently dependent upon the Salton Sea. The Project would incorporate an adaptive management framework to guide evaluation and improved management of the newly created habitat as well as to inform future restoration. An adaptive management framework
- 26 provides a flexible decision-making process for ongoing knowledge acquisition, monitoring, and
- evaluation, leading to continuous improvement in management planning and Project implementation to
- achieve specified objectives. The information obtained would be used to measure Project effectiveness, to

refine operations and management of the ponds, to reduce uncertainties about key issues, and to inform

30 subsequent stages of habitat restoration at the Salton Sea.

#### 31 **OBJECTIVES FOR GOAL 2:**

- Identify uncertainties in achieving the objectives of providing habitat and prey for piscivorous birds
   (e.g., maintaining suitable water temperature and dissolved oxygen) and minimizing impacts on
   species (e.g., selenium ecorisk).
- 35 2. Design science-based means to test alternatives and reduce uncertainty.
- 36 3. Develop and implement a monitoring plan.
- 37 4. Develop a decision-making framework.
- 38 5. Provide proof of concept for future restoration.
- The purpose of the Project under NEPA is to develop a range of aquatic habitats that will support and wildlife species dependent on the Salton Sea in Imperial County, California.

## **B.2** Potential Project Locations, Configurations, and Components

## 2 B.2.1 Potential Pond Locations and Configurations

Three generalized locations for the SCH ponds initially were identified by DWR and DFG based on the potential availability of contiguous acreage and the potential availability of a nearby, suitable water supply. The most suitable general areas based on this initial screening were located near the mouths of the New, Alamo, and Whitewater rivers, as shown on Figure B-1. More specific views of areas considered as

- 7 potential ponds sites are shown on Figures B-2 through B-4.
- 8 At the Sea's northern end near the Whitewater River, only about 900 acres are available, while larger
- 9 areas are available at the Sea's southern end near the Alamo and New rivers. Therefore, several acreage
- 10 combinations were developed using one or more of the rivers, resulting in habitats that were contiguous
- 11 or dispersed, as follows.
- 12 6. Contiguous SCH Ponds at Whitewater River (900 acres)
- 13 7. Contiguous SCH Ponds at New River (2,400 acres)
- 14 8. Contiguous SCH Ponds at Alamo River (2,400 acres)
- 15 9. Dispersed SCH Ponds at New and Alamo Rivers (4,800 acres)
- 16 10. Dispersed SCH Ponds at Whitewater and New Rivers (3,300 acres)
- 17 11. Dispersed SCH Ponds at Whitewater and Alamo Rivers (3,300 acres)
- 18 12. Dispersed SCH Ponds at Whitewater, New, and Alamo rivers (5,700 acres)
- 19





Figure B-1 Regional Setting and Generalized Locations of Potential SCH Alternative Sites



Figure B-2 Conceptual SCH Pond Sites near the Whitewater River Based on DFG and DWR Evaluations

3 Note: Dikes and conveyances shown on this figure are hypothetical and subject to change





Figure B-3 Conceptual SCH Pond Sites near the New River Based on DFG and DWR Evaluations

3 Note: Dikes and conveyances shown on this figure are hypothetical and subject to change

4



#### Figure B-4 Conceptual SCH Pond Sites near the Alamo River Based on DFG and DWR Evaluations

3 Note: Dikes and conveyances shown on this figure are hypothetical and subject to change

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2

1 A description of each of these configurations is presented below. The pond locations refer to the areas

initially identified by DFG and DWR, including areas between elevations -228 to -232 and -232 to -234
 feet.

- **Contiguous SCH Ponds at Whitewater River** 4 1) 900 acres of ponds at Whitewater River using the Whitewater 1 and Whitewater 2 areas. 5 Areas with a seabed elevation from -228 to -234 feet. 6 • 7 2) **Contiguous SCH Ponds at New River** 2,400 acres of SCH ponds at the New River using New 2 and New 3, and part of New 1. 8 • 9 Areas with seabed elevations from -228 to -234 feet, with over half the area between -228 and -• 232 feet. 10 11 3) **Contiguous SCH Ponds at Alamo River** 2,400 acres of ponds at Alamo River using the Alamo 1 and Alamo 2 areas. 12 • Areas with a seabed elevations from -228 to -232 feet. 13 • **Contiguous SCH Ponds at New River** 14 4) 2,400 acres of SCH ponds at the New River using New 2 and New 3, and part of New 1. 15 • 16 • Areas with seabed elevations from -228 to -234 feet, with over half the area between -228 and -232 feet. 17 5) **Contiguous SCH Ponds at Alamo River** 18 19 2,400 acres of ponds at Alamo River using the Alamo 1 and Alamo 2 areas. • 20 • Areas with a seabed elevations from -228 to -232 feet. 21 6) **Contiguous SCH Ponds at Alamo River** 2,400 acres of ponds at Alamo River using the Alamo 1 and Alamo 2 areas. 22 • Areas with a seabed elevations from -228 to -232 feet. 23 • 7) **Contiguous SCH Ponds at New River** 24 25 • 2,400 acres of SCH ponds at the New River using New 2 and New 3, and part of New 1. 26 Areas with seabed elevations from -228 to -234 feet, with over half the area between -228 and -• 232 feet. 27 8) **Contiguous SCH Ponds at Alamo River** 28 29 2,400 acres of ponds at Alamo River using the Alamo 1 and Alamo 2 areas. • 30 • Areas with a seabed elevations from -228 to -232 feet. 9) **Dispersed SCH Ponds at New and Alamo Rivers** 31 • 4,800 acres of dispersed SCH ponds at the New and Alamo rivers using New 2, New 3, Alamo 1, 32 33 and Alamo 2.
- Areas with seabed elevations from -228 to -234 feet, with over half the area between -228 and -23
   feet 2.

2 3

#### 1 10) **Dispersed SCH Ponds at Whitewater and New Rivers**

- 3,300 acres of SCH ponds at the Whitewater and New rivers using Whitewater 1, Whitewater 2, New 2, New 3, and a portion of New 1.
- Areas with seabed elevations from -228 to -234 feet.

#### 5 11) **Dispersed SCH Ponds at Whitewater and Alamo Rivers**

- 3,300 acres of SCH ponds at the Whitewater and Alamo rivers using Whitewater 1, Whitewater 2,
   Alamo 1, and Alamo 2.
- Areas with seabed elevations from -228 to -232 feet.

#### 9 12) Dispersed SCH Ponds at Whitewater and Alamo Rivers

- 5,700 acres of SCH ponds at the Whitewater, New, and Alamo rivers using Whitewater 1,
   Whitewater 2, New 2, New 3, Alamo 1, and Alamo 2.
- Areas with seabed elevations from -228 to -234 feet for maximum area or -228 to -232 feet for a smaller area.

#### 14 B.2.2 Potential Project Components

Basic Project components and alternative ways of constructing those components were identified, including methods of diverting and conveying water from the rivers to the ponds, conveying saline water needed to maintain the appropriate range of salinities in the ponds, and potential means of treating suspended sediment. The components were combined in functional categories to aid in the comparison of components. The functional categories and associated components are as follows:

#### 20 1) **Diversion Mechanisms**

- 21 a) Inline weir in river (brackish water)
- 22 b) Lateral weir in river (brackish water)
- 23 c) Pump water from the river (brackish water)
- 24 d) Pump shallow groundwater (saline water)
- e) Pump water from the Sea (saline water)

#### 26 2) **River Water (Brackish) Conveyance**

- a) Open canal
- b) Pipeline
- 29 c) Combination
- 30 3) Saline Water Conveyance
- 31 a) Pipeline groundwater
- 32 b) Pipeline seawater
- 33 c) Backwater channel
- 34 d) Tailwater Return Pump

#### 35 4) Suspended Sediment Management

- 36 a) Sedimentation basin near diversion
- b) Sedimentation basin near SCH ponds
- 38 e) No sediment management

#### 1 5) **Power Supply**

- a) Three-phase power
- b) Diesel generator
- 4 c) Solar power

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## 5 **B.3** Criteria Used to Evaluate Sites and Project Components

6 Broad screening criteria were developed to allow sites and Project components to be compared, and 7 potentially eliminated where appropriate. This screening was done through a combination of exclusionary 8 criteria and evaluative criteria.

#### 9 B.3.1 <u>Exclusionary Criteria</u>

Exclusionary criteria relate to those factors that are essential to the successful completion of the SCH Project. These criteria include (1) available water rights, (2) available land (ownership and accessibility), and (3) adequate water supply (quantity, quality, and seasonal availability).

#### 13 **B.3.2** Evaluative Criteria

These criteria were considered when determining the types of components that would included in the alternatives carried forward for detailed analysis and include (1) engineering feasibility/constructability, (2) relative cost-effectiveness (including capital cost and operations and maintenance) measured as cost per acre, (3) potential for physical environmental impacts, (4) compatibility with existing and planned land uses, and (5) ability to meet SCH schedule. Components were eliminated or refined based on these criteria.

#### 20 B.3.3 Rating Definitions

#### 21 Exclusionary Criteria

A potential site or component that failed to meet any one of the three exclusionary criteria would automatically be eliminated.

#### 24 Evaluative Criteria

The purpose of applying the evaluative criteria was to eliminate Project components where appropriate and determine whether individual components would be feasible or practicable at each of the potential sites. The evaluative criteria considered and issues associated with each are described below.

#### 28 Engineering Feasibility/Constructability

- 29 Complexity of design
- 30 Special equipment needs
- 31 Land acquisition issues

#### 32 *Relative Cost-effectiveness (including Capital Cost and Operations and Maintenance)*

- 33 Level of capital expenditures
- Long-term operations and maintenance needs
- 35

- 1 Potential for Physical Environmental Impacts
- 2 Conversion of Important Farmland to nonagricultural use
- Air emissions during construction, operations, and maintenance
- Impacts on biological resources (selenium ecorisk, special-status species, wetlands)
- 5 Disturbance/destruction of cultural resources
- 6 Unsuitable geologic/soil condition

#### 7 *Compatibility with Existing and Planned Land Uses*

- 8 Potential conflicts with future geothermal uses of sites
- 9 Potential conflicts with existing and planned use of Sonny Bono National Wildlife Refuge
- Potential loss of hunting opportunities
- 11 Potential conflicts with use of public recreational facilities at marina
- Potential conflicts with agricultural practices

#### 13 Ability to Meet SCH Schedule

- Number of construction seasons
- 15 Time required to obtain easements, permits, or approvals

#### **B.4** Screening Process

The screening process for the concept alternatives to be carried forward into the engineering design and considered in the EIS/EIR included the following four steps:

- Apply exclusionary criteria to eliminate potential sites or Project components that are dependent on land and/ or water availability.
- Apply evaluative criteria to determine the comparative merits of individual Project components at each site.
- 23 3. Apply evaluative criteria to eliminate or retain individual Project components at each site.
- 4. Combine the sites and Project components into alternatives to be evaluated in the EIS/EIR.

Representatives of the Corps, DFG, DWR, and consultant team met and applied these step to develop an initial set of screened alternatives. Since that time, additional refinements have occurred based on input from the preliminary geotechnical study, Stakeholders, land use compatibility, special studies, the environmental impact analysis, and budgetary considerations. The results of this process are described below.

#### 30 B.4.1 Exclusionary Criteria Screening Process Results

The results of the exclusionary criteria screening process for the potential SCH sites, including the locations of diversion and conveyance facilities needed to provide water to the SCH ponds, are discussed below.

#### 34 *Water Rights*

A water right is legal permission to use a reasonable amount of water for a beneficial purpose such as swimming, fishing, farming, or industry. The Whitewater River is designated by the State Water Resources Control Board as a fully appropriated stream from the Salton Sea to the headwaters. This distinction relates to the availability of water in the stream to divert for beneficial uses. A fully appropriated stream by definition does not have additional water available for diversion. The Metropolitan Water District of Southern California has applications pending for appropriative rights for essentially all the available water in both New and Alamo rivers. The Whitewater River sites were eliminated based on the lack of available water rights. The New and Alamo river sites were retained for further consideration.

A water right would not be needed to use Salton Sea water, which is carried forward as a source of saline water for the Project. In 1968, the California Legislature adopted a statute declaring the Salton Sea's primary use for the collection of agricultural drainage water, seepage, and other flows (Assembly Bill 461, 1968; Statutes 1968, Chapter 392). Use of water from an agricultural repository does not require a

12 water right.

#### 13 Available Land

Adequate land appears to be available at the New and Alamo river sites, which contain approximately 2,648 acres and 3,417 acres, respectively (New 1 - 879 acres; New 2 - 907 acres; New 3 - 862 acres)

(Alamo 1 - 1,111 acres; Alamo 2 - 2,027 acres; Alamo 3 - 279 acres). Most of this land is owned by

2 - 2,027 acres, Alano 3 - 279 acres). Most of this failut is owned by public entities, primarily Imperial Irrigation District (IID), which would facilitate its acquisition, although

the land in the Wister Beach area is owned by multiple private parties. Land owned by the Torres

19 Martinez Desert Cahuilla Indian Tribe (Torres Martinez Tribe) would be required to convey water to the

20 Whitewater 1 and Whitewater 2 sites; the amount of available land is limited. Based on the larger area of

21 available land, the New and Alamo river sites were retained for further consideration.

## 22 Available Water

The SCH ponds could be operated as brackish water, saline water, or blended water habitat. Different ponds could be operated under different salinities to test which salinity regime results in the best combination, or balance, of invertebrate and fish productivity, bird use, and seasonal fish survival (refer to Appendices D, Project Operations and E, Monitoring and Adaptive Management Framework. Sources of brackish water initially considered included river water, water directly from agricultural drains, and groundwater; while sources of saline water included Salton Sea water and groundwater.

### 29 River Water<sup>1</sup>

Assuming 6 feet of evaporation annually, the amount of water required to supply each of the SCH pond configurations outlined in Section B.2 each year is as follows:

- 900 acres = 5,400 acre-feet (af) (12 cubic feet per second [cfs] peak month)
- 2,400 acres = 14,400 af (32 cfs peak month)
- 3,300 acres = 19,800 af (44 cfs peak month)
- 4,800 acres = 28,800 af (62 cfs peak month)
- 5,700 acres = 34,200 af (76 cfs peak month)

Water from the Colorado River is not a potential source of water for the SCH Project, as discussed in detail the Salton Sea Ecosystem Restoration Program Programmatic Environmental Impact Report (DWR and DFG 2007). Use of such water would require a change in the authorized uses of Colorado River water for fish and wildlife uses; additionally, the availability of surplus water is not expected to occur frequently, if at all.

- 1 Additional water would be required to maintain the salt balance or to flush the SCH ponds. The amount of
- 2 water available seasonally and annually at each of the three rivers is shown in Table B-1.

Table B-1         Annual Flows in the New, Alamo, and Whitewater Rivers (acre-feet						acre-feet)
	New	River	Alamo River		Whitewater River	
	October to March	April to September	October to March	April to September	October to March	April to September
Mean	593	633	780	913	72.5	71.4
Minimum	150	343	288	495	43	40
Maximum	2,000	3,000	4,000	4,500	185	137
Total	443	,968	613,320		52,010	
Source: U.S. G	eological Survey	2010a, b, c. Gage	es 10254730 Alam	no River near Nilai	nd CA; 10255550	New River near

Source: U.S. Geological Survey 2010a, b, c. Gages 10254730 Alamo River near Niland CA; 10255550 New River new Westmorland CA; and 10259540 Whitewater River near Mecca

3

4 Based on the information in Table B-2, water in the New and Alamo rivers is adequate to supply the SCH

5 Project, and use of this water was retained for further consideration.

6 In the Whitewater River, flow is present at the downstream-most gage (Mecca), but is often zero about 7 7 miles upstream at the Indio gage. DWR has estimated that 58 percent of the flow entering the Salton Sea 8 is from the Coachella Valley (either in the Whitewater River, via direct discharge in drains or via 9 underflow, or effluent from the wastewater treatment plant). In the future, inflows from agricultural uses 10 and treatment plant effluent will decrease because of water reuse occurring in the Coachella Valley. The Coachella Valley Water District (CVWD) is the primary water purveyor in the area, serving water to 11 12 60,000 irrigated acres and 102,000 customers (CVWD 2002). The water comes primarily from the 13 Colorado River via the All American Canal and the Coachella Canal. CVWD also obtains water from groundwater, reclaimed wastewater, and a State Water Project contract delivered through the Colorado 14 River Aqueduct. About 15,000 af of recycled wastewater is used within the CVWD service area (CVWD 15 2002). CVWD has prepared a water management plan that would attempt to reuse some of these return 16 flows, especially the wastewater treatment plant effluent. Therefore, the accretions to the Whitewater 17 18 River downstream of Indio will decrease as wastewater reuse and irrigation efficiency improves within the CVWD service area. Additionally, the Torres Martinez Tribe has indicated that it will have further 19 20 need for Whitewater River water for future restoration efforts. Apart from its fully appropriated status, adequate water is not available from the Whitewater River; therefore, it was eliminated from further 21 consideration. 22

## 23 Agricultural Drainwater

Agricultural drainwater was eliminated as a potential water source for a variety of reasons, including poorer water quality than that of the rivers (drainwater is primarily tilewater and not as diluted as river water; thus, its pollutants are more concentrated). Additionally, the availability of drainwater varies seasonally (not as much water is available when agricultural users are not discharging water); thus, it is less reliable than river water. Lastly, the agricultural drains are habitat for the Federally and state-listed desert pupfish (*Cyprinodon macularius*), and use of drainwater would reduce this habitat in violation of Federal and state laws intended to protect such species.

31

#### Salton Sea Water 1

2 The salinity of Salton Sea water is currently about 51 ppt. For reference, the ocean is about 35 ppt. Water

from the Salton Sea is a viable source of saline water because adequate supplies are available now and in 3

4 the future. Storage will decrease over time, but approximately 1,515,030 af of water are expected to be 5 stored in the Sea in the year 2077 given implementation of the SCH Project (refer to Section 3.11,

Hydrology and Water Ouality). Even though the Salton Sea is receding, the saline water pipeline could be 6

7 extended to access this water; therefore, accessing the Sea's saline water is feasible. Thus, this option was

8 retained for further consideration.

#### Groundwater 9

10 The Project area is part of the Imperial Valley Groundwater Basin. Previous studies (Lawrence Livermore National Laboratory [LLNL] 2008) have found that production of groundwater in the central portion of 11 12 the Imperial Valley is limited because of the low permeability of the aquifer and also poor groundwater 13 quality. The low permeability is a consequence of the deposition of former lakebed sediments that comprise the Imperial Valley soils. Some of these sediments have low transmissivity and, therefore, do 14 not produce significant amounts of groundwater. The groundwater is characterized as occurring in a 15 16 shallow system (ground surface to 2,000 feet deep) and a deeper system (extending to bedrock). The shallow system in the Imperial Valley Groundwater Basin consists of low permeability lake deposits from 17 18 0 to 80 feet, a low-permeability aquitard from 60 to 450 feet, and alluvium down to about 1,500 feet 19 (LLNL 2008). Well production data are limited for the Imperial Valley aquifer, but available data suggest 20 the wells in the central portion of the aquifer (closest to the Project area) have the following

- 21 characteristics:
- 22 Production rates of less than 100 gallons per minute (0.2 cfs),
- 23 Salinity generally ranged between 1,000 and 2,000 to as high as 15,700 parts per million, and
- 24 Hydraulic conductivity of 0.6 foot/day (LLNL 2008). •

25 Although groundwater in the central Imperial Valley aquifer has high salinity, this source is not a 26 replacement for the Salton Sea as a source of high-salinity water for the Project (the salinity is less than 27 the lowest pond salinity proposed). At this time, it appears that groundwater is not a suitable replacement supply for the river water used in the Project because of inadequate yield of the shallow groundwater and 28 29 insufficient data regarding this source, including depth to groundwater, salinity, subsidence, and location 30 of cost-effective production wells. Therefore, this option was eliminated from further consideration.

#### **B.4.2 Evaluative Criteria Screening Process Results** 31

The evaluative screening process was applied to the remaining Project components, and the results are 32

- summarized in Table B-2. Figures showing potential environmental constraints and land ownership at the 33
- three Project areas are presented in Attachment A. Key terms are defined in Attachment B. 34

Table B-2       Results of Evaluative Screening Process				
Component	Status	Rationale		
Diversion Mechanisms (Brackish Water)				
Inline weir	E	Construction and maintenance access issues would be extensive, involving an extended time period and specialized equipment needs. A temporary diversion would need to be put in place to construct the facility.		
		A structure in the river with gates would be expensive from the standpoint of capital cost and maintenance.		
		Sediment may accumulate behind the weir; the sediments may contain contaminants.		
		Weir may block the movement of any fish present.		
		Weir would raise the water-surface elevation and may adversely affect the upstream agricultural drains, causing flooding of agricultural land.		
		This Project component must be permitted through a 401 Permit, which may delay the permitting process and Project schedule.		
Lateral weir	R	A lateral weir may present construction access issues; however, these access issues would not be as great as constructing an inline weir. Also, the rivers would have no fixed grade control; if the rivers dropped because the Salton Sea dropped, the lateral weir would become less effective.		
		Although the cost for the structure is moderately expensive, the cost considerations are less than for the inline weir.		
		Sediment would not accumulate in the river channel, structure would not impede fish passage, and the weir would not cause as much habitat destruction as an inline weir, nor would the lateral weir back up water into the upstream agricultural drains.		
		Installing a lateral weir would not affect current or planned land uses.		
		The Corps generally considers a lateral weir a more accepted engineering control than an inline weir.		
Pump water from river	R	This component involves a basic design of a pump system and associated piping.		
		A large capital expense is involved for the facilities and to bring three-phase power to the Project.		
		Energy use is the only substantive consideration; noise impacts could be mitigated.		
		Installing this component would involve obtaining an easement from IID to bring in electricity, if needed, but would not substantively affect surrounding land uses.		
		The only potential schedule delay could occur in trying to obtain an easement from IID.		
River Water Conveyance				
Open canal	E	Would have to go far upstream to provide the head to convey the water to the SCH ponds. Ground and river elevation data suggest a deep channel is needed.		
		The cost of excavation, lining the canal, and operations and maintenance of the canal would be high.		
		A canal would require a large/wide right-of-way (50-60 feet) and a very large footprint during construction and operation. Construction would result in considerable air emissions and could adversely affect cultural resources (areas near rivers are		

Table B-2       Results of Evaluative Screening Process			
Component	Status	Rationale	
		known to be particularly sensitive). The channel could also result in the permanent conversion of Important Farmland to nonagricultural use.	
		Construction would result in temporary disturbance of farming operations.	
		This facility would require extensive negotiations to acquire right-of-way easements from landowners and, therefore, result in a long schedule.	
Pipeline	R	The cost would be less than an open channel.	
		A pipeline would have a large footprint during construction and maintenance, thereby potentially affecting cultural resources, and would result in moderate air emissions during construction. Impacts on agricultural resources likely would be temporary because some crops could be planted over the pipeline.	
		A pipeline would have a large footprint during construction and maintenance, but would have little to no permanent land use impacts.	
		As with an open channel, a pipeline would require extensive negotiations with landowners for right-of-way.	
Open canal and pipeline E		This option would have the disadvantages of the open canal and would not result in benefits over the pipeline alone.	
Saline Water Conveyance			
Backwater channel	E	Such a facility would require continuous upgrading and maintenance as the Salton Sea recedes.	
		High maintenance costs would be involved because the Sea is receding, so it would be necessary to constantly "chase the Sea" to connect the Sea with the channel.	
		Construction would occur in the "wet;" therefore, the channel has the potential to constantly collapse on itself, requiring reconstruction.	
Pipeline	R	A pipeline conveyance from the Salton Sea would be relatively easy to design and construct.	
		This conveyance would be relatively low cost and involve land that was mostly exposed playa. Additional pipe would have to be added as the Sea recedes, but is feasible.	
		This facility would be constructed mostly on exposed playa and cause few impacts.	
		This facility could be constructed quickly, within 6 months.	
Tailwater return pump	R	Recirculation is easy to design and construct and would use the facilities that are in place for the SCH ponds.	
		This element is inexpensive, consisting of a relatively short pipe and small pump. The pump may require frequent maintenance because of pond salinity.	
		This facility could be constructed quickly, within 6 months.	
Suspended Sediment Manageme	nt		

Table B-2   Results of Evaluative Screening Process			
Component	Status	Rationale	
No sediment management	E	Sediment would be deposited in the SCH ponds, thereby affecting habitat function and conflicting with SCH Goal 1. In addition, extensive maintenance would be required to remove built-up sediment within the SCH ponds.	
Sedimentation basin near SCH	R	Retained as a necessary component of the alternatives using pumped diversion for river water.	
ponds		Design and construction of a sedimentation pond is not complicated and would not require new construction methods. It can also be designed into the SCH ponds.	
		The cost of a joint facility would be less than a separate facility.	
		A pond near the diversion would use land that is marginal farmland or playa.	
		The settling pond would not be likely to conflict with surrounding land uses.	
		The time required to obtain easements or a lease for a pond would be short.	
Sedimentation basin near diversion	R	Retained as a necessary component of the alternatives using a pipeline to divert river water, despite potential impacts on Important Farmland and challenges associated with land acquisition since multiple private parties would be involved.	
Selenium Treatment and Managem	nent		
Constructed wetlands (treat between river diversion and SCH)	E	Selenium treatment (all methods) was eliminated at this time due to the large cost involved, technical uncertainty associated with each of the methods, and the lack of a significant impact on breeding bird populations that would merit such an undertaking (refer to Section 3.4, Biological Resources, for additional discussion).	
Controlled Eutrophication Process (algae) (treat between river diversion and SCH ponds)	E	See above.	
Anaerobic bacteria (treat between river diversion and SCH ponds)	E	See above.	
Cleaner source water (treat sources that drain into river, upstream of diversion)	E	See above.	
Salinity gradient (water management within SCH ponds)	E	See above.	
Power Supply			
Three-phase power	R	Adequate power is available nearby.	
Diesel generators	E	Because the pumps may run 24 hours per day, a portable diesel generator would not be practical because of the need for	

Table B-2       Results of Evaluative Screening Process			
Component	Status	Rationale constant maintenance of fuel and also the emissions from the motor that drives the generator.	
Solar power for pump energy supply	E	This supply would require solar panels, power inverter, transformer, and backup power supply. Solar panels produce from 10-12 watts per square foot of panel (World Watts no date). The saline and river pumps would draw between 100 to 900 kilowatts (100,000-900,000 Watts). At 11 Watts per square foot, this power requirement would necessitate between 0.2 and 1.9 acres of panels). In addition, there would have to be a hard power source for operating the pumps at night or cloudy days, and for accommodating the power surge associated with the start-up of a pump. These factors render the option of solar panels expensive, maintenance intensive, and impractical.	
E = Eliminated, R = Retained			

## **B.5** Development of EIS/EIR Alternatives

2 Based on the above analysis, six conceptual alternatives were developed that included two different locations and two methods of diverting and conveying the water to the SCH ponds. These alternatives 3 4 would comply with NEPA and CEQA requirements to evaluate a reasonable range of alternative ways of implementing a project and CEOA's requirement to identify alternatives that would avoid or substantially 5 6 lessen one or more of a project's significant environmental impacts. For example, those alternatives 7 requiring gravity diversion would result in a significant impact on lands under Williamson Act contracts<sup>2</sup> (refer to Section 3.2, Agricultural Resources), whereas this impact would not occur under the alternatives 8 9 requiring a pumped diversion. The latter generally would result in greater demand for power, however, as discussed in Section 3.6, Energy Consumption. 10

- 11 The initial alternatives included:
- Alternative 1 New River, Gravity Diversion: 2,460 acres of ponds constructed on either side of the New River, upstream gravity diversion of river water, and independent and cascading pond units.
- Alternative 2 New River, Pumped Diversion: 2,260 acres of ponds constructed on either side of
   the New River, pumped river diversion at the SCH ponds, and independent ponds.
- Alternative 3 Alamo River, Gravity Diversion: 2,420 acres of ponds constructed on either side of
   the Alamo River, upstream gravity diversion of river water, and independent and cascading pond
   units.
- Alternative 4 Alamo River, Pumped Diversion: 2,860 acres of ponds constructed on either side of
   the Alamo River, pumped river diversion at the SCH ponds, and independent ponds units.
- Alternative 5 New and Alamo Rivers, Gravity Diversion: This alternative is a combination of
   Alternatives 1 and 3 (4,880 acres).
- Alternative 6 New and Alamo Rivers, Pumped Diversion: This alternative is a combination of
   Alternatives 2 and 4 (5,120 acres).

These initial alternatives were subsequently refined, based on Stakeholder input, information about existing and proposed land uses in the Project area, special studies, geotechnical information, and budgetary considerations. Results of the preliminary geotechnical study indicated that construction would be more costly than originally anticipated due to soils that had low strength and were dispersive; would be subject to erosion from wave action; had the potential for compressibility, seepage, expansion, and liquefaction; and that could not support conventional construction equipment.

Refinements included modifying the configuration of the New River alternatives involving pumped diversion of river water. The configuration originally included a narrow, roughly 2-mile-long pond on the far western side that was eliminated due to the relatively high cost of berm construction required in order to obtain a comparatively small amount of habitat. Additionally, eliminating this area avoided channels carrying natural drainage. The alternatives that included both New and Alamo river sites were eliminated because the costs to construct habitat in both areas would have greatly exceeded available funds;

<sup>&</sup>lt;sup>2</sup> Commonly referred to as the Williamson Act, the California Land Conservation Act of 1965 (Government Code sections 51200–51297.4) enables local governments to enter into contracts with private landowners that restrict specific parcels of land to agricultural or related open space use. In return, these landowners receive property tax assessments that are much lower than normal because they are based upon farming and open space uses rather than the property's full market value. Local governments receive an annual subvention of forgone property tax revenues from the State of California via the Open Space Subvention Act of 1971 (Government Code sections 16140–16154).

therefore, they were considered infeasible. Additionally, the portion of the alternatives that included Red Hill Bay was eliminated because the United States Fish and Wildlife Service (USFWS) has plans to develop shallow water habitat in this area as part of the Sonny Bono Salton Sea National Wildlife Refuge (NWR). (The USFWS also has a planned restoration project at the New River, and DWR and DFG are working in close coordination with NWR staff to avoid any conflicts between the two projects.) The refined alternatives being considered in the EIS/EIR are as follows:

- Alternative 1 New River, Gravity Diversion + Cascading Ponds: 3,130 acres of ponds
   constructed on either side of the New River, upstream gravity diversion of river water, and
   independent and cascading pond units.
- Alternative 2 New River, Pumped Diversion: 2,670 acres of ponds constructed on either side of
   the New River, pumped river diversion at the SCH ponds, and independent ponds.
- Alternative 3 New River, Pumped Diversion + Cascading Ponds: 3,770 acres of ponds
   constructed on either side of the New River, pumped river diversion at the SCH ponds, and
   independent and cascading pond units.
- Alternative 4 Alamo River, Gravity Diversion + Cascading Ponds: 2,290 acres of ponds
   constructed on northern side of the Alamo River, upstream gravity diversion of river water, and
   independent and cascading pond units.
- Alternative 5 Alamo River, Pumped Diversion: 2,080 acres of ponds constructed on northern side of the Alamo River, pumped river diversion at the SCH ponds, and independent ponds units.
- Alternative 6 Alamo River, Pumped Diversion + Cascading Ponds: 2,940 acres of ponds
   constructed on northern side of the Alamo River, pumped river diversion at the SCH ponds, and
   independent and cascading ponds units.

23 The actual design of the ponds and other facilities is being developed based on habitat requirements, 24 results of special studies, bathymetry, engineering requirements, and Division of Safety of Dams requirements. Depths within the ponds would range from 0 to about 10 feet (0 would be at the shoreline 25 26 and edges of berms and islands). Water deeper than 6 feet would be obtained by excavation within the pond because the maximum water depth at the berm constructed to contain water in the pond would be 6 27 28 feet (as measured from the water surface on the upslope side of the berm to the toe of the downstream 29 side of the berm) to avoid Division of Safety of Dams jurisdiction. The berms would have 2 feet of 30 freeboard above the pondwater surface to allow for wave run-up and safety. Based on existing 31 topography, particularly near the New and Alamo rivers, large expanses of very shallow (less-than-1-foot) 32 water are present. These expanses do not provide suitable habitat for fish, so excavation/grading in these 33 areas would be needed to deepen the water, at least over part of the area. The excavated/graded material 34 would be used for constructing islands and berms.

## 35 **B.6** Other Alternatives Considered but Eliminated

Additional alternatives to the SCH Project were identified during the scoping process, including outreach
 to individual Stakeholder groups. These included the following:

- Use of agricultural drain water instead of river water (eliminated for reasons described above);
- Use of fresh (brackish) water (eliminated due to the potential for increased impacts associated with
   the bioaccumulation of selenium and the potential for increased mosquito populations due to growth
   of emergent vegetation).
- Use of fish hatcheries instead of raising fish in ponds (eliminated because this would not meet either of the two Project goals).

#### 1 B.7 References

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ATTACHMENT A

# Potential Environmental Constraints and Land Ownership

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Potential Environmental Constraints at New River Sites


1 2

Figure 3 Potential Environmental Constraints at Whitewater River Sites

- 3
- 4



Land Availability

#### 2 Figure 4 Land Ownership at the Alamo River Sites

1











1

2

Figure 6 Land Ownership and Available Acreage at the Whitewater River Sites

ATTACHMENT B

# **Definition of Key Terms**

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Water Supply (Brackish) – This term refers to the low-salinity water supply that comes from the rivers and how it is delivered to the SCH ponds. The sources initially considered for this water supply were the New, Alamo, and Whitewater rivers. The options for conveying the water include a gravity system (pipeline or channel) from a point on the river upstream of the SCH ponds, a pumped system located near the SCH ponds, or a combination of a low-head lift and gravity flow from an upstream point.

6 Water Supply (Saline) - This term refers to the high-salinity water from the Salton Sea or saline shallow groundwater and how it is delivered to the SCH ponds to increase their salinity. The options include a 7 pump and a pipeline from the Sea to the SCH ponds or an excavated channel from the Sea to the SCH 8 9 ponds with a pump lift into the ponds. The excavated channel method was used at the nearby U.S. Geological Survey ponds and involved a channel that was excavated to a depth lower than the current Sea 10 11 elevation along its entire length. The Sea flowed into this excavated area and was pumped out at a point 12 near the ponds. With either delivery system, changes would be needed as the Sea recedes. With a pipeline, additional sections of pipe would be added to extend the pipeline to the Sea. With the channel 13 14 method, the channel would need to be excavated deeper as the Sea's elevation declines. The third option for saline water is shallow groundwater that would be pumped from one or more wells near the SCH 15 ponds. 16

**Diversion** – This term refers to the type of structure placed on a river used to deliver water to the SCH 17 ponds. The water could be diverted by gravity flow, or it could be lifted by means of a pump. A gravity 18 19 flow diversion would be a lateral weir where water flows through a structure in the river bank to either a pipeline or channel. The lateral weir structure would use gates or stop logs to control the water flowrate 20 from the river, which would depend on the river's water-surface elevation of the river. As the river flow 21 22 changed, the river's water-surface elevation would change, and so the differential between the water 23 surface and the diversion structure would change. If the diversion flow rate were to be controlled, the 24 gates or stop logs would need to be actively managed as the river's water surface changed. The other 25 option is a lifted diversion in which the water is raised to a higher elevation than the river's water surface by means of a pump, which requires a power source. The diversion flowrate could be controlled by either 26 27 staging multiple pumps or with a variable speed pump. An issue that needs to be considered is that as the 28 Sea recedes, the river's elevation will get lower, causing the differential between the river's water surface and the diversion structure to decrease, which in turn would cause the ability to divert flow by gravity to 29 30 decrease. An inline weir (a structure across the river channel) would raise the water-surface elevation for diversion. An inline weir is essentially a small dam that would fix the water surface upstream at a 31 constant elevation regardless of the downstream (Sea) elevation. The elevation would, however, change 32 33 relative to flow in the river. The disadvantage of the inline weir is that it is an obstruction in the channel during flood conditions. 34

Inflow Volume - This term refers to the amount of freshwater needed to moderate salinity during 35 operation of the SCH ponds. The freshwater diversion rate could be equal to the water lost to evaporation, 36 but because the diverted water contains some salt, the SCH salinity would increase over time with this 37 38 diversion rate. Water could also be diverted in sufficient quantity to maintain a desired salinity. To 39 achieve this desired salinity, the SCH ponds would have a continuous outflow to the Sea to remove saline 40 water, and the diversion would be sufficient to replace evaporation and meet the outflow requirement to 41 maintain the salt balance. A third potential diversion option would allow operators to quickly drain and refill the ponds, essentially flushing the ponds. The quantity of water for this option would be greater than 42 either of the previous amounts. Inflow is what is entering the ponds, not what is coming off the rivers. 43 Diversion volume would be greater than inflow volume. 44

45 Treatment – This term refers to treatment of the freshwater supply to remove selenium, suspended 46 sediment, or other water quality constituents that could be detrimental to the Project by using pond 47 treatment or mechanical treatment. The pond system could be operated to allow deposition of suspended

- 1 sediment or treatment of other water quality constituents. Such a pond would need to be coordinated with
- 2 the current understanding of selenium treatment. A treatment pond could be located adjacent to the SCH
- 3 ponds or located near the diversion facility, upstream of the SCH ponds. A mechanical treatment system could be used to remove sediment or other water quality constituents but would typically be limited by
- 4
- the total flow it could reasonably treat. 5
- 6 **Pond Design** – This term refers to the depth and size of the individual SCH ponds. The size of the 7 individual ponds considered for this analysis could range from approximately 100 acres to over 500 acres. 8 A variety of pond sizes is needed to evaluate what size provides the best habitat for fish and the birds that 9 forage on them, while also facilitating management and maintenance activities.
- Depths within the ponds need to range from 0 to about 10 feet with 0 being at the shoreline and edges of 10 berms and islands. Water deeper than 6 feet would be obtained by excavation within the pond because the 11 12 maximum water depth at the berm constructed to contain water in the pond would be 6 feet (as measured 13 from the water surface on the berm's upslope side to the toe of the berm's downstream side) to avoid Division of Safety of Dams jurisdiction. The berms would have 2 feet of freeboard above the pondwater 14 15 surface to allow for wave run-up and safety. Based on existing topography, particularly near the New and Alamo rivers, large expanses of very shallow (less-than-1-foot) water are present. These expanses do not 16 provide suitable habitat for fish, so excavation/grading in these areas would be needed to deepen the 17 water, at least over part of the area. The excavated/graded material would be used for constructing islands 18 19 and berms.
- 20 **Pond Connectivity** – This term reflects how the ponds interconnect and if they are independent or 21 cascading. Independent ponds are self contained with their own water supply and drainage. These ponds would be operated to fill or drain as needed and would be managed for a specified salinity. Cascading 22 ponds are interconnected ponds where one pond outflows to another pond. A control structure would 23 24 regulate the flow between ponds. The ponds could be constructed with individual fill and drain facilities, 25 or the fill could occur at the pond at the top of the cascade and the drain at the bottom pond. The watersurface elevation would decrease between ponds going down the cascade. 26
- 27 **Pond Salinity** – Salinity in the ponds could range from approximately 20 to 40 ppt, although this range 28 could occasionally be exceeded depending on how the ponds are managed. Fish that would provide forage 29 for a variety of bird species and that are being considered for use in the SCH ponds are freshwater to brackish water species, most of which can tolerate higher salinities, but those levels are not optimal for 30 their growth. Invertebrates, such as pileworms and barnacles, that have done well in the Salton Sea in the 31 past and could provide forage for fish and birds, are marine species that require salinity near 35 ppt. The 32 33 risk of selenium accumulation and the resulting toxicity to birds (primarily to species that breed at the 34 Sea) also needs to be considered in selecting salinity levels for the ponds.

APPENDIX C

# **Geotechnical Investigations**

# PRELIMINARY GEOTECHNICAL INVESTIGATION

## SPECIES CONSERVATION HABITAT PROJECT SALTON SEA, CALIFORNIA

Project No. 758.01 January 21, 2011

Prepared by

Hultgren – Tillis Engineers

A California Corporation Specializing in Geotechnical Engineering



January 21, 2011 Project No. 758.01

Cardno 701 University Avenue, Suite 200 Sacramento, California 95825

Attention: Mr. Paul Wisheropp

#### Preliminary Geotechnical Investigation Species Conservation Habitat Project Salton Sea, California

Dear Mr. Wisheropp:

We performed a geotechnical investigation for preliminary design of the Species Conservation Habitat Project along the southeast shoreline of the Salton Sea. Our services are part of Cardno Project Number 32676001-5000, Task 5 of the Salton Sea SCH Project. Our task number is HT-DWR-2010-01, dated July 22, 2010. The results of the investigation are presented in the attached report.

It was a pleasure working with you on this project and we look forward to working with you during design development and construction. If you have any questions, please call.

Sincerely,

Hultgren – Tillis Engineers

Edwin M. Hultgren Geotechnical Engineer

WRC:SKT:EMH:db:la

6 copies submitted

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#### I. INTRODUCTION

This report presents the results of our preliminary geotechnical investigation for the proposed Salton Sea Species Conservation Habitat Project (SCH Project). The preliminary investigation is intended to provide a general characterization of on-site soil conditions and to provide geotechnical engineering criteria for preliminary design. The preliminary design will be the basis for the project description in the environmental impact documents. The findings and conclusions presented in this report are not intended for final design. A more detailed investigation should be conducted for the final berm alignment, berm configurations, borrow sources and anticipated construction methodologies.

#### II. PROJECT DESCRIPTION

The SCH Project will be located along the southeast shore of the Salton Sea. A Vicinity Map is presented on Plate 1. The project will consist of creating shallow ponds along the existing shoreline. The ponds will be located on both sides of the mouths of the New River and the Alamo River. The approximate boundaries of the ponds near New River and Alamo River are shown on the Exploration Site Plans, Plates 2 and 3, respectively.

In the area of the New River, the ponds will extend approximately 2.5 miles southwest and 1.5 miles east from the mouth of the river. In the area of the Alamo River, the ponds will extend between 1.5 miles south to about 2 miles northeast of the river mouth. Immediately adjacent to both river mouths, the berms will close off existing bays, and the berms will be approximately 1.5 to 2 miles off shore of the existing levees. Beyond the bays, the seaward-most berms will be approximately 0.5 to 1 mile beyond the existing levees. The total length of seaward berms will be up to approximately 5.5 miles in the vicinity of New River and approximately 3.5 miles in the Alamo River area. These estimates of berm lengths are preliminary as berm alignments continue to be evaluated.

The water depths within the ponds will typically be 6 feet or less. Ponds will contain water with varying degrees of salinity. Interior berms will subdivide the site into smaller ponds for individual salinity control. The target salinities are 20 parts per thousand (ppt) and 35 ppt. Water for the ponds will come from the New River and the Alamo River. Additional water for mixing various salinities in the ponds will come from the Salton Sea.

#### III. SCOPE OF SERVICES

For this preliminary investigation, our scope of services included reviewing the existing geotechnical data, exploring subsurface conditions at shallow depths along the berm alignments, assigning laboratory testing to be done by others, characterizing the materials encountered, and performing analyses and developing preliminary geotechnical conclusions and recommendations for constructing berms for the ponds.

#### IV. PREVIOUS INVESTIGATION

Two previous investigations contained geotechnical exploration and testing data.

The September 1972 Federal-State Feasibility Report, Salton Sea Project, California contain a summary of shallow probes drilled between the shoreline and five miles offshore. The thickness of sediment and the material type that refused further penetration are presented on Map 13, "Subaqueous Geology", in the 1972 report. Map 14, titled "Subaqueous Structure Contours, Top of Foundation" provides bathymetry in 1972 and generalized elevation contours of the top of relatively firm foundation materials.

URS issued a report for the "Preliminary In-Sea Geotechnical Investigation, Salton Sea Restoration Project" in February 2004. One cone penetration test, CPT-13, and one boring, 14, were performed near the SCH Project. Conclusions reached in URS's report regarding the engineering properties they observed in what they labeled "sea floor deposits" across the length of the sea were similar to our findings and conclusions regarding sea sediments (term used in our report) in the SCH Project area.

#### V. FIELD EXPLORATION

Methods for exploring subsurface conditions were dependent in part on site accessibility. On the playa (beach) above the water's edge, the site conditions are too soft to support conventional exploration equipment. This portion of the site was explored by hand-augering. At and beyond the water's edge (within the Sea), vibracore samples were taken from an airboat. At each exploration location, the insitu strength was characterized by hand-held vane shear apparatus (Geonor model H-60). Vane shear strength measurements were made at 0.5 foot intervals on the playa and at 1.0 foot intervals beneath the Sea. The vane was advanced between reading depths by pressing the vane further into the formation. In addition to the vane shear measurements taken by continuous advancement of the vane, hand-held vane shear strength measurements were also taken within the hand auger borings at approximately one foot intervals. A cone penetrometer test was conducted adjacent to each of the six hand auger borings. As the hand-held cone penetrometer (Durham model S-214) was pushed, the maximum and minimum penetration resistance was recorded for each 0.5 foot of penetration.

The locations of the exploration points are shown on the Exploration Site Plans, Plates 2 and 3. Logs of the hand auger borings and vibracores are presented on Plates 4 through 18. The key to the logs is presented on Plate 19. The hand-held vane shear tests performed adjacent to the hand auger and vibracore locations are summarized on Plate 20. (To better define the individual vane shear test results, the data points are shown vertically offset, in depth, by up to +/- 0.14 foot. The sole purpose of this arbitrary shift is to avoid having one data point masked by another.) The hand-held vane shear tests taken within the hand auger borings are presented on the logs of borings. Those shown on the logs of vibracores are from the continuous advancement of the vane adjacent to the vibracore. The hand-held cone penetrometer tests are presented on Plates 21 and 22.

#### VI. LABORATORY TESTING

Samples recovered from the hand augers and vibracores were delivered to the Moore Twining Associates, Inc. laboratory in Fresno, California. Laboratory testing on selected samples from the hand auger borings and vibracores consisted of 46 moisture content tests, 24 sieve analyses, and 18 Atterberg limits. Two bulk samples were collected from the playas near the New and Alamo Rivers (hand auger boring locations HA-1 and HA-4). Two laboratory compaction curves were performed on each bulk sample. One laboratory compaction test used "modified" Proctor compactive effort (ASTM Test D-1557) and the other "standard Proctor" (ASTM Test D-698).

To evaluate the dispersive characteristics of the on-site soils, six samples were selected for additional laboratory testing. They included the two bulk samples (HA-1 and HA-4) and four vibracore composite samples (VC-11, VC-16, VC-20 and VC-28). For each sample, the following laboratory tests were performed: gradation; Atterberg limits; organic content; crumb test; double hydrometer test; percent sodium in saturation extract; and pinhole test.

All of the laboratory testing was performed by Moore Twining Associates, Inc. except the pinhole tests. The pinhole tests were performed by the Department of Water Resources' Bryte Soils and Concrete Laboratory in West Sacramento.

The results of the laboratory testing are presented in Appendix A. A summary of the laboratory test results is presented in Table A-1 in Appendix A. Moisture contents and Atterberg limits are included in the logs of borings. A plot of the Atterberg limit tests and the corresponding in-situ moisture contents is presented on Plate 23. A combined plot of the four compaction tests is presented on Plate 24.

#### VII. SITE AND SUBSURFACE CONDITIONS

Several processes have gone into creating the feature now known as the Salton Sea. The Salton Sea basin is a northern extension of the Sea of Cortez, a down-dropped block created as Pacific Plate moved northwest and the Gulf of California spread open. The San Andreas Fault system forms a boundary between the low lying Salton Sea basin and mountain range further east. Some active faults may lie beneath the Alamo River portion of the SCH Project.

The Salton Sea basin is now isolated from the Sea of Cortez by an enormous alluvial fan created by the Colorado River. In the past, the Colorado River has flowed into the Salton Sea basin to heights well above those experienced in historic times. Upon European man's arrival in the Imperial Valley, the Salton Sea was a dry sink. Beginning in 1900, irrigation canals were constructed from the Colorado River into the Imperial Valley and northern Mexico. In 1905, control of the river was lost at one of the canal headworks, and the Colorado River flowed uncontrolled into the Salton Sea for one and a half years. The Sea as it is known today was reborn.

Over the subsequent century, the Sea has shrunk, swelled and now is again shrinking, all in response to the extent of irrigation and irrigation practices. Since the flood of 1905 – 1906, much of the site drainage and irrigation tail water has been collected by the New and Alamo Rivers and discharged into the Salton Sea. These waters are fairly high in dissolved solids, about 3 ppt. These rivers also bring suspended sediments. Upon reaching the high salinity of the Salton Sea (currently about 51 ppt), the finer grained sediments (clay size) flocculate and settle out on the floor of the Sea. The coarser grained sediments, including silt and fine sands, settle by normal gravity forces.

The Sea is now receding. On the exposed playa, the sediments are drying, creating a crust strong enough to walk on. However, as one approaches the shoreline, within one to two feet of elevation above the current sea level, the ground remains too soft to walk on in some areas. The surface of the playa is cracked in many areas as the sediments shrink from evaporation. At fairly shallow depths, the sediments remain nearly saturated over much of the playa.

In approximately half of the locations explored within the Sea, the mudline beneath the Sea is very soft and will not support a person wading. Grades are generally very flat.

The thicknesses of sea sediments nominally range from 3 to 8 feet in the areas we explored along and adjacent to the southeast shore of the Salton Sea. The thicknesses probably exceed this range in some areas. Most of these sediments likely accumulated within the last sixty years during the Sea's most recent rise above Elevation -240 feet. The sea sediments consist of very soft to medium stiff fat and lean clays, loose clayey and silty sands and soft to medium stiff silt. Red-brown lean clay, commonly medium stiff to stiff, was encountered below the sea sediment in many areas.

#### VIII. DISCUSSION OF FINDINGS

#### A. General

The most significant geotechnical issues for the project include the low strength of the sea sediments, the potential dispersive nature of the sediments and erosion from wave action. Compressibility, seepage and the expansion potential are also significant issues.

In some portions of the currently submerged areas, very flat slopes may be needed to safely construct the planned berms. Over a greater portion of the site, moderate slopes may be used but the ground is too weak to support traditional low-ground-pressure trackmounted construction equipment.

Sea sediments, including those beneath the playa, are predominantly fine grained soils. These soils will readily erode when exposed to even light wave action. The soils are also dispersive in fresh water. Their performance in brackish water is yet to be evaluated. If seepage developed through a berm and daylighted on the downstream slope, the dispersive nature of the soils could lead to fairly rapid development of a piping condition and loss of the embankment.

#### B. Settlement

The embankments for the berm will settle appreciatively during and following construction. To qualify the potential settlement, we performed one dimensional settlement analysis. This assumes that the loaded area is wide relative to the thickness of the compressible layer and ignores edge effects. We considered varying thicknesses of new fill, from two feet thick to 12 feet thick. The analyses were done for a range of compressible soil thicknesses from two feet to 12 feet. For the preliminary design, no undisturbed samples were taken from which to do consolidation testing. To assess potential settlement, we used estimated values of the compression ratio and coefficient of consolidation in our settlement analysis. We assumed that the sea sediments are normally consolidated and that the virgin compression ratio,  $C_{ce}$ , equals 0.3. The alluvial soil beneath the sea sediment overconsolidated relative to the weight of the planned berms and was assumed to be incompressible.

Results of the settlement analyses are summarized on Plate 25. To use this figure, select the thickness of fill along the bottom portion of the chart (for example: 10 feet

thickness of fill), go vertically until intercepting the curved line representing the sediment thickness at that location (for example, 4 feet soft soil thickness), then find the estimate of ultimate settlement on the vertical axis (in this case 1.5 feet). For this example, placing 10 feet of fill causes 1.5 feet of settlement resulting in a final embankment height of 8.5 feet. Conceptual design consists of a berm whose crest will be eight feet above the toe of the berm after settlement has occurred. The diagonal line marked on the chart labeled "Fill for Net 8 Feet" shows the combinations of fill thicknesses and thicknesses of soft sediment that result in a berm crest 8 feet above the original ground surface after settlement is complete.

To estimate how quickly this settlement may occur, we ran analyses that assumed single drainage, meaning that the soils beneath the sea sediments are very low in permeability and are considered a impermeable boundary and the soils overlying sea sediments are sufficiently permeable to provide unrestricted drainage. Pore water trying to escape the sea sediments under the weight of the fill is assumed to travel vertically to the top of the sediment layer. Lateral drainage is ignored. These are simplifying assumptions. Fill that will be placed to create the berm will be of low permeability and will inhibit drainage at the surface. Some drainage will likely occur into the underlying alluvial formation and some lateral drainage will occur. For the purpose of these analyses, we have assumed that modeling single vertical drainage and ignoring lateral drainage is offset by ignoring the low permeability of the overlying fill.

In estimating the time rate of consolidation, we assumed a coefficient of consolidation ( $c_v$ ) of 10 feet squared per year. The estimated time for 50 percent degree of consolidation is less than one to two months. The time requirement for 90 percent of the settlement to occur for varying thicknesses of soft soil sediments are presented on Table 1.

Thickness of Compressible Soils (feet)	Time required for 90 percent of Ultimate Settlement (months)
4	3
6	6
8	12
10	18
12	28

Table 1. Time for 90 Percent Consolidation

The above time rates of settlement as well as the estimated magnitudes of settlement were developed for assumed properties of the sea sediments. The presented results are intended to provide order of magnitude understanding for preliminary planning only.

### C. Stability

The results of the vane shear tests at the fifteen exploration locations are summarized on Plate 20. In this plot, the vane shear data taken adjacent to hand auger borings on the exposed playa are shown in warm colors (pale yellow, orange, and brown tones). Those vane shear tests taken from the airboat on the Sea or at its shoreline are shown in cool (lavender and blue) colors. On average, the strength of the materials beneath the Sea are considerably weaker than those beneath the playa.

The strength plots shown on Plate 20 as well as the strengths taken within the hand auger borings are measures of peak strength. No residual strength tests were performed for the preliminary investigation. Because the sediments coming out of the New and Alamo Rivers were essentially coming from a fresh water environment and hitting a highly saline body of water, the clayey materials likely have a flocculated structure. Flocculated clays can be highly sensitive, meaning that the residual strength may be much less than the peak strength.

The strength of the foundation soils (sea sediment) will greatly influence the way in which the berms are constructed. Where the shear strength in the foundation soil is consistently greater than 300 pounds per square feet (psf), the foundation soil can support the berm fill with little risk of foundation failure. (We discuss ability of construction equipment to operate on weak foundation soil in a later section.) At strengths lower than 300 psf, the risk of shear failure in the foundation soils needs to be carefully considered.

There are several states of stress that are commonly considered when assessing the stability of a water retention embankment such as the planned berms. The "end of construction" condition assumes that the soils are undrained and that no consolidation (and corresponding strength gain) has occurred in the weak foundation soils. The "steady state seepage" (or "long-term") condition assumes that the soils are fully consolidated and that the water level in the pond has been in place long enough for the embankment to become saturated up to a stable phreatic surface. "Sudden drawdown" occurs when the pool elevation in the pond is lowered quickly, faster than the embankment soils can drain. "Seismic loading" includes inertial lateral forces from earthquake shaking. Other seismic considerations are liquefaction in cohesionless soil, strength reduction in sensitive cohesive soils, and excessive deformations. The more critical cases for the berms at this site will be the end of construction condition and, for seismic considerations, liquefaction and strength reduction.

To check the capacity of the Salton Sea sediments to support fill for the berms, we performed a series of stability analyses for the end of construction condition. We considered three idealized strength profiles, various thicknesses of sediments, various thickness of berm fill and three slope inclinations.

For soil parameters, we assumed the densities of fill and underlying sea sediments were 110 and 100 pounds per cubic feet (pcf), respectively. Three models for shear strength for the foundation were used. To represent what we judge to be the weakest conditions, we assumed an undrained shear strength ( $S_u$ ) of 100 psf at the mudline, increasing at 10 psf per foot of depth below the mud line. We note this as  $S_u=100+10D$  psf in our results summary (discussed below). Several vane shear measurements at one foot depth had strengths less than this "weakest" shear strength model. Under almost any method of fill placement, we concluded that this very weak surficial material will be displaced.

To characterize the mid-range of shear strengths in sea sediments beyond the shoreline, we used a shear strength profile of 200 psf at the mudline, increasing at 10 psf per foot of depth ( $S_u=200+10D \text{ psf}$ ).

We used one additional strength profile of  $S_u=300+10D \text{ psf}$ . This third profile is stronger than most strength measurements taken in the sea sediments beyond the current shoreline, but it was also weaker than essentially all of the vane shear strength data measured beneath the exposed playa. This strength profile was used as a lower bound strength for sediments beneath the playa.

We ran a suite of stability analyses using Spencers method for soft sea sediment thicknesses of 4, 8, and 12 feet. We evaluated three slope inclinations of 3 horizontal to 1 vertical (3H:1V), 5H:1V and 10H:1V. The factor of safety was computed for berm fill thicknesses of between 2 to 12 feet.

The results of stability analyses for the  $S_u=100+10D$  psf profile are summarized on Plate 26. Those for the  $S_u=200+10D$  psf strength profile are summarized on Plate 27. All of the computed factors of safety were greater than 2.0 for the  $S_u=300 + 10D$  psf strength profile and a plot of these results is not presented.

Using the findings of the settlement and stability analyses, we computed factors of safety for the end of construction condition for fill thicknesses that will result in an eight feet high berm after consolidation. The computed factors of safety for the two weaker soil profiles are presented in Table 2.

Depth of Soft	Shear Strength S <sub>u</sub> =100+10D psf		Shear Strength S <sub>u</sub> =200+10D psf	
(ft)	5H:1V Slope	10H:1V Slope	5H:1V Slope	10H:1V Slope
4	1.1	1.8	2.0	3.5
8	1.0	1.6	1.7	2.5
12	0.9	1.5	1.6	2.4

Table 2. Factor of safety for fills that will yield an eight feet high berm

For most projects, the minimum factor of safety for an end of construction condition is commonly required to be at least 1.3. As discussed above, the sea sediments at this site are likely to be highly sensitive and may exhibit considerable strength loss once strained beyond their peak strength. To reduce the risk of overstressing the foundation soil and experiencing a strength reduction, a higher target should be set for the minimum end of construction factor of safety. The selection should be made during final design, when the sensitivity of the sea sediment is more fully assessed. We anticipate that the minimum recommended factor of safety may be on the order of 1.5 or higher.

For the steady state seepage (long term) conditions, we checked two profiles whose end of construction factors of safety were between 1.5 and 2.0. For effective stress parameters, we used an angle of internal friction of 27 degrees and zero cohesion. We assumed a phreatic surface that intercepts the toe of the berm. For eight feet high berms (post settlement), we computed factors of safety for the steady state seepage condition of 1.9 for a 5H:1V slope and 3.2 for a 10H:1V slope.

A pseudo-static stability analyses, using consolidated strengths, was not performed at the conceptual design phase. With long-term static factors of safety of 1.9 to 3.2, the application of an inertial force to represent seismic loading would indicate a factor of safety still greater than 1.0. However, during a large earthquake, we believe that some reduction in strength is likely within the foundation soils and that the embankment foundation may fail. This is discussed in the following section.

#### D. Seismic Performance

Sand, silty sand and sandy silt were encountered at some of the exploration locations. Standard penetration testing was not a part of the preliminary geotechnical investigation, so no definitive measure (SPT blow count) is available to classify the density of these cohesionless soils. The recent disposition history of these soils suggest that these are all loose deposits. With several seismic sources close by, most notably the San Andreas Fault, sandy materials with little to no cohesion are likely to liquefy during a large nearby earthquake. Lateral deformation and/or settlement is likely to occur if the foundation soils liquefy. Lateral deformation and/or settlement could lead to cracking of the berm, which could in turn lead to increased seepage, internal erosion and a piping failure through the berm. The berm settlement and deformation could also lead to overtopping of the berm. Seismic shaking may strain some portions of cohesive foundation soils beyond their peak strength. If these soils are highly sensitive, the marked reduction in strength within these overstressed zones would put increased demands on adjacent zones, expanding the overstressed area and potentially leading to instability of the foundation.

A detailed risk analyses was not part of the preliminary geotechnical investigation. The consequences of berm failure are not likely to include property damage beyond that of the ponds, and chance of injury or death from berm failure is low. For the purpose of assessing the economic impact of a seismically-induced berm failure, an annual chance of occurrence of between 1 to 2 percent is reasonable. This applies to berms constructed over the sea sediments. If the sea sediments are excavated and the berms are constructed on the underlying alluvium, the risks decrease.

#### E. Plasticity and Expansion Potential

Half of the samples tested for Atterberg limits had a plasticity index (PI) greater than 30. More than two-thirds classify as fat clays. These classification tests indicate that these materials have a high potential for shrinking and swelling with changes in moisture content. During our field investigation, we had judged the materials to be lower plasticity, observing a more silt-like behavior than the classification tests indicate. The six bulk and composite samples indicated higher plasticity on average compared to the individual sample tests. The bulk/composite samples were for depth intervals of 3.6 to 5.3 feet. The individual samples from the hand auger borings commonly covered a 1.0 to 1.5 foot depth interval. The vibracore samples covered a 2.7 foot depth interval, though some samples were shorter. We suspect that high plasticity clay layers within the longer stratigraphic samples dominated the sample behavior, masking lower plasticity silts within the sample intervals.

As the Sea level falls and the sea sediments become exposed, cracking is observed on the surface of the playa. These cracks extend at least in the range of 1 to 2 feet deep; though no detailed assessment of the depths of the cracks was performed. Water can be seen within some of the cracks. Surface cracking is an indication of the expansive character of the soil. Though cracking was observed, the pervasiveness was not as extensive as one would expect from the Atterberg limit tests.

#### F. Dispersion

Dispersive clay soils are clays that disaggregate (or deflocculate and lose their cohesion) easily and rapidly in water of low-salt concentration and become susceptible to erosion and piping. Dispersive clay soils can be eroded by slow-moving water, at gradients that would not erode cohesionless fine sands and silts.

Dispersive clay soils cannot be identified by the usual laboratory index tests such as moisture and dry density measurements, grain size distribution or Atterberg limits. Other special laboratory tests (i.e. crumb test, double hydrometer test, percent sodium in saturation extract and pinhole test) were performed as mentioned earlier. Samples for the pinhole tests were compacted to near 95 percent relative compaction using Standard proctor (ASTM Test D-698) as the laboratory compaction reference. The moisture content was near optimum. This results in a moderately compacted clay. We chose this level of compaction to reflect our belief that higher degrees of compaction may not be readily achievable for the soft site conditions. A summary of the dispersion potential from the individual laboratory tests performed for this purpose is shown in Table 3. Each of these samples were logged as gray fat clay (CH). Detailed results of the dispersion tests are included in Appendix A.

Sample	Crumb Test (ATM Test D-6572)	Double Hydrometer Test (ASTM Test D-4221)	Percent Sodium in Saturation Extract (EPA 60103)	Pinhole Test (ASTM Test D-4647)
HA-1	Nondispersive	Nondispersive	Nondispersive	Dispersive
HA-4	Intermediate	Nondispersive	Nondispersive	Dispersive
VC-11	Dispersive	Dispersive	Nondispersive	Dispersive
VC-16	Intermediate	Nondispersive	Nondispersive	Dispersive
VC-20	Nondispersive	Nondispersive	Nondispersive	Dispersive
VC-28	Nondispersive	Nondispersive	Nondispersive	Dispersive

As shown, the results from the individual tests do not agree. Due to the very high TDS, the correlation with Percent Sodium in Solution Extract and dispersion potential were beyond the range used in the Bureau of Reclamation's chart of percent sodium versus total dissolved salts. Extrapolation of that chart suggests the non-dispersive classification. In general, the pinhole test is considered the most reliable since it is a direct physical test. Based on these considerations, it appears likely that the on-site soils would have a tendency to disperse in a fresh water environment. The validity of extending this finding to the SCH Project ponds, which will retain brackish to saline water, is not clear.

The tendency toward dispersive erosion in a dispersive clay depends on the chemistry of the water. The dispersion potential likely decreases with increasing salinity of the water. The ASTM standard for pinhole test uses distilled water. The retained water will have 20 ppt to 35 ppt TDS. These concentrations may not disperse the clays. To further assess the dispersion potential of the on-site soils, additional pinhole tests are being performed using water of various salt concentrations modeling the waters in the planned ponds.

When dispersive clay soils are used for construction of embankments without filters, piping and erosion may occur. Dispersive piping is usually initiated when water flows into small cracks and fissures caused by desiccation and/or differential settlement, particularly if the soils are placed dry of optimum or not well compacted. The water that flows through the cracks will remove the disaggregated particles, with the rate of removal increasing as the seepage velocity and size of opening increase.

The risk of a dispersive erosion induced failure is greatest in areas of higher seepage potential, such as around pipes through the embankments, adjacent to concrete structures, and at the foundation interface where compaction may have been less methodical. Deep gullies may also form on embankment slopes, where dispersive clay soils are exposed to rainwater run-off as well as water retained by the ponds. Severe dispersive erosion can lead to costly and difficult operation and maintenance.

#### G. Seepage

A wide range of permeabilities likely occurs within the sea sediments. In some hand auger holes, no apparent water seeped into the boring as it was drilled. In other hand auger borings where sandy silt layers were encountered, water percolated into the hole during drilling. Permeability in the undisturbed sea sediment is likely anisotropic. One slug test was performed in hand auger boring HA-4. The transmissivity was too low to develop reliable data from the sensors used. For purposes of estimating seepage through the soil matrix, the permeability correlations with material type and gradation presented in Table 4 may be used.

Material Type	Vertical Permeability cm/sec	Horizontal Permeability cm/sec
Sand	1x10 <sup>-4</sup>	1x10 <sup>-3</sup>
Silty Sand and Clayey Sand	1x10 <sup>-5</sup>	1x10 <sup>-4</sup>
Silt	1x10 <sup>-6</sup>	1x10 <sup>-5</sup>
Clay	1x10 <sup>-7</sup>	1x10 <sup>-6</sup>

Table 4. Permeability Estimates for Conceptual Design

Where shrinkage cracks have developed, structure of the soil will dominate seepage performance. The cracking will need to be considered when estimating seepage potential beneath the embankments. The tendency of the embankments themselves to develop shrinkage cracks will also need to be considered in evaluating seepage risks.

Seepage may occur through and beneath the berms. The fills used to construct the berms will be predominately fine grained soils of low permeability. Factors with the greatest potential for causing adverse seepage through the berms include less-than-rigorous placement and compaction methods, cracking due to settlement, shrinkage cracking, and dispersion potential. By "adverse seepage", we refer to conditions that could potentially lead to internal erosion within the berm.

On the playa, the sea sediments have dried on the surface and shrinkage cracks extend at least a couple of feet. These cracks could become seepage paths beneath the berm fill. Having a pre-existing cracking pattern coupled with the dispersive character of the soil creates risk of piping beneath the berm. Leakage through these cracks can be limited by constructing a wide, shallow cutoff trench during site preparation, prior to placing berm fill. The trench will disrupt the interconnected cracks. Using a non-dispersive soil for the cutoff trench backfill would further reduce the risk of an under seepage failure. Sand and silty sand within the foundation can be a seepage path beneath the berm. Though some water loss may occur at these locations, the sandy soils would not be dispersive, and the risk is low for a berm failure by under seepage in these soils. The magnitude of seepage through an underlying sand layer may be best controlled by an upstream blanket of lower permeability soil.

If local seepage is identified once the ponds are containing water, excavating a trench parallel to the berm's axis and remixing the soils can be an inexpensive method of disrupting a seepage path and controlling seepage.

#### IX. CONCLUSIONS

#### A. General

There are several major considerations in assessing what may be the more efficient methods for constructing the berms. Major considerations include:

- Will the toe of the berm be above the water level in the Sea and will the Sea be covering the site?
- What kind of equipment can access the site?
- Will the berm be supported on the existing weak sea sediments or will the berm fill be placed in such a manner as to intentionally displace (fail) the sediments?
- Will soft sea sediments be used to create the berm or will stiffer soils be used?

These and other issues are addressed in this section.

#### B. Berm Embankments

In much of the currently submerged areas, the sea sediments are quite weak. To avoid failing the ground, the berm embankments will need to have very flat slopes. In these areas, the ground is too weak to support construction equipment, and barge-mounted equipment will be needed. One method to construct berms in those conditions is to excavate sediment immediately adjacent to the berm's alignment and cast it up on the berm. The berm footprint would be quite wide, and it may be most practical to operate draglines (or similar barge-mounted equipment) on both sides of the berm alignment. The saturated soft berm fill material cannot be effectively compacted. Once the surface of the fill extends more than about one foot above the level of the Sea, the dragline bucket can be dropped on the fill as a means of providing some compactive effort.

This is likely the most cost-effective method for constructing some form of berm in these weak foundation areas. However, the berm fill would be weak and have a high moisture content, subject to shrinking and cracking as the fill dries. The upper several feet of the fill will need to be moisture conditioned and compacted to provide support for service vehicles.

With a fill poorly compacted and having a high potential for shrinkage cracks, there is risk of seepage developing through the berm. If seepage is observed, it can be remediated by excavating a trench partially down through the center of the berm crest. Within the trench, the excavator bucket can be used to remold the soils at depth. Pre-mixing a thick bentonite slurry to the partially excavated trench can aid the remolding process. This technique would be useful for treating local seepage zones. If seepage over long sections develop, a traditional slurry trench cutoff wall may be needed.

An alternate approach for constructing a berm in submerged areas would be to create a berm using moisture conditioned fill. The fill material could be prepared on the higher portions of the site, above the Sea. In many areas, the sediments are only three to four feet thick. The underlying alluvial soils are stiff and can support track-mounted construction equipment. A pad could be developed for spreading the playa sediments in a thin lift (about one foot thick). The sediments could be moisture conditioned by discing and/or rototilling and kneaded until a moisture content suitable for compaction is developed. Another material source could be to excavate (mine) the alluvial soils beneath the sediments.

The stiff fills would be placed by end-dumping from the end of the berm alignment and advancing the berm as additional fill is placed. The fill can either be placed on the soft sediments or the sediments could be excavated to a firm bottom prior to placing the fill. Soft sediments will not support steeper sloped fills in many areas. The weight of the fill will create a "mud wave" as the displaced sediments are heaved up in front of and/or to the sides of the advancing fill. Creating mudwaves is a valid form of berm construction in very weak areas. One drawback is that the weak soils are displaced in a non-uniform manner and the final thickness of fill will vary along the berm alignment. Excavating the soft soil prior to placing the fill can develop a more uniform thickness fill.

Whether placed with mudwaves or in areas where soft soil is removed, the fills below the water will not be compacted. As the fill extends above the water surface, the fills can be compacted. However, in the mudwave case, the compacted fill will be dropping in irregular sections as the foundation soil becomes over-stressed from increasing fill thickness. On the playa where sediments can support the fill, they still may not be able to support low ground pressure track-mounted construction equipment. Though the vane shear data indicate the shear strength is greater than 300 psf which would normally support low ground pressure equipment, the potential for strength loss when the soils are overloaded suggests to us that using tracked equipment directly on the playa surface would be risky. Dozing 18-inches to two feet of fill out in front of the tracked equipment and keeping this thickness beneath the tracks may spread the contact pressure enough to support light, low ground pressure equipment. (Note - This discussion is not directed toward suggesting to a contractor what it might take to work on the playa. Rather, it is aimed at providing a general understanding of what kinds of methods may need to be considered in preparing environmental documentation.)

The thick initial lift (bridging lift) will not be well compacted. It would likely only be track-walked by the low ground pressure dozer. A poorly compacted zone has increased potential for seepage. A bridging lift, as well as moisture-conditioned soil placed below water in the previously described method, would not be effectively compacted. An upstream blanket of sediment could be used to resist seepage. If seepage develops, a cutoff wall may be needed.

#### C. Treating Dispersion

Even if it is determined during the next stage of investigation that the majority of the on-site soils may be dispersive when retaining brackish water, there may be no economic alternative other than to use these soils for the construction of the embankments. Embankments can be constructed with dispersive clay soils provided certain precautionary measures are taken. Some of these precautionary measures are discussed below.

Erosion of dispersive clay soils through embankments can be controlled by properly designed and constructed filters. The filter may be part of a downstream seepage berm. Filter material should be placed around the downstream one-third portion of pipes through the embankments, regardless of whether the soils are dispersive or not.

Embankments constructed with dispersive clay soils should be properly compacted; especially if the soils are being placed around pipes, adjacent to concrete structures, at the foundation interface, and if no filters are being provided. Achieving a wellcompacted embankment on the soft subgrade may not be feasible.
Risk of seepage induced failures, including those due to dispersive soils can be reduced somewhat by simply making a wider embankment.

Most dispersive clay soils can be rendered non-dispersive by the addition of lime. Lime modification of dispersive clay soils may be considered for the surface of the embankments to provide slope protection (discussed later). Lime-modified dispersive clay soils may also be considered for portions of the interface with rigid structures such as pipes through the embankments.

A cutoff wall to block seepage through the embankments may be considered to lower the risk of piping. The cutoff wall may consist of a soil-bentonite cutoff wall constructed by slurry trench methods and using non-dispersive clay for source fill. As an alternative, plastic sheetpiling may be considered, but would likely be more expensive than a soil-bentonite cut-off.

Impermeable liners placed on the waterside slopes of the ponds may also be considered to reduce seepage through the embankments. Liners may include plastic liners (such as a thick HDPE membrane) or a well-compacted clay blanket comprised of low-permeability non-dispersive soils.

Most of these schemes reduce the potential rate of dispersion, but the risk of an eventual piping failure may still remain.

#### D. Shoreline Protection

There are two shorelines for the ponds. The interior of each pond will have water lapping against the interior face of the berm. During construction and during the first several years of operation, the seaward-most berm will be exposed to wave action from the Salton Sea.

For the interior face of the berms, the wave height will be fetch-limited with maximum fetches of about two miles for some ponds. Berm faces derived from sediment fill sources will be highly erodible. Some form of shoreline protection will be needed on the interior faces of the berms. The protective facing will need to extend over the portion of slope face that will be exposed to wave action, including the estimated height of run-up.

The traditional scheme for erosion protection is riprap facing. Riprap would be quarried rock material with an angular to subangular shape. Riprap should be placed on slopes no steeper than 2H:1V. Steeper as opposed to flatter slopes will limit the square footage of berm face that needs to be protected with riprap. Riprap would be placed on a geotextile designed for riprap underlayment.

Soil cement can be used for erosion protection and often is a viable option when riprap is not available. Soil cement consists of mixing portland cement with a locally available source of sand or silty sand. For good quality control, it is preferable to mix the soil cement in a pugmill at a central location within the project site and deliver the soil cement by dump truck to the berm. Soil cement is most efficient when there is little to no clay or organic material in the sands to be treated. Identifying a suitable source of sand within the project site may be a challenge. The vibracores near the mouth of Alamo River (VC-22 and 24) indicated about one foot of silty sand over fat clay and silt. No other surficial sand deposits were identified. These thin layers would be difficult to mine. At present there is no readily available source of sand for soil cement.

A hard clay is erosion resistant, though not nearly to the extent of riprap or soil cement. A hard clay can be developed by lime treating on-site clays. Lime is mixed with the clays on the berm slope and compacted. The equipment can safely operate on a 6H:1V slope. A flatter slope may be more appropriate near the still water elevation where most of the erosion action might occur. This erosion method would have a limited service life, perhaps in the range of five years, before major reconstruction is needed.

Geomembrane facing has been used to line reservoirs. The service life of the linings vary considerably with the type of material used and its resistance to degradation under extended sunlight. A geomembrane would have the smoothest surface of the erosion protection systems addressed here, and for similar slope inclinations would have the highest run-up.

On the outward face of the seaward-most berm, waves from across the 40-mile fetch of the Salton Sea will attach the slope. Unprotected fill will readily erode. The installation of shore protection will be complicated by interfacing the berm embankment construction method selected.

As with the pond interiors, riprap would be our first choice. Depending on the embankment construction method used for the seaward berm, placing riprap can be reasonably efficient to quite inefficient. Some embankment construction methods will have flat slopes or heaved up sediments on the seaward side of the berm. These geometries will be inefficient to armor with riprap. Excavating the sediment in front of placing moisture-conditioned soil can develop reasonably steep slopes, likely in the range of 3H:1V to 5H:1V. These slopes allow reasonably efficient use of riprap.

Riprap could be used to create an offshore breakwater, creating a fairly still water pool adjacent to the berm. After the level in the Sea has dropped, the riprap could be more easily salvaged for reuse on future projects if placed against the slope rather than as a separate offshore breakwater.

Other off shore breakwater systems could be considered, including a cable tire system. This system could be relocated further off shore as the Sea level drops.

A geomembrane could be used to wrap the face of fill. Though the material may have a limited service life, the period that sea waves may attack the berm of service would likely be shorter than the service life for many materials. We are not aware of an example of this scheme, suggesting that issues such as how to anchor the geomembrane and how to distribute stresses at anchorage points have not been satisfactorily resolved. Deployment may also be difficult.

A geotube is a large diameter geotextile tube (in the range of 20 to 30 feet in diameter), that is filled by pumping slurried soil into the tube, creating a gravity structure. The more common applications of geotubes include serving as groins to control onshore/offshore and longshore migration of beach sand and as containment structures for fine grained slurries to allow the slurries to drain. The geotube would become the seaward toe of the berm. A geotube would be compatible with the berm construction method of excavating adjacent sediments and casting them up on the landward side of the geotube. Fill for the geotube will need to be sand or silty sand. The material requirements of the sands would not be as strict as those for soil-cement. Material logged as clayey sand in the hand auger borings and vibracores would likely be suitable fill. This material was found in limited locations. Further exploration near the mouths of the New and Alamo Rivers may disclose additional sources of silty sand.

**PLATES** 





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Project No. 758.01

Plate No. 2



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Project No. 758.01	
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Plate No. 3

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/15/ Drilling Method : Hand Elevation (Feet) : Latitude : 33.09 Longitude : -115 Material De	/2010 d Auger 949 .6957 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
1- 2- 3- 4- 5-				CH		Fat Clay (CH), olive gray, r         occassional sand partings         Becoming wet         Becoming dark gray         Becoming saturated         Lean Clay (CL), gray, satu         Lean Clay (CL), reddish br         Bottom of boring at 5 feet         No groundwater encounte         Refusal to vane shear dev         *Atterberg Limits measure         (0 - 3.6 feet).         **Full suite of laboratory te         3.6 feet).	rated, medium stiff, with rated, medium stiff own, saturated, stiff red during drilling. ice at 5.2 feet. ments on bulk sample ests on bulk sample (0 -	0.33 0.33 0.41 0.55	45 65 35 22	63* 42	27	Full Suite** Sieve Sieve
Salton Sea SCH Project Salton Sea, California <b>Hultgren - Tillis Engineers</b>						ers	Log (Pa Project No. 758.	<b>g of</b> I <b>ge 1</b>	HA-1 of 1	I )	Plate	e No. 4

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/16/ Drilling Method : Hand Elevation (Feet) : Latitude : 33.10 Longitude : -115	2010 4 Auger 099 6855 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
	· · · · · · · · ·					Lean Clay (CL), tan brown soft, with some shell fragm	, moist, medium stiff to nents					
1—	B					Becoming dark gray, satur	ated	0.32	31			
2—	B			CL	Ā			0.24	45	43	24	Sieve
3—	B							0.21	54			
4	B			ML		Silt (ML), reddish brown, sa	aturated, medium stiff	0.40	41			
						Groundwater encountered to cone penetrometer at 4.	during drilling. Refusal 3 feet.					
	Salto SCH Salto	n Sea Projeo n Sea	ct , Cal	iforn	ia		Lo (Pa	g of Ige 1	HA-2 of 1	2)		
	Hultgren - Tillis Engineers						Project No. 758.01 Plate No. 5				e No. 5	

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/14/ Drilling Method : Hand Elevation (Feet) : Latitude : 33.19 Longitude : -115	/2010 d Auger 939 .6129 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
						Silt (ML), mottled olive brow	wn, moist, stiff to			56*	36*	Sieve*
	· · · · · · · · ·											Full Suite**
1-	B			ML					29			
	· · · · · ·											
	· · ·											
2-	· · · · · · · · · · ·					Lean Clay (CL), gray, mois with some fine grained sar	st, soft to medium stiff, nd, low plasticity	0.22				
	B			CL		Becoming wet, with shell fi	ragments		33			Sieve
3-	· · · · · · · · ·							0.24				
	· · · · · ·					Fat Clay (CH), dark gray, v	vet, soft to medium stiff					
4-	· · · · · · · · ·							0.21				
	B				$\overline{\Sigma}$			0.21	46			Sieve
5-	· · · · · · ·											
ľ	· · · · · ·			СН								
	· · · · · ·							0.23				
6-	B							0.26	47			
	· · · · · · · · ·							0.20	-1			
7-	•••					Detterre of hering of 7.0 for		0.24				
		<u> </u>	1	I	1	Vane shear device used to	ر o measure undrained	0.24	I	1	I	1
shear strength to a dep Groundwater encounte *Atterberg Limits meas on bulk sample (0 - 5.3 **Full suite of laborator 5.3 feet).							of 7.2 feet during drilling. ment and sieve analysis et). ests on bulk sample (0 -					
	Salto SCH Salto	n Sea Projeo n Sea	ct , Cal	liforn	ia		Loợ (Pa	g of Ige 1	HA-4 of 1)	1 )		
	Hultgren - Tillis Engineers					ers	Project No. 758.01 Plate No. 6					

1       B       Fat Clay (CH), motified olive gray, moist, medulin       44         1       B       B       0.44         2       B       B       0.44         3       B       B       0.44         3       B       B       0.44         4       0.44       0.44         4       0.44       0.44         9       52       28         2       B       B         3       B       B         4       B       B         4       B       B         5       B       B         5       B       B         5       B       B         5       B       B         6       Sifty Sand (SM), dark gray, fine grained, saturated, locz         0.22       20       Sieve         Bottom of boring at 5.3 feet       0.22       0.22         10:05e       Sittor or penetrometer at 5.0 feet.       0.22       20         Sieve       Sieve       Sieve       Sieve       0.22       Sieve         Bottom of boring at 5.3 feet       Croundwater encountered during drilling. Refusal       0.24       Sieve         S	Depth in Feet Samples Type/ Recovery Blow Count Graphic USCS Water Levels	Date : 9/14/ Drilling Method : Hand Elevation (Feet) : Latitude : 33.19 Longitude : -115 Material De	/2010 d Auger 981 .5979 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
Salton Sea       Log of HA-5         SCH Project       (Page 1 of 1)         Salton Sea, California       Project No. 758.01	L 00 J > 1- B CH 2- B CH 3- B CH 5- B SM ✓	Material Definition         Fat Clay (CH), mottled olivistiff, trace of organics, rare         Becoming moist, thin shell         Sand seams between 1.7         Becoming dark gray, satur         stiff, organic odor         Soft zone between 3 and 3         Becoming gray         Silty Sand (SM), dark gray         loose         Bottom of boring at 5.3 feed         Groundwater encountered         to cone penetrometer at 5.3	e gray, moist, meduim e gray, moist, meduim e salt crystals bed at 1.5 feet and 2 feet ated, soft to medium 3.5 feet , fine grained, saturated, during drilling. Refusal 0 feet.	0.44 0.31 0.21 0.29 0.22	44 49 55 49 20	52	28	Sieve
	Salton Sea SCH Project Salton Sea, California		Log (Pag	ge 1	HA-{	5		

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/17/ Drilling Method : Hand Elevation (Feet) : Latitude : 33.18 Longitude : -115. Material De	2010 I Auger 336 6222 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
1- 2- 3- 5-				CL SC CL CL		Lean Clay (CL), mottled ta medium stiff to soft, with sh Sandy Lean Clay (CL), we odor Clayey Sand (SC), gray, sa Sandy Lean Clay (CL), gra Lean Clay (CL), gray, satur Lean Clay (CL), reddish br Bottom of boring at 5 feet No groundwater enountere Refusal to vane shear devi Refusal to cone penetrome	n and dark gray, wet, hell fragments t, medium stiff, organic aturated, medium dense <u>y, saturated, stiff</u> rated, stiff own, saturated, stiff own, saturated, stiff ed. ice at 4.5 feet. eter at 6 feet.	0.21 0.33 0.42 0.68+	44 44 29 33 31	31	15	Sieve
Salton Sea SCH Project Salton Sea, California						Log of HA-9 (Page 1 of 1)						
	Hultgren - Tillis Engineers					ers	Project No. 758.01 Plate No. 8			• No. 8		

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/16/ Drilling Method : Hand Elevation (Feet) : Latitude : 33.10 Longitude : -115.	2010 I Auger 009 7263 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
1— 2— 3— 5—	B B B B			ML- CL SC	Ţ.	Clayey Silt (ML-CL), tan ar soft to medium stiff, with sa fragments Becoming dark gray to bla Clayey Sand (SC), tan, sat medium dense Sandy Lean Clay (CL), red stiff Bottom of boring at 5 feet	d gray, dry to moist, and, abundant shell ck, saturated urated, loose to	0.29 0.28 0.35 0.50	25 21 34 31	25	5	Sieve
	Salton	n Sea				Groundwater encountered to vane shear device at 3.3 Refusal to cone penetrome	during drilling. Refusal 3 feet. eter at 5.3 feet.	of H	<b>1A-1</b>	0		
Salton Sea, California Hultgren - Tillis Engineers						ers	(Page 1 of 1) Project No. 758.01 Plate No. 9				No. 9	

Depth in Feet	<ul> <li>Samples Type/</li> <li>Recovery</li> </ul>	Blow Count	Graphic	NSCS	Water Levels	Date : 9/17/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.09 Longitude : -115. Material De Silt (ML), gray, saturated, so organic odor	2010 core 968 7109 escription soft to stiff, with sand,	Vane Shear (tsf)	8 Moisture Content (%)	Z Liquid Limit (%)	Z Plasticity Index (%)	Other Laboratory Tests Sieve
				-		No recovery below 1.3 feet	:	0.68+				
	Salto					Bottom of boring at 2 feet Water level approximately Refusal to vane shear devi	2 feet above surface. ce at 1.5 feet.					
	Salto SCH Salto	n Sea Proje n Sea	ct , Cal	liforn	ia		Log (Pa	g of Ige 1	VC-6 of 1	5 )		
	Hultgren - Tillis Engineers						Project No. 758.	01		F	Plate	No. 10

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/17/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.1 Longitude : -115	2010 acore 109 6931 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
1 2 3 5 6 7 8				СН		Fat Clay (CH), gray, satura odor No recovery below 3.6 feet Bottom of boring at 5.0 feet Refusal to vane shear devi	t t t	0.05 0.11 0.11 0.14 0.22 0.36 0.61	56	68*	47*	Sieve* Full Suite**
						Vane Shear device used to shear strength to a depth o *Atterberg Limits measure (0 - 3.6 feet). **Full suite of laboratory te (0 - 3.6 feet).	o measure undrained of 8.5 feet. ments on bulk sample sts on bulk sample					
	Salto SCH Salto	n Sea Proje n Sea	ct , Cal	iforn	ia		Log (Pa	of \ ge 1	/C-1 of 1	1 )		
	Hultgren - Tillis Engineers						Project No. 758.0	01		I	Plate	No. 11

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	NSCS	Water Levels	Date : 9/17/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.12 Longitude : -115	2010 acore 268 .6743 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
1— 2— 3— 5— 6— 7—				CH		Fat Clay (CH), gray, satura odor Becoming soft Lean Clay (CL), reddish br No recovery below 4.0 feet	ted, very soft, organic	0.05 0.13 0.17 0.12 0.26 0.68+	43	66*	46*	Sieve* Full Suite**
Water level approximately 2-feet above surface.         Refusal to vane shear device at 5.5 feet.         *Atterberg Limits measurements and sieve analysis on bulk sample (0 - 3.9 feet).         **Full suite of laboratory tests on bulk sample (0 - 3.9 feet).         (0 - 3.9 feet).         Salton Sea       Log of VC-16 (Page 1 of 1)         Salton Sea, California       Project No. 758.01									6 )	Plate	No. 12	

Depth in Feet Samples Type/	Recovery Blow Count		Graphic	USCS	Water Levels	Date : 9/14/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.18 Longitude : -115.	2010 Icore 38 6184 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
V 1- 2- V 3- 4- 5- V 6- 7-				ML		Sandy Silt (ML), gray, satu organic odor Silt (ML), gray, saturated, s plasticity Fat Clay (CH), gray, satura stiff, organic odor Becoming stiff at 6 feet No recovery below 6.2 feet Bottom of boring at 7.5 fee	rated, medium stiff, soft to medium stiff, low	0.28 0.17 0.39 0.25 0.29	44 34 38	NP	NP 37	Sieve
Salton Sea     Log of VC-19       SCH Project     (Page 1 of 1)       Salton Sea, California     Project No. 758.01									No. 13			

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/14/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.18 Longitude : -115. Material De	2010 acore 391 617 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
1 2 3 4 5	V			СН		Fat Clay (CH), gray, satura organic odor Becoming soft No recovery below 4.7 feet	ated, medium stiff,	0.32 0.27 0.19 0.17 0.45	29	67*	49*	Sieve* Full Suite**
	6 Bottom of boring at 6 feet Water level approximately 1-foot above surface. Refusal to vane shear device at 6 feet. *Atterberg Limits measurements and sieve analysis on bulk sample (0 - 4.7 feet). **Full suite of laboratory tests on bulk sample (0 - 4.7 feet). Salton Sea SCH Project Salton Sea, California Log of VC-20 (Page 1 of 1)											
	Hultgren - Tillis Engineers					ers	Project No. 758.01 Plate No. 14				No. 14	

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/14/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.19 Longitude : -115	2010 acore 901 6065 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
 2 3 5				СН		Fat Clay (CH), gray, satura odor Becoming soft to medium No recovery below 4.8 feet	stiff	0.04 0.07 0.11 0.18 0.41	56	57	38	Sieve
	Salton SCH Salton	n Sea Projed n Sea	ct , Cal	iforn	ia	Bottom of boring at 5.5 fee Water level on the surface Refusal to vane shear devi	t ce at 5.3 feet. Log (Pa	y of N ige 1	/C-2 of 1]	1		



Jepth in Feet	amples Type/ ecovery	slow Count	Braphic	JSCS	Vater Levels	Date : 9/14/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.2 Longitude : -115.	2010 acore 176 6115	/ane Shear (tsf)	Aoisture Content (%)	iquid Limit (%)	Plasticity Index (%)	Other Laboratory
	, Ж Ш	ш			>	Material De	escription	>	2			10010
1 2 3 5 6				SM		Silty Sand (SM), gray, satu Silt (ML), gray, saturated, r organic odor, non-plastic	rated, loose	0.27 0.17 0.18 0.16 0.20	28 57	NP 26	NP	Sieve
						No recovery below 6.4 feet	t					
7—								0.60				
	Bottom of boring at 7.5 feet Water level approximately 2-inches above surface. Refusal to vane shear device at 7 feet.											
	Salto SCH Salto	n Sea Projeo n Sea	ct , Cal	iforn	ia		Log of VC-24 (Page 1 of 1)					
	Hultgren - Tillis Engineers						Project No. 758.01 Plate No.					No. 17

Depth in Feet	Samples Type/ Recovery	Blow Count	Graphic	USCS	Water Levels	Date : 9/14/ Drilling Method : Vibra Elevation (Feet) : Latitude : 33.22 Longitude : -115	2010 acore 274 5999 escription	Vane Shear (tsf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Other Laboratory Tests
1- 2- 3- 4- 5- 6-				СН		Fat Clay (CH), gray, satura odor Becoming soft No recovery below 5.7 fee	ited, very soft, organic	0.10 0.10 0.12 0.11 0.13 0.14	48 45 64	65*	47*	Sieve* Full Suite**
7       Bottom of boring at 7 feet Water level approximately 1-foot above surface. Refusal to vane shear device at 7.3 feet. *Atterberg Limits measurements and sieve analysis on bulk sample (0.4 - 5.7 feet). **Full suite of laboratory tests on bulk sample (0.4 - 5.7 feet).         Salton Sea SCH Project Salton Sea, California       Log of VC-28 (Page 1 of 1)												
Hultgren - Tillis Engineers							Project No. 758.01 Plate No. 18					

	MAJOR DIVISIO	ONS				GROUP	NAMES				
ш		CLEAN GRAVE	LS (	GW		WELL GRADED	GRAVEL				
LS 00 SIEV	GRAVELS MORE THAN 50% OF	WITH LESS THAN 5% I	FINES	GP		POORLY GRADE	ED GRAVEL				
<b>D SOI</b> N NO. 2(	COARSE FRACTION IS RETAINED ON NO. 4 SIEVE	GRAVELS		GM		SILTY GRAVEL					
		WITH OVER 12% FIN	NES (	GC		CLAYEY GRAVE	L				
E GR. % Reta			S	SW		WELL GRADED	SAND				
DARS HAN 50'	SANDS 50% OR MORE OF	WITH LESS THAN 5% I	FINES	SP		ED SAND					
	COARSE FRACTION PASSES NO. 4 SIEVE	SANDS		SM		SILTY SAND					
		WITH OVER 12% FIN	NES	SC		CLAYEY SAND					
Sieve				ML		SILT					
<b>SOIL</b> (	SILTS AND LIQUID LIMIT LE	D CLAYS ESS THAN 50		CL		LEAN CLAY					
NED SSES N				OL		ORGANIC CLAY,	DRGANIC CLAY, ORGANIC SILT				
<b>GRAI</b> RE PA:			ľ	MH		ELASTIC SILT					
OR MO	SILTS AND LIQUID LIMIT 5	0 OR MORE	(	СН		FAT CLAY					
20% <b>H</b>			(	ОН		ORGANIC CLAY, ORGANIC SILT					
	HIGHLY ORGANIC	SOILS		Pt		PEAT					
	UNIFIED SC	DIL CLASSIFICATIO	ON SYSTI	EM-	ASTM	D 2487					
s	- SPT - 💆 -	- Water Level at Time of Dri	illing			P - Push					
	<b>¥</b>	- Water Level after Drilling (	with date me	easure	ed)	Perm - Perm	eability				
v	- Vibracore Consol	- Consolidation				Sieve - Partic	cle Size Analysis				
	Gs ·	- Specific Gravity				-200 - % Pa	ssing No. 200 Sieve				
с	- 3.0 inch TxUU	- Shear Strength (psf) - Unc	consolidated	Undra	ined Tria	kial Shear					
	TxCU	- Shear Strength (psf) - Con	nsolidated Un	ndraine	ed Triaxia	l Shear					
т	- Shelby Tube UC	- Compressive Strength (ps	f) - Unconfin	ied Co	ompressio	n					
B	- Bag										
		KEY TO TES	ST DATA								
S S S	alton Sea CH Project alton Sea, California				So	oil Classifica	tion				
н	ultgren - Tillis Engineers	rojec	t No. 758.01 Plate No. 19								

















**APPENDIX A** 

Laboratory Test Results

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Pinhole Tests	Plate A-67

# Summary of Laboratory Test Results

				0 H E	Atte	rberg L	imits (		Compaction (Stand.) Compaction (Mod.)			Anion Fracton				Cation				<b>_</b>			
<b>_</b> .			In-situ	Soil Fines					Doptimum Doptim		Optimum									Double		Pinhole Test -	
Boring	Depth	Unified Soil Classification/	Moisture	Passing No.				Organic	Max Dry	Moisture	Max Dry	Moisture	Bromide	Chloride	Nitrate	Nitrite	Calcium	Magnesium	Potassium	Sodium	Hydrometer	Crumb Test (Grade)	Dispersive
No.	(ft.)	Description	Content	200 Sieve	LL	PL	PI	Content (%)	Density	Content	Density	Content	(ma/ka)	(ma/ka)	(ma/ka)	(ma/ka)	(ma/ka)	(ma/ka)	(ma/ka)	(ma/ka)	Dispersion		Classification
			(%)	(%)					(pcf)	(%)	(pcf)	(%)	(	(119/119)	(119/119)	(119/119)	(	(119/119)	(119/119)	(119/119)	(%)		
HA-1	0.0 - 1.5	Olive Grav Fat Clay (CH)	45	94						(/0)		(70)											
HA-1	1.5 - 3.0	Olive Grav Fat Clay (CH)	65	91																			
HA-1	3.0 - 3.6	Grav Lean Clav (CL)	35																				
HA-1	3.6 - 5.0	Reddish Brown Lean Clay (CL)	22	97	42	15	27																
HA-1	0.0 - 3.6	Bulk Sample		89	63	19	44	Non-Organic	94	15	113	13	ND	29000	ND	ND	62000	11000	5900	18000	11	1 - Nondispersive	D1 - Dispersive
HA-2	0.0 - 1.5	Tan Brown Lean Clay (CL)	31						-			-											
HA-2	1.5 - 3.0	Tan Brown Lean Clay (CL)	45	99	43	19	24																
HA-2	3.0 - 4.0	Dark Gray Lean Clay (CL)	54																				
HA-2	4.0 - 4.3	Reddish Brown Silt (ML)	41																				
HA-4	0.0 - 2.0	Olive Brown Silt (ML)	29																				
HA-4	2.0 - 3.5	Gray Lean Clay (CL)	33	85																			
HA-4	3.5 - 5.3	Dark Gray Fat Clay (CH)	46	93																			
HA-4	5.3 - 7.0	Dark Gray Fat Clay (CH)	47																				
HA-4	0.0 - 5.3	Bulk Sample		75	56	20	36	Non-Organic	107	14	119	11	ND	12000	ND	ND	48000	9000	3700	8500	17	2 - Intermediate	D1 - Dispersive
HA-5	0.0 - 1.5	Olive Gray Fat Clay (CH)	44																				
HA-5	1.5 - 2.5	Olive Gray Fat Clay (CH)	49	94	52	24	28																
HA-5	2.5 - 4.0	Dark Gray Fat Clay (CH)	55																				
HA-5	4.0 - 4.9	Gray Fat Clay (CH)	49																				
HA-5	4.9 - 5.3	Dark Gray Sandy Fat Clay (CH)	20	72																			
HA-9	0.0 - 1.5	Tan & Gray Lean Clay (CL)	44																				
HA-9	1.5 - 3.0	Dark Gray Sandy Lean Clay (CL)	44	62	31	16	15																
HA-9	3.0 - 4.0	Gray Clayey Sand (SC)	29																				
HA-9	4.0 - 4.5	Gray Lean Clay (CL)	33																				
HA-9	4.5 - 4.8	Reddish Brown Lean Clay (CL)	31																				
HA-10	0.0 - 1.5	Tan & Gray Clayey Silt (CL-ML)	25	78	25	20	5																
HA-10	1.5 - 3.0	Tan Clayey Sand (SC)	21	42																			
HA-10	3.0 - 4.0	Tan Sandy Lean Clay (CL)	34																				
HA-10	4.0 - 5.0	Reddish Brown Lean Clay (CL)	31																				
VC-6	0.0 - 1.3		69	83	NV	NP	NP																
VC-11	0.0 - 0.8	Gray Fat Clay (CH)	31																				
VC-11	0.8 - 3.6	Gray Fat Clay (CH)	56	00	<u> </u>	04	47	Non Organia						E E00			44.000	0.000	2 700	C 400	61	2 Dianarajua	D2 Dianarajua
VC-11	0.0 - 3.6	Bulk Sample	40	90	68	21	47	Non-Organic					ND	5,500	ND	ND	41,000	8,000	3,700	6,400	01	3 - Dispersive	D2 - Dispersive
VC-16	12 20	Gray Fat Clay (CH) & Roddish	43																				
VC-10	1.5 - 5.9	Brown Loop Cloy (CL)	50																				
VC-16	0.0 - 3.0	Bulk Samplo	52	05	66	20	46	Non-Organic						6 000	ND	ND	36.000	7 500	3 500	6 700	0	2 - Intermodiate	D1 - Disporsivo
VC-10	0.0 - 0.9	Gray Sandy Silt (ML)	44	93 64	NV	NP	40 NP	Non-Organic					ND	0,900	ND	ND	30,000	7,300	3,500	0,700	3		DT - Dispersive
VC-10	0.0 - 3.5	Gray Silt (ML)	34																				
VC-19	35-62	Grav Fat Clay (CH)	38	93	58	21	37																
VC-20	0.0 - 2.0	Grav Fat Clav (CH)	29	~~~																			
VC-20	2.0 - 4.7	Grav Fat Clav (CH)	39				1																
VC-20	0.0 - 4.7	Bulk Sample	00	89	67	18	49	Non-Organic					ND	4 600	ND	ND	40 000	7 600	2 000	4 600	13	1 - Nondispersive	D2 - Dispersive
VC-21	0.0 - 2.1	Grav Fat Clay (CH)	56	00	0.	10	10	rton organio					110	1,000		110	10,000	1,000	2,000	1,000	10		
VC-21	2.1 - 4.8	Grav Fat Clav (CH)	53	98	57	19	38														1		
VC-22	0.0 - 1.3	Grav Silty Sand (SM)	33		-																		
VC-22	1.3 - 4.0	Gray Fat Clay (CH)	32	75	60	19	41																
VC-24	0.0 - 1.1	Gray Silty Sand (SM)	28	40	NV	NP	NP																
VC-24	1.1 - 3.7	Gray Silt (ML)	57																				
VC-24	3.7 - 6.4	Gray Lean Clay (CL)	42	89	26	16	10																
VC-28	0.0 - 0.4	Gray Fat Clay (CH)	48																				
VC-28	0.4 - 3.0	Gray Fat Clay (CH)	45																				
VC-28	3.0 - 5.7	Gray Fat Clay (CH)	64																				
VC-28	0.4 - 5.7	Bulk Sample		98	65	18	47	Non-Organic					ND	8,600	ND	ND	48,000	7,900	3,400	8,400	9	1 - Nondispersive	D2 - Dispersive

Note:

1. "Bulk Sample" indicates that Isample was recovered over a wide depth interval. Several additional hand auger borings were drilled immediately adjacent to the logged boring to recover a large quantity of soil for testing. The depth interval is noted.

depth interval is noted.

2. "Composite sample" indicates that a sample that extends more than one 2.7-feet section of vibracore tubing. The

depth interval is noted.

3. Abbreviations - NV: No Value, NP: Non Plastic, ND: Not Detected.

Plate A-1

### Table A-1

**Tests on Individual Samples** 

### **DENSITY MOISTURE**

PROJECT	Hu	ltgren - Tillis	s Engineer	s ( Salton S	Sea)	DATE		10/5/2010					
PROJECT NUM	BER		6	0		TECHNIC			997				
[ <del></del>				· · · · · · · · · · · · · · · · · · ·	<b></b>	T	1						
BORING NO.	HA-1				HA-2				HA-4				
DEPTH, ft	0-1.5	1.5-3	3-3.6	3.6-5	0-1.5	1.5-3	3-4	4-4.3	0-2	2-3.5			
SAMPLE NO.		-											
LENGTH (IN.)					5 5 5								
TOTAL WT. (g)													
WET WT. (g)	423.1	357.9	400.2	454.4	421.1	465.6	432.3	406.9	609.7	609.4			
DRY WT. (g)	291.4	216.7	297.6	371.7	322.6	320.6	281.7	289.6	473.4	457.4			
WET DENSITY													
% MOISTURE	45.2	65.2	34.5	22.2	30.5	45.2	53.5	40.5	28.8	33.2			
DRY DENSITY													
BORING NO.	HA-4		HA-5					HA-9					
DEPTH, ft	3.5-5.3	5.3-7	0-1.5	1.5-2.5	2.5-4	4-4.9	4.9-5.3	0-1.5	1.5-3	3-4			
SAMPLE NO.	:												
LENGTH (IN.)													
TOTAL WT. (g)													
WET WT. (g)	522.2	437.7	455.3	599.2	443	410.4	519.3	550.6	441.7	585.9			
DRY WT. (g)	357.1	298.3	316.3	401.1	285.8	276.4	433.6	383.6	306.4	453.2			
WET DENSITY													
% MOISTURE	46.2	46.7	43.9	49.4	55.0	48.5	19.8	43.5	44.2	29.3			
DRY DENSITY													
## **DENSITY MOISTURE**

PROJECT	Hultgren - Tillis Engineers (Salton Sea)					DATE		10/5/2010		
PROJECT NUMBER			60			TECHNICIAN		997		
					1	1				
BORING NO.	HA-9		HA-10				VC-6C	VC-11B	VC-11C	VC-16B
DEPTH, ft	4-4.5	4.5-4.8	0-1.5	1.5-3	3-4	4-5	0-1.3	0-0.8	0.8-3.6	0-1.3
SAMPLE NO.										
LENGTH (IN.)										
TOTAL WT. (g)										
WET WT. (g)	518.9	252.4	578.9	583.5	557.8	562.2	442.2	288.8	471.4	480.9
DRY WT. (g)	389.6	192.2	461.7	483.1	416.5	430.4	262.4	220.9	302.9	336.6
WET DENSITY										
% MOISTURE	33.2	31.3	25.4	20.8	33.9	30.6	68.5	30.7	55.6	42.9
**							14/1.5	8.5/0.5	33/0	13/0.5
**	Length of S	Solid colum	n/Length of	f Water Co	lumn, Resp	pectively, I	N			
BORING NO.	VC-16C	VC-19A	VC-19B	VC-19C	VC-20B	VC-20C	VC-21B	VC-21C	VC-22B	VC-22C
DEPTH, ft	1.3-3.9	0-0.9	0.9-3.5	3.5-6.2	0-2	2-4.7	0-2.1	2.1-4.8	0-1.3	1.3-4
SAMPLE NO.										
LENGTH (IN.)										
TOTAL WT. (g)										
WET WT. (g)	345.6	220	496.3	325.9	481.7	317.8	523.9	439.8	336.6	482.1
DRY WT. (g)	227.4	153.2	370.1	235.9	374.2	228.7	336.5	288.4	253.3	365.6
WET DENSITY										
% MOISTURE	52.0	43.6	34.1	38.2	28.7	39.0	55.7	52.5	32.9	31.9
**	33/0	7.5/0.5	32.0	33/0	21.5/1.0	33/0	21/2	33/0	8.5/0	31/0 5
44								~~//V	~~~/ V	0.0010

Length of Solid column/Length of Water Column, Respectively, IN

## DENSITY MOISTURE

PROJECT	Hultgren - Tillis Engineers ( Salton Sea)					DATE 10/5/2010				
PROJECT NUMBER						TECHNIC	IAN		997	
I <del></del>	T	T	1	1	I	T	1	1	<del></del>	1
BORING NO.	VC-24A	VC-24B	VC-24C	VC-28A	VC-28B	VC-28C				
DEPTH, ft	0-1.1	1.1-3.7	3.7-6.4	0-0.4	0.4-3	3-5.7				
SAMPLE NO.										
LENGTH (IN.)										
TOTAL WT. (g)										
WET WT. (g)	342.7	440	444.7	306.7	488.6	335.9				
DRY WT. (g)	266.9	280.9	312.4	207.3	337.9	205.5				
WET DENSITY										
% MOISTURE	28.4	56.6	42.3	47.9	44.6	63.5				
**	10/1	31/0	32/0	3/6	32/0	28.5/0				
**	Length of S	Solid column	1/Length of	Water Col	lumn, Resp	pectively, IN	٧			
BORING NO.										
DEPTH, ft										
SAMPLE NO.										
LENGTH (IN.)										
TOTAL WT. (g)										
WET WT. (g)										

DRY WT. (g)

WET DENSITY

% MOISTURE

DRY DENSITY































































Test on Bulk and Composite Samples




















Plate A-47





Plate A-49





Plate A-51







2527 Fresno Street Fresno, CA 93721 (559) 268-7021 Phone (559) 268-0740 Fax

October 22, 2010

Work Order #: 0l29061

Michael Shwiyhat MTA Materials Division 2527 Fresno St. Fresno, CA 93721

RE: Salton Sea Project

Enclosed are the analytical results for samples received by our laboratory on 09/29/10. For your reference, these analyses have been assigned laboratory work order number 0129061.

All analyses have been performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, Moore Twining Associates, Inc. (MTA) is not responsible for use of less than complete reports. Results apply only to samples analyzed.

If you have any questions, please feel free to contact us at the number listed above.

Sincerely,

Moore Twining Associates, Inc.

- for AG

Allen Glover Director of Analytical Chemistry



2527 Fresno Street Fresno, CA 93721 (559) 268-7021 Phone (559) 268-0740 Fax

MTA Materials Division 2527 Fresno St.	Project: Salton Sea Project Project Number: Salton Sea Project	Reported:
Fresno CA, 93721	Project Manager: Michael Shwiyhat	10/22/10

#### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
HA1 Bułk Comp.	0129061-01	Soil	09/29/10 00:00	09/29/10 15:22
HA4 Bulk Comp.	0129061-02	Soil	09/29/10 00:00	09/29/10 15:22
VC 11 (B+C)	0129061-03	Soil	09/29/10 00:00	09/29/10 15:22
VC 16 (B+C)	0129061-04	Soil	09/29/10 00:00	09/29/10 15:22
VC 20 (B+C)	0129061-05	Soil	09/29/10 00:00	09/29/10 15:22
VC 28 (B+C)	0129061-06	Soil	09/29/10 00:00	09/29/10 15:22



2527 Fresno Street Fresno, CA 93721 (559) 268-7021 Phone (559) 268-0740 Fax

MTA Materials Division 2527 Fresno St. Fresno CA, 93721	Project: Salton Sea Project Project Number: Salton Sea Project Project Manager: Michael Shwiyhat	<b>Reported:</b> 10/22/10
---	--	------------------------------

## HA1 Bulk Comp.

0I29061-01 (Soil) Sampled:09/29/10 00:00

		Reporting							
Ананую	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Inorganics									
Bromide	ND	4000	mg/kg	2000	T0J1910	10/19/10	10/20/10	EPA 300.0	
Chloride	29000	4000	mg/kg	2000	T0J1910	10/19/10	10/20/10	EPA 300.0	
LOI (% Organic Matter)	2.3	0.10	%	l	T0J1123	10/11/10	10/13/10	ASTM D2074	
Nitrate as NO3	ND	4000	mg/kg	2000	T011910	10/19/10	10/20/10	EPA 300 0	
Nitrite as NO2	ND	2000	mg/kg	2000	T0J1910	10/19/10	10/20/10	EPA 300.0	
Metais - Totals									
Calcium	62000	50	mg/kg	5	T010514	10/05/10	10/12/10	EDA COLOD	
Magnesium	11000	10	mø/kø	1	T010514	10/05/10	10/12/10	EPA 4010B	
Potassium	5900	500	mø/kø	5	T010514	10/05/10	10/13/10	EPA COLOD	
Sodium	18000	200	mg/kg	50	T0J0514	10/05/10	10/12/10	EPA 6010B	



2527 Fresno Street Fresno, CA 93721 (559) 268-7021 Phone (559) 268-0740 Fax

MTA Materials Division	Project: Salton Sea Project	
2527 Fresno St.	Project Number: Salton Sea Project	Reported:
Fresno CA, 93721	Project Manager: Michael Shwiyhat	10/22/10

#### HA4 Bulk Comp.

0I29061-02 (Soil) Sampled:09/29/10 00:00

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Inorganics									
Bromide	ND	2000	mg/kg	1000	T0J1910	10/19/10	10/20/10	EPA 300.0	
Chloride	12000	2000	mg/kg	1000	T0J1910	10/19/10	10/20/10	EPA 300.0	
LOI (% Organic Matter)	0.80	0.10	%	L	T0J1123	10/11/10	10/13/10	ASTM D2974	
Nitrate as NO3	ND	2000	mg/kg	1000	T0J1910	10/19/10	10/20/10	EPA 300.0	
Nitrite as NO2	ND	1000	mg/kg	1000	T0J1910	10/19/10	10/20/10	EPA 300,0	
Metals - Totals		Destr.							
Calcium	48000	50	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	
Magnesium	9000	10	mg/kg	1	T0J0514	10/05/10	10/09/10	EPA 6010B	
Potassium	3700	500	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	
Sodium	8500	80	mg/kg	20	T0J0514	10/05/10	10/12/10	EPA 6010B	



Sodium

2527 Fresno Street Fresno, CA 93721 (559) 268-7021 Phone (559) 268-0740 Fax

MTA Materials Division 2527 Fresno St. Fresno CA, 93721	Proj Proj	Proj ject Numl ect Manag	ect: Salton ber: Salton ger: Michae	Sca Projec Sea Projec I Shwiyha	et et at			<b>Repo</b> 10/2	rted: 2/10
	012906	<b>VC</b> 51-03 (So	11 ( <b>B+C</b> ) ii) S	) Sampled:(	)9/29/10 (	00:00	_		
Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
norganics									*****
Bromide	ND	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0	
Chloride	5500	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300,0	
litrate as NO3	ND	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0	
litrite as NO2	ND	500	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0	
Aetals - Totals									
Calcium	41000	50	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	
<b>A</b> agnesium	8000	10	mg/kg	1	T0J0514	10/05/10	10/09/10	EPA 6010B	
<b>'otassium</b>	3700	500	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	

mg/kg

20

T0J0514

10/05/10

10/12/10 EPA 6010B

6400

80



2527 Fresno Street Fresno, CA 93721 (559) 268-7021 Phone (559) 268-0740 Fax

MTA Materials Division 2527 Fresno St. Fresno CA, 93721	Pro Proj	Project: Salton Sea Project Project Number: Salton Sea Project Project Manager: Michael Shwiyhat							
	012906	<b>VC</b> 51-04 (So	<b>16 (B+C)</b> il) S	) Sampled:(	)9/29/10 (	00:00			
		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Inorganies			11-21						
Bromide	ND	1000	mo/ko	500	(TO[1010	10/10/10	10/20/10	EDA 300.0	
Chloride	6900	1000	mø/ko	500	T011010	10/10/10	10/20/10	EDA 200.0	
litrate as NO3	ND	1000	mg/kg	500	T011910	10/19/10	10/20/10	EPA 300,0	
Jitrite as NO2	ND	500	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0	
Aetals - Totals									
Calcium	36000	50	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	
Aagnesium	7500	10	mg/kg	1	T0J0514	10/05/10	10/09/10	EPA 6010B	
otassium	3500	500	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	
Jodium	6700	80	mg/kg	20	T0J0514	10/05/10	10/12/10	EPA 6010B	



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MTA Materials Division 2527 Fresno St. Fresno CA, 93721	Project: Salton Sea Project Project Number: Salton Sea Project Project Manager: Michael Shwiyhat VC 20 (B+C) 0I29061-05 (Soil) Sampled:09/29/10 00:00							Repo 10/2	Reported: 10/22/10	
Analyic	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes	
Inorganics		·								
Bromide	ND	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0	THE REAL PROPERTY.	
Chloride	4600	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0		
Vitrate as NO3	ND	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0		
Vitrite as NO2	ND	500	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0		
Metals - Totals	1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 - 1040 -									
Calcium	40000	100	mg/kg	10	T0J0514	10/05/10	10/12/10	EPA 6010B		
Magnesium	7600	10	mg/kg	1	Т0Ј0514	10/05/10	10/09/10	EPA 6010B		
Potassium	2000	1000	mg/kg	10	T0J0514	10/05/10	10/12/10	EPA 6010B		
Sodium	4600	40	mg/kg	10	T0J0514	10/05/10	10/12/10	EPA 6010B		



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MTA Materials Division 2527 Fresno St. Fresno CA, 93721	Project: Salton Sea Project Project Number: Salton Sea Project Project Manager: Michael Shwiyhat	<b>Reported:</b> 10/22/10
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# VC 28 (B+C)

0I29061-06 (Soil) Sampled:09/29/10 00:00

		Reporting							
Analyte	Result	Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Inorganics									
3romide	ND	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300 0	
Chloride	8600	1000	mg/kg	500	Т0Ј1910	10/19/10	10/20/10	EPA 300.0	
Vitrate as NO3	ND	1000	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0	
Nitrite as NO2	ND	500	mg/kg	500	T0J1910	10/19/10	10/20/10	EPA 300.0	
Metals - Totals								1.000	
Calcium	48000	50	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	
Aagnesium	7900	10	mg/kg	1	T0J0514	10/05/10	10/09/10	EPA 6010B	
Potassium	3400	500	mg/kg	5	T0J0514	10/05/10	10/12/10	EPA 6010B	
Jodium	8400	80	mg/kg	20	T0J0514	10/05/10	10/12/10	EPA 6010B	

#### **Notes and Definitions**

The RPD result exceeded the QC control limits. However, both percent recoveries were acceptable. RPD

The spike recovery for this QC sample is outside of established control limits due to matrix interference. QM

The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to analyte concentration at 4 times or greater the Q4 spike concentration. ug/L

- micrograms per liter (parts per billion concentration units)
- milligrams per liter (parts per million concentration units) mg/L
- mg/kg milligrams per kilogram (parts per million concentration units)
- Analyte NOT DETECTED at or above the reporting limit ND RPD Relative Percent Difference

Quality Control Data Available Upon Request



MTA Project Name:	Huitgren	n - Tillis Engir	neers Re	port Date:	10/14/2010 Sont 20010	
MTA Project Number	Salton e	60	Sar	Sample I.D.:		
Sample Location: Visual Classification:	VC-28 @ 0.4-5.7 Fe Fat Clay	eet				
Sampled By:	Client		Tested By: Test Date:	TD 10/9/201	10	
ASTM D422 Procedu	re		ASTM D4221	Procedure		
Dry Sample Wt., gm % Passing #10 Sieve % Passing #200 Siev Hydrometer Reading Temperature, °C Hydrometer Correctio % Passing 5-µm(a)	e <u>70.1</u> <u>100</u> <u>97.7</u> @ 60 min <u>37</u> <u>21.4</u> n <u>-4</u> <u>46</u>		Dry Sample Wi % Passing #10 % Passing #20 Hydrometer Re Temperature, ° Hydrometer Co % Passing 5-µr	t., gm Sieve 0 Sieve pading @ 60 min C c prrection m(b)	25 100 97.7 1 25.5 0 4	
% Dispersion =	<u>{% Passing 5-μm(k</u> (% Passing 5-μm(a	<u>)))</u> * 100	4.0	<u>(100)</u> =	9%	
	Dispersive Chara	acteristic of C ASTM D6	lay Soil by Cruml 572	o Test		
Sample Location: Visual Classification:	VC-28 @ 0.4-5.7 Fe Fat Clay	et				
Sampled By:	Client		Tested By: Test Date:	TD 10/9/201	10	

#### Test Results:

Grade: 1 - Nondispersive

(a) % by ASTM D422

(b) % by ASTM D4221

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MTA Project Name:	Hultgren - 1	Hultgren - Tillis Engineers Report Date:					
MTA Project Number	60		San	nple I.D.:	Sept. 20010		
Sample Location: Visual Classification: Sampled By:	VC-20 @ 0-4.7 Feet Fat Clay Client		Tested By: Test Date:	TD 10/9/2016	0		
ASTM D422 Procedu	re		ASTM D4221 P	rocedure			
Dry Sample Wt., gm % Passing #10 Sieve % Passing #200 Sieve Hydrometer Reading Temperature, °C Hydrometer Correctio % Passing 5-µm(a)	$ \begin{array}{r}                                     $		Dry Sample Wt. % Passing #10 % Passing #200 Hydrometer Re Temperature, % Hydrometer Con % Passing 5-µn	nple Wt., gm 25 ing #10 Sieve 100 ing #200 Sieve 88.8 leter Reading @ 60 min 1 rature, °C 25.5 leter Correction 0 ing 5-µm(b) 4			
% Dispersion =	<u>(% Passing 5-μm(b))</u> (% Passing 5-μm(a))	* 100	4.0	<u>(100)</u> =	13%		
	Dispersive Characte	ristic of Cl STM D65	ay Soil by Crumb 72	Test			
Sample Location: Visual Classification:	VC-20 @ 0-4.7 Feet Fat Clay			0 1071.0 Z			
Sampled By:	Client		Tested By: Test Date:	ited By: TD t Date: 10/9/2010			

#### Test Results:

Grade: 1 - Nondispersive

(a) % by ASTM D422
(b) % by ASTM D4221



MTA Project Name:	Hultgren - T Salton Sea	illis Engir	neers	Report Date: <u>10/14/201</u> Sample Date: Sept. 200			
MTA Project Number	60			Sample I.E	D.:		
Sample Location: Visual Classification: Sampled By:	VC-16 @ 0-3.5 Feet Fat Clay Client		Tested By: Test Date:	)			
ASTM D422 Procedu	re		ASTM D42	21 Procedu	ire		
Dry Sample Wt., gm % Passing #10 Sieve % Passing #200 Sieve Hydrometer Reading Temperature, °C Hydrometer Correctio % Passing 5-µm(a)	e <u>95.1</u> @ 60 min <u>35</u> 21.4 n <u>-4</u> 42.5	B Dry Samp % Passin % Passin % Passin Hydromet Temperat Hydromet % Passin			Sample Wt., gm assing #10 Sieve assing #200 Sieve rometer Reading @ 60 min operature, °C rometer Correction assing 5-µm(b)		
% Dispersion =	<u>(% Passing 5-μm(b))</u> (% Passing 5-μm(a))	* 100		<u>4.0 (100)</u> 42.5	- =	9%	
	Dispersive Characte	ristic of C	lay Soil by Ci 572	rumb Test			
Sample Location: Visual Classification:	VC-16 @ 0-3.5 Feet Fat Clav						
Sampled By:	Client		Tested By: Test Date:		TD 10/9/2010	,	
Test Results: Grade: 2 - Interme	ediate						



MTA Project Name:	Hultgren - T Salton Sea	illis Engir	ieers	Report Da	te:	10/14/2010 Sept 20010
MTA Project Number	60			Sample I.E	).:	0000.20010
Sample Location: Visual Classification: Sampled By:	VC-11 @ 0-3.5 Feet Fat Clay Client		Tested By: Test Date:		TD 10/9/2010	)
ASTM D422 Procedu	re		ASTM D422	21 Procedu	ire	
Dry Sample Wt., gm % Passing #10 Sieve % Passing #200 Sieve Hydrometer Reading Temperature, °C Hydrometer Correctio % Passing 5-µm(a)	$ \begin{array}{r}             \frac{72.4}{100} \\             \underline{89.9} \\             \underline{30} \\             \underline{21.4} \\             \underline{-4} \\             \underline{33} \\             \underline{33} \\             \end{array} $		Dry Sample % Passing % Passing Hydrometer Temperatur Hydrometer % Passing	e Wt., gm #10 Sieve #200 Sieve Reading ( e, °C Correction 5-µm(b)	25 100 89.9 6 25.5 0 20	
% Dispersion =	<u>(% Passing 5-μm(b))</u> (% Passing 5-μm(a))	* 100		20.0 (100) 33.0	- =	61%
	Dispersive Character	istic of C STM D68	lay Soil by Cr 572	umb Test	conner o l	
Sample Location: Visual Classification:	VC-11 @ 0-3.5 Feet Fat Clay					
Sampled By:	Client		Tested By:TDTest Date:10/			)
Test Results: Grade: 3 - Dispers	sive					

(a) % by ASTM D422

(b) % by ASTM D4221

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MTA Project Name: MTA Project Number	Huitgren - Salton Se 60	· Tillis Engir a )		Report Date:         10/12/2010           Sample Date:         Sept. 20010           Sample I.D.:			
Sample Location: Visual Classification: Sampled By:	HA-4 (Bulk) Fat Clay W/Sand Client		Tested By: Test Date:		TD 10/9/2010		
ASTM D422 Procedu	re	_	ASTM D422	1 Procedu	ire		
Dry Sample Wt., gm % Passing #10 Sieve % Passing #200 Sieve Hydrometer Reading Temperature, °C Hydrometer Correctio % Passing 5-µm(a) % <b>Dispersion =</b>	e 70.6 100 75.2 @ 60 min 22 21.4 n -4 23 (% Passing 5-μm(b)) (% Passing 5-μm(a))		Dry Sample % Passing # Hydrometer Temperature Hydrometer % Passing 5	e Wt., gm 25 #10 Sieve 75.2 #200 Sieve 75.2 er Reading @ 60 min 1 ire, °C 25.5 er Correction 0 5- $\mu$ m(b) 4 17%			
	Dispersive Charac	teristic of C ASTM D6	lay Soil by Cru 572	umb Test			
Sample Location: Visual Classification: Sampled By:	HA-4 (Bulk) Fat Clay W/Sand Client		Tested By: Test Date:				
Test Results:							

Grade: 2 - Intermediate

(a) % by ASTM D422
(b) % by ASTM D4221

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MTA Project Name: MTA Project Number		Hultgren - Ti Salton Sea 60	llis Engine	ers	Report Dat Sample Da Sample I.D	e: ite: .:	10/12/2010 Sept. 20010
Sample Location: Visual Classification: Sampled By:	HA-1 (Bulk Fat Clay Client	)		Tested By: Test Date:		TD 10/9/2010	
ASTM D422 Procedur	e	,		ASTM D42	21 Procedu	re	
Dry Sample Wt., gm % Passing #10 Sieve % Passing #200 Sieve Hydrometer Reading ( Temperature, °C Hydrometer Correction % Passing 5-µm(a)	e @ 60 min n	77.5 100 88.9 30 21.3 -4 36		Dry Sample % Passing % Passing Hydromete Temperatu Hydromete % Passing	iple Wt., gm     25       ng #10 Sieve     100       ng #200 Sieve     88.9       ster Reading @ 60 min     1       ature, °C     25.5       ster Correction     0       ng 5-µm(b)     4		
% Dispersion <b>≍</b>	(% Passing (% Passing	g 5-µm(b)) g 5-µm(a))	* 100	>	<u>4.0 (100)</u> 36.0	-	11%
	Dispersi	ve Character A	istic of Cla STM D65	ay Soil by C 72	rumb Test	-	
Sample Location:	HA-1 (Bulk)	)				·····	
Sampled By:	Client		Tested By:TDTest Date:10/9				
Test Results: Grade: 1 - Nondis	persive						

(a) % by ASTM D422
(b) % by ASTM D4221

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# OFFICE MEMO

TO:	DATE:
Thang (Vic) Nguyen	December 29, 2010
	SUBJECT: Test Request No. 2010-29: Pin Hole
FROM:	Tests of Salton Sea Restoration
Mike Driller	Samples

Attached are the results of testing performed under Test Request No. 2010-29, "Pin Hole Tests of Salton Sea Restoration Soil Samples." Soil samples were received at the Bryte Laboratory on October 7, 2010 in six small plastic bags.

Pin Hole Tests were performed according to ASTM Test Designation D 4647 - 06, "Identification and Classification of Dispersive Clay Soils by the Pinhole Test." Results are listed below and on the attached Pin Hole Test Data Sheets.

The Method A procedure was used, and testing consisted of compacting the 38-mm (1.5-in.) long specimens into the pinhole test cylinder on top of the coarse sand and wire screen (see Figure 1). Samples were compacted to the density and moisture contents provided. The test method used distilled water flowing horizontally under a hydraulic head of 50 mm (2 in.) through a 1.0-mm (0.04-in.) diameter hole punched in the soil specimen. Pictures were taken before and after the Pinhole Test are attached.

## Pinhole Test Results

The Pin Hole test is a direct, qualitative measurement of the dispersibility and erodibility of clay soils when subjected to water of low-salt concentration. The test is performed by passing water through a small hole punched in a specimen (see Figure 1). Flow from *dispersive* clays will be distinctly dark and the hole through the specimen will enlarge rapidly, with a resultant increase in the flow rate. Flow from slightly to *moderately dispersive* clays will be slightly dark with a constant hole size and flow rate. Flow from *nondispersive* clays will be completely clear with no measureable increase in the hole size. Classifications were determined using criteria from ASTM (see attached) based on the flow rate, turbidity, and hole size at the end of the test.



FIG. 1 Schematic Drawing of the Pinhole Test Equipment

Table	1:	Results	of	pinhole	tests
labic		results		pinnoic	10010

Hole No.	Bryte	Dry Unit	Moisture	Dispersive	Remarks
	Lab No.	Weight	Content	Classification	
HA-1	10-528	90 pcf	14.2	D1	Dispersive
HA-4	10-529	101 pcf	11.9	D1	Dispersive
VC-11	10-530	95 pcf	12.9	D2	Dispersive
VC-16	10-531	95 pcf	13.4	D1	Dispersive
VC-20	10-532	95 pcf	13.2	D2	Dispersive
VC-28	10-533	101 pcf	12.3	D2	Dispersive

Please call myself at 916-764-0277 or Doug Najima of my staff at 916-375-6012 if you have any questions.

## **PIN HOLE TEST DATA**

Pin Hole Test No. 1

Sample No. 10-528 (HA-1)

Compaction Characteristics good, firm, pliable

yes

no

Water Content\_14.2% @ 90pcf

Distilled water added X or \_\_\_\_\_

Curing time: 24 hrs.

Page:\_1

Date: 12/11/2010





Flow started on 1 trial.

		Flow	/ Rate		Color f	rom Si	de	> do	Particles Falling				
Clock Time	Head	ml	sec	Dark	Slight to Medium	Barely Visible	Completely Clear	Completel Clear From 1	None	Few	Heavy	Flow Rate ml / sec	Remarks
1.33p	2"	25	31.1		x					x		0.80	
	2"	25	24.4		x					х		1.02	
	2"	25	20.2		x					x		1.24	
	2"	25	17.6		x					x		1.42	
1:38p	2"	25	17.5		x					х		1.43	<stop td="" test.<=""></stop>
													Classification of test results:
													Method A: D1, Dispersive clay with
													cloudy suspension of colloids in water.
													Pinhole after test was larger than the
													needle punch and expanded from 1.0mm
									_				to 3.58mm hole.
													Soil was air dried and moisturized to
				_									14.2%.
									-				
				-									
				_									

**PIN HOLE TEST DATA** 

Pin Hole Test No. 2

Sample No. 10-529 (HA-4)

Compaction Characteristics good, firm, pliable

Water Content 11.9% @ 101pcf

Distilled water added X or \_\_\_\_\_

yes no

Curing time: 48 hrs.

Date: 12/13/2010

Page: 1

Speciman after test:



Flow started on <u>1</u>\_\_\_\_\_ trial.

		FION	/ Kate		Color f	rom Si	de						
Clock Time	Head	ml	sec	Dark	Slight to Medium	Barely Visible	Completely Clear	Completel Clear From T	None	Few	Heavy	Flow Rate ml / sec	Remarks
1:00p	2"	25	25	×						x		1.00	
	2"	25	20.1	x						x		1.24	
	2"	25	18.2	x						x		1.37	
	2"	25	17.9	x						x		1.40	
	2"	25	17.8	х						х		1.40	
1.05p	2"	25	17.6	x						x		1.42	<stop td="" test.<=""></stop>
													Classification of test results:
													Method A: D1, Dispersive clay with cloudy
													suspension of colloids in water.
													Pinhole after test was larger than the needle
	_												punch and expanded from 1.00mm to a
					1								8.89mm hole.
													Soil was air dried and moisturized to
													11.9%.

**PIN HOLE TEST DATA** 

Pin Hole Test No. 3

Sample No. 10-530 (VC-11)

Compaction Characteristics good, firm, pliable

yes

no

Water Content 12.9% @ 95pcf

Distilled water added X or \_\_\_\_\_

Curing time: 24 hrs.

Date: 12/14/2010

Page: 1

# Speciman after test:



Flow started on 1\_\_\_\_\_ trial.

		Flow	Flow Rate Color from Side		A.	Part	icles F	alling					
Clock Time	Head	ml	sec	Dark	Slight to Medium	Barely Visible	Completely Clear	Completel Clear From T	None	Few	Heavy	Flow Rate ml / sec	Remarks
1:30p	2"	25	54		x					x		0.46	
	2"	25	52.5		x					x		0.48	
	2"	25	49.9		x					x		0.50	
	2"	25	49.8		x					x		0.50	
	2"	25	47.2		x					x		0.53	
	2"	25	32.8		x					x		0.76	
	2"	25	29.8		х					x		0.76	
	2"	25	27.1		x					x		0.92	
	2"	25	26.8		x					x		0.93	
	2"	25	26.5		x					x		0.94	
	2"	25	25.1		x					х		1.00	
1:41p	2"	25	24.9		x					x		1.004	< stop test
													Classification of test results:
													Method A: D2, Dispersive clay with cloudy
													suspension of colloids in water.
													Pinhole after test was larger than the needle
													punch and expanded from 1.00mm to a
-													9.5mm hole.
													Soil was air dried and moisturized to
													12.9%.
			-										

- 1

**PIN HOLE TEST DATA** 

Pin Hole Test No. 4

Sample No. 10-531 (VC-16)

Compaction Characteristics good, firm, pliable

Water Content 13.4% @ 95pcf

Distilled water added <u>x</u> or \_\_\_\_\_ yes no

Curing time: 24 hrs.

Date: 12/15/2010

Page: 1

# Speciman after test:



Flow started on 1\_\_\_\_\_ trial.

		Flow	/ Rate		Color f	rom Si	de	op	Particles Falling				
Clock Time	Head	ml	sec	Dark	Slight to Medium	Barely Visible	Completely Clear	Completel	None	Few	Heavy	Flow Rate ml / sec	Remarks
2:55p	2"	25	43.4		x					x		.058	
	2"	25	37.6		×					x		0.66	
	2"	25	31.9		x					x		0.78	
	2"	25	30.0		x					x		0.83	
	2"	25	25.6		x					x		0.98	
3:00p	2"	25	22.5		x					×		1.11	< stop test
													Classification of test results:
													Method A: D1, Dispersive clay with cloudy
													suspension of colloids in water.
													Pinhole after test was larger than the needle
													punch and expanded from 1.00mm to a
													7.061mm hole.
													Soil was air dried and moisturized to
						-							13.4%.

**PIN HOLE TEST DATA** 

Pin Hole Test No. 5

Sample No. 10-532 (VC-20)

Compaction Characteristics good, firm, pliable

yes

no

Water Content\_13.2% @ 95pcf

Distilled water added X\_\_\_\_\_ or \_\_\_\_\_

Curing time: 24 hrs.

Page	:1	

# Speciman after test:



Flow started on 1\_\_\_\_\_ trial.

Clock Time Head		Flow Rate		Color from Side				A do	Particles Falling				
	Head	ml	sec	Dark	Slight to Medium	Barely Visible	Completely Clear	Completely Clear From T	None	Few	Heavy	Flow Rate ml / sec	Remarks
2:09p	2"	25	53.8		x					x		0.46	
	2"	25	47.3		x					x		0.53	
	2"	25	40.8	-	x					x		0.61	
	2"	25	36.1		x					x		0.69	
	2"	25	35.8		x					x		0.70	
	2"	25	33.3		x					х		0.75	
	2"	25	32.5		x					х		0.77	
	2"	25	31.2		x					x		0.80	
	2"	25	29.7		×					x		0.84	
	2"	25	28.6		x					х		0.87	
	2"	25	27.8		x					x		0.90	
	2"	25	27.5		x					x		0.91	
	2"	25	26.3		×					x		0.95	
	2"	25	26.0		x					x		0.96	2:20pstop test.
	2"	25	25.7		х					x		0.97	Classification of test results:
2:20p	2"	25	25.0		x					х		1.00	Method A: D2, Dispersive clay with cloudy
													suspension of colloids in water.
													Pinhole after test was larger than the needle
													punch and expanded from 1.00mm to a
													5.105mm hole.
													Soil was air dried and moisturized to 13.2%.

Date: 12/16/2010

**PIN HOLE TEST DATA** 

Pin Hole Test No. 6

Sample No. 10-533 (VC-28)

Compaction Characteristics good, firm, pliable

Water Content\_12.3% @ 101pcf

Distilled water added <u>x</u> or \_\_\_\_\_ yes no

Curing time: 24 hrs.

Date: 12/17/2010

Page:\_1\_\_\_\_\_

# Speciman after test:



Flow started on 1\_\_\_\_\_ trial.

Clock Time Head	Flow Rate		Color from Side				v qo	Particles Falling					
	Head	ml	sec	Dark	Slight to Medium	Barely Visible	Completely Clear	Completel	None	Few	Неачу	Flow Rate ml / sec	Remarks
2:06p	2"	25	49.5		x					x		0.51	
	2"	25	47.4		x					x		0.53	
	2"	25	41.8		x					x		0.60	
	2"	25	38.1		x					x		0.66	
	2"	25	37.9		x					x		0.66	
	2"	25	37.1		x					x		0.67	
	2"	25	36.2		x					х		0.69	
	2"	25	28.9		x					х		0.87	
	2"	25	27.1		x					x		0.92	
	2"	25	26.4		x					x		0.95	
	2"	25	24.7		x					x		1.01	
2:16p	2"	25	22.6		x					x		1.11	< stop test
													Classification of test results:
	-	-											Method A: D2, Dispersive clay with cloudy
													suspension of colloids in water.
													Pinhole after test was larger than the needle
													punch and expanded from 1.00mm to a
					_								5.029mm hole.
													Soil was air dried and moisturized to 12.3%.

ULE TEST DATA

Hole HA-1(Lab No. 10-528):


Hole HA-4(Lab No. 10-529):



Hole VC-11(Lab No. 10-530):



Hole VC-16(Lab No. 10-531):







### Hole VC-20(Lab No. 10-532):







Hole VC-28(Lab No. 10-533):



## 7. Classification

7.1 The observations of this test method provide the basis for classifying the soil specimen into a category of dispersiveness according to the following general criteria:

7.1.1 Method A:

D1, D2—Dispersive clays that fail rapidly under 50-mm (2-in.) head.

ND4, ND3—Slightly to moderately dispersive clays that erode slowly under 50-mm (2-in.) or 180-mm (7-in.) head.

ND2, ND1—Nondispersive clay with very slight to no colloidal erosion under 380-mm (15-in.) or 1020-mm (40-in.) head.

Dispersive	Head,	Test time for given beed	Final flow rate	Cloudine	Hole size	
Classification <sup>®</sup>	mm	min.	mL/s	from side	from top	mm
D1	50	5	1.0-1.4	dark	very dark	≥2.0
D2	50	10	1.0-1.4	moderately dark	dark	>1.5
ND4	50	10	0.8-1.0	slightly dark	moderately dark	≤1.5
ND3	180	5	1.4-2.7	barely visible	slightly dark	≥1.5
	380	5	1.8-3.2	-		
ND2	1020	5	>3.0	clear	barely	<1.5
ND1	1020	5	≤3.0	perfectly clear	perfectly clear	1.0

TABLE 1 Criteria for Evaluating Pinhole Test Results<sup>4</sup>

APPENDIX D

# **Project Operations**

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	Appendix D
Project Op	perations

#### 3 D.1 Introduction

1

2

4 The Species Conservation Habitat (SCH) ponds are intended to be operated in a manner that would both 5 provide a partial in-kind replacement for some of the near-term habitat losses at the Salton Sea (the Sea) 6 and answer key question s regarding t he development of shallo w-water habitat as part of a long- term 7 restoration program at the Sea. Operations of the Salton Sea SCH Project (Project) co mponents would 8 have to balance habitat requirements necess any to achieve desired objectives against competing 9 constraints such as environmental limitations (ph ysical, water quality, and clim atological conditions); 10 compatibility with existing and future adjacent land uses (agricultural fields, geothermal development, and other habitat projects at the Sonny Bono Salton Sea National Wildlife Refuge); and habitat values (at 11 the refuge); and consistency with the applicable requirements of the Im perial Irrigation District (IID) 12 13 Habitat Conservation Plan/Natural Communities C onservation Plan. Decisions necessary to strike this 14 balance and meet the objectives would be made within an adaptive management framework.

This appendix provides a conceptual overview of the ra nge of op erations that could be used to provide suitable habitat (for species dependent on the Salton Sea) and to test different operational scenarios as part of the "proof-of-concept" aspect of the SCH Project. Key indicators of physical, chemical, and biological attributes of that habitat would be m onitored to de termine the effects of different operational scenarios, and any adjust ments would be im plemented as nee ded in accordance with the SCH Monitoring and

20 Adaptive Management Framework, as described in Appendix E.

#### 21 D.2 Key Project Components

The general facilities necessary for each alternative in clude river water diversion, sedimentation basin, saline water diversion, SCH ponds, in-pond habitat features, and an agricultural drain interception ditch.

#### 24 D.2.1 River Water Diversion

River water would be diverted for the use of producing shall ow-water aquatic habitat in one of two manners. For Alternatives 1 and 4, river water would be diverted via a lateral weir placed on the edge of the river channel. The diversion weir would be located upstream of the SCH p onds to provide sufficient hydraulic head to convey the water to the SCH pond s with gravity. For Alternatives 2, 3, 5, and 6, river water would be diverted via electrically driven pumps located adjacent to the SCH ponds.

#### 30 D.2.2 Sedimentation Basin

31 Waters in the New and Alamo rivers contain suspended sediment that would need to be rem oved prior to 32 conveyance and delivery to the SCH h abitat ponds. The concentration of the suspended sediment in the 33 rivers is recently reported at about 219 milligrams per liter (mg/L) for the New River and 280 m g/L for 34 the Alamo River. The water diverted to the SCH ponds from the rivers would have to go through a 35 sedimentation basin to rem ove the sediment load before the water is released to the SCH ponds. For 36 alternatives using a gravity diversion, the sedi mentation basin would be locat ed upstream of the SCH 37 ponds near the point of di version. For alternatives using the pumped diversion, the sedimentation basin 38 would be located within the SCH pond footprint.

The sedimentation basin would be operated to hold the water just long enough f or the sediment to settle out. T he settling time is a function of the size of the partic les suspended in the water column. Sedimentation basins elsewhere in the Imperial Valley store water for about 5 day s. Routine operations would inclu de the rem oval and dispo sal of the sed iments collected in the sedimentation basin. The frequency of these actions and amount of material to be removed would be determined once an alternative were selected for design and could be modified during the life of the SCH Project as a result of sediment control measures being independent ly im plemented as part of the Clean Water Act Section 303(d)

6 requirements (Total Maximum Daily Loads).

#### 7 D.2.3 Saline Water Diversion

8 Saline water would be diverted by electrically driven pumps placed on a struc ture in or adjacent to the 9 Salton Sea to produce the desired salinity in the SCH ponds. The water must be pumped (lifted) because 10 the Sea's elevation Sea is less th an the desired p ond elevation of -228 feet mean sea level (msl). 11 Currently, the water would have to be lifted about 4 feet in elevation from the Sea to the SCH ponds. As 12 the Sea's elevation declines over time, the height that the saline water would have to be lifted would 13 increase, along with the distance that the water had to be conveyed to reach the ponds.

#### 14 D.2.4 SCH Pond Berms

15 The SCH poind complex would be formed by constructing low height (up to approximately 8-foot-high) 16 berms to contain water and separate the SCH poinds from the remainder of the Salton Sea and its recently 17 exposed playa. Internal berms would segment the SCH poinds into experimental units.

18 be constructed prim arily on recently exposed pla ya following the existing The SCH ponds would 19 topography (ground-surface contours) where possible. The ground surface within the SCH ponds would 20 be excavated (with a balance between cut and fill) to acquire material to build the berm s and habitat islands. The borrow areas for the berms would generally form adjacent channels, swale channels, and 21 22 shallow excavations. The maxim um water surface elevation would be -228 feet msl. Pond depth would 23 range from near zero toward the shoreline (-228 msl) to 6 feet at the exterior b erm. Maximum depth in excavated areas would be up to 10 feet. Outflow stru ctures would be constructed in the outer berms, and 24 25 maximum outflow from the SCH pond co mplex to the Salton Sea would total approxim ately 130 cubic 26 feet per second.

Berms would be maintained to repa ir dam age due to structural failu res, differential settli ng, surface
 erosion, access, and water management functions. Ber ms may require future s trengthening by others to
 accommodate other compatible land uses (e.g., geothermal development).

#### 30 D.2.5 In-Pond Habitat Features

31 Several constructed bird and fish habitat structures would be included in the SCH ponds, such as swales, 32 holes, and habitat islands. Swales are 2-foot or d eeper channels within the pond u nits that would be 33 constructed with scr apers and excavat ors. They ultimately would serve as habitat feature s to incre ase 34 aquatic habitat heterogeneity, connect shallow and deep areas of a pond unit, and provide deeper refugia 35 near shallow areas. Each S CH pond would include several islands for bird habitat: one to three nesting 36 islands (suitable for tern species) and three to six smaller roosting islands (s uitable for cor morants and 37 pelicans). The overall SCH pond complex could also include one or more large (2- to 10-acre) islands that 38 have rocky and sandy substrate (suitable for cormorant nesting).

#### 39 D.2.6 Agricultural Drain Interception Ditch

Water from adjacent agricultural drains that currently flows (or is pum ped) directly into the Salton Sea
would be rerouted around the SCH ponds. The inter ception ditch would allow for the continuation
connection of these drains to the Salton Sea and not disturb the flow of agricultural drainwa ter from the

adjacent fiel ds. IID woul d maintain operational cont rol of these drains and continue to provide all
 maintenance activities necessary on these drains.

### 3 D.3 Operational Variables and Range

#### 4 D.3.1 Habitat Requirements and Operational Constraints

- 5 SCH ponds are intended to:
- Provide habitat suitable for production of fish dependent on the Salton Sea. Likely fish candidates are one or more varieties of tilapia, which are an important forage species for fish-eating birds. Other
   fishes that could become established in the SCH ponds include desert pupfish (*Cyprinodon macularius*), sailfin mollies (*Poecilia latipinna*), mosquitofish (*Gambusia affinis*), and threadfin shad
   (*Dorosoma petenense*).
- Provide habitat suitable to support fish-eating birds and other birds dependent on the Salton Sea.
   Foraging habitat would be a key attribute, but other features to meet habitat needs for nesting and resting would also be included.

SCH pond o perations would attem pt to meet Project goals and objectives given certain constraints of physical conditions, water qualit y, and climate. The general characteristics of the aquatic habitat that would likely be present for fish include:

- 17 Highly eutrophic, shallow-water ponds that would be highly turbid in spring through fall.
- Low temperatures below 50 degrees Fahrenheit (°F) (10 degrees Celcius [°C]) during short periods of the winter and high temperatures in the low-to mid 90s °F (low 30s °C) in the late spring through early fall.
- Dissolved oxygen (DO) concentrations ranging from zero mg/L at the mudline to super-saturated during daylight hours in spring to fall.

SCH Project operations would be constrained by the physical characteristics of the ponds (e.g., depth, area, and bot tom profile), but certain w ater quality conditions could be modified, within some range of conditions, as needed, by adjusting t he li mited opera tional controls to create more desirable habitat conditions in the ponds. The primary operational variables that could be controlled are:

- Salinity of the water within the ponds;
- Volume of water in the ponds;
- Residence time of the water in the ponds;
- Pond depth;
- Fish species stocked in the ponds; and
- **32** Physical cover elements.

33 Depending on the specific alternative and p ond design selected, the habitat would be com posed of a few

34 to several individual ponds. This design would allow the operators to tr y different com binations of

35 storage, salinity, and residence times to investigate how these factors could be adjusted to provide the best 36 conditions for fish and birds. Di fferent operational scenarios would be tested during the proof-of-concept

phase, the first 10 years of Project operation (to approximately 2025). After the proof-of-concept phase,

1 pond variables would be managed to produce the best habitat for fish and wildlife dependent on the 2 Salton Sea.

3 The following discussion is based on the construction of approximately 2,400 acres of

4 habitat, but the acreage could be less or m ore depending on the alternative select ed and the funding 5 available for Project construction.

#### 6 D.3.2 Salinity of Stored Water

7 The SCH ponds would typically be operated within the range of 20 to 40 parts per thousand (ppt) salinity.

8 Water from the Alamo River or New River (salinity approximately 2 ppt) would be blended with water

from the Sal ton Sea (current <sup>1</sup> salinity approximately 53 ppt) t o produce the desired pond salinity. 9

Blending the river water and seawater in different amounts would allow for a range of salinities to be used 10 in the ponds.<sup>2</sup>

11

12 Different ponds could be operated under different salinities to test which salinity regime results in the best 13 combination, or balance, of invertebrate and fish productivity, bird use, seasonal fish survival. and exposure to selenium (Figure D-1). For example, cold tolerance by tilapia is better at lower salinities (20 14 15 ppt) than at higher salinities (60 ppt) (Lorenzi and S chlenk, in preparation), but seleniu m loading to the 16 pond is increased (more river water equals lower salin ity but higher inputs of water-borne selenium) 17 (Appendix I, Selenium Management Strategies). Salinity in the ponds could also be increas ed as needed 18 to control mosquito populations (App endix F. Mo squito Control Plan), control em ergent vegetation 19 growth (Table D-1), and limit the development of aquatic habitat that would support fre shwater fish 20 known to be predators of desert pupfish.

21 During the proof-of-concept phase, sali nities would be typically managed bet ween 20 to 40 ppt. This

22 range is generally sufficient to control many of the negative factors listed above and within the range to

23 be tolerated by the fish s pecies expected to be u sed in the SCH ponds. Pond salinity may be allowed to 24

exceed this general range (from undiluted river water [2 ppt] up to 50 ppt) in the course of balancing 25 evaporation and water pum ping, or if deem ed appropriate to test specific fish management or habitat

26 value hy potheses. For example, it may be desirable to operate each pond at a different salinity (e.g.,

27 undiluted river water, 20 ppt, and 40 ppt) and m onitor biological outcomes and long-term operational

28 feasibility. SCH ponds would not be operated with hy persaline conditions (greater than 50 ppt) because

29 they would result in decreased viability of the desired aquatic habitat.

<sup>&</sup>lt;sup>1</sup> The salinity in the Salton Sea is expected to increase in the future, with salinity exceeding 100,000 ppt by 2030 (DWR and DFG 2007).

<sup>&</sup>lt;sup>2</sup> Evapoconcentration, increasing the salinity through the evaporation process, was simulated in the water quality modeling for this Project and found to be ineffective in achieving the desired salinity range in a short period of time.

			0 ppt	10	:	20	30	4	0 1	50	60	70
	8	CH OPERATIONS Salinity in Ponds		Occasi	onal	TYPIC	AL OPERA	TIONS	Occasional			
	8	<b>Tilaçia survival</b>	Disea	ise risk cold	Optima	I SU	RVIVE AI	ND REPR	ODUCE T	olerate	Survival unlikely	
	OLERANC	Emergent vegetation	Veget Surv	tation ives	COMPLETE							
	SALINITY T	Selenium Loading	Mo Ris	re :k	SELENIUM	load from river Less Rist				IUM RISK		
		Masquito control		Mosq	uitoes Surv	ive	Tolerat	te	C Mosq	OMPLETE UITO CONTROL		
Figure	D-1	Operation	al Ran	ge of	Saliniti	es and	Biolog	gical C	onstrair	its		

1

2 3

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Salton Sea SCH Project Draft EIS/EIR

#### APPENDIX D PROJECT OPERATIONS

Table D-1 S	alinity Tolerances of L	ocal Plant Sp	ecies	
Species	Habitat	Typical Salinity Preference	Widest Salinity Tolerated	Comments and Sources
California Bulrush ( <i>Schoenoplectus californicus</i> )	Widespread in fresh and intermediate marsh zone	0-3.5 ppt	Approximately 10 ppt or greater will control populations	Stutzenbaker 1999 Prolonged exposure to extreme conditions (15-20 ppt) exceeds the typical salinity tolerance and populations decline (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2002)
American Bulrush ( <i>Scirpus americanus</i> ) Olney's three-square bulrush ( <i>Schoenoplectus</i> <i>americanus</i> )	Fresh to intermediate marshes	0-3.5 ppt	50% reduction at 4 ppt and no germination above 13 ppt	Stutzenbaker 1999; Uchytil 1992 Management and maintenance depends primarily on maintenance of water levels and secondarily on salinity levels (Uchytil 1992)
Saltmarsh Bulrush ( <i>Scirpus maritimus</i> or <i>Scirpus robustus</i> )	Intermediate to brackish marshes, often on soils subject to tidal influence	3.5-10 ppt	Has been found in hypersaline lakes (~60 ppt) Germination reduced 50% at salinity = 9 ppt. No germination at salinity = 21 ppt.	Stutzenbaker 1999; International Lake Environment Committee 1998; Snyder 1991
Broad Leaf Cattail ( <i>Typha latifolia</i> )	Freshwater aquatic normally, but also found in intermediate marshes	0-0.5 ppt	Found in intermediate marshes with salinity up to 3.5 ppt In marshes of southeastern Louisiana, occurred at salt levels up to 1.13%	Stutzenbaker 1999
Narrow Leaf Cattail ( <i>Typha angustifolia</i> )	Freshwater aquatic normally, but also found in intermediate marshes; coastal	0-0.5 ppt	15-30 ppt	Stutzenbaker1999; Reed et al.1995
Southern Cattail ( <i>Typha domingensis</i> )	Wetlands ranging from fresh to brackish	0-10 ppt	75% mortality occurred at 15 ppt	Stutzenbaker 1999; Glenn et al. 1995

1

#### 2 D.3.3 Volume of Water in Storage

Storage is the amount of water contained in the SCH ponds at a given time. The volume that could be stored would depend upon the size of the ponds, which varies by alternative. The storage would also be controlled by changing the inflow and outflow to the SCH ponds. A pond could be operated at a constant storage or vary ing storage, depending on the proof-o f-concept testing. Reasons for vary ing storage (and hence the maximum depth and inundated area) inclu de responding to water quality conditions, desire to create different habitat conditions in the pond (e.g., shallow-water hab itat), vector control, or pond maintenance.

Water quality m odeling performed for the SCH Project has shown that DO or tem perature conditions respond to several operational parameters, including the depth of the water in a pond and pond shape (the

relationship between wat er depth and surface ar ea). Therefore, changing storage in the pond can alter

13 these conditions by changing the amount of shallow- and deepwater habitat.

- 1 The storage could be operated at any amount from empty (e.g., for emergency maintenance) to full with a
- 2 maximum depth of approximately 6 feet at the term inal berm. Should the average depth of the pond be 3
- 3 feet, the storage at full depth would be approximately 7,200 acre-feet for a constructed pond complex of
- 4 2,400 acres. Operators would determine the appropriate depth and manage the total storage in the p ond to
- 5 meet that depth.

### 6 D.3.4 Residence Time

7 Residence time is a measure of the time it would take the average unit of water volume to pass through

- 8 the SCH ponds (or loss to evaporation). The residence time defines the amount of water diverted from the 9 river and the Sea and in turn controls the diversion facilities, Project energy use, and cost. Residence time
- 10 may be an important parameter for the control of habitat conditions in the SCH operations.
- SCH pond residence time would be altered as a result of other operations of the SCH ponds or could be an experimental variable for operational testing. Residence time may vary in response to climatic conditions (including temperature, wind frequency, direction and speed, and solar illumination) or may be modified to test various hypotheses regarding the habitat value during differing climatic conditions and to contr ol anticipated negative conditions. These negative conditions would include the increased probability of
- 16 depleted DO concentration (anoxia) in portions of the water column or pond areas.
- 17 During the Project's proof-of-concept phase, pond r esidence time would be managed to test the
- 18 hypotheses developed through the use of the adaptive management process (see Appendix E). Based on
- 19 preliminary water quality modeling results (see Appendix J, Summary of Special Studies Supporting the
- EIS/EIR Impact Analysis), it is anticipated that r esidence times could vary from a couple of weeks (2
- 21 weeks) to several months (32 weeks). This range is generally sufficient to support the pr oof-of-concept 22 testing while allowing for the control of potential negative factors and the production n of the desired
- 22 testing wi

### 24 D.3.5 Pond Depth

The maximum and average depth of water in the SCH ponds would be varied to test various hy potheses regarding habitat value during differing climatic conditions and to control anticipated negative conditions listed above for residence time. Depth also could be controlled to manage predation on the fish in the

ponds. Different ponds could be operate d at different depths, and pond de pth could be changed to test

- different scenarios. A range of depths would be crea ted through excavation of material used for ber ms.
- The depth (and pond area) could also be changed by varying the amount of water stored in a pond during the year.
- During the Project's proof-of-concept phase, pond de pth woul d be managed to test the hy potheses developed through the use of the adapti ve management process (see Appendix F). Based on preli minary water quality m odeling results (see Ap pendix J), i t is anticipated that the m aximum pond depth at t he edge of the berms would be 6 feet. Pond depth may be managed outside this general range to test specific fish management or habitat value hy potheses. Ponds may need to be drained or the elevation lowered fo r emergency maintenance or to cont rol aquatic conditions, bu t this dr ainage would not be a routine occurrence.

## 39D.3.6Fish Stocking in Ponds

#### 40 Fish Species Selection

The SCH poinds would be designed to support fish to serve as prey for pis civorous birds. Promising candidate species must be able to forage, grow, and reproduce in fluctuating salinities using the soft, fine1 grained sediment that would naturall y form the p ond substrate. Fish t hat h ave evolved to deal with

- environmental fluctuations would be better able to th rive in SCH ponds than those whose phy siology is
   less plastic when dealing with environmental extremes
- 3 less plastic when dealing with environmental extremes.

4 A number of species present in ri verine or estuarine ha bitats of Southern California and Baja California, 5 Mexico, could be suitable candidates for a productive SCH fish community (DFG 2011). The main 6 attributes considered were foraging suitability for a wide range of piscivorous birds (e.g., no "bottom-7 hugging" flatfish that would be inaccessible to most birds), resistance to perturbation (e.g., tolerates wide 8 fluctuations in tem perature, DO, salinity), high productivity, and sustainability. These att ributes were 9 weighed against potential risk to desert pupfish, pot ential risk for spread to new habitats not current ly 10 occupied, and difficulty or expense in obtaining or producing sufficient numbers for stocking. F or the 11 Project's initial establish ment, however, only those species currently inhabiting the Salton Sea and its 12 connected waters would be consider ed for use. Desert pupfish, a federally protected species, are present around the Salton Sea and would be included in the SCH ponds. Selecting only fish species that currently 13 14 reside at the Sea would avoid any new impacts beyond what the Salton Sea desert pupfish population is

- 15 currently exposed.
- 16 Therefore, the fish assemblage propos ed for initia l deliberate in troduction into the SCH p onds would

17 include one or more forms of tilapia and possibly threadfin shad, as well as desert pupfish, sailfin molly,

18 and mosquitofish. Stocking more than one fish species in the ponds would provide some redundancy and

19 improve sustainability of the fish community. If these initial species do not meet the Project objectives,

20 other candidate species evaluated by DFG (DFG 2011) would be considered.

#### 21 Tilapia

22 Tilapia satisfy the entire suite of attributes sought in a candidate species, more than any other single species being considered for the SCH Project (DFG 2011). This family of fishes has wide t olerances for 23 24 water quality conditions, f lexible diet i ncluding algae and inverte brates, high fecundity, and distribution 25 throughout the water column. Furthermore, they could also support sport fishing. This species is highly 26 tolerant of a wide range of salinities, including high salinities, as demonstrated by their current dominance 27 in the hypersaline Salton Sea. Juvenile Mozambique hybrids can be slowly acclimated up to 95 grams per 28 liter and survive at least for 5 days if the tem perature is kept c onstant at 73 to 77 °F (2 3 to 25 °C) 29 (Sardella et al. 2004a). Til apia are less capable of dealing with high salinity under extreme t emperatures 30 (Sardella et al. 2004b). The preferred temperature range for optimum tilapia growth is 82° to 86°F (28 t o 31 30°C). Growth diminishes significantly at temperatures below 68°F (20°C) and death would occur below 32 50°F (10°C) (Rakocy and McGint y 1998). At tem peratures b elow 54°F (12°C), tilapi a are more 33 vulnerable to infections by bacteria, fungi, and parasites. The tem perature regime in the SCH ponds 34 would be expected to be more extreme than that of the current l ake (DWR and DFG 20 07). Models of 35 water temperatures for the SCH ponds predict temperatures below the lethal thr eshhold for Mozambique 36 hybrid tilapia (Appendix J).

37 Tilapia are remarkably tolerant of low DO concentrations, considerably below tolerance limits for most

fish. Tilapia can thrive at DO concentrations of 2 mg/L, can survive extended periods of 1 mg/L, and can

tolerate routine dawn DO concentrations of l ess than 0.3 m g/L (Popm a and Masser 1999). In low DO conditions, fi sh frequently are found near the surface ta king in water in the thin surficial lay er t hat

40 conditions, fi sh frequently are found near the surface ta king in water in the thin surficial lay er that 41 remains somewhat oxygenated (personal communication, K. Fitzsimmons 2010). Such behavioral coping

42 responses could increase the vulnerability of fish to bird predation near the surface.

43 Their main drawback, other than potential competition with desert pupfish, is whether they could handle

the lowest water tem peratures pr edicted for SCH ponds. Stocki ng diffe rent tilapia species or strains

45 (individually or in combination) among the SCH poinds could test which species is most sustainable and

- 1 resilient, and could enhance st ability of the fishery resource in t he ponds in the face of seasonal and 2 annual fluctuations in water quality parameters. The three tilapia species under consideration for stocking
- 3 in the SCH ponds include the following:

4 California Mozambique Hybrid Tilapia – California Mozam bique hy brid tilapia (" Mozambique 5 tilapia") are a hybrid of Oreochromis mossambicus and O. urolepis hornorum. This species is currently 6 the dominant species in the Salton Sea and is widely u sed in aqua culture including at fish far ms in the 7 Salton Sea watershed. Advantages of this species ar e its demonstrated ability to survive, thrive, and achieve high productivit v in hy persaline conditions, as well as its presumed importance as a suitable 8 9 forage fish for all piscivorous birds at the Salton S ea. The risk from using Mozambique tilapia as the sole 10 forage species is the potential for population crashes, as seen with the massive fish die -offs at the beginning of the decade. The proposed SCH opera tions would be designe d to keep w ater quality 11 12 conditions within known tolerances and, therefore, population fluctuations may be dampened.

**Blue Tilapia** – Blue tilapia (*Oreochromis aureus*) have a lower tolerance for salinity, but handle colder temperatures than the other two tilapia (Popm a and Masser 1999). Tilapia resem bling blue tilapia are currently only present in the New and Alamo rivers. The genetic makeup of this tilapia assem blage is uncertain, but likely includes *O. aureus* and possibly Mozam bique tilapia genetic material given the checkered h istory of tilapia introductions an d movements in souther n California (personal communication, K. Fitzsimmons 2010).

**Redbelly Tilapia** – Redbelly tilapia (*Tilapia zillii*) were once the dominant tilapia species in the Salton Sea, when salinit y was lower. Although the y were replaced by the Mozam bique tilapia, they are still thriving in some of the agricultural drains. The difference in their tolerance to salinity and temperature, as well as a different breed ing strategy, may provide plasticity in response to perturbation n for a fish community that contains both species.

24 The relative tolerances of these species to combinations of salinities (20 ppt, 45 ppt, and 60 ppt) and 25 temperatures (cold 11-16°C [52-61 °F]), warm 23-28°C [73-82 °F], and hot 33-38°C [91-100°F]) were 26 tested experimentally (Lorenzi and Schlenk, in preparation). The tested fish included Mozambique tilapia 27 (two strains: wild fish from Salton Sea and an aquaculture strain from a local fish farm), fish from a blue 28 tilapia assemblage in the New River, and redbelly tilapia from the New River. The best survival at cold 29 temperatures was observed with the wild Mozam bique tilap ia, while the aquacultural strain of 30 Mozambique tilapia was the best performer overal 1 for all sali nities at warm tem peratures. The blue 31 tilapia strain surprisingly did not have better survival than Mozam bique tilapia in cold conditions. 32 Redbelly tilapia results were equivocal, due to other sources of mortality in captivity. While most strains 33 and species had m oderately good sur vival in 45 ppt and 60 ppt conditions at warm temperatures, all 34 species showed poor survival in hot high-salinity (60 ppt) conditions.

#### 35 Desert Pupfish

36 Desert pupfish are listed as an endangered species un der both Federal and California Endangered Species 37 Acts. They currently inhabit the agricultural drains and creeks that feed into the Salton Sea, shallow areas 38 of the Sea itself, and numerous cr eated refuge habitats. A stu dy of IID agricultural drains found a n 39 correlated w ith west ern mosquitofish, salfin molly, and abundance of desert pupfish positively 40 Mozambique hy brid tilapi a (Martin an d Saiki 2005). Desert pupfish are observed m ost f requently in 41 shallow water less than ab out 1 foot (30 centi meters) deep with v elocities less than about 1 foot/second 42 (Black 1980). They are capable of moving freely between the relatively fresh water in the agricultural 43 drains and the highly saline environment in the Salton Sea (DWR and DFG 2007).

1 Desert pupfish are very tolerant of extreme water quality conditions, and have been held in the laboratory 2 in water with salinit y greater than 98 ppt (Barlow 1958, as cited in Moyle 2002). T he ability of desert 3 pupfish to tolerate high salinity, high pH, and low DO contributes to their ability to persist at the Salton 4 Sea. Moyle (2002) summarized the life histor y of desert pupfish as follows, with additi onal information 5 as noted. This species can tolerate salinities ranging from freshwater to considerably greater than seawater 6 (up to 68 ppt in the wild), DO from saturation to as low as 0.1 to 0.4 m g/L (parts per million), and 7 temperatures from 39.9°F (4.4°C) in winter (Schoenherr 1990) to 108.3°F (42.4°C) in summer (Carveth et 8 al. 200 6). Individuals can survive daily temperature fluctuations of up to 78.8°F (26°C) and salinit V

- 9 changes of 10 to 15 ppt. Larvae have a higher salinity tolerance (up to 90 ppt) than do adults (68 ppt) and 10
- can withstand sudden salinity changes of up to 35 ppt.

Under current conditions at the Salton Sea, individu al desert pupfish inhabiting creeks and drains that 11

12 flow into t he Sea are presumed to m over along the Sea's margins and am ong drains. This movement,

13 which provi des the opportunit y for genetic exch ange am ong desert pupfish, reduces the potentia

14 deleterious effects of isolation of individual populations. It also provides the opportunity to recolonize

15 these same areas in the event a local population is extirpated (DWR and DFG 2007). Therefore, the SCH

16 Project design would include features to maintain connectivity among populations.

17 Desert pupfi sh would li kelv t hrive at the SCH ponds, as seen at the Bur eau of Reclamation/U.S .

18 Geological Survey Saline Habitat Ponds (Miles et al. 2009). The ponds that had pupfish were mostly less

19 than 1 meter deep and had salinities ranging from 12 to 70 ppt (Miles et al. 2009). Pupfish were the most

20 abundant fish in the Saline Habita t Ponds: over one million were captured when the ponds were drained

21 in late 2010 (personal communication, J. Crayon 2010).

#### Sailfin Molly and Mosquitofish 22

23 Sailfin mollies and mosquitofish are sy mpatric with desert pupfish in the Salton Sink. Due to their 24 presence in the Colorado River, they also occupy much of the agricultural water supply and drainage 25 systems around the Salton Sea. Like desert pupfish, they demonstrate plasticity in their diet, and tolerance 26 of high water temperature, high salinity, and low oxygen levels. They inhabit the shallow edges of water 27 bodies, usually less than 2 feet deep. As livebear ers, they require no special substrate or structure for

28 reproduction.

29 Desert pupfish, sailfin m ollies, and m osquitofish overlap considerably in t heir trophic roles where they 30 co-exist in the Salton Sink . They would provide diversity and a d egree of redundancy in the SCH fish 31 community, which could buffer the effects of perturba tion in a dynam ic system. Birds that forage for 32 small fish would prey on all three species; however, surface gleaners and skimmers would find sailfin

33 mollies and mosquitofish more accessible, since these fishes are usually active higher in the water column

34 than are desert pupfish.

#### 35 Threadfin Shad

36 Threadfin shad form schools near the surface in open water. They can live in seawater but do not

- 37 reproduce at that salinity. Spawning takes place in open water near floating or partially submerged objects 38 to which the fertilized eggs stick. The eadfin shad feed heavily on larger zooplankton and can greatly
- 39 reduce the abundance of these organisms (Moyle 2002).

#### Filling and Stocking of SCH Ponds 40

The SCH ponds would be stocked with fish species currently in the Salton Sea Basin and captured from 41

42 local drainages. The initial SCH aquati c community would be comprised of four prim ary types of fish:

43 tilapia, sailfin molly, mosquitofish, and desert pupfish. Unintentional invasion of other fish from the river 1 waters, such as common carp (Cyprinus carpio), various Centrarchid species, red shiners (Cyprinella

2 *lutrensis*), and threadfin s had, may also occur. All but the shad would be unable to survive in water s

3 above 20 ppt salinity.

4 Following construction, t he SCH ponds would be f illed with water for the first tim e and allowed to 5 "season" for a period of several weeks while undergoing various stages of che mical and biological

6 succession. Water chemi stry woul d f luctuate as compounds leach from the newly wetted soils and

7 microbial communities are initiated. Once phyto- and zooplankton are established and salinity exceeds 20

8 ppt, fish could be introduced, starting with sailfin mollies and mosquitofish.

9 The first fishes introduced would li kely be small species. Sailfin mollies are ubiquitous in the Salton Sea and the agricultural drains surrounding it. They could be easily trapped/and or seined for st ocking into SCH ponds. The most productive colle ction of sailfin mollies would take place in the spring, when the young-of-the-year would still have an approximately 1:1 sex ratio and have not yet been exhausted by the energetic costs of reproduction. Mosquitofish are nume rous in the agricultural drains at the Salton Sea's southern end. The y also could be easily trapped a nd/or seined for stocking, or alternately could be obtained from aquaculture or vector control agen cies. Pupfish would be trapped and/or seined from

16 several natural localities and created refuges to insure a good representation of available genetic diversity.

17 Several species and str ains of tilapia are present in the waters of the Salton Sea drainag e, and each 18 requires a different approach for securing sufficiently large num bers of founders. Moza mbique hybrid 19 tilapia are currently abundant in the Sal ton Sea and large numbers could easily be captured for stocking 20 into SCH ponds. However, their long-t erm availability is tenuous with the incr easing salinity in the Sea. 21 The same fish is available from local aquacultural facilities, but may not perform as well as wild caught 22 fish, given the selection pressure on the wild population that would likely result in greater tolerance of the 23 Sea's salinity and temperature range (Lorenzi and Schlenk, in preparation). Redbelly tilapia are abundant in drains at the Sea's northern end, particularly those filled by tilewater. These populations should persist, 24 25 due to the consistency of water quality in those drains, and fish would be available for seining/trapping 26 for SCH ponds in the future. Finally, tilapia resembling blue tilapia are present in the rivers, agricultural 27 drains, and Brawley Wetlands.

The release of tilapia into SCH ponds should only take place after phy toplankton and zoopl ankton are established. If stocks were from freshwater habitats or held in fre shwater while captive, they would be first acclimated to the salinity in the ponds. This acclimation could be done under captive maintenance, or by sequestering in a small part of t he ponds and allowing the salinity to gradually rise to pond levels

32 before releasing fish into the larger habitat.

### 33 Fish Rearing

34 Due to ever-i ncreasing salinity and degraded wat er quality in the Salton Sea, the Mozambique hybrid 35 tilapia population in the Sea may have declined seriously by the time of construction of the SCH ponds. If 36 so, extremely intense predation pressure on the fish initially stocked in the ponds may occur. A supply of 37 fish would be needed for initial stocking of the SC H ponds and possible restocking if severe fish die-offs 38 occur. It would be important to stock fi sh in sufficient numbers to start a sustainable population in the 39 face of predation. Securing an adequate num ber of fish for stocking m ay require producing a generation 40 in captivity from captured wild fish. Tilapia could be collected now from local sources while wild stocks 41 remain and held for captive propagation at one or more of the private licensed aquaculture facilities in the 42 area (within 15 m iles of all alternative sites). Several tr ips (fewer than ten) by small ( $\frac{1}{2}$  to 1 ton) trucks 43 would be required if cultured fish are to be delivered from an aquaculture facility to SCH ponds.

#### Physical Cover 1

2 Heterogeneity in physical habitat structure could be manipulated in the SCH ponds to enhance cover and 3 refugia for fish from predators and possible therma l fluctuations. Refugia from predators would be 4 necessary to allow a sustainable population of fish t o persist in the face of expected heavy predation by 5 piscivorous birds, especially when fishery resources in the Salton Sea decline and disappear. Refugia or 6 cover could be provided by deeper waters or phy sical structural complexity. Types of cover ele ments 7 considered include:

8 Swales and Channels – Having water deeper than 3 feet in proximity to shallower areas would allow fish 9 to disperse into areas where they would be m ore dispersed and/or less visible due to turbidity. These 10 constructed regions of greater depth would provide this element.

11 **Submerged Aquatic Vegetation** – Vegetation could also provide cover from predators, especially for 12 small fish. Widgeon gra ss (*Ruppia* spp.) is expected to become established in the SCH ponds. This 13 vegetation would li kely enhance food supplies by providing more microhabitat structure to support 14 invertebrate diversity and productivity. Widgeon grass establishes from seed and needs sufficient light for 15 photosynthesis to reach the pond bottom. Given the projected turbidity, it would be lim ited to shallow

16 areas of SCH ponds.

17 Floating Islands – These artificial str uctures could be used to provide visual cover and shading for

18 potential thermal refugia. Floating islands could be deployed in different areas, and would likely be most

19 useful in shallower are as where other cover is limited. More information would be necess ary to evaluate

20 the applicability and feasibility of floating islands.

21 While many of these components would be considered part of the initial pond construction, placement 22 and size of floating islands could be manipulated to test habitat function. Monitoring of their effectiveness 23 would be a component of the adaptive management approach for the SCH design and operations.

#### D.4 Possible Operational Scenarios 24

25 Possible operational scenarios are shown in Tables D-2 to D-7. These scenarios are meant to test different 26 concepts for creating sustainable saline habitat for fish and wildlife that minimizes risks of impacts such 27 as fish die-offs, ecotoxicity from sel enium, and diseases vector s. Upper and lower extre mes of the 28 operational range would be tested to detect any effect of that variable on Project performance. Operational 29 values for ea ch variable c ould be held constant over time or could be adjusted sea sonally according to

30 expected outcomes.

31 The ranges of operational variables to be tested are as follows:

32 Salinity -20-40 ppt.

33 **Storage** – Approxim ately 80 to 1 00 percent of cap acity (the volume would depend on the actual

34 alternative selected and am ount of ponds constructed). For example, for a constructed pond complex of 35 2,400 acres, storage could range from 6,000 to 7,200 acre-feet, assuming an average depth of 3 feet deep

- 36 over 2,400 acres).
- 37 **Residence Time** – 2 to 32 weeks. This range reflects rate of inflow and outflow.

38 **Fish Species** – Fishes considered for initial introduction into S CH ponds would include one or more 39 forms of tilapia, threadfin shad, desert pupfish, sailfin molly, and mosquitofish.

1 Several constraints and potential impacts were considered in the design of the operational scenarios:

2 Water Quality Tolerances of Target Fish – The fish species us ed in the ponds would have to surviv e 3 and reproduce given the expected water quality conditions, both managed (salinity) and uncontrolled (air 4 temperature, wind m ixing, DO) conditions. Tilapia appear to meet many of the require ments for a 5 productive, sustainable fishery resource for piscivor ous birds. For some tilapia species or strains, cold 6 tolerance (below 13°C [ 55°F]) is im paired at high er salinities ( Lorenzi and Schlenck, in preparation). 7 Hydrological modeling suggests that water tem peratures could drop below 11-13°C (52- 55°F) during 8 December through Februa ry. DO concentrations coul d dip below tilapia minimum toleran ces. Nutrient 9 concentrations are high in the New and Alamo rivers, due to contributions from agricultural runoff. Water 10 quality m odeling su ggests high levels of algal growth are possible, along with o xygen deprivation 11 problems that accompany hot weather algal blooms (B. Barry and M. Anderson, University of California 12 Riverside, unpublished data). Also, seasonal anoxia could be more frequent and prolo nged in sprin g 13 (March through May) and fall (October) due to algal blooms.

- 14 **Relative Selenium Loading** Selenium in river water supplying the ponds could bioaccumulate through
- 15 the food web from invertebrates and fish to birds (see Appendix I, Selenium Management Strategies).
- 16 Shorter residence ti me and lower salin ity means greater inputs of river water, which would increase
- 17 overall selenium loading to the ponds.
- 18 Vector Risk Mosquit oes that breed at the pond s could pose a potential hum an health risk. The
- likelihood for mosquito vector i mpacts is based on (1) breeding season (March through Nove mber) and
  (2) salinity tolerance of mosquito larvae (can survive up to 25 ppt, some reduction in populations between
- 21 25-28 ppt, < 28 ppt, reduced population 28-34 ppt, control 35 ppt ).
- 22 **Emergent Vegetation Control** The SCH ponds would be managed using elevated salinity to reduce
- establishment of emergent vegetation, such as cattails and bulrush. Most vegetation is inhibited by 10 ppt
- 24 salinity, but some strains could tolerate salinities up to 35 ppt (Table D-2).

#### APPENDIX D PROJECT OPERATIONS

Table D-2	Constant Salinity (20 ppt) a	nd Constar	nt Storage	e Operatior	nal Scenar	10							
	Scenario Name						Wate	r Year					
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1a	Constant Salinity (low range	e), Constar	nt Storag	e									
Onenetine	Salinity (ppt)	20	20	20	20	20	20	20	20	20	20	20	20
Operating Variables	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100%
Variables	Residence time (weeks)	4	4	4	4	4	4	4	4	4	4	4	4
	Dissolved oxygen	Anoxia	a				Anoxia	a more co	mmon				
Potential	Fish temperature		Potentially too cold										
Constraints	tolerance		-				ļ	-					
and	Selenium loading <sup>1</sup>					High	relative se	elative selenium loading					
Impacts	Mosquito vector relative risk <sup>2</sup>	High		Low mos	quito risk				High	n mosquite	o risk	I     Aug       0     20       100     100       10     4       4     1       6     16       ading	
1b	Residence time (weeks)	16	16	16	16	16	16	16	16	16	16	16	16
	Selenium loading <sup>1</sup>	Medium re						relative selenium loading					
									Relativ	/e Seleniu	m Loadin	g	

1. Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).

	Relative Selenium Loading											
	Salinity range ppt											
Residence Time	10-19	20-29	30-39	40 50								
4-8 weeks	Higher	High	Medium	Low								
10-16 weeks	High	Medium	Low	Lower								

2

1

3

Table D-3	Constant Salinity (35 ppt)	and Consta	ant Storage	e Operatio	nal Scena	rio							
	Scenario Name						Wate	r Year					
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2	Constant Salinity (high ran	ge), Consta	ant Storag	e									
	Salinity (ppt)	35	35	35	35	35	35	35	35	35	35	35	35
Operating Variables	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100
Variables	Residence time (weeks)	16	16	16	16	16	16	16	16	16	16	16	16
	Dissolved oxygen	Anoxia					Anoxia	Anoxia more common					
Potential Constraints	Fish temperature tolerance			Pote	ntially too	cold							
2 Operating Variables Potential Constraints and Impacts	Selenium loading <sup>1</sup>	Low relative selenium loading											
	Mosquito vector relative risk <sup>2</sup>						Low mos	quito risk					
									Rela	tive Seler	ium Load	ing	

1. Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.

2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced population 28-34 ppt, control 35 ppt ) and breeding season (Mar-Nov).

R	Relative Selenium Loading											
	Salinity range ppt											
Residence Time	10-19	20-29	30-39	40 50								
4-8 weeks	Higher	High	Medium	Low								
10-16 weeks	High	Medium	Low	Lower								

2

1

#### APPENDIX D PROJECT OPERATIONS

1

2

	Scenario Name						Wate	er Year					
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jur	n Jul	Aug	Sep
3	Variable Salinity, Variable Storage			-	-	-	-	_					_
	Salinity (ppt)	20	20	20	20	20	20	25	30	35	35	30	25
Operating Variables	Storage (% of capacity)	100	100	100	100	100	95	90	85	80	80	90	95
Variables	Residence time (weeks)	8	6	4	4	6	8	10	12	16	5 16	12	10
	Dissolved oxygen	Anoxia	kia Anoxia						nmon				
Potential Constraints	Fish temperature tolerance		Potentially too cold										
and Impacts	Selenium loading <sup>1</sup>		High relative selenium loading						Med- ium Low relative selenium loading			Med- ium	
	Mosquito vector relative risk <sup>2</sup>	High		Low mos	quito risk		High	Medium			Low risk Medium		
		-							Re	lative S	Selenium Lo	oading	
											Salinity r	ange ppt	
1. Relative se inputs of rive	elenium loading – shorter re er water, which increases se	esidence ti elenium lo	ime and lo ading.	ower salin	ity means	greater		Residenc Time	e 10	)-19	20-29	30-39	40 50
2. Vector risk	of mosquitoes based on s	alinity tole	rance (su	rvive <28	ppt,			4-8 week	s <mark>Hi</mark>	gher	High	Medium	Low
reduced pop Nov).	ulation 28-34 ppt, control 3	35 ppt) and	d breeding	g season (	Mar-			10-16 weeks	н	ligh	Medium	Low	Lower

3

Table D-5 Variable Salinity (20-35 ppt) and Constant Storage Operational Scenario													
	Scenario Name	Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
4	Variable Salinity, Consta	nt Storage	2										
	Salinity (ppt)	20	20	20	20	20	20	25	30	35	35	30	25
Operating Variables	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100
Variables	Residence time (weeks)	8	6	4	4	6	8	10	12	16	16	12	10
	Dissolved oxygen	Anoxia Anoxi					a more co	mmon					
Potential Constraints	Fish temperature tolerance	Potentially too cold						-					
and	Selenium loading <sup>1</sup>	High relative selenium loading						Medium		Low relative selenium		Medium	
	Mosquito vector relative risk <sup>2</sup>	High Low mosquito risk High					High	Medium		Low		Medium	
								Relative Selenium Loading					
								Salinity range ppt					
<ol> <li>Relative selenium loading – shorter residence time and lower salinity means greater inputs of river water, which increases selenium loading.</li> </ol>								Resideno Time	ce	10-19	20-29	30-39	40 50
2. Vector risk	of mosquitoes based on s	alinitv tole	rance (sui	vive <28 p	opt.			4-8 wee	ks	Higher	High	Medium	Low
reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).								10-16 weeks High Medium			Low	Lower	

	Scenario Name						Wate	er Year					
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
5	Variable Salinity, Consta	nt Storage	•										
	Salinity (ppt)	20	20	20	20	20	20	30	40	40	40	40	30
Operating Variables	Storage (% capacity)	100	100	100	100	100	100	100	100	100	100	100	100
Variables	Residence time (weeks)	12	10	8	8	10	12	16	20	20	20	20	16
Potential Constraints and Impacts	Dissolved oxygen	Anoxia Anoxi						ia more common					
	Fish temperature tolerance	Potentially too cold											
	Selenium loading <sup>1</sup>	High relative selenium loading				Med	lium	Low			Lower relative loading		
	Mosquito vector relative risk <sup>2</sup>	High Low mosquito risk					High	Med- ium		Low Med ium			
1. Relative selenium loading – shorter residence time and lower salinity means greater								Relative Selenium Loading					
inputs of river water, which increases selenium loading.											Salinity r	ange ppt	
2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt, reduced Re								Residenc	e				
population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).								Time	10-1	.9	20-29	30-39	40 50
								4-8 week	s High	er	High	Medium	Low
								10-16					

Lower

High

weeks

Medium

Low

	Scenario Name	Water Year											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep
6	Variable Salinity, Varia	ble Storage	2										
Operating Variables	Salinity (ppt)	20	20	20	20	20	20	30	40	40	40	40	30
	Storage (% capacity)	100	100	100	100	100	95	90	85	80	80	90	95
	Residence time (weeks)	12	10	8	8	10	12	16	20	16	20	20	16
Potential	Dissolved oxygen	Anoxia					Anox	ia more cor	nmon		·		·
	Fish temperature tolerance			Pote	entially too	cold				·			
and	Selenium loading <sup>1</sup>		ive loading	Med	lium	Low		Very Low relative loading			Low		
Impacts	Mosquito vector relative risk <sup>2</sup>	High Low mosquito risk					High	Med- ium	Med-Low				
									F	Relative Se	lenium Loa	ding	
1. Relative selenium loading –shorter residence time and lower salinity means greater								Salinity range ppt					
inputs of river water, which increases selenium loading. Residence Time 10-19 20-29 30-39									40 50				
2. Vector risk of mosquitoes based on salinity tolerance (survive <28 ppt. 4-8 weeks Higher H								High	Medium	Low			
reduced population 28-34 ppt, control 35 ppt) and breeding season (Mar-Nov).								10-16 weeks High Medium		Low	Lower		

Table D-7	Highly Variable Salinity (20-40 ppt) and Variable Storage Operational Scenario
	righty variable balling (20 to pp) and variable biologe operational boenante

#### 1 D.5 Testing Operational Scenarios

Different operational scenarios would be tested in the proof-of-concept period for approximately 10 years (estimated 2015–2025). Two or m ore operational scen arios would be im plemented si multaneously in separate ponds, and outcomes monitored to test p erformance in meeting o bjectives and minimizing impacts. Key indicators of i mportant phy sical, water quality, and biol ogical attributes would be monitored.

Certain indicators of flow and water quality would be frequently monitored to guide daily or weekly pond
 operations. These operational triggers include pum ping or inflow rates of river water and saline water ,
 outflow rates and solinity of water at inflow and in ponds.

9 outflow rates, and salinity of water at inflow and in ponds.

Indicators of Project performance would be identified based on the SCH objectives. Thresholds or desired
 conditions for each indicator would be defined, and progress toward meeting those objectives measured
 according to the Monitoring and Adaptive Mana gement Fra mework (Ap pendix E). For exa mple,

13 measuring abundance and community composition of fishes in different ponds would be an indicator of

14 SCH Project effectiveness at providing foraging habitat for piscivorous birds (Objective 1) and creating

15 sustainable aquatic habitat (Objective 3).

#### 16 **D.6** Maintenance Activities

SCH Project im plementation would also include st andard maintenance that would n ot be variedexperimentally. These types of operations would include:

- 19 Sedimentation basin operations;
- Infrastructure maintenance;
- Erosion control structure maintenance;
- Vegetation control; and
- Vector control (see Appendix F, Mosquito Control Plan).

#### 24 D.6.1 Sedimentation Basin Operations

There would be two sedimentation basi ns. Operation and maintenance would o ccur throughout the year and at the end of t he year. One basin would be operated at any given tim e, storing water and settling sediment. The other basin would be drained of water, the sediment dried, and sediment excavated down to original design elevation. Excavated sediment would be used on the Project to m aintain berms, offset settling of berms, and create additional habitat islands if necessary.

#### 30 D.6.2 Infrastructure Maintenance

Monitoring of phy sical structures would be conduc ted on a regular basis to check condition, and and maintenance or repairs implemented on an ongoin g basis as need ed. Project infrastructure for the water supply includes pumps, pump facilities and pipelines and inlet structures. Infrastructure for the water control structures includes culverts, gates, and weirs between ponds and from the ponds to the Salton Sea.

#### 35 D.6.3 Erosion Control

Berm structure, riprap, and roadway s on the crown would be checked periodically for seepage, cracking,
 erosion, and extensive burrowing by animals. Areas that would potentially receive more wave action due

1 to extended wind fetch would receive closer scrutiny. Typical maintenance activities could include adding

2 riprap, filling cracks or eroded areas, or spreading gravel on the roadway.

#### 3 D.6.4 Vegetation Control

Unwanted vegetation at SCH infrastructure could include cattails, tules and salt cedar. Measures would be implemented to control vegetation on berms that could compromise structural integrity. Vegetation would also be rem oved from the sedimentati on basin, interception ditch, and aro und the river p ump station to maintain storage and flow capacity . Best management practices for vegetation control would be implemented as appropri ate, includin g but not li mited to phy sical rem oval and chemical control appropriate near waterways.

### 10 D.7 Emergency Operations

Under certain circumstances, it may be necessary to enact rapid response operations in response to a
 sudden threat or emergency, such as:

- 13 Avian disease outbreak;
- 14 Rapid drawdown of ponds for emergency actions; and
- 15 Mosquito-borne diseases (see Appendix F, Mosquito Control Plan).

#### 16 D.7.1 Avian Disease Outbreak

Birds would be monitored regularly for signs of disease outbreaks, and monitoring would be intensified if signs of dise ase ar e present. Dead and dy ing birds would be collected to disrupt c ycles of infectious diseases. Potentially infectious carcasses would be incinerated at the Sonny B ono Refuge. For diseases that can be treated, such as the early stages of botu lism, sick birds would be collected for rehabilitation and release, as is currently done on the Salton Sea.

#### 22 D.7.2 Pond Drawdown

23 Under certain conditions it may become necessary to rapidly reduce water elevations a pond, such as 24 emergency repair of water control structures or be rms, sudden change in po nd water quality, or noxious 25 species control. The drawdown would involve raising the flashboards on the outlet control structure(s) to 26 release water to the Sea. Draining of the ponds could occur as a result of a breach in one or more berms, 27 but com plete draining would not be utilized as a typical pond m anagement action. Under certai n 28 emergency conditions, such as a pesticide spill in the SCH source waters, or to eradicate a noxious 29 aquatic invader, SCH ponds could be deliberately drained. In such an event, low areas of the ponds' 30 would retain water and act as tem porary refugia for fish by design, by allowing either the salvage of the 31 remaining fish or leaving fish in place as recruitment stocks for re-establishing fish populations.

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APPENDIX E

# Monitoring and Adaptive Management Framework
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# Appendix E Monitoring and Adaptive Management Framework

### 4 E.1 Introduction

5 The two goals of the Salton Sea Species Conservation Habitat (SCH) Project are (1) to provide aquatic 6 habitat to support fish and wildlife species dependent on the Salton Sea, and (2) to develop and refine 7 information needed to successfully manage the SCH Project. The Project is intended to serve as a proof of 8 concept for the long-term restoration envisioned for the Salton Sea. Therefore, the SCH Project is being 9 developed consistent with the principles of adaptive management with the following objectives for its 10 second goal:

- Identify uncertainties in achieving the objectives of providing habitat and prey for piscivorous birds and minimizing impacts on species (e.g., selenium, disease);
- 13 2. Design science-based means to test alternatives and reduce uncertainty;
- 14
   3. Develop and implement a monitoring plan that measures key indicators of SCH Project performance;
- 4. Develop a decision-making framework to evaluate data, adjust management, and refine
   operations and monitoring as needed to achieve Project goals; and
- 18
  5. Provide proof of concept for future restoration to verify that the core ideas are functional and feasible prior to full scale restoration of the Salton Sea.

The purpose of this document is to present a monitoring and adaptive management framework to guide evaluation and improved management of the newly created habitat, as well as to inform future restoration. Because the SCH Project has not reached final design or construction, this document does not include the detailed protocols and site-specific sampling design necessary for actual implementation. A more detailed monitoring plan and decision-making process would be developed should the SCH Project be constructed.

### 26 E.2 Adaptive Management Process

Adaptive management is a process that promotes flexible decision-making that can be adjusted as new

and improved information becomes available about outcomes of management actions and other events
 (Williams et. al 2007). Adaptive management provides the necessary flexibility and feedback to manage

30 complex natural resources in the face of considerable uncertainty about the effectiveness of specific

- 31 management actions. It is an iterative process with the following steps:
- 32 33

34

- 1. **Plan** Define/redefine the problem, establish goals and objectives, develop restoration alternatives;
- 35 2. Design Develop designs and operational scenarios for habitat ponds, develop monitoring
   36 framework;

- 1 3. **Implement** Design, construct, and operate the SCH ponds;
- 2 4. **Monitor** Conduct monitoring to detect change and determine status of resources;
- 3 5. **Evaluate** Analyze, synthesize, and manage data; and
- 4 6. Adapt and Learn Make any necessary adjustments to management, share information.

5 Because uncertainties remain about habitat function and biological responses at the ponds, the SCH 6 Project is being designed with a range of operational scenarios (Appendix D, Project Operations) to 7 evaluate the effectiveness of different management actions. A monitoring program would be implemented 8 to collect data necessary to operate and evaluate the Project's success.

### 9 E.3 Monitoring Framework

### 10 E.3.1 Objective-Based Monitoring

Monitoring is a fundamental element of adaptive management because effective evaluation and management requires information about the status of target resources and their response to management activities. The information obtained would be used to measure Project effectiveness, to refine operation and management of the SCH ponds, to reduce uncertainties about key issues, and to inform subsequent stages of habitat restoration at the Salton Sea.

Monitoring can be defined as the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective (Elzinga et al. 1998). Inherent in defining monitoring as part of the adaptive management cycle are two key concepts (Elzinga et al. 1998). The first is that monitoring is driven by objectives. The objective describes the desired condition. Management is designed to meet the objective and monitoring is designed to determine if the objective is met. Objectives form the foundation of the entire monitoring project. The second concept is that monitoring is only initiated if opportunities for management change exist.

23 Monitoring efforts would be guided by the specific SCH Project objectives and desired outcomes. Table 24 E-1 outlines the Project's objectives to meet its primary goal of providing aquatic habitat to support fish 25 and wildlife species dependent on the Salton Sea. What is measured (indicator), how well it is measured, 26 and how often it is measured are design features that would be defined by how an objective is articulated 27 (Elzinga et al. 1998). The next step would be to define, quantitatively or qualitatively, the specific desired 28 outcomes for each objective and to identify appropriate indicators for measurement. Monitoring should 29 focus on the most informative, efficient, and cost-effective indicators and methods. Types of potential 30 indicators include:

- Triggers for real-time pond operations salinity, storage, residence time (inflow and outflow rates),
   depth;
- Performance measures attributes of target species and their habitat, such as physical habitat
   conditions, water quality, and distribution, abundance and composition of aquatic invertebrates, fish
   and birds; and
- Threat indicators contaminants of concern (selenium), mosquitoes, disease outbreaks.
- 37

Goal 1 - Provide aquatic habitat to support fish and wildlife species of	lependent on the Salton Sea
Objectives	Examples of Potential Indicators
1. Provide appropriate foraging habitat for piscivorous birds	Fish species, relative abundance, and size distribution
2. Develop habitats to support piscivorous birds	<ul> <li>Bird utilization (species, numbers) of islands and snags</li> <li>Bird roosting and nesting activiity</li> </ul>
3. Support a sustainable, productive aquatic community	<ul><li>Fish species composition and abundance</li><li>Aquatic invertebrates</li><li>Phytoplankton</li></ul>
4. Provide suitable water quality to sustain productive fish community	<ul> <li>Salinity</li> <li>Dissolved oxygen</li> <li>Temperature</li> <li>Water depth</li> </ul>
5. Minimize adverse effects on desert pupfish	<ul> <li>Pupfish relative abundance and distribution in ponds</li> <li>Pupfish connectivity from drains around the ponds</li> </ul>
6. Minimize impacts from selenium	<ul> <li>Selenium concentrations in water and sediment</li> <li>Selenium concentrations in invertebrates and fish</li> <li>Egg selenium concentrations</li> </ul>
7. Minimize impacts from disease or toxicity	<ul> <li>Bird die-offs - species, number, disease mechanism</li> <li>Fish die-offs</li> <li>Contaminant concentrations in bird eggs</li> </ul>

1

### 2 E.3.2 SCH Monitoring Plan Development

A detailed monitoring plan would be developed once the final SCH Project design was approved. The actions identified in the monitoring plan would be based on the information needed to operate the Project facilities, to evaluate success and threats, and to help resolve remaining uncertainties, as well as available funding and monitoring requirements for compliance.

The SCH monitoring plan would be developed in coordination with broader efforts to plan for restoration of the Salton Sea ecosystem. The Salton Sea Ecosystem Monitoring and Assessment Plan (MAP) is being developed by the California Department of Water Resources (DWR), California Department of Fish and Game (DFG), Bureau of Reclamation, and United States Geological Survey (USGS in preparation). The MAP will provide a blueprint for quantitative evaluation of ecosystem restoration activities and will serve as a cornerstone for scientific studies that will help guide efforts to restore the Salton Sea. The SCH monitoring plan protocols would be consistent with the MAP.

14 Design and implementation of SCH monitoring would also be coordinated with ongoing and proposed 15 survey and monitoring efforts at the Salton Sea to share and build on available data. This coordination would be especially valuable for evaluating SCH performance relative to other reference sites and for 16 17 understanding regional patterns of physical and biological change. Examples of past and ongoing studies include biological surveys by DFG, monitoring at the Sonny Bono Salton Sea National Wildlife Refuge 18 19 by the United States Fish and Wildlife Service, water quality monitoring by the Bureau of Reclamation, 20 studies of water quality and biota in agricultural drains and rivers by USGS, bird surveys by the Natural History Museum of Los Angeles County, surveys for the Imperial Irrigation District's Habitat 21

1 Conservation Plan/Natural Community Conservation Plan, and studies of selenium and other

contaminants by university researchers (University of California Riverside, San Diego State University,
 University of California Berkeley).

### 4 E.3.3 Elements of Monitoring Plan

5 The SCH monitoring plan would include several monitoring elements, modeled on the MAP framework. Each monitoring element would include a description of the purpose and justification for the monitoring 6 7 activity, location(s), time period(s) and frequency of monitoring, protocol(s) for data collection, a 8 description of the data to be collected and the anticipated use of the data, proposed quality assurance 9 measures, reporting, and an overview of similar monitoring activities and opportunities for integration. 10 The frequency of data collection and evaluation would be guided by the purpose of monitoring. For 11 example, operational triggers such as water supply flow rates would be measured daily or weekly, while status of target resources would be monitored seasonally or annually. A detailed monitoring protocol 12 would be developed prior to initiating monitoring activities in the field. This protocol would include a 13 14 description of the measures that would be taken to ensure the quality of the data collected and how those 15 measures would be implemented. The data quality assurance measures may include, but would not be 16 limited to, procedures for calibrating or ensuring the accuracy of any instruments (e.g., GPS) employed in the field, procedures for recording and transferring electronic data, methods for ensuring proper operation 17 18 of field equipment during surveys, and methods for avoiding double counting or insufficient coverage of 19 survey areas.

- 20 Key monitoring elements would include the following:
- Physical Habitat flow rate, depth, wetted area, islands, snags, submerged vegetation, and other
   habitat elements;
- Water Quality salinity, temperature, dissolved oxygen, nutrients;
- Aquatic Biota algae, plankton, invertebrates, fish community (species, distribution, abundance),
   desert pupfish;
- Birds species, abundance and distribution, use of habitat features, breeding and nesting, sick or dead birds; and
- Contaminants selenium concentrations in water, sediment, bird eggs, and other biota (invertebrates, fish).

### 30 E.4 Data Management and Assessment

31 Data collected, stored, or made accessible from the data management system would be available to the 32 SCH Project team for the application of statistical and other analytical techniques. Data assessment would 33 be used to foster the integration, consolidation, and review of data, updating of conceptual models, 34 answering of key questions, reporting, and providing management recommendations. Consistent review 35 and assessment of the data would be needed to assure that performance objectives are being met and that 36 funding for data collection is effectively utilized. In addition to program-level data assessment and 37 analysis, data assessment should take place at the individual monitoring activity level through regular 38 evaluation and assessment of data collected over time. This individual monitoring would help ensure data 39 quality and usefulness relative to meeting monitoring objectives.

40 Each year that surveys are conducted, an annual report would be generated that summarizes the data 41 collected during that year and updates prior reports in a cumulative fashion. A synthesis report would be 1 prepared at the end of the 10-year proof-of-concept period with final recommendations for long-term

2 SCH management.

3 Data, analyses, and publications developed from this monitoring plan would be organized, stored, and 4 made publicly accessible through a common distributed data management system, in coordination with 5 the broader Salton Sea MAP efforts. Common protocols would be developed and applied when possible, 6 and all geospatial data would include full metadata and would be compliant with the Federal Geographic 7 Data Committee (FGDC) standards. DFG would establish and maintain the data management system. The 8 data collected as part of the Salton Sea restoration program would be stored in DFG's Biogeographic 9 Information and Observation System (BIOS) map viewer and all documentation including metadata 10 would be accessible to the public via metadata clearinghouses and DFG's document library.

### 11 E.5 Decision-Making Process

To track progress in meeting SCH Project objectives, the scientists and managers responsible for the Project would regularly synthesize and analyze the monitoring data and evaluate the status and trends in target resources through the use of monitoring data. An overall review would be conducted annually to evaluate Project performance. A decision-making framework would be established to provide recommendations to SCH managers for maintaining or adjusting operations.

The managers of the SCH Project, DFG and DWR, must have the capacity to change practices in response to what is learned over time. Governance for adaptive management should provide a decisionmaking structure that fosters communication between scientists and decision makers, and has clear lines of authority where timely decisions are made and implemented. Governance for implementing adaptive management must provide for the institutional capacity to interact, learn, and adapt. The decision-making structure would be developed in further detail with the monitoring plan prior to operation of the SCH ponds.

In accordance with the adaptive management framework, the assessment and analysis of data are anticipated to lead to periodic adjustments in management of the SCH ponds and updates in the operations and monitoring plans, especially during the 10-year initial implementation phase. The monitoring plan is envisioned to be a living document and would need to remain flexible to respond effectively to unanticipated events.

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APPENDIX F

# **Mosquito Control Plan**

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	Арр	oendix F
Mosquito	Control	Plan

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### 4 **F.1** Introduction

5 This plan addresses monitoring mosquito populations, the surveillance of mosquito-borne pathogens that cause diseases in human and wildlife, and the implementation of a treatment program to control 6 7 mosquitoes at the Species Conservation Habitat (SCH) ponds and sedimentation basins at the outflows of 8 the Alamo River or New River into the Salton Sea. The plan addresses human health concerns and is 9 modeled after the Mosquito Monitoring Program for the Sonny Bono Salton Sea National Wildlife 10 Refuge, Calipatria, California (United States Fish and Wildlife Service [USFWS] 2005). Monitoring activities would be used to locate mosquito life stages (larvae, pupae, and adults), estimate their 11 abundance and determine species composition for the purpose of making treatment decisions. Disease 12 13 surveillance would be used to detect the presence of mosquito-borne disease as part of a state-wide program. Mosquito treatments would be used to reduce the abundance of mosquito populations and 14 associated mosquito-borne disease risk. Vector population and pathogen monitoring are fundamental 15 16 components of any mosquito management program and are necessary for making informed decisions related to cost-effective mosquito management. 17

Mosquitoes are considered an annoyance because of their biting, and many species are known vectors of pathogens that cause serious diseases in California. Of the mosquito-borne viruses known to occur in California, western equine encephalomyelitis virus (WEE), St. Louis encephalitis virus (SLE), and West Nile virus (WN) have caused significant outbreaks of human disease (California Department of Public Health [CDPH] 2009, 2011). WEE and WN have been detected in adult mosquito samples from the Sonny Bono Salton Sea National Wildlife Refuge, which is adjacent to the SCH ponds and sedimentation basin associated with the Alamo River.

25 WEE tends to be most serious in very young children, whereas elderly people are most at risk from SLE 26 and WN (CDPH 2009). Both WEE and WN can cause serious diseases in horses and emus, and WN kills 27 a wide variety of endemic and imported birds. Birds are the primary reservoirs of the viruses and differ 28 among species in the amplification of viruses within the bloodstream and susceptibility to the viruses. 29 Humans and horses are dead-end hosts for the viruses; although the effects of a virus infection can be severe, titers of the virus in the bloodstream are insufficient to reinfect the mosquito vectors. With the 30 31 exception of available vaccines to protect horses against WEE and WN, there are no known specific treatments or cures for diseases caused by these viruses (CDPH 2009). At the present time, mosquito 32 control is the only practical method of protecting the people of California from mosquito-borne diseases. 33

The mosquito species potentially utilizing the SCH habitats as developmental sites for the immature stages of the mosquito life cycle include *Culex erythrothorax*, *Cx. tarsalis* and *Aedes vexans*. *Culex tarsalis* is the primary vector of WEE, SLE and WN in rural settings of California (CDPH 2009). *Cx. erythrothorax* and *Aedes vexans* may also contribute to disease transmission (Goddard et al. 2002). These mosquito species are targeted for monitoring and treatment. The proposed habitats are located in Imperial Valley adjacent to the Salton Sea at the outflows of the New River and Alamo River. Within 30 miles of the SCH are the communities of Niland<sup>1</sup> (population 1,329), Calipatria (population 7,623), Westmorland (population 1,620), Brawley (population 22,438), Imperial (population 12,162) and El Centro (39,902); and another 10,000 people live in the unincorporated region. Surrounding land use includes farming, recreational camping and hunting, and geothermal power generation.

### 7 F.1.1 <u>Mosquito Control Methods</u>

Larval mosquito control has three key components: environmental management, biological control, and chemical control (Knight et al. 2003; CDPH 2008, 2011). Environmental management includes the measures that decrease habitat availability or suitability for immature mosquitoes. Environmental management includes the design and management practices applicable to the SCH Project and may also include water-level management; environmental alterations that reduce standing water through evaporation, percolation, recirculation, or drainage; and vegetation management.

14 Biological control uses natural predators, parasites, or pathogens to reduce immature mosquito numbers. No efficacious biological control agents are available for adult mosquitoes. Incorporation and 15 management practices to enhance populations of mosquito-eating fish and naturally occurring insect 16 predators can be important adjunct Integrated Vector Management (IVM) measures that significantly 17 reduce mosquito production. While the mosquitofish, Gambusia affinis, is the most widely used 18 biological control agent in California, many of the native fish species merit consideration as biological 19 20 control agents for mosquitoes. The fish fauna in the agricultural drains and other aquatic habitats surrounding the Salton Sea include several small, introduced and native fish species (Saiki et al. 2010), 21 22 including the desert pupfish (Cyprinodon macularius), that consume immature mosquitoes (Walters and Legner 1980; Walton 2007). One goal of the SCH Project is to include fish in the food web of the habitat 23 24 ponds. An ancillary benefit of managing the habitat to support healthy fish populations is the planktivorous life stages and species are likely to assist mosquito control where mosquito larvae occur in 25 the ponds or in other component habitats. 26

Chemical control for the aquatic stages of the mosquito life cycle includes non-persistent biological 27 agents. The non-persistent biological agents include microbial control agents, such as Bacillus 28 29 thuringiensis subsp. israelensis (Bti) and Bacillus sphaericus, and insect growth regulators (IGRs), such as methoprene. The Bacillus produce protein precursors during sporulation that, following ingestion by 30 31 the mosquito larva, disrupt the integrity of mosquito digestive tract and interfere with the ability of the 32 larva to osmoregulate. In California, the microbial agents are used most frequently to reduce populations 33 of mosquito larvae. The IGR mimics an insect-specific hormone that prevents immature mosquitoes from 34 developing into adults. Other control agents include chemicals (e.g., monomolecular surface films, lightgrade oils) that alter the surface tension of the water drowning the immature stages of mosquitoes and 35 insecticidal chemicals. These surface-tension agents are used rarely but are used against pupae which do 36 not feed and consequently do not ingest the microbial agents. Organophosphate pesticides such as 37 temephos are rarely used in California to control the immature stages of mosquitoes because of their 38 39 potential impact on nontarget organisms and the environment.

### 40 **F.2** Monitoring

41 It is expected that the SCH ponds would not be conducive to mosquito production because the 42 configuration of the ponds includes a large proportion of the surface area with open water at a depth > 243 feet. Open water should reduce the survival of immature mosquitoes because of disturbance and drowning

<sup>&</sup>lt;sup>1</sup> Populations are based on the 2005-2009 American Community Survey 5-Year Estimates (United States [U.S.] Census Bureau 2011).

caused by wind-driven waves and high susceptibility to predators. The SCH ponds at the high end of the range of operational salinities are predicted to be too salty for significant mosquito production and colonization by wetland plants. If mosquito production occurs in the SCH ponds, it is likely to be limited to the shallow zones of the upslope periphery of the pond and maybe the berms, if aquatic vegetation and/or inundated grasses (i.e., *Distichlis*) colonize the shallow water and berms. The width of this area may be only 3 feet to 6 feet (1 to 2 meters) which represents only 0.6-1.1 percent of the surface area of a 100-acre pond. If vegetation is found along the periphery of the sedimentation pond, then monitoring for

8 larval mosquito populations would occur at natural openings in vegetation.

9 The ponds could be managed at a salinity ranging from 20 parts per thousand (ppt) to 40 ppt, which 10 would reduce the potential for vegetation to grow in the ponds because the higher salinities exceed the 11 tolerances of most freshwater macrophytes. Salinities at the lower end of the management range, 12 however, may not limit macrophyte colonization. Vegetation management in the low salinity ponds may 13 be required to reduce or eliminate conditions conducive to mosquito production.

14 The primary mosquito vector of encephalitis viruses in the Imperial Valley, *Culex tarsalis*, is capable of surviving and developing to adulthood successfully in salinities up to 70 percent (24.5 ppt) of full-15 strength sea water (Bradley 1987; Garrett and Bradley 1987). While laboratory studies using larvae 16 17 collected from the Central Valley of California indicated that Cx. tarsalis production would be greatly reduced at salinities > 24.5 ppt, Cx. tarsalis larvae have been collected from the periphery of the Salton 18 19 Sea (personal communications, T. J. Bradley 2011; H. Lothrop 2011; and W. K. Resien 2011). The salinity of the Salton Sea at the time these larvae were collected is estimated to have been 39 ppt. The 20 occurrence of larvae of a brackish-water mosquito species (Bradley 1987) of public health importance in 21 22 the Salton Sea raises concern that mosquito production may be possible across the entire range of 23 salinities of the SCH ponds.

Immature (larvae, pupae) mosquito abundance is monitored using dippers. A dipper is a long-handled ladle that collects a 500 ml water sample from pools potentially serving as mosquito sources. The water sample is evaluated for the presence of larval mosquitoes and when mosquito larva are present, 'dipcounts' are used as a measure of immature mosquito abundance. Captured mosquitoes are then identified to species by skilled technicians.

29 Adult mosquitoes are monitored using carbon dioxide-baited traps (CO<sub>2</sub>-baited suction traps). The traps 30 are baited with 1-2 kilograms of dry ice that attracts adult mosquitoes as it sublimates. An electric fan forces the adult mosquitoes into a collection container. Trapped mosquitoes are enumerated, identified 31 32 and processed for mosquito-borne disease detection in a laboratory. Six traps are proposed for deployment adjacent to the SCH habitats. A minimum of three traps (6 traps total) should be deployed at 33 34 each group of SCH ponds at the outflows of the New River or the Alamo River, depending on the selected alternative. Traps should be placed at the western and eastern ends of each of SCH pond systems and at a 35 site approximately equidistant between the traps on the east-west transect. Alternative placement of the 36 traps could be carried out after operation of the SCH ponds begins if better trapping sites become evident. 37 38 At least one CDC style CO<sub>2</sub>-baited trap should be deployed at each sedimentation basin. More than one 39 trap per each component would increase the reliability of the numbers for adult mosquito population monitoring and provide a collection if one of the traps were to fail on a particular night. Labor and time 40 41 constraints, as well as funds budgeted for monitoring, would determine the extent of sampling.

42 Monitoring for immature and adult mosquito populations would occur from April through October. 43 Monitoring activities may occur at any time during the day. Mosquito monitoring crews may require one 44 half to one full day to conduct monitoring activities and the frequency would depend on mosquito activity 45 which is in turn dependent on environmental conditions such as temperature. Monitoring frequency may 46 range from twice per month to once every week.

### **F.3** Treatment

Treatment of larval mosquito populations would be focused on larvae occurring in vegetated wetland habitats that may develop along the periphery of the SCH ponds and the sedimentation basins. Only those areas where monitoring has shown that larval average dip counts for *Culex* have reached or exceeded one larva per dip would be targeted for treatment. However, specific areas treated and the extent of treatment would vary from year to year depending on mosquito populations and environmental conditions.

Larval thresholds may be reached or exceeded at any point during the monitoring season from April through October, thereby resulting in treatment. Larval treatments may occur anytime during the daylight hours. The frequency of larval treatments would depend on larvicide persistence, rate of post-treatment mosquito recovery, and species specific seasonal development. Larval treatment frequency may range

11 from once per seven days to once per month.

12 The larvicides proposed to be used are Vectolex CG and Vectobac 12AS. Vectobac CG contains the active ingredient Bacillus sphaericus. Vectobac 12AS contains the active ingredient Bacillus 13 thuringiensis subsp. israelensis (Bti). B. sphaericus and Bti are naturally occurring anaerobic spore 14 15 forming bacteria mass produced using modern fermentation technology. Formulated B. sphaericus and Bti 16 products contain bacterial spores and protein endotoxins. The endotoxin is activated in the alkaline midgut of susceptible insect species with subsequent binding to protein-specific receptors resulting in a 17 lethal response (Lacev and Mulla 1990; Walton et al. 1998; Knight et al. 2003). Therefore, these products 18 19 must be ingested by the target insect to be effective. Mosquito pupae and adults are not affected because they do not ingest the product. 20

Vectolex CG is a granular formulation consisting of 7.5 percent active ingredient. It would be applied at a rate of 5.0 to 20.0 pounds of formulated product per acre. Vectobac 12AS is a liquid formulation with 1.2 percent active ingredient. It would be applied at a rate of 0.25-1 pt/acre. Either product may be applied as a spot treatment to small areas or broadcast over larger areas by ground and/or aerial (fixed wing or helicopter) equipment. Ground-based equipment includes gas powered broadcasters affixed to a backpack, an all-terrain vehicle, or truck. The application would be done by the County Public Health Department or their contractor.

Treatment of adult mosquitoes would be initiated only if larval treatments failed to prevent adult mosquito populations from reaching and/or exceeding 25 adult *Culex* in any single trap or 5 adult *Culex* per trap in one night. Treatment may occur in riparian and upland habitats near or adjacent to the SCH Project, but not directly over the water. The specific areas treated and the extent of treatment would vary from year to year depending on mosquito populations and environmental conditions. Adulticide treatments have the potential to drift beyond the targeted treatment area.

Treatment thresholds should reflect changes in mosquito-borne disease threats. The California Mosquitoborne Virus Surveillance and Response Plan (CDPH 2009) provides a semi-quantitative measure of virus transmission risk to humans that can be used by local vector control agencies to plan and modulate control activities. This plan can be used to develop management and vector control activities at the SCH Project site. Table G-1 provides a response matrix that is a function of the mosquito-borne disease health threat.

Adult thresholds may be reached or exceeded at any point during the monitoring season from April through October, thereby resulting in treatment. Adult mosquito treatments would occur during early morning or evening hours. The frequency of adult mosquito treatments would depend on the rate of post treatment recovery and species specific seasonal development. Adult mosquito treatment frequency may range from once per five days to once per month. 1 The proposed adulticide is Pyrenone 25-5. Pyrenone 25-5 consists of 5 percent natural pyrethins and 25 2 percent piperonyl butoxide. Natural pyrethrins are extracted from chrysanthemum plants and consist of a 3 mixture of pyrethrin-I, pyrethrin-II, cinerin I and II, and jasmolin I and II (Extension Toxicology Network 4 1996). The natural pyrethrins are non-systemic contact poisons which quickly penetrate the insect nervous system causing paralysis and subsequent death (Extension Toxicology Network 1996; Tomlin 1997). A 5 few minutes after application, the insect cannot move or fly away. However, the pyrethrins are swiftly 6 7 detoxified by enzymes in the insect and thus, exposed insects can recover. To delay the enzyme action so 8 a lethal dose is assured, commercial products are formulated with the synergist piperonyl butoxide (PBO)

9 to inhibit detoxification (Tomlin 1997).

### 10 **Table F-1 Mosquito-Borne Disease Health Threat and Response Matrix**

Current Conditions		Threat Level	Response
Health Threat Category <sup>1</sup>	SCH Mosquito Populations <sup>2</sup>		
No documented existing or historical health threat/emergency	No action threshold	1	Remove/manage artificial mosquito breeding sites such as tires, tanks, or similar debris/containers.
Documented historical health threat/emergency	Below action threshold	2	Response as in threat level 1, plus: allow compatible monitoring and disease surveillance. Consider compatible nonpesticide management options to reduce mosquito production.
	Above action threshold	3	Response as in threat level 2, plus: allow site-specific compatible larviciding of infested areas as determined by monitoring.
Documented existing health threat. Disease found in sentinels (chicken), equines, wildlife, mosquitoes or	Below action threshold	4	Response as in threat level 2, plus: increase monitoring and disease surveillance.
humans.	Above action threshold	5	Response as in threat levels 3 and 4, plus: allow compatible site-specific larviciding, or adulticiding of infested areas as determined by monitoring.
Officially determined existing health emergency	Below action threshold	6	Maximize monitoring and disease surveillance.
	Above action threshold	7	Response as in threat level 6, plus: allow site-specific larviciding, and adulticiding of infested areas as determined by monitoring.

1. Health threat/emergency as determined by Federal and/or State/local public health authorities with jurisdiction inclusive of SCH boundaries and/or neighboring public health authorities.

2. Action thresholds represent mosquito population levels that may require intervention measures. Thresholds would be developed in collaboration with State/local public health authorities and vector control districts.

11

12 Pyrenone 25-5 is a liquid formulation that would be applied using a rate of 0.0025 pounds active

13 ingredient per acre. Treatments would be made using ultra-low volume (ULV) sprays that incorporate

small amounts of the active ingredient as very fine droplets (10-30 micrometers in diameter). This small

droplet size allows the spray to drift for a relatively longer period of time compared to larger droplets, and the small size delivers an appropriate dose of the pesticide to kill an adult mosquito. Drift is a necessary component of adulticiding because these sprays are most effective on flying insects. For this reason, adulticide applications generally occur in the evening or early morning hours when the majority of mosquito species are most active. Adulticides may be applied by truck-mounted sprayers or applied aerially by helicopter or fixed-wing aircraft. Pyrenone 25-5 will not be applied directly over water. The application would be done by the County Public Health Department or their contractor.

### 8 F.4 Availability of Resources

9 Significant service staff resources may be needed for environmental compliance responsibilities. The 10 agency/agencies responsible for the mosquito-related activities has/have yet to be determined. A vector control agency/consultant/staff would be responsible for coordination and monitoring and control through 11 the California Department of Fish and Game contact person. In order to monitor vector control activities, 12 it is estimated that 5 percent of a full-time employee would be required. Monitoring would involve 13 determining effects of treatments on wildlife and the presence of nesting birds and coordinating 14 permitting, documentation, and recordkeeping with the agency/agencies responsible for vector control 15 activities. 16

At present, funding has not been set aside by the State for source reduction and vector control. Physical removal of vegetation would be addressed on a case-by-case basis by the pond management agencies. Mosquito production is predicted to be low from the SCH ponds and sedimentation basins. Nevertheless, if vegetation management is needed, then this contingency should be planned for, including defining action thresholds and identifying a source of funding.

### 22 **F.5** Anticipated Impacts of Use

### 23 F.5.1 Monitoring

Impacts on wildlife resources resulting from monitoring activities are expected to be negligible because of the limited scale of these activities. Some disturbance related to accessing the monitoring sites is expected to occur. Adult traps would be located adjacent to the SCH ponds and sedimentation basins. Dipping for immature mosquitoes would occur on the edges of the habitats that are expected to be generally devoid of vegetative cover.

### 29 **F.5.2** <u>Treatment</u>

30 Several mosquito control products are highly specific to nematoceran dipterans (i.e., mosquitoes and related flies), have no or minimal impact on non-target organisms, and are safe for wildlife and humans 31 32 (Ali 1981; Boisvert and Boisvert 2000). Because mosquitoes are more susceptible to the non-persistent 33 biological agents than are related flies such as midges (chironomids), there is a large margin of safety against potential negative food web effects provided EPA-approved application rates are followed. The 34 35 non-persistent biological agents include microbial control agents, such as Bti and B. sphaericus. The Bacillus produce protein precursors during sporulation that, following ingestion by the mosquito larva, 36 37 disrupt the integrity of mosquito digestive tract and interfere with the ability of the larva to osmoregulate.

*Bacillus sphaericus* has slight to practically no acute mammalian toxicity, practically no acute avian toxicity, slight to practically no acute fish toxicity, and slight aquatic invertebrate toxicity (USFWS 1984; Florida Coordinating Council on Mosquito Control 1998). Spores and toxins become suspended in the water column and retain insecticidal activity in water with high organic matter content and suspended solids. The toxicity data available indicate a high degree of specificity of *B. sphaericus* for mosquitoes, with no demonstrated toxicity to chironomid larvae at any mosquito control application rate (Lacey and 1 Mulla 1990). Therefore, risks to sensitive wildlife resources resulting from direct exposure to a single *B*. 2 *sphaericus* application and indirect food chain effects are expected to be negligible.

Bti has practically no acute or chronic toxicity to mammals, birds, fish, or vascular plants (U.S. 3 Environmental Protection Agency [USEPA] 1998). Extensive acute toxicity studies indicated that Bti is 4 5 virtually innocuous to mammals (Siegel and Shadduck 1990). These studies exposed a variety of 6 mammalian species to *Bti* at moderate to high doses and no pathological symptoms, disease, or mortality were observed. Laboratory acute toxicity studies indicated that the active ingredient of *Bti* formulated 7 products is not acutely toxic to fish, amphibians or crustacaceans (Garcia et al. 1980; Lee and Scott 1989; 8 9 Wipfli et al. 1994; Brown et al. 2000, 2002). Other ingredients such as xylene in early formulations of Bti products were suspected to be potentially toxic (Fortin et al. 1986; Wipfli et al. 1994). Field studies 10 11 however indicated no acute toxicity to several fish species exposed to *Bti* (Merritt et al. 1989; Jackson et 12 al. 2002); no detectable adverse effects on breeding redwing black birds using and nesting in *Bti* treated areas (Hanowski 1997; Niemi et al. 1999); and no detectable adverse effects to tadpole shrimp 48 hours 13 14 post Bti treatment (Dritz et al. 2001). Therefore, risks to sensitive wildlife resources resulting from direct exposure to a single *Bti* application are expected to be negligible. 15

16 Bti activity against target and susceptible nontarget invertebrates is also related to Bti persistence and environmental fate (Dupont and Boisvert 1986; Mulla 1990). Simulated field studies resulted in the 17 suppression of two unicellular algae species, *Closterium* sp. and *Chlorella* sp., resulting in secondary 18 19 effects on turbidity and dissolved oxygen of aquatic habitats, with potential trophic effects (Su and Mulla 1999). For these reasons, Bti effects on target and susceptible nontarget organisms, and potential indirect 20 trophic impacts in the field are difficult to predict. However, single applications to limited areas are not 21 22 expected to cause significant food chain effects. The ability for a population to recolonize a wetland 23 following multiple larvicide treatments would depend on the intensity and frequency of applications at 24 different spatial scales.

Pyrethrin has moderate to high acute mammalian toxicity, practically no acute avian toxicity, extreme fish 25 26 toxicity, and high aquatic invertebrate toxicity (USFWS 1984; USEPA 2011). The USEPA uses the Risk Quotient method to estimate potential hazard to nontarget organisms. Risk quotients (ROs) are calculated 27 by dividing acute and chronic exposure estimates by ecotoxicity values for various wildlife species. ROs 28 29 are then compared to levels of concern (LOCs). Risk characterization provides information on the 30 likelihood of an adverse effect occurring by considering the fate of the chemical in the environment, 31 communities and species potentially at risk, their spatial and temporal distributions, and the nature of the 32 effects observed in studies. Davis et al. (2007) found that all risk quotients for nontargets (small mammals, birds, as well as aquatic vertebrates and invertebrates in a pond subject to receiving the 33 34 chemical via drift and runoff) exposed to ULV-applied adulticides were low indicating that risks to ecological receptors most likely were small. Field bioassays supported a risk assessment using actual 35 36 environmental concentrations indicating that a single ULV application of synergized (with PBO) or unsynergized permethrin is unlikely to result in population impacts on medium- to large-bodied insects 37 38 (Schleier and Peterson 2010). Long-term studies over two years indicated that multiple permethrin applications did not cause a reduction in terrestrial arthropods (Davis and Peterson 2008). Schleier et al. 39 (2008) found that risk quotients for aquatic species in California wildlife refuges were 0.002 or less at 1 h 40 41 after application, which did not exceed the USEPA risk quotient level of concern for endangered aquatic organisms of 0.05. These findings suggest that the amounts of pyrethrins and PBO deposited on the 42 ground and in water after aerial ULV insecticide applications are lower than those estimated by previous 43 44 exposure and risk assessments (Schleier et al. 2008).

### 1 F.5.3 <u>Threatened and Endangered Species</u>

2 Permanent vegetated wetlands in the region provide habitat for the endangered Yuma clapper rail. Desert pupfish (Cyprinodon macularius) occasionally are found in some of the agricultural drains connected to 3 4 the Salton Sea as well as in the Salton Sea. The Sonny Bono Salton Sea National Wildlife Refuge Plan 5 does not permit adulticide applications directly over any wetland. Some drift would probably occur; 6 however, minimal negative impacts to rails and desert pupfish from drift are expected. A study of the 7 impacts of pyrethrin on aquatic invertebrates in wetlands on Sutter NWR indicated no decrease in total 8 abundance of invertebrates (Jensen et al. 1999). The predominant food item of Yuma clapper rails is 9 crayfish (*Procambarus clarkii*). It is expected that direct effects of larvicide application in the rails habitat on cravfish would be minimal. Use of bacterial larvicides in desert pupfish habitat is expected to have 10 minimal effects on invertebrate prey used by this species and no direct toxicity effects on the pupfish. 11 Cumulative effects of larviciding and adulticiding on clapper rails and pupfish are difficult to estimate, 12 but it is probable that they would have minimal impact because of the expected short duration of 13 14 applications, the short life time of the treatment agents in the environment and the normal quick response of insects to reinvade habitats. 15

### 16 **F.5.4** <u>Wetlands and Waterfowl</u>

Migratory birds and waterfowl (geese, ducks, and coots, sandhill cranes) may be present year-round but are most abundant in wetlands and ponds from August through March (USFWS 2005). The USFWS (2005) document provides the following information on the predicted effects of mosquito control agents on the wetland found of the Salton Sag radion and their dista

20 on the wetland fauna of the Salton Sea region and their diets.

21 Ducks are known to be opportunistic feeders on both plants and invertebrates, utilizing the most readily 22 available food sources. Invertebrates, plants, and seeds compose the majority of their diet, varying with the season and the geographic location. A study in California's Sacramento Valley has shown that plant 23 24 foods are dominant in fall diets of northern pintails, while invertebrate use increases in February and 25 March (Miller 1987). Seeds of swamp timothy comprise the most important duck food in the summer-dry 26 habitats of the San Joaquin Valley (Miller 1987). At the Kern National Wildlife Refuge, the fall diet of 27 northern pintails and greenwinged teal was composed of over two-thirds seeds (Euliss and Harris 1987). Thus any food chain impacts resulting from larvicide and adulticide treatment would have limited impacts 28 29 to the mainly seed diet of newly arriving ducks. Summer molting waterfowl are not expected to be present 30 in the treatment area. Studies have shown that aquatic invertebrates are a dominant food of nonbreeding 31 waterfowl during the summer molt, and the fall and winter periods (Heitmeyer 1988).

Invertebrates are also critical for egg production during the spring (Swanson et al. 1979), and duckling 32 growth during the summer rearing period (Krapu and Swanson 1977). Mosquitoes and chironomids make 33 an important contribution to invertebrate food resources throughout the year. Other significant food 34 35 resource contributors of the invertebrate community are Coleoptera, Odonata, and Trichoptera. However, 36 during fall flood-up of seasonal wetlands and peak mosquito populations, ducks tend to feed on seed and other plant material. Waterfowl in general tend to feed on seeds when they reach their wintering areas, 37 38 perhaps to regain energy lost during long flights (Heitmeyer 1988; Miller 1987). Thus any food chain 39 impacts resulting from larvicide and adulticide treatment would have limited impacts to the mainly seed diet of newly arriving ducks. Their diets shift to invertebrates before treatments are expected to 40 41 temporarily, but substantially reduce available invertebrate food resources. Furthermore, mosquito treatments in the spring are not expected to result in limited invertebrate food resources because of the 42 limited frequency and area of treatment in the spring. 43

#### F.5.5 **Other Migratory Birds** 1

2 Shorebirds, egrets, herons, as well as some gull and tern species feed in seasonal wetlands near the SCH 3 ponds. Shorebirds feed on a wide variety of invertebrates all year, feeding which intensifies at the onset of 4 spring migration. Field studies indicated no acute toxicity to several fish species exposed to Bti (Merritt et 5 al. 1989; Jackson et al. 2002); no detectable adverse effects to breeding redwing blackbirds using and nesting in *Bti*-treated areas (Niemi et al. 1999; Hanowski 1997); and no detectable adverse effects on 6 tadpole shrimp 48 hours post Bti treatment (Dritz et al. 2001). Therefore risks to other sensitive wildlife 7 8 resources resulting from direct exposure to a single larvicide application are expected to be negligible.

9 Risk to shorebirds, egrets, herons, gulls and terns resulting from direct exposure to pyrethrins at rates used for mosquito control is expected to be negligible. Adulticide treatments are not anticipated to result in 10 11 limited invertebrate food resources because of the limited area of treatment.

#### F.5.6 Other Wildlife 12

In an extensive literature review on the effects of Bti on mammals, Siegel and Shadduck (1990) found the 13 bacterium innocuous. A variety of mammals were exposed to Bti at moderate to high doses and observed 14 15 no pathological symptoms, disease or mortality. Continued use of Bti and B. sphaericus at moderate control rates are likely to have a negligible effect on mammal species on the refuge. Pyrethrin is also 16

likely to have a negligible effect on mammals. 17

18 The actual toxicity of *Bacillus* and/or pyrethrin to amphibians and reptiles subject to direct treatment is less clear. In general, however, actual toxicity of *Bacillus* and pyrethrin to nontarget amphibians or 19 20 reptiles is expected to be minimal. The target specificity of B. sphaericus and Bti for only mosquitoes 21 should prove harmless to amphibians and reptiles and to their food supply.

22 Fish are not susceptible to toxic effects of *Bti* or *B. sphaericus*. Fish can be severely affected by pyrethrins 23 when subjected to direct application. The little amount of pyrethrin that makes contact on the aquatic 24 substrate would be immediately diluted to insignificant amounts. Also, adsorption by abundant organic 25 matter in the target wetland would likely occur, reducing the potential for negative impacts to mosquitofish and other fish. Jensen et al. (1999) detected no mortality to mosquitofish from pyrethrin 26 27 applications to seasonal wetlands on Sacramento NWR Complex.

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APPENDIX G

# Air Quality/Greenhouse Gases Documentation

APPENDIX G-1

## Imperial County Air Pollution Control District, Regulation VIII, Fugitive Dust Control Measures

**REGULATION VIII - FUGITIVE DUST CONTROL MEASURES (Most recently** adopted) – All construction sites, regardless of size, must comply with the requirements contained within Regulation VIII. Although compliance with Regulation VIII does not constitute mitigation under the reductions attributed to environmental impacts its main purpose is to reduce the amount of  $PM_{10}$  entrained into the atmosphere as a result of anthropogenic (man-made) fugitive dust sources. Therefore, under all preliminary modeling a presumption is made that all projects are in compliance with Regulation VIII.

### Standard Mitigation Measures for Fugitive PM<sub>10</sub> Control

- a. All disturbed areas, including Bulk Material storage which is not being actively utilized, shall be effectively stabilized and visible emissions shall be limited to no greater than 20% opacity for dust emissions by using water, chemical stabilizers, dust suppressants, tarps or other suitable material such as vegetative ground cover.
- b. All on site and off site unpaved roads will be effectively stabilized and visible emissions shall be limited to no greater than 20% opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.
- c. All unpaved traffic areas one (1) acre or more with 75 or more average vehicle trips per day will be effectively stabilized and visible emission shall be limited to no greater than 20% opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.
- d. The transport of Bulk Materials shall be completely covered unless six inches of freeboard space from the top of the container is maintained with no spillage and loss of Bulk Material. In addition, the cargo compartment of all Haul Trucks is to be cleaned and/or washed at delivery site after removal of Bulk Material.
- e. All Track-Out or Carry-Out will be cleaned at the end of each workday or immediately when mud or dirt extends a cumulative distance of 50 linear feet or more onto a paved road within an Urban area.
- f. Movement of Bulk Material handling or transfer shall be stabilized prior to handling or at points of transfer with application of sufficient water, chemical stabilizers or by sheltering or enclosing the operation and transfer line.
- g. The construction of any new Unpaved Road is prohibited within any area with a population of 500 or more unless the road meets the definition of a Temporary Unpaved Road. Any temporary unpaved road shall be effectively stabilized and visible emissions shall be limited to no greater than 20% opacity for dust emission by paving, chemical stabilizers, dust suppressants and/or watering.

In order to provide a greater degree of  $PM_{10}$  reductions, above that required by Regulation VIII, the ICAPCD recommends the following:

### **Discretionary Mitigation Measures for Fugitive PM<sub>10</sub> Control**

- a. Water exposed soil with adequate frequency for continued moist soil.
- b. Replace ground cover in disturbed areas as quickly as possible
- c. Automatic sprinkler system installed on all soil piles
- d. Vehicle speed for all construction vehicles shall not exceed 15 mph on any unpaved surface at the construction site.
- e. Develop a trip reduction plan to achieve a 1.5 AVR for construction employees
- f. Implement a shuttle service to and from retail services and food establishments during lunch hours

Although the preceding discussion of construction impacts and mitigation measures are primarily focused on PM<sub>10</sub> emissions from fugitive dust sources, Lead Agencies should also seek to reduce emissions from construction equipment exhaust. Because of the availability of new control devices, required in the manufacturing of PM oxidation catalysts and NOx absorbers, substantial reductions in PM and NOx emissions from diesel engines is achievable. These new retrofit kits and in some cases new original equipment require the use of ultra low sulfur diesel in order to be effective.

### Standard Mitigation Measures for Construction Combustion Equipment

- a. Use of alternative fueled or catalyst equipped diesel construction equipment, including all off-road and portable diesel powered equipment.
- b. Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes as a maximum.
- c. Limit, to the extent feasible, the hours of operation of heavy duty equipment and/or the amount of equipment in use
- d. Replace fossil fueled equipment with electrically driven equivalents (provided they are not run via a portable generator set)

To help provide a greater degree of reduction of PM emissions from construction combustion equipment the ICAPCD recommends the following enhanced measures.

### Enhanced Mitigation Measures for Construction Equipment

- Curtail construction during periods of high ambient pollutant concentrations; this a. may include ceasing of construction activity during the peak hour of vehicular traffic on adjacent roadways
- Implement activity management (e.g. rescheduling activities to reduce short-term b. impacts)

#### 7.2 **Standard Mitigation Measures for Project Operations**

These standard air quality mitigation measures have been separated according to land use and mitigation type.

According to Table 1, Tier I, projects generating less than 55 lbs/day of NOx or ROG; less than 150 lbs/day of PM<sub>10</sub> or SOX; or less than 550 lbs/day of CO than 55 Ibs/day, the Initial Study should require implementation of all the Standard Mitigation Measures in order to help mitigate or reduce the air quality impact to a level of insignificance. However, simple implementation of the mitigation measures does not guarantee that the project will be insignificant. The insignificance must be determined by the results of the Initial Study.

According to Table 1, Tier II, projects generating 55 lbs/day or greater of NOx or ROG; 150 lbs/day or greater of PM<sub>10</sub> or SOX; or 550 lbs/day or greater of CO, the EIR or Comprehensive Air Quality Analysis Report should select and implement all feasible and practicable measures from the discretionary list, in addition to the Standard Mitigation Measures.

### **RESIDENTIAL PROJECTS**

Standard mitigation measures for residential projects include the following site design and energy efficiency standards:

### Standard Site Design Measures

- Link cul-de-sacs and dead-end streets to encourage pedestrian and bicycle a. travel:
- b. Allocate easements or land dedications for bikeways and pedestrian walkways;
- Provide continuous sidewalks separated from the roadway by landscaping and C. on-street parking. Adequate lighting for sidewalks must be provided, along with crosswalks at intersections:

d. Bicycle storage at apartment complexes or condos without garages.

### Standard Energy Efficiency Measures

a. Measures which meet mandatory, prescriptive and/or performance measures as required by Title 24.

### COMMERCIAL PROJECTS

Standard mitigation measures for commercial projects include the following site design and energy efficiency standards:

### Standard Site Design Measures

- a. Provide on-site bicycle lockers and/or racks;
- b. Provide on-site eating, refrigeration and food vending facilities to reduce lunchtime trips;
- c. Provide shower and locker facilities to encourage employees to bike and/or walk to work;
- d. Provide for paving a minimum of 100 feet from the property line for commercial driveways that access County paved roads as per County Standard Commercial Driveway Detail 410B (formerly SW-131A).

### Standard Energy Efficiency Measures

a. Measures which meet mandatory, prescriptive and/or performance measures as required by Title 24.

### 7.3 Discretionary Mitigation Measures

The discretionary mitigation measures listed in this section have been separated according to land use and mitigation type. It is important to note that the measures identified here do not represent a comprehensive list of all mitigation measures possible. Project proponents are encouraged to propose other alternatives that are capable of providing the same level of mitigation.

### **RESIDENTIAL PROJECTS**

### **Discretionary Site Design Measures**

- a. If the project is located on an established transit route, improve public transit accessibility by providing transit turnouts with direct pedestrian access to project.
- b. For bus service within a <sup>1</sup>/<sub>4</sub> mile of the project provide bus stop improvements such as shelters, route information, benches and lighting.
- c. Increase street tree planting.
- d. Outdoor electrical outlets to encourage the use of electric appliances and tools.
- e. Provide bikeway lanes and/or link new comparable bikeway lanes to already existing lanes.
- f. Increase the number of bicycle routes/lanes.
- g. Provide pedestrian signalization and signage to improve pedestrian safety.
- h. Synchronize traffic lights on streets impacted by development

### **Discretionary Energy Efficiency Measures**

- a. Use roof material with a solar reflectance value meeting the EPA/DEO Energy Star® rating to reduce summer cooling needs.
- b. Use high efficiency gas or solar water heaters.
- c. Use built-in energy efficient appliances.
- d. Use double-paned windows.
- e. Use low energy street lighting (i.e. sodium).
- f. Use energy efficient interior lighting.
- g. Use low energy traffic signals (i.e. light emitting diode).
- h. Install door sweeps and weather stripping if more efficient doors and windows are not available.

### **COMMERCIAL PROJECTS**

### **Discretionary Site Design Measures**

- a. Increase street tree planting
- b. Shade tree planting in parking lots to reduce evaporative emissions from parked vehicles.
- c. Increase number of bicycle routes/lanes.
- d. If the project is located on an established transit route, improve public transit accessibility by providing transit turnouts with direct pedestrian access to protect or improve transit stop amenities.
- e. For bus service within a <sup>1</sup>/<sub>4</sub> mile of the project provide bus stop improvements such as shelters, route information, benches and lighting
- f. Implement on-site circulation design elements in parking lots to reduce vehicle queuing and improve the pedestrian environment.
- g. Provide pedestrian signalization and signage to improve pedestrian safety.
- h. Synchronize traffic lights on streets impacted by development

### Discretionary Energy Efficiency Measures

- a. Use roof material with a solar reflectance value meeting the EPA/DOE Energy Star® rating to reduce summer cooling needs.
- b. Use built-in energy efficient appliances, where applicable.
- c. Use double-paned windows.
- d. Use low energy parking lot and street lights (i.e. sodium).
- e. Use energy efficient interior lighting.
- f. Use low energy traffic signals (i.e. light emitting diode).
- g. Install door sweeps and weather stripping if more efficient doors and windows are not available.
- h. Install high efficiency gas/electric space heating.
### **INDUSTRIAL PROJECTS**

- a. Implement carpool/vanpool programs and incentives (i.e. carpool ride matching for employees, assistance with vanpool formation, provision of vanpool vehicles, etc.)
- b. Provide for shuttle/mini bus service such as to establish a shuttle service from residential care areas to the worksite.
- c. Provide preferential carpool and vanpool parking
- d. Construct transit facilities such as bus turnouts/bus bulbs, benches, shelters, etc if the project is located on an established transit route.
- e. Design and locate buildings to facilitate transit access (i.e., locate building entrances near transit stops, eliminate building setbacks, etc.)
- f. Provide incentives to employees to take public transportation, walk, bike, etc.
- g. Provide pedestrian signalization and signage to improve pedestrian safety.
- h. Implement on-site circulation design elements in parking lots to reduce vehicle queing and improve the pedestrian environment.
- i. Provide on-site bicycle and motorcycle parking. Such as providing weatherprotected bicycle parking for employees.
- j. Provide safe, direct access for bicyclists to adjacent bicycle routes.
- k. Provide shower and locker facilities to encourage employees to bike and/or walk to work typically, one shower and three lockers for every 25 employees.
- I. Provide on-site eating, refrigeration and food vending facilities to reduce lunchtime trips.
- m. Increase street tree planting
- n. Measures which meet mandatory, prescriptive and/or performance measures as required by Title 24.
- o. Use low emission fleet vehicles such as TLEV, ULEV, LEV, ZEV
- p. Install an electrical vehicle charging station with both conductive and inductive charging capabilities.
- q. Use built-in energy efficient appliances, where applicable.

- r. Use double-paned windows
- s. Use low energy parking lot and street lights
- t. Use energy efficient interior lighting

## 7.4 Off-site Mitigation

#### **Off-site mitigation for Commercial and Residential Developments:**

Off-site mitigation measures are designed to offset emissions from residential and commercial projects that cannot be fully mitigated with on-site measures. Typically, off-site reductions can occur as a result from either stationary or mobile sources. For example, NOx emissions from increased vehicle trips from a residential development could be reduced by funding the expansion of existing transit services. Rule 310, Operational Development Schedule Fee has been adopted by the ICAPCD as a sound method for mitigating the emissions produced from the operations of new development projects throughout the County of Imperial. All project proponents have the option of either providing off-site mitigation or paying an Operational Development Fee. The evaluation process in providing this fee is found within the applicability and administrative requirements of Rule 310

#### **Off-site mitigation for Industrial Projects:**

Because industrial development projects are by their very nature much more complex, the evaluation of the air impacts resulting from an industrial development is addressed at two levels: that of the environmental review process and that of the ICAPCD permitting review process. The ICAPCD permitting review process addresses mitigation of air emissions from the Stationary source. Therefore, the ICAPCD has adopted the guidance policy #5 to help Lead Agencies and interested parties in the evaluation of off-site mitigation from mobile sources attracted to the stationary sources.

APPENDIX G-2

# Air Quality/Greenhouse Gas Emissions Calculations

## Apdx G - Emissions Summary Tables G-1 & G-2

			Project A	Iternative		
Onroad Vehicle Type	1	2	3	4	5	6
	gallons	gallons	gallons	gallons	gallons	gallons
California Ultra-Low Sulfur Diesel Fuel	562,000	465,000	644,000	329,000	296,000	384,000
Source: USEPA 2011 (1996)	-					-

			Project A	lternative		
Onroad Vehicle Type	1	2	3	4	5	6
	trips	trips	trips	trips	trips	trips
Tractor Trailer (heavy heavy duty) - Local	6,450	5,520	7,920	2,100	2,000	2,16
Tractor Trailer (heavy heavy duty) - Import	190	130	150	160	100	13
Water Truck (medium duty)	470	470	470	470	470	47
Pickup/SUV (light duty)	6,540	5,340	7,740	4,140	3,740	4,94
Source: Applicant		-	-			
Notes:						
For Tractor Trailer, local is construction-related	trips					
For Tractor Trailer, import is bringing in equipme	ent from other a	areas in state (S	SD, LA, SF, SA	C)		
Applicant real number data converted to up-rou	nded integer va	lues to avoid u	ndercounts			

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#### Apdx G - Schedule Table G-3

Table G-3 Estimated Equipment and Vehicle	Schedule for Propos	sed Project Alt	ernatives										
Phase or Activity	Equipmer	nt and Vehicles	;	Т	wo-Year C	onstructio	n Schedule	;		Annual Ma	aintenance	Schedule	
Thase of Activity	Туре	Category	BHP	quantity	days	hrs/day	trips/day	mi/trip	quantity	days/yr	hrs/day	trips/day	mi/trip
ALTERNATIVE 1 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		50	43		3	50	1	37		2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		17	11		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	3	325	8			1	28	8		
Low ground pressure haulers	Dump Truck	offroad	300	12	261	8			1	18	8		
Tracked excavator	Excavator	offroad	200	3	375	8			1	35	8		
Low ground pressure dozer	Dozer	offroad	125	2	233	8			1	5	8		
Small motor grader	Grader	offroad	140	1	25	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	3	265	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	20	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	24	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		3	470		0.33	65					
Equipment Operator	Pickup/SUV	onroad LD		36	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 2 - New River		1 1		1						1			
Haul equipment and materials to site	Tractor Trailer	onroad HHD		40	46		3	50	1	34	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		11	12		1	280				-	
Agricultural tractor with carrvall scrapers	Tractor Scraper	offroad	400	.1	264	8		200	1	27	8		
Low ground pressure haulers	Dump Truck	offroad	300	10	265	8			1	19	8		
Tracked excavator	Excavator	offroad	200	3	200	8			1	38	8		
	Dozer	offroad	125	2	163	8			1	6	8		
Small motor grader	Grader	offroad	1/0		28	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	2	20	8			1	25	0		
Hydraulic Drodgo, 16 inch boat mounted	Other Industrial	offroad	1000		203	20			-				
		offreed	250	1	91	20							
Medium backbas loader	Crarie Rig	offroad	300	1	21	0			1	11	0		
	Tasatas	officated	100	1	200	0			1	11	0		
Agricultural tractor with mower		offroad	1/5		470		4	10	1	3	ð		10
Fugitive dust control	Vvater Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65		005			05
Equipment Operator	Pickup/SUV	onroad LD		27	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 3 - New River	<b>-</b> . <b>-</b> .	<b>.</b> [						- 4					- 1
Haul equipment and materials to site	Tractor Trailer	onroad HHD		60	44		3	50	1	45	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		14	11		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	4	265	8			1	28	8		
Low ground pressure haulers	Dump Truck	offroad	300	14	267	8			1	19	8		
Tracked excavator	Excavator	offroad	200	4	291	8			1	44	8		
Low ground pressure dozer	Dozer	offroad	125	3	146	8			1	6	8		
Small motor grader	Grader	offroad	140	1	34	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	4	264	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	28	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		3	470		0.33	65					
Equipment Operator	Pickup/SUV	onroad LD		45	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 4 - Alamo River	• · ·	· I											
Haul equipment and materials to site	Tractor Trailer	onroad HHD		20	35		3	50	1	20	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		18	.9		1	280				-	
Agricultural tractor with carrvall scrapers	Tractor Scraper	offroad	400	.3	307	8		200	1	26	8		
Low ground pressure haulers	Dump Truck	offroad	300	7	260	8			1	18	8		
Tracked excavator	Excavator	offroad	200	2	309	8			1	26	8		
l ow ground pressure dozer	Dozer	offroad	125	2	156	5 و			1	5	ں ع		
Small motor grader	Grader	offroad	140	1	1/	ں و			1	5 25	ں ع		
Barge with crane and clampholl bucket	Crane	offroad	500	1	206	0				20	0		
Darge with crane and clamshell bucket		uniudu	200	1	290	Q							

#### Apdx G - Schedule Table G-3

Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	6	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65					
Equipment Operator	Pickup/SUV	onroad LD		18	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 5 - Alamo River	· ·												
Haul equipment and materials to site	Tractor Trailer	onroad HHD		18	37		3	50	1	20	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		10	10		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	2	258	8			1	26	8		
Low ground pressure haulers	Dump Truck	offroad	300	7	250	8			1	18	8		
Tracked excavator	Excavator	offroad	200	2	220	8			1	27	8		
Low ground pressure dozer	Dozer	offroad	125	2	102	8			1	5	8		
Small motor grader	Grader	offroad	140	1	19	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	1	253	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	7	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD		1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65					
Equipment Operator	Pickup/SUV	onroad LD		15	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					
ALTERNATIVE 6 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		24	30		3	50	1	26	8	2	50
Import equipment from other areas	Tractor Trailer	onroad HHD		16	8		1	280					
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	3	222	8			1	27	8		
Low ground pressure haulers	Dump Truck	offroad	300	10	239	8			1	18	8		
Tracked excavator	Excavator	offroad	200	2	284	8			1	29	8		
Low ground pressure dozer	Dozer	offroad	125	2	133	8			1	5	8		
Small motor grader	Grader	offroad	140	1	22	8			1	25	8		
Barge with crane and clamshell bucket	Crane	offroad	500	2	249	8							
Hydraulic Dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	1	91	20							
Truck with crane for installed pilings	Crane Rig	offroad	350	1	21	8							
Medium backhoe loader	Backhoe	offroad	100	1	200	8			1	13	8		
Agricultural tractor with mower	Tractor	offroad	175						1	3	8		
Fugitive dust control	Water Truck	onroad HHD	-	1	470		1	10	1	25		1	10
Manager	Pickup/SUV	onroad LD		2	470		0.50	65	1	235		1	65
Foreman	Pickup/SUV	onroad LD		2	470		0.50	65					
Equipment Operator	Pickup/SUV	onroad LD		24	400		0.33	65	1	235		1	65
Laborers	Pickup/SUV	onroad LD		6	400		0.33	65					

Source: Applicant

Notes:

LD = light duty, MD = medium duty, HHD = heavy heavy duty, BHP = brake horsepower

Overall project life expected to be 2 years, 47 weeks/year average to account for holidays, vacations, weather, illness, etc.

For 235 work days in a year, managers and foremen commute 2 or 3 per vehicle, all other workers commute 3 per vehicle, 65 miles per round trip average (New River or Alamo River).

Short Trip: Hauling gravel and riprap rock into the project site from nearby quarries; assume 50 miles per round trip.

Long Trip: Hauling construction equipment and facility materials to the project site from major distribution centers, such as San Diego; assume 280 miles round trip.

Daily equipment operating hours assume typical average utilization over the life of the project to allow for staging, breaks, lunch, maintenance, repairs, etc.

#### Apdx G - Activity Table G-4

ble G-4 Estimated Equipment and Vehicle Activity for Proposed Project Alternatives													
Phase or Activity	Equipmer	nt and Vehicles		Const	. Daily	Const	. Total	Maint.	Daily	Maint.	Total	Total Trip	Counts
Filase of Activity	Туре	Category	BHP	hrs	VMT	hrs	VMT	hrs	VMT	hrs	VMT	Const.	Maint.
ALTERNATIVE 1 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			7,500		322,500		100		3,700	6,450	74
Import equipment from other areas	Tractor Trailer	onroad HHD			4,760		52,360		-		-	187	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	24		7,800		8		224			
Low ground pressure haulers	Dump Truck	offroad	300	96		25,056		8		144			
Tracked excavator	Excavator	offroad	200	24		9,000		8		280			
Low ground pressure dozer	Dozer	offroad	125	16		3,728		8		40			
Small motor grader	Grader	offroad	140	8		200		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	24		6,360		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		160		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		192			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			780		312,000		65		15,275	4,800	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 2 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			6,000		276,000		100		3,400	5,520	68
Import equipment from other areas	Tractor Trailer	onroad HHD			3,080		36,960		-		-	132	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	24		6,336		8		216			
Low ground pressure haulers	Dump Truck	offroad	300	80		21,200		8		152			
Tracked excavator	Excavator	offroad	200	24		6,984		8		304			
Low ground pressure dozer	Dozer	offroad	125	16		2,608		8		48			
Small motor grader	Grader	offroad	140	8		224		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	16		4,304		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,880		8		88			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			585		234,000		65		15,275	3,600	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 3 - New River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			9,000		396,000	72	100		4,500	7,920	72
Import equipment from other areas	Tractor Trailer	onroad HHD			3,920		43,120		-		-	154	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	32		8,480		8		224			
Low ground pressure haulers	Dump Truck	offroad	300	112		29,904		8		152			

#### Apdx G - Activity Table G-4

Tracked excavator	Excavator	offroad	200	32		9,312		8		352			
Low ground pressure dozer	Dozer	offroad	125	24		3,504		8		48			
Small motor grader	Grader	offroad	140	8		272		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	32		8,448		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		224			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			975		390,000		65		15,275	6,000	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 4 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			3,000		105,000		100		2,000	2,100	40
Import equipment from other areas	Tractor Trailer	onroad HHD			5,040		45,360		-		-	162	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	16		4,912		8		208			
Low ground pressure haulers	Dump Truck	offroad	300	56		14,560		8		144			
Tracked excavator	Excavator	offroad	200	16		4,944		8		208			
Low ground pressure dozer	Dozer	offroad	125	16		2,496		8		40			
Small motor grader	Grader	offroad	140	8		112		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	8		2,368		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		48			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	25
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	235
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			390		156,000		65		15,275	2,400	235
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 5 - Alamo River													
Haul equipment and materials to site	Tractor Trailer	onroad HHD			2,700		99,900	98	100		2,000	1,998	98
Import equipment from other areas	Tractor Trailer	onroad HHD			2,800		28,000		-		-	100	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	16		4,128		8		208			
Low ground pressure haulers	Dump Truck	offroad	300	56		14,000		8		144			
Tracked excavator	Excavator	offroad	200	16		3,520		8		216			
Low ground pressure dozer	Dozer	offroad	125	16		1,632		8		40			
Small motor grader	Grader	offroad	140	8		152		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	8		2,024		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		56			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			

#### Apdx G - Activity Table G-4

Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	10
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	64
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			325		130,000		65		15,275	2,000	64
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
ALTERNATIVE 6 - Alamo River	-	-	-		-		<u>.</u>		<u>.</u>				
Haul equipment and materials to site	Tractor Trailer	onroad HHD			3,600		108,000	98	100		2,600	2,160	98
Import equipment from other areas	Tractor Trailer	onroad HHD			4,480		35,840		-		-	128	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	24		5,328		8		216			
Low ground pressure haulers	Dump Truck	offroad	300	80		19,120		8		144			
Tracked excavator	Excavator	offroad	200	16		4,544		8		232			
Low ground pressure dozer	Dozer	offroad	125	16		2,128		8		40			
Small motor grader	Grader	offroad	140	8		176		8		200			
Barge with crane and clamshell bucket	Crane	offroad	500	16		3,984		-		-			
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	20		1,820		-		-			
Truck with crane for installed pilings	Crane Rig	offroad	350	8		168		-		-			
Medium backhoe loader	Backhoe	offroad	100	8		1,600		8		104			
Agricultural tractor with mower	Tractor	offroad	175	-		-		8		24			
Fugitive dust control	Water Truck	onroad HHD			10		4,700		10		250	470	10
Manager	Pickup/SUV	onroad LD			65		30,550		65		15,275	470	64
Foreman	Pickup/SUV	onroad LD			65		30,550		-		-	470	-
Equipment Operator	Pickup/SUV	onroad LD			520		208,000		65		15,275	3,200	64
Laborers	Pickup/SUV	onroad LD			130		52,000		-		-	800	-
Trip Count Totals													
	Tractor Trailer (loc)	onroad HHD										6,450	74
	Tractor Trailer (imp)	onroad HHD										187	-
	Water Truck	onroad HHD										470	25
	Pickup/SUV	onroad LD										6,540	470
	Tractor Trailer (loc)	onroad HHD										5,520	68
	Tractor Trailer (imp)	onroad HHD										132	-
	Water Truck	onroad HHD										470	25
	Pickup/SUV	onroad LD										5,340	470
	Tractor Trailer (loc)	onroad HHD										7,920	72
AL TERNATIVE 3	Tractor Trailer (imp)	onroad HHD										154	-
	Water Truck	onroad HHD										470	25
	Pickup/SUV	onroad LD										7,740	470
	Tractor Trailer (loc)	onroad HHD										2,100	40
	Tractor Trailer (imp)	onroad HHD										162	-
	Water Truck	onroad HHD										470	25
	Pickup/SUV	onroad LD										4,140	470
	Tractor Trailer (loc)	onroad HHD										1,998	98
	Tractor Trailer (imp)	onroad HHD										100	-
ALTERNATIVE 3	Water Truck	onroad HHD										470	10
	Pickup/SUV	onroad LD										3,740	128

	Tractor Trailer (loc)	onroad HHD		2,160	98
	Tractor Trailer (imp)	onroad HHD		128	-
ALTERNATIVE 0	Water Truck	onroad HHD		470	10
	Pickup/SUV	onroad LD		4,940	128
Source: Applicant					
Notes:					
LD = light duty, MD = medium duty, HHD = heav	y heavy duty, BHP = I	orake horsepow	er		
Overall project life expected to be 2 years, 47 we	eks/year average to a	account for holic	ays, vacations, weather, illness, etc.		
For 235 work days in a year, managers and fore	men commute 2 or 3 p	per vehicle, all c	ther workers commute 3 per vehicle, 65 miles per round trip average (New River or Alamo River).		
Short Trip: Hauling gravel and riprap rock into the	e project site from nea	arby quarries; a	sume 50 miles per round trip.		
Long Trip: Hauling construction equipment and fa	acility materials to the	project site fror	n major distribution centers, such as San Diego; assume 280 miles round trip.		
Daily equipment operating hours assume typical	average utilization ov	er the life of the	project to allow for staging, breaks, lunch, maintenance, repairs, etc.		

## Apdx G - Factors Table G-5

able G-5 Emission Factors for Proposed Project Alternatives													
Phase or Activity	Equipme	ent and Vehicle	s	VOC	CO	NO <sub>X</sub>	SOx	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH₄	N <sub>2</sub> 0	CO <sub>2</sub> eqv
Thuse of Activity	Туре	Category	BHP	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit	lbs/unit
ALTERNATIVE 1													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 2	•												
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 3	•	·		• • • • •							<b>L</b>		

## Apdx G - Factors Table G-5

Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 4													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 5													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895

#### Apdx G - Factors Table G-5

Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
ALTERNATIVE 6	-												
Haul equipment and materials to site	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Import equipment from other areas	Tractor Trailer	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	400	0.28128	0.98313	2.51652	0.00284	0.09758	0.08977	276.64526	0.02538	0.01128	280.67495
Low ground pressure haulers	Dump Truck	offroad	300	0.15537	0.43417	1.34715	0.00203	0.04566	0.04201	187.70309	0.01402	0.00623	189.92895
Tracked excavator	Excavator	offroad	200	0.12195	0.56261	0.97411	0.00144	0.04656	0.04284	127.70865	0.01100	0.00489	129.45575
Low ground pressure dozer	Dozer	offroad	125	0.13278	0.50931	0.81266	0.00083	0.06805	0.06261	70.84486	0.01198	0.00532	72.74703
Small motor grader	Grader	offroad	140	0.13313	0.60498	0.89885	0.00107	0.06596	0.06068	92.76728	0.01201	0.00534	94.67452
Barge with crane and clamshell bucket	Crane	offroad	500	0.15509	0.52921	1.42304	0.00177	0.05183	0.04769	180.10128	0.01399	0.00622	182.32308
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1000	0.52457	1.67930	6.00668	0.00563	0.18046	0.16602	559.60311	0.04733	0.02104	567.11825
Truck with crane for installed pilings	Crane Rig	offroad	350	0.12445	0.38855	1.16607	0.00146	0.04179	0.03845	139.33583	0.01123	0.00499	141.11880
Medium backhoe loader	Backhoe	offroad	100	0.07512	0.34343	0.40872	0.00055	0.03416	0.03143	45.61918	0.00678	0.00301	46.69540
Agricultural tractor with mower	Tractor	offroad	175	0.20452	0.83349	1.53367	0.00147	0.08711	0.08014	130.41728	0.01845	0.00820	133.34733
Fugitive dust control	Water Truck	onroad HHD		0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784
Manager	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Foreman	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Equipment Operator	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Laborers	Pickup/SUV	onroad LD		0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Sources: SCAQMD 2008; USEPA 2011	-	-	-	-			-						

Notes:

SCAQMD emission factors for 2013 Offroad diesel exhaust PM<sub>2.5</sub> = 92% of PM<sub>10</sub> per EMFAC 2007 version 2.3 Offroad N<sub>2</sub>O per Annex 3, Table A-101 Non-matching application-specific values interpolated or extrapolated USEPA GWPs for CO<sub>2</sub> eqv (1, 21, 310)

## Apdx G - Daily Emissions

Table G-6

able G-6 Daily Emissions for Proposed Project Alternatives														
Phase or Activity	Equipment and	d Vehicles	Maximu	ım Daily	VOC	CO	NOx	SOx	<b>PM</b> 10	PM <sub>2.5</sub>	CO <sub>2</sub>	CH₄	N <sub>2</sub> 0	CO₂ eqv
	Туре	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		7,500	16.97	69.88	205.72	0.31	10.03	8.60	31,614	0.78	0.74	31,859
Import equipment from other areas	Tractor Trailer	onroad HHD		4,760	10.77	44.35	130.56	0.19	6.36	5.46	20,064	0.50	0.47	20,220
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	24		6.75	23.60	60.40	0.07	2.34	2.15	6,639	0.61	0.27	6,736
Low ground pressure haulers	Dump Truck	offroad	96		14.92	41.68	129.33	0.20	4.38	4.03	18,019	1.35	0.60	18,233
Tracked excavator	Excavator	offroad	24		2.93	13.50	23.38	0.03	1.12	1.03	3,065	0.26	0.12	3,107
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	24		3.72	12.70	34.15	0.04	1.24	1.14	4,322	0.34	0.15	4,376
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		780	0.58	5.53	0.56	0.01	0.07	0.05	859	0.05	0.02	866
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 2														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		6,000	13.58	55.91	164.58	0.25	8.02	6.88	25,291	0.63	0.59	25,487
Import equipment from other areas	Tractor Trailer	onroad HHD		3,080	6.97	28.70	84.48	0.13	4.12	3.53	12,983	0.32	0.30	13,083
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	24		6.75	23.60	60.40	0.07	2.34	2.15	6,639	0.61	0.27	6,736
Low ground pressure haulers	Dump Truck	offroad	80		12.43	34.73	107.77	0.16	3.65	3.36	15,016	1.12	0.50	15,194
Tracked excavator	Excavator	offroad	24		2.93	13.50	23.38	0.03	1.12	1.03	3,065	0.26	0.12	3,107
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	16		2.48	8.47	22.77	0.03	0.83	0.76	2,882	0.22	0.10	2,917
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		585	0.44	4.15	0.42	0.01	0.05	0.03	644	0.04	0.02	650
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 3														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		9,000	20.37	83.86	246.86	0.37	12.03	10.32	37,937	0.94	0.88	38,231
Import equipment from other areas	Tractor Trailer	onroad HHD		3,920	8.87	36.53	107.52	0.16	5.24	4.49	16,524	0.41	0.39	16,652
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	32		9.00	31.46	80.53	0.09	3.12	2.87	8,853	0.81	0.36	8,982

## Apdx G - Daily Emissions

Table G-6

Low ground pressure haulers	Dump Truck	offroad	112		17.40	48.63	150.88	0.23	5.11	4.70	21,023	1.57	0.70	21,272
Tracked excavator	Excavator	offroad	32		3.90	18.00	31.17	0.05	1.49	1.37	4,087	0.35	0.16	4,143
Low ground pressure dozer	Dozer	offroad	24		3.19	12.22	19.50	0.02	1.63	1.50	1,700	0.29	0.13	1,746
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	32		4.96	16.93	45.54	0.06	1.66	1.53	5,763	0.45	0.20	5,834
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		975	0.73	6.91	0.69	0.01	0.09	0.06	1,073	0.07	0.03	1,083
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 4	-													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,000	6.79	27.95	82.29	0.12	4.01	3.44	12,646	0.31	0.29	12,744
Import equipment from other areas	Tractor Trailer	onroad HHD		5,040	11.41	46.96	138.24	0.21	6.74	5.78	21,245	0.53	0.50	21,409
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	16		4.50	15.73	40.26	0.05	1.56	1.44	4,426	0.41	0.18	4,491
Low ground pressure haulers	Dump Truck	offroad	56		8.70	24.31	75.44	0.11	2.56	2.35	10,511	0.79	0.35	10,636
Tracked excavator	Excavator	offroad	16		1.95	9.00	15.59	0.02	0.74	0.69	2,043	0.18	0.08	2,071
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	8		1.24	4.23	11.38	0.01	0.41	0.38	1,441	0.11	0.05	1,459
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		390	0.29	2.77	0.28	0.00	0.04	0.02	429	0.03	0.01	433
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 5														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		2,700	6.11	25.16	74.06	0.11	3.61	3.09	11,381	0.28	0.27	11,469
Import equipment from other areas	Tractor Trailer	onroad HHD		2,800	6.34	26.09	76.80	0.11	3.74	3.21	11,803	0.29	0.28	11,894
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	16		4.50	15.73	40.26	0.05	1.56	1.44	4,426	0.41	0.18	4,491
Low ground pressure haulers	Dump Truck	offroad	56		8.70	24.31	75.44	0.11	2.56	2.35	10,511	0.79	0.35	10,636
Tracked excavator	Excavator	offroad	16		1.95	9.00	15.59	0.02	0.74	0.69	2,043	0.18	0.08	2,071
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	8		1.24	4.23	11.38	0.01	0.41	0.38	1,441	0.11	0.05	1,459
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129

## Apdx G - Daily Emissions

Table G-6

Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		325	0.24	2.30	0.23	0.00	0.03	0.02	358	0.02	0.01	361
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
ALTERNATIVE 6														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,600	8.15	33.54	98.75	0.15	4.81	4.13	15,175	0.38	0.35	15,292
Import equipment from other areas	Tractor Trailer	onroad HHD		4,480	10.14	41.74	122.88	0.18	5.99	5.14	18,884	0.47	0.44	19,030
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	24		6.75	23.60	60.40	0.07	2.34	2.15	6,639	0.61	0.27	6,736
Low ground pressure haulers	Dump Truck	offroad	80		12.43	34.73	107.77	0.16	3.65	3.36	15,016	1.12	0.50	15,194
Tracked excavator	Excavator	offroad	16		1.95	9.00	15.59	0.02	0.74	0.69	2,043	0.18	0.08	2,071
Low ground pressure dozer	Dozer	offroad	16		2.12	8.15	13.00	0.01	1.09	1.00	1,134	0.19	0.09	1,164
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	16		2.48	8.47	22.77	0.03	0.83	0.76	2,882	0.22	0.10	2,917
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	20		10.49	33.59	120.13	0.11	3.61	3.32	11,192	0.95	0.42	11,342
Truck with crane for installed pilings	Crane Rig	offroad	8		1.00	3.11	9.33	0.01	0.33	0.31	1,115	0.09	0.04	1,129
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Equipment Operator	Pickup/SUV	onroad LD		520	0.39	3.69	0.37	0.01	0.05	0.03	572	0.03	0.01	578
Laborers	Pickup/SUV	onroad LD		130	0.10	0.92	0.09	0.00	0.01	0.01	143	0.01	0.00	144
Maximum Daily Construction Emission	s													
A	LTERNATIVE 1, LB	S			17.8	77.4	206.7	0.3	10.1	8.7	32,801	1.4	0.8	33,056
A	LTERNATIVE 2, LB	S			14.2	62.0	165.5	0.3	8.1	6.9	26,264	1.2	0.6	26,468
A	LTERNATIVE 3, LB	S			21.3	92.7	248.0	0.4	12.2	10.4	39,338	1.7	0.9	39,645
A	LTERNATIVE 4, LB	S			11.0	38.3	120.9	0.1	4.1	3.5	13,403	1.0	0.4	13,508
A	LTERNATIVE 5, LB	S			11.0	37.8	120.8	0.1	3.7	3.4	12,067	1.0	0.4	12,161
A	LTERNATIVE 6, LB	S			13.0	40.4	121.0	0.2	4.9	4.2	16,076	1.2	0.5	16,201
Sources: SCAQMD 2008; USEPA 2011														

#### Notes:

SCAQMD emission factors for 2013

Offroad diesel exhaust  $PM_{2.5}$  = 92% of  $PM_{10}$  per EMFAC 2007 version 2.3

Offroad N<sub>2</sub>O per Annex 3, Table A-101

Non-matching application-specific values interpolated or extrapolated

USEPA GWPs for CO<sub>2</sub> eqv (1, 21, 310)

Special Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)

Apdx G - Total

Table G-7 Total Emissions for Proposed	<b>Project Alternatives</b>	5												
Bhase or Activity	Equipment and	d Vehicles	Projec	t Total	VOC	CO	NOx	SOx	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH₄	N <sub>2</sub> 0	CO₂ eqv
Phase of Activity	Туре	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		322,500	730	3,005	8,846	13	431	370	13,4359,397		32	1,369,929
Import equipment from other areas	Tractor Trailer	onroad HHD		52,360	118	488	1,436	2	70	60	220,707	5	5	222,417
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	7,800		2,194	7,668	19,629	22	761	700	21,91857,833		88	2,189,265
Low ground pressure haulers	Dump Truck	offroad	25,056		3,893	10,879	33,754	51	1,144	1,053	43,57103,089		156	4,758,860
Tracked excavator	Excavator	offroad	9,000		1,098	5,063	8,767	13	419	386	19,9149,378		44	1,165,102
Low ground pressure dozer	Dozer	offroad	3,728		495	1,899	3,030	3	254	233	264,110	45	20	271,201
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	6,360		986	3,366	9,051	11	330	303	18,9145,444		40	1,159,575
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	18,6018,478		38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	160		20	62	187	0	7	6	22,294	2	1	22,579
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		312,000	233	2,213	222	3	28	18	343,473	21	8	346,539
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 2	• · ·	<u> </u>	J			<u>I</u>					J	J		
Haul equipment and materials to site	Tractor Trailer	onroad HHD		276,000	625	2,572	7,571	11	369	316	12,9163,391		27	1,172,405
Import equipment from other areas	Tractor Trailer	onroad HHD		36,960	84	344	1,014	2	49	42	155,793	4	4	157,000
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	6,336		1,782	6,229	15,945	18	618	569	11,67152,824		71	1,778,356
Low ground pressure haulers	Dump Truck	offroad	21,200		3,294	9,204	28,560	43	968	891	32,99779,306		132	4,026,494
Tracked excavator	Excavator	offroad	6,984		852	3,929	6,803	10	325	299	891,917	77	34	904,119
Low ground pressure dozer	Dozer	offroad	2,608		346	1,328	2,119	2	177	163	184,763	31	14	189,724
Small motor grader	Grader	offroad	224		30	136	201	0	15	14	20,780	3	1	21,207
Barge with crane and clamshell bucket	Crane	offroad	4,304		667	2,278	6,125	8	223	205	775,156	60	27	784,719
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	18,6018,478		38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,880		141	646	768	1	64	59	85,764	13	6	87,787
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		234,000	174	1,660	167	3	21	14	257,605	16	6	259,904
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 3	-													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		396,000	896	3,690	10,862	16	529	454	14,1669,213		39	1,682,146
Import equipment from other areas	Tractor Trailer	onroad HHD		43,120	98	402	1,183	2	58	49	181,759	5	4	183,167
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8,480		2,385	8,337	21,340	24	827	761	22,13545,952		96	2,380,124
Low ground pressure haulers	Dump Truck	offroad	29,904		4,646	12,983	40,285	61	1,365	1,256	54,16913,073		186	5,679,635
Tracked excavator	Excavator	offroad	9 312		1 136	5 239	9 071	13	434	399	1101289223		46	1 205 492

Apux G - Total	Apdx	G	- '	Total
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Table G-7 Total Emissions for Proposed	Project Alternatives	5												
Phase or Activity	Equipment and	d Vehicles	Projec	t Total	VOC	CO	NOx	SOx	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH₄	N <sub>2</sub> 0	CO₂ eqv
	Туре	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Low ground pressure dozer	Dozer	offroad	3,504		465	1,785	2,848	3	238	219	248,240	42	19	254,906
Small motor grader	Grader	offroad	272		36	165	244	0	18	17	25,233	3	1	25,751
Barge with crane and clamshell bucket	Crane	offroad	8,448		1,310	4,471	12,022	15	438	403	11,15821,496		53	1,540,265
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	18,6018,478		38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		390,000	291	2,766	278	4	35	23	429,341	26	11	433,174
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 4	-													
Haul equipment and materials to site	Tractor Trailer	onroad HHD		105,000	238	978	2,880	4	140	120	442,594	11	10	446,024
Import equipment from other areas	Tractor Trailer	onroad HHD		45,360	103	423	1,244	2	61	52	191,201	5	4	192,682
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	4,912		1,382	4,829	12,361	14	479	441	11,23558,882		55	1,378,675
Low ground pressure haulers	Dump Truck	offroad	14,560		2,262	6,321	19,614	30	665	612	22,07432,957		91	2,765,365
Tracked excavator	Excavator	offroad	4,944		603	2,782	4,816	7	230	212	631,392	54	24	640,029
Low ground pressure dozer	Dozer	offroad	2,496		331	1,271	2,028	2	170	156	176,829	30	13	181,577
Small motor grader	Grader	offroad	112		15	68	101	0	7	7	10,390	1	1	10,604
Barge with crane and clamshell bucket	Crane	offroad	2,368		367	1,253	3,370	4	123	113	426,480	33	15	431,741
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	18,6018,478		38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		156,000	116	1,106	111	2	14	9	171,736	10	4	173,270
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 5		•				<u> </u>						<u> </u>		
Haul equipment and materials to site	Tractor Trailer	onroad HHD		99,900	226	931	2,740	4	134	115	421,097	10	10	424,360
Import equipment from other areas	Tractor Trailer	onroad HHD		28,000	63	261	768	1	37	32	118,025	3	3	118,940
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	4,128		1,161	4,058	10,388	12	403	371	11,01541,992		47	1,158,626
Low ground pressure haulers	Dump Truck	offroad	14,000		2,175	6,078	18,860	28	639	588	21,96627,843		87	2,659,005
Tracked excavator	Excavator	offroad	3,520		429	1,980	3,429	5	164	151	449,534	39	17	455,684
Low ground pressure dozer	Dozer	offroad	1,632		217	831	1,326	1	111	102	115,619	20	9	118,723
Small motor grader	Grader	offroad	152		20	92	137	0	10	9	14,101	2	1	14,391
Barge with crane and clamshell bucket	Crane	offroad	2,024		314	1,071	2,880	4	105	97	364,525	28	13	369,022
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	18,6018,478		38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713

#### Apdx G - Total

Table G-7 Total Emissions for Proposed	I Project Alternative	s												
Bhase or Activity	Equipment an	d Vehicles	Projec	t Total	VOC	CO	NOx	SOx	<b>PM</b> 10	PM <sub>2.5</sub>	CO <sub>2</sub>	CH₄	N <sub>2</sub> 0	CO₂ eqv
Phase of Activity	Туре	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		130,000	97	922	93	1	12	8	143,114	9	4	144,391
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
ALTERNATIVE 6														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		108,000	244	1,006	2,962	4	144	124	455,240	11	11	458,767
Import equipment from other areas	Tractor Trailer	onroad HHD		35,840	81	334	983	1	48	41	151,072	4	4	152,243
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	5,328		1,499	5,238	13,408	15	520	478	11,34573,966		60	1,495,436
Low ground pressure haulers	Dump Truck	offroad	19,120		2,971	8,301	25,757	39	873	803	32,65888,883		119	3,631,441
Tracked excavator	Excavator	offroad	4,544		554	2,556	4,426	7	212	195	580,308	50	22	588,247
Low ground pressure dozer	Dozer	offroad	2,128		283	1,084	1,729	2	145	133	150,758	25	11	154,806
Small motor grader	Grader	offroad	176		23	106	158	0	12	11	16,327	2	1	16,663
Barge with crane and clamshell bucket	Crane	offroad	3,984		618	2,108	5,669	7	207	190	717,524	56	25	726,375
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	1,820		955	3,056	10,932	10	328	302	18,6018,478		38	1,032,155
Truck with crane for installed pilings	Crane Rig	offroad	168		21	65	196	0	7	6	23,408	2	1	23,708
Medium backhoe loader	Backhoe	offroad	1,600		120	549	654	1	55	50	72,991	11	5	74,713
Agricultural tractor with mower	Tractor	offroad	-		-	-	-	-	-	-	-	-	-	-
Fugitive dust control	Water Truck	onroad HHD		4,700	11	44	129	0	6	5	19,811	0	0	19,965
Manager	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Foreman	Pickup/SUV	onroad LD		30,550	23	217	22	0	3	2	33,632	2	1	33,932
Equipment Operator	Pickup/SUV	onroad LD		208,000	155	1,475	148	2	19	12	228,982	14	6	231,026
Laborers	Pickup/SUV	onroad LD		52,000	39	369	37	1	5	3	57,245	3	1	57,757
Total Construction Emissions														
A	LTERNATIVE 1, TO	IS			5.5	19.6	48.4	0.07	1.9	1.8	6,310	0.5	0.2	6,388
A	LTERNATIVE 2, TO	IS			4.5	16.1	40.3	0.05	1.6	1.4	5,227	0.4	0.2	5,292
A	LTERNATIVE 3, TO	IS			6.2	22.2	55.1	0.08	2.2	2.0	7,241	0.5	0.3	7,330
A	LTERNATIVE 4, TO	IS			3.3	11.8	29.3	0.04	1.1	1.0	3,701	0.3	0.1	3,748
A	LTERNATIVE 5, TO	IS			2.9	10.4	26.3	0.03	1.0	0.9	3,328	0.3	0.1	3,370
A	LTERNATIVE 6, TO	IS			3.8	13.4	33.6	0.05	1.3	1.2	4,311	0.3	0.2	4,366
Sources: SCAQMD 2008; USEPA 2011														

Notes:

SCAQMD emission factors for 2013 Offroad diesel exhaust  $PM_{2.5}$  = 92% of  $PM_{10}$  per EMFAC 2007 version 2.3 Offroad N<sub>2</sub>O per Annex 3, Table A-101

Non-matching application-specific values interpolated or extrapolated USEPA GWPs for  $CO_2$  eqv (1, 21, 310)

## Apdx G - Daily Maintenance

Table G-8 Daily Maintenance Emissions	s for Proposed Proj	ect Alternatives	;											
Phase or Activity	Equipment an	d Vehicles	Daily	Maint,	VOC	CO	NOx	SOx	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH₄	N <sub>2</sub> 0	CO <sub>2</sub> eqv
Thuse of Adamiy	Туре	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		100	0.23	0.93	2.74	0.00	0.13	0.11	422	0.01	0.01	425
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 2														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		100	0.23	0.93	2.74	0.00	0.13	0.11	422	0.01	0.01	425
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 3														
Haul equipment and materials to site	Tractor Trailer	onroad HHD	72	100	0.16	0.67	1.97	0.00	0.10	0.08	303	0.01	0.01	306
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036

Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 4	-							-						
Haul equipment and materials to site	Tractor Trailer	onroad HHD		100	0.23	0.93	2.74	0.00	0.13	0.11	422	0.01	0.01	425
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 5	-							-						
Haul equipment and materials to site	Tractor Trailer	onroad HHD	98	100	0.22	0.91	2.69	0.00	0.13	0.11	413	0.01	0.01	416
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8		1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72

Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 6a														
Haul equipment and materials to site	Tractor Trailer	onroad HHD	98	100	0.22	0.91	2.69	0.00	0.13	0.11	413	0.01	0.01	416
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	8		2.25	7.87	20.13	0.02	0.78	0.72	2,213	0.20	0.09	2,245
Low ground pressure haulers	Dump Truck	offroad	8	_	1.24	3.47	10.78	0.02	0.37	0.34	1,502	0.11	0.05	1,519
Tracked excavator	Excavator	offroad	8		0.98	4.50	7.79	0.01	0.37	0.34	1,022	0.09	0.04	1,036
Low ground pressure dozer	Dozer	offroad	8		1.06	4.07	6.50	0.01	0.54	0.50	567	0.10	0.04	582
Small motor grader	Grader	offroad	8		1.07	4.84	7.19	0.01	0.53	0.49	742	0.10	0.04	757
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	8		0.60	2.75	3.27	0.00	0.27	0.25	365	0.05	0.02	374
Agricultural tractor with mower	Tractor	offroad	8		1.64	6.67	12.27	0.01	0.70	0.64	1,043	0.15	0.07	1,067
Fugitive dust control	Water Truck	onroad HHD		10	0.02	0.09	0.27	0.00	0.01	0.01	42	0.00	0.00	42
Manager	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		65	0.05	0.46	0.05	0.00	0.01	0.00	72	0.00	0.00	72
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Maximum Daily Maintenance Emission	S													
A	LTERNATIVE 1, LB	s			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432
A	LTERNATIVE 2, LB	s			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432
A	LTERNATIVE 3, LB	S			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432
A	LTERNATIVE 4, LB	s			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432
A	LTERNATIVE 5, LB	s			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432
A	LTERNATIVE 6, LBS	S			2.4	8.9	20.5	0.0	0.8	0.7	2,398	0.2	0.1	2,432
Sources: SCAQMD 2008; USEPA 2011														

#### Notes:

 $\label{eq:scaQMD} \begin{array}{l} \text{SCAQMD emission factors for 2013} \\ \text{Offroad diesel exhaust $PM_{2.5}$ = 92\% of $PM_{10}$ per $EMFAC$ 2007$ version $2.3$ \\ \text{Offroad $N_2O$ per Annex $3$, Table $A$-101} \\ \text{Non-matching application-specific values interpolated or extrapolated} \end{array}$ 

USEPA GWPs for CO<sub>2</sub> eqv (1, 21, 310)

Special Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)

## Apdx G - Annual Maintenance

Table G-9 Annual Maintenance Emissio	ns for Proposed P	roject Alternativ	res											
Phase or Activity	Equipment an	d Vehicles	Annua	Maint,	VOC	CO	NOx	SOx	<b>PM</b> 10	PM <sub>2.5</sub>	CO <sub>2</sub>	CH₄	N <sub>2</sub> 0	CO₂ eqv
Filase of Activity	Туре	Category	hours	VMT	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
ALTERNATIVE 1														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,700	8	34	101	0	5	4	15,596	0	0	15,717
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	224		63	220	564	1	22	20	61,969	6	3	62,871
Low ground pressure haulers	Dump Truck	offroad	144		22	63	194	0	7	6	27,029	2	1	27,350
Tracked excavator	Excavator	offroad	280		34	158	273	0	13	12	35,758	3	1	36,248
Low ground pressure dozer	Dozer	offroad	40		5	20	33	0	3	3	2,834	0	0	2,910
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	192		14	66	78	0	7	6	8,759	1	1	8,966
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 2	• •					<u> </u>						<u> </u>		
Haul equipment and materials to site	Tractor Trailer	onroad HHD		3,400	8	32	93	0	5	4	14,332	0	0	14,443
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	216		61	212	544	1	21	19	59,755	5	2	60,626
Low ground pressure haulers	Dump Truck	offroad	152		24	66	205	0	7	6	28,531	2	1	28,869
Tracked excavator	Excavator	offroad	304		37	171	296	0	14	13	38,823	3	1	39,355
Low ground pressure dozer	Dozer	offroad	48		6	24	39	0	3	3	3,401	1	0	3,492
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	88		7	30	36	0	3	3	4,014	1	0	4,109
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 3	1 ·							<u> </u>						
Haul equipment and materials to site	Tractor Trailer	onroad HHD		4,500	10	42	123	0	6	5	18,968	0	0	19,115
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	224		63	220	564	1	22	20	61,969	6	3	62,871
Low ground pressure haulers	Dump Truck	offroad	152		24	66	205	0	7	6	28,531	2	1	28,869
Tracked excavator	Excavator	offroad	352		43	198	343	1	16	15	44,953	4	2	45,568

	1													
Low ground pressure dozer	Dozer	offroad	48		6	24	39	0	3	3	3,401	1	0	3,492
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	224		17	77	92	0	8	7	10,219	2	1	10,460
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 4	-	-												
Haul equipment and materials to site	Tractor Trailer	onroad HHD		2,000	5	19	55	0	3	2	8,430	0	0	8,496
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	208		59	204	523	1	20	19	57,542	5	2	58,380
Low ground pressure haulers	Dump Truck	offroad	144		22	63	194	0	7	6	27,029	2	1	27,350
Tracked excavator	Excavator	offroad	208		25	117	203	0	10	9	26,563	2	1	26,927
Low ground pressure dozer	Dozer	offroad	40		5	20	33	0	3	3	2,834	0	0	2,910
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	48		4	16	20	0	2	2	2,190	0	0	2,241
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 5	-	-												
Haul equipment and materials to site	Tractor Trailer	onroad HHD		2,000	5	19	55	0	3	2	8,430	0	0	8,496
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	208		59	204	523	1	20	19	57,542	5	2	58,380
Low ground pressure haulers	Dump Truck	offroad	144		22	63	194	0	7	6	27,029	2	1	27,350
Tracked excavator	Excavator	offroad	216		26	122	210	0	10	9	27,585	2	1	27,962
Low ground pressure dozer	Dozer	offroad	40		5	20	33	0	3	3	2,834	0	0	2,910
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	56		4	19	23	0	2	2	2,555	0	0	2,615
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966

Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
ALTERNATIVE 6														
Haul equipment and materials to site	Tractor Trailer	onroad HHD		2,600	6	24	71	0	3	3	10,959	0	0	11,044
Import equipment from other areas	Tractor Trailer	onroad HHD		-	-	-	-	-	-	-	-	-	-	-
Agricultural tractor with carryall scrapers	Tractor Scraper	offroad	216		61	212	544	1	21	19	59,755	5	2	60,626
Low ground pressure haulers	Dump Truck	offroad	144		22	63	194	0	7	6	27,029	2	1	27,350
Tracked excavator	Excavator	offroad	232		28	131	226	0	11	10	29,628	3	1	30,034
Low ground pressure dozer	Dozer	offroad	40		5	20	33	0	3	3	2,834	0	0	2,910
Small motor grader	Grader	offroad	200		27	121	180	0	13	12	18,553	2	1	18,935
Barge with crane and clamshell bucket	Crane	offroad	-		-	-	-	-	-	-	-	-	-	-
Hydraulic dredge, 16-inch boat-mounted	Other Industrial	offroad	-		-	-	-	-	-	-	-	-	-	-
Truck with crane for installed pilings	Crane Rig	offroad	-		-	-	-	-	-	-	-	-	-	-
Medium backhoe loader	Backhoe	offroad	104		8	36	43	0	4	3	4,744	1	0	4,856
Agricultural tractor with mower	Tractor	offroad	24		5	20	37	0	2	2	3,130	0	0	3,200
Fugitive dust control	Water Truck	onroad HHD		250	1	2	7	0	0	0	1,054	0	0	1,062
Manager	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Foreman	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Equipment Operator	Pickup/SUV	onroad LD		15,275	11	108	11	0	1	1	16,816	1	0	16,966
Laborers	Pickup/SUV	onroad LD		-	-	-	-	-	-	-	-	-	-	-
Total Maintenance Emissions														
AL	TERNATIVE 1, TON	S			0.10	0.46	0.74	0.001	0.04	0.03	104	0.009	0.004	106
AL	TERNATIVE 2, TON	S			0.10	0.45	0.73	0.001	0.04	0.03	103	0.009	0.004	104
AL	TERNATIVE 3, TON	S			0.11	0.49	0.81	0.001	0.04	0.04	112	0.010	0.004	114
AL	TERNATIVE 4, TON	S			0.09	0.40	0.64	0.001	0.03	0.03	90	0.008	0.003	92
AL	TERNATIVE 3, TON	S			0.09	0.40	0.64	0.001	0.03	0.03	91	0.008	0.003	92
AL	TERNATIVE 4, TON	S			0.09	0.42	0.68	0.001	0.03	0.03	96	0.008	0.004	97
Sources: SCAQMD 2008; USEPA 2011														

#### Notes:

SCAQMD emission factors for 2013 Offroad diesel exhaust  $PM_{2.5} = 92\%$  of  $PM_{10}$  per EMFAC 2007 version 2.3 Offroad N<sub>2</sub>O per Annex 3, Table A-101 Non-matching application-specific values interpolated or extrapolated

USEPA GWPs for CO<sub>2</sub> eqv (1, 21, 310)

### Apdx G - Offroad Dust Table G-10

Table G-10 Offroad Fugitive Dust Emissions for Proposed Alternatives																	
	Acti	ivity				Required	Variables				Uncon	trolled		Conti	olled Emiss	ions	
Earthmoving	Pk. Daily	Project	EET	Moist (M)	Silt (s)	Drop (d)	Speed (S)	Wind (U)	Den (D)	Rate (V)	PM <sub>10</sub>	PM <sub>2.5</sub>	Control	PM <sub>10</sub>	PM <sub>2.5</sub>	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>
	hours	hours	code	percent	percent	feet	mph	mph	ton/cy	cy/hr	lb/hr	lb/hr	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1	1	<b>-</b>		1		T	T						-				
Tractor Scraper	24	7,800	B+C	20		3	5			30	0.04216	0.15507	95%	0.05	0.19	16.4	60.5
Dump Truck	96	25,056	В	20		6				30	0.06849	0.00316	95%	0.33	0.02	85.8	4.0
Excavator	24	9,000	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.01	0.00	2.6	0.4
Dozer	16	3,728	А	20	9						0.30548	0.17057	95%	0.24	0.14	56.9	31.8
Grader	8	200	С	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	24	6,360	В	20		9				30	0.09097	0.00493	95%	0.11	0.01	28.9	1.6
Crane Rig	8	160	С	20			1				0.03100	0.00120	95%	0.01	0.00	0.2	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	С	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 2																	
Tractor Scraper	24	6,336	B+C	20		3	5			30	0.04216	0.15507	95%	0.05	0.19	13.4	49.1
Dump Truck	80	21,200	В	20		6				30	0.06849	0.00316	95%	0.27	0.01	72.6	3.3
Excavator	24	6,984	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.01	0.00	2.0	0.3
Dozer	16	2,608	Α	20	9						0.30548	0.17057	95%	0.24	0.14	39.8	22.2
Grader	8	224	С	20			4				1.98400	0.15360	95%	0.79	0.06	22.2	1.7
Clamshell Derrick	16	4,304	В	20		9				30	0.09097	0.00493	95%	0.07	0.00	19.6	1.1
Crane Rig	8	168	С	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,880	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	С	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 3																	
Tractor Scraper	32	8,480	B+C	20		3	5			30	0.04216	0.15507	95%	0.07	0.25	17.9	65.8
Dump Truck	112	29,904	В	20		6				30	0.06849	0.00316	95%	0.38	0.02	102.4	4.7
Excavator	32	9,312	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.01	0.00	2.7	0.4
Dozer	24	3,504	Α	20	9						0.30548	0.17057	95%	0.37	0.20	53.5	29.9
Grader	8	272	С	20			4				1.98400	0.15360	95%	0.79	0.06	27.0	2.1
Clamshell Derrick	32	8,448	В	20		9				30	0.09097	0.00493	95%	0.15	0.01	38.4	2.1
Crane Rig	8	168	С	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	С	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 4	11			11			1										
Tractor Scraper	16	4,912	B+C	20		3	5			30	0.04216	0.15507	95%	0.03	0.12	10.4	38.1
Dump Truck	56	14,560	В	20		6				30	0.06849	0.00316	95%	0.19	0.01	49.9	2.3
Excavator	16	4,944	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	1.4	0.2
Dozer	16	2,496	Α	20	9						0.30548	0.17057	95%	0.24	0.14	38.1	21.3
Grader	8	112	С	20			4				1.98400	0.15360	95%	0.79	0.06	11.1	0.9

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Clamshell Derrick	8	2,368	В	20		9				30	0.09097	0.00493	95%	0.04	0.00	10.8	0.6
Crane Rig	8	168	С	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	С	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 5																	
Tractor Scraper	16	4,128	B+C	20		3	5			30	0.04216	0.15507	95%	0.03	0.12	8.7	32.0
Dump Truck	56	14,000	В	20		6				30	0.06849	0.00316	95%	0.19	0.01	47.9	2.2
Excavator	16	3,520	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	1.0	0.2
Dozer	16	1,632	А	20	9						0.30548	0.17057	95%	0.24	0.14	24.9	13.9
Grader	8	152	С	20			4				1.98400	0.15360	95%	0.79	0.06	15.1	1.2
Clamshell Derrick	8	2,024	В	20		9				30	0.09097	0.00493	95%	0.04	0.00	9.2	0.5
Crane Rig	8	168	С	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	С	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
ALTERNATIVE 6																	
Tractor Scraper	24	5,328	B+C	20		3	5			30	0.04216	0.15507	95%	0.05	0.19	11.2	41.3
Dump Truck	80	19,120	В	20		6				30	0.06849	0.00316	95%	0.27	0.01	65.5	3.0
Excavator	16	4,544	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	1.3	0.2
Dozer	16	2,128	А	20	9						0.30548	0.17057	95%	0.24	0.14	32.5	18.1
Grader	8	176	С	20			4				1.98400	0.15360	95%	0.79	0.06	17.5	1.4
Clamshell Derrick	16	3,984	В	20		9				30	0.09097	0.00493	95%	0.07	0.00	18.1	1.0
Crane Rig	8	168	С	20			1				0.03100	0.00120	95%	0.01	0.00	0.3	0.0
Backhoe	8	1,600	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.2	0.0
Tractor	-	-	С	20			3				0.83700	0.05612	95%	0.00	0.00	0.0	0.0
											Ons	ite Equipme	ent	lbs/day	lbs/day	tons	tons
											AL	TERNATIVE	1	1.5	0.4	0.11	0.05
											AL	TERNATIVE	2	1.5	0.4	0.09	0.04
										ĺ	AL	TERNATIVE	3	1.8	0.5	0.12	0.05
										ĺ	AL	TERNATIVE	4	1.3	0.3	0.06	0.03
										ĺ	AL	TERNATIVE	5	1.3	0.3	0.05	0.02
										ĺ	AL	TERNATIVE	6	1.5	0.4	0.07	0.03

## Apdx G - Onroad Dust Table G-11

Table G-11 Onroad Fug	itive Dust Emis	sions for Pr	oposed Alte	rnatves	
	Vahiala	Acti	vity	Usa	age
All Roads Travelled	Catagory	Pk. Daily	Project	Unpaved	Paved
	Category	VMT	VMT	%	%
ALTERNATIVE 1					
Tractor Trailer (materials/hauling)	onroad HHD	7,500	322,500	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	4,760	52,360	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	780	312,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 2					
Tractor Trailer (materials/hauling)	onroad HHD	6,000	276,000	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	3,080	36,960	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	585	234,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 3					
Tractor Trailer (materials/hauling)	onroad HHD	9,000	396,000	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	3,920	43,120	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	975	390,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 4					
Tractor Trailer (materials/hauling)	onroad HHD	3,000	105,000	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	5,040	45,360	1%	99%

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	Tab	<u>e G-11</u>			
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	390	156,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 5					
Tractor Trailer (materials/hauling)	onroad HHD	2,700	99,900	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	2,800	28,000	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	325	130,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%
ALTERNATIVE 6					
Tractor Trailer (materials/hauling)	onroad HHD	3,600	108,000	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	4,480	35,840	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	4,700	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	30,550	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	65	30,550	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	520	208,000	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	130	52,000	6%	94%

#### Apdx G - Onroad Dust Table G-11

	Malala	Act	ivity			Required	l Variables			Uncon	trolled		Cont	rolled Emiss	sions	
Unpaved Road Dust	Vehicle	Pk. Daily	Project	EET	Moist (M)	Silt (s)	Weight (W)	Speed (S)	Precip (P)	<b>PM</b> 10	PM <sub>2.5</sub>	Control	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Category	VMT	VMT	code	percent	percent	tons	mph	days/yr	lb/VMT	lb/VMT	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1	-	•			•											
Tractor Trailer (materials/hauling)	onroad HHD	825	35,475	G	20	g	30	20	20	1.89491	0.18933	95%	78.2	7.8	3,176.9	317.4
Tractor Trailer (equipment/supplies)	onroad HHD	48	524	G	20	g	30	20	20	1.89491	0.18933	95%	4.5	0.5	46.9	4.7
Cement Truck (concrete/pumping)	onroad HHD			G	20	ç	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	ç	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	ç	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	ç	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	ç	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	ç	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	47	18,720	G	20	ç	3	20	20	0.84222	0.08407	95%	2.0	0.2	745.1	74.4
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	ç	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
ALTERNATIVE 2																
Tractor Trailer (materials/hauling)	onroad HHD	660	30,360	G	20	ç	30	20	20	1.89491	0.18933	95%	62.5	6.2	2,718.9	271.7
Tractor Trailer (equipment/supplies)	onroad HHD	31	370	G	20	ç	30	20	20	1.89491	0.18933	95%	2.9	0.3	33.1	3.3
Cement Truck (concrete/pumping)	onroad HHD			G	20	ç	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	ç	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	ç	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	ç	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	ç	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	C)	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	35	14,040	G	20	C)	3	20	20	0. 4222	0. 8407	95%	1.	0.	558.	55.
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	ç	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
ALTERNATIVE 3																
Tractor Trailer (materials/hauling)	onroad HHD	180	7,920	G	20	ç	30	20	20	1.89491	0.18933	95%	17.1	1.7	709.3	70.9
Tractor Trailer (equipment/supplies)	onroad HHD	39	431	G	20	C)	30	20	20	1.89491	0.18933	95%	3.7	0.4	38.6	3.9
Cement Truck (concrete/pumping)	onroad HHD			G	20	C)	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	g	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	g	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	g	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	g	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	g	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	59	23,400	G	20	g	3	20	20	0.84222	0.08407	95%	2.5	0.2	931.4	93.0
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	g	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
ALTERNATIVE 4																
Tractor Trailer (materials/hauling)	onroad HHD	60	2,100	G	20	C)	30	20	20	1.89491	0.18933	95%	5.7	0.6	188.1	18.8
Tractor Trailer (equipment/supplies)	onroad HHD	50	454	G	20	g	30	20	20	1.89491	0.18933	95%	4.8	0.5	40.6	4.1
Cement Truck (concrete/pumping)	onroad HHD			G	20	ç	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	ç	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	g	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2

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Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	23	9,360	G	20	9	3	20	20	0.84222	0.08407	95%	1.0	0.1	372.6	37.2
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
ALTERNATIVE 5																
Tractor Trailer (materials/hauling)	onroad HHD	162	5,994	G	20	9	30	20	20	1.89491	0.18933	95%	15.3	1.5	536.8	53.6
Tractor Trailer (equipment/supplies)	onroad HHD	28	280	G	20	9	30	20	20	1.89491	0.18933	95%	2.7	0.3	25.1	2.5
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	20	7,800	G	20	9	3	20	20	0.84222	0.08407	95%	0.8	0.1	310.5	31.0
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
ALTERNATIVE 6																
Tractor Trailer (materials/hauling)	onroad HHD	216	6,480	G	20	9	30	20	20	1.89491	0.18933	95%	20.5	2.0	580.3	58.0
Tractor Trailer (equipment/supplies)	onroad HHD	45	358	G	20	9	30	20	20	1.89491	0.18933	95%	4.2	0.4	32.1	3.2
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	4,230	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	352.5	35.2
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (supervisors/foremen)	onroad LD	4	1,833	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	73.0	7.3
Pickup/SUV (operators/drivers)	onroad LD	31	12,480	G	20	9	3	20	20	0.84222	0.08407	95%	1.3	0.1	496.7	49.6
Pickup/SUV (tradesmen/laborers)	onroad LD	8	3,120	G	20	9	3	20	20	0.84222	0.08407	95%	0.3	0.0	124.2	12.4
Special Note: Daily maximums do not incl	ial Note: Daily maximums do not include importing equipment from other areas in state (local emissions only)													lbs/day	tons	tons
										AL	TERNATIVE	1	81.6	8.2	2.30	0.23
									ſ	AL	TERNATIVE	2	65.5	6.5	1.97	0.20

2.1

0.8

1.8

2.3

1.15

0.61

0.75

0.87

0.11

0.06

0.07

0.09

21.0

8.1

17.6

23.2

ALTERNATIVE 3

ALTERNATIVE 4

ALTERNATIVE 5

ALTERNATIVE 6

#### Apdx G - Maintenance Offroad Dust Table G-12

Fable G-12 Offroad Fugitive Dust Emissions for Maintenance Activities Controlled Emissions   Activity Required Variables Uncontrolled																	
	Acti	vity				Required	Variables				Uncont	rolled		Cont	rolled Emiss	ions	
Earthmoving	Pk. Daily	Project	EET	Moist (M)	Silt (s)	Drop (d)	Speed (S)	Wind (U)	Den (D)	Rate (V)	<b>PM</b> 10	PM <sub>2.5</sub>	Control	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	hours	hours	code	percent	percent	feet	mph	mph	ton/cy	cy/hr	lb/hr	lb/hr	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1																	
Tractor Scraper	8	224	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7
Dump Truck	8	144	В	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	280	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	40	А	20	9						0.30548	0.17057	95%	0.12	0.07	0.6	0.3
Grader	8	200	С	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	В	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	С	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	192	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	С	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 2																	
Tractor Scraper	8	216	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7
Dump Truck	8	152	В	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	304	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	48	А	20	9						0.30548	0.17057	95%	0.12	0.07	0.7	0.4
Grader	8	200	С	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	В	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	С	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	88	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	С	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 3																	
Tractor Scraper	8	224	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7
Dump Truck	8	152	В	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	352	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	48	А	20	9						0.30548	0.17057	95%	0.12	0.07	0.7	0.4
Grader	8	200	С	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	В	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	С	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	224	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	С	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 4																	
Tractor Scraper	8	208	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.4	1.6
Dump Truck	8	144	В	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	208	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	40	А	20	9						0.30548	0.17057	95%	0.12	0.07	0.6	0.3
Grader	8	200	С	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	В	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	С	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	48	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	С	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 5				· · · · · · ·							<u> </u>						
Tractor Scraper	8	208	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.4	1.6

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Dump Truck	8	144	В	20		6				30	0 06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	216	D	20				67	15	60 60	0.00577	0.00089	95%	0.00	0.00	0.0	0.0
Dozer	8	40	A	20	9			•			0.30548	0.17057	95%	0.12	0.07	0.6	0.3
Grader	8	200	С	20	-		4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	В	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	С	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	56	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	С	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
ALTERNATIVE 6				<u> </u>									<u> </u>	<u> </u>			
Tractor Scraper	8	216	B+C	20		3	5			30	0.04216	0.15507	95%	0.02	0.06	0.5	1.7
Dump Truck	8	144	В	20		6				30	0.06849	0.00316	95%	0.03	0.00	0.5	0.0
Excavator	8	232	D	20				6.7	1.5	60	0.00577	0.00089	95%	0.00	0.00	0.1	0.0
Dozer	8	40	A	20	9						0.30548	0.17057	95%	0.12	0.07	0.6	0.3
Grader	8	200	С	20			4				1.98400	0.15360	95%	0.79	0.06	19.8	1.5
Clamshell Derrick	-	-	В	20		9				30	0.09097	0.00493	95%	0.00	0.00	0.0	0.0
Crane Rig	-	-	С	20			1				0.03100	0.00120	95%	0.00	0.00	0.0	0.0
Backhoe	8	104	D	20				6.7	1.5	20	0.00192	0.00030	95%	0.00	0.00	0.0	0.0
Tractor	8	24	С	20			3				0.83700	0.05612	95%	0.33	0.02	1.0	0.1
											On	site Equipme	nt	lbs/day	lbs/day	tons	tons
											AL	TERNATIVE	1	1.3	0.2	0.011	0.002
											AL	TERNATIVE	2	1.3	0.2	0.011	0.002
											AL	TERNATIVE	3	1.3	0.2	0.011	0.002
											AL	TERNATIVE	4	1.3	0.2	0.011	0.002
											AL	TERNATIVE	5	1.3	0.2	0.011	0.002
											AL	TERNATIVE	6	1.3	0.2	0.011	0.002

	Acti	ivity				Required	Variables				Uncon	trolled		Cont	rolled Emiss	sions	
Construction	Pk. Daily	Project	EET	Moist (M)	Silt (s)	Drop (d)	Speed (S)	Wind (U)	Den (D)	Rate (V)	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	Control	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>
Laramoving	hours	hours	code	percent	percent	feet	mph	mph	ton/cy	cy/hr	lb/hr	lb/hr	%	lb/day	lb/day	lbs	lbs
Bulldozer (tracked)			А	7	9						1.32827	0.66775	56%	0.00	0.00	0.0	0.0
Bulldozer (wheeled)			А	7	9						0.99621	0.50081	56%	0.00	0.00	0.0	0.0
Scraper			B+C	7		3	5			30	0.89477	0.15562	56%	0.00	0.00	0.0	0.0
Dump Truck/ADT			В	7		6				30	0.09385	0.00432	56%	0.00	0.00	0.0	0.0
Clamshell Derrick			В	7		9				30	0.12465	0.00675	56%	0.00	0.00	0.0	0.0
Dragline (small)			В	7		12				60	0.30491	0.01854	56%	0.00	0.00	0.0	0.0
Grader			С	7			4				1.98400	0.15360	56%	0.00	0.00	0.0	0.0
Tractor			С	7			3				0.83700	0.05612	56%	0.00	0.00	0.0	0.0
Compactor			С	7			2				0.24800	0.01358	56%	0.00	0.00	0.0	0.0
Crane			С	7			1				0.03100	0.00120	56%	0.00	0.00	0.0	0.0
Backhoe			D	7				6.7	1.5	20	0.00836	0.00129	56%	0.00	0.00	0.0	0.0
Bobcat			D	7				6.7	1.5	10	0.00418	0.00065	56%	0.00	0.00	0.0	0.0
Drill auger			D	7				6.7	1.5	10	0.00418	0.00065	56%	0.00	0.00	0.0	0.0
Excavator			D	7				6.7	1.5	60	0.02507	0.00387	56%	0.00	0.00	0.0	0.0
Front end loader			D	7				6.7	1.5	30	0.01254	0.00194	56%	0.00	0.00	0.0	0.0
Concrete grinder			E	10					1.9	40	0.18240	0.03040	78%	0.00	0.00	0.0	0.0

#### Apdx G - Maintenance Offroad Dust

Table G-12

Screener (coarse)		F	18			1.9	40	0.66120	0.04560	92%	0.00	0.00	0.0	0.0

#### EET Code A

$$\begin{split} & \text{AP-42 Chapter 11.9 for bulldozer, tractor dozer (Tables 11.9-1):} \\ & \text{E} = 0.75 \, ^* \, 1.0 \, ^* \, (s)^{1.5} \, / \, (M)^{1.4} \, \, \text{for PM}_{10} \\ & \text{E} = 0.105 \, ^* \, 5.7 \, ^* \, (s)^{1.2} \, / \, (M)^{1.3} \, \text{for PM}_{2.5} \\ & \text{Simplifies to E} = 0.75 \, ^* \, (s)^{1.5} \, / \, (M)^{1.4} \, \text{for PM}_{10} \end{split}$$

Simplifies to E =  $0.60 * (s)^{1.2} / (M)^{1.3}$  for PM<sub>2.5</sub>

E = lb/hr fugitive

- s = silt content, percent
- M = moisture content, percent

#### EET Code B

AP-42 Chapter 11.9 for small dragline, clamshell, dumping, scraper (Table 11.9-1): E =  $0.75 \times 0.0021 \times (d)^{0.7}$  / (M)<sup>0.3</sup> for PM<sub>10</sub> E =  $0.017 \times 0.0021 \times (d)^{1.1}$  / (M)<sup>0.3</sup> for PM<sub>2.5</sub> Simplifies to E =  $1.6e-3 \times (d)^{0.7}$  / (M)<sup>0.3</sup> for PM<sub>2.5</sub> E =  $1b/cy \times cy/hr = 1b/hr$  fugitive M = moisture content, percent d = drop distance = 12 feet (small dragline) d = drop distance = 9 feet (clamshell) d = drop distance = 6 feet (dump truck/ADT) d = drop distance = 3 feet (scraper)

#### EET Code C

 $\begin{array}{l} AP-42 \ Chapter \ 11.9 \ for \ scraper, \ grader, \ tractor, \ compactor, \ crane \ (Table \ 11.9-1): \\ E = S \ ^* \ 0.60 \ ^* \ 0.051 \ x \ (S)^{2.0} \ for \ PM_{10} \\ E = S \ ^* \ 0.031 \ ^* \ 0.040 \ x \ (S)^{2.5} \ for \ PM_{2.5} \\ Simplifies \ to \ E = \ 0.031 \ x \ (S)^{3.0} \ for \ PM_{10} \\ Simplifies \ to \ E = \ 0.031 \ x \ (S)^{3.0} \ for \ PM_{2.5} \\ E = \ Ib/VMT \ ^* \ VMT/hr = \ Ib/hr \ fugitive \\ S = Mean \ Vehicle \ Speed = 5 \ mph \ (scrapers) \\ S = Mean \ Vehicle \ Speed = 4 \ mph \ (graders) \\ S = Mean \ Vehicle \ Speed = 3 \ mph \ (tractors) \\ S = Mean \ Vehicle \ Speed = 2 \ mph \ (compactors) \\ S = Mean \ Vehicle \ Speed = 2 \ mph \ (compactors) \\ S = Mean \ Vehicle \ Speed = 1 \ mph \ (cranes) \end{array}$ 

#### EET Code D

$$\begin{split} & \text{AP-42 Chapter 13.2.4 Loading/Handling (backhoe, Bobcat, drill auger, excavator, backhoe, front end loader):} \\ & \text{E} = V * D * 0.35 * 0.0032 * (U/5)^{1.3/} (M/2)^{1.4} \text{ for PM}_{10} \\ & \text{E} = V * D * 0.053 * 0.0032 * (U/5)^{1.3/} (M/2)^{1.4} \text{ for PM}_{2.5} \\ & \text{Simplifies to E} = V * D * 1.1e-3 * (U/5)^{1.3/} (M/2)^{1.4} \text{ for PM}_{10} \end{split}$$
Simplifies to E = V \* D \* 1.7e-4 \* (U/5)<sup>1.3</sup>/ (M/2)<sup>1.4</sup> for PM<sub>2.5</sub>

Simplifies to L = V b  $T_1/6 - Y$  (0/3)  $T_1(W/2)$  for  $T_1/6 - Y$  V = cy/hr M = moisture content, percent E = lb/ton \* tons/cy \* cy/hr = lb/hr fugitive D = 1.3 tons/cy for sand or cinder concrete D = 1.5 tons/cy for sand stone or stone concrete D = 2.1 tons/cy for granite rock U = wind speed = 1 m/s or 2.2 mi/hr (light air) U = wind speed = 2 m/s or 4.5 mi/hr (light breeze) U = wind speed = 3 m/s or 6.7 mi/hr (light breeze) U = wind speed = 4 m/s or 8.9 mi/hr (gentle breeze) U = wind speed = 5 m/s or 11.2 mi/hr (gentle breeze) U = wind speed = 6 m/s or 13.4 mi/hr (moderate breeze)U = wind speed = 7 m/s or 15.7 mi/hr (moderate breeze)

#### EET Code E

 $\begin{array}{l} AP-42\ Chapter\ 11.19.2\ Coarse\ Tertiary\ Crushing\\ E=0.0024\ lb/ton\ uncontrolled\ PM_{10}\\ E=0.0004\ lb/ton\ uncontrolled\ PM_{2.5}\\ E=D\ *\ V\ 0.0024\ lb/hr\ uncontrolled\ PM10\\ E=D\ *\ V\ 0.0024\ lb/hr\ uncontrolled\ PM2.5\\ V=cy/hr\\ E=lb/ton\ *\ tons/cy\ *\ cy/hr\ =\ lb/hr\ fugitive\ D\\ =\ 1.3\ tons/cy\ for\ sand\ or\ cinder\ concrete\\ D=1.9\ tons/cy\ for\ sand\ sone\ or\ stone\ concrete\\ D=2.1\ tons/cy\ for\ granite\ rock\\ Control\ efficiency\ =\ 78\%\ where\ applicable\ (water\ spray)\\ \end{array}$ 

#### EET Code F

AP-42 Chapter 11.19.2 Coarse Screening E = 0.0087 lb/ton uncontrolled  $PM_{10}$ E = 0.0006 lb/ton uncontrolled  $PM_{2.5}$ E = D \* V \* 0.0087 lb/hr uncontrolled PM10 E = D \* V \* 0.0006 lb/hr uncontrolled PM2.5 V = cy/hr E = lb/ton \* tons/cy \* cy/hr = lb/hr fugitive D = 1.3 tons/cy for sand or cinder concrete D = 1.9 tons/cy for sandstone or stone concrete D = 2.1 tons/cy for granite rock Control efficiency = 92% where applicable (water spray)

Table G-13 Onroad Fugi	itive Dust Emiss	sions for Mai	intenance A	ctivities	
	Mahiala	Acti	ivity	Usa	age
All Roads Travelled		Pk. Daily	Project	Unpaved	Paved
	Category	VMT	VMT	%	%
ALTERNATIVE 1					
Tractor Trailer (materials/hauling)	onroad HHD	100	3,700	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 2					
Tractor Trailer (materials/hauling)	onroad HHD	100	3,400	11%	89%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 3	•				
Tractor Trailer (materials/hauling)	onroad HHD	100	4,500	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 4					
Tractor Trailer (materials/hauling)	onroad HHD	100	2,000	2%	98%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				

Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 5					
Tractor Trailer (materials/hauling)	onroad HHD	100	2,000	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%
ALTERNATIVE 6	-				
Tractor Trailer (materials/hauling)	onroad HHD	100	2,600	6%	94%
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	1%	99%
Cement Truck (concrete/pumping)	onroad HHD				
Dump Truck (soil/sand/gravel transport)	onroad HHD				
Water Truck (dust control)	onroad HHD	10	250	90%	10%
Work Truck (all trades)	onroad MD				
Pickup/SUV (managers/engineers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	6%	94%
Pickup/SUV (operators/drivers)	onroad LD	65	15,275	6%	94%
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	6%	94%

		Act	ivity			Required	Variables			Unconf	rolled		Cont	rolled Emiss	sions	
Unpaved Road Dust	Vehicle	Pk. Daily	Project	EET	Moist (M)	Silt (s)	Weight (W)	Speed (S)	Precip (P)	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	Control	<b>PM</b> <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
	Category	VMT	VMT	code	percent	percent	tons	mph	days/yr	lb/VMT	lb/VMT	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1	•	•			·					•						
Tractor Trailer (materials/hauling)	onroad HHD	11	407	G	20	9	30	20	20	1.89491	0.18933	95%	1.0	0.1	36.4	3.6
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
ALTERNATIVE 2		•								•						
Tractor Trailer (materials/hauling)	onroad HHD	11	374	G	20	9	30	20	20	1.89491	0.18933	95%	1.0	0.1	33.5	3.3
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
ALTERNATIVE 3	•	1			<u> </u>				R	1		<u>.                                    </u>				
Tractor Trailer (materials/hauling	onroad HHD	2	90	G	20	9	30	20	20	1. 9491	0. 8933	95%	0.	0.	8.	0.
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
ALTERNATIVE 4		•								•						
Tractor Trailer (materials/hauling)	onroad HHD	2	40	G	20	9	30	20	20	1.89491	0.18933	95%	0.2	0.0	3.6	0.4
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-

ALTERNATIVE 5																
Tractor Trailer (materials/hauling)	onroad HHD	6	120	G	20	9	30	20	20	1.89491	0.18933	95%	0.6	0.1	10.7	1.1
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	- 1
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	- 1
ALTERNATIVE 6	•	•														
Tractor Trailer (materials/hauling)	onroad HHD	6	156	G	20	9	30	20	20	1.89491	0.18933	95%	0.6	0.1	14.0	1.4
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	G	20	9	30	20	20	1.89491	0.18933	95%	-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Dump Truck (soil/sand/gravel transport)	onroad HHD			G	20	9	30	20	20	1.89491	0.18933	95%				
Water Truck (dust control)	onroad HHD	9	225	G	20	9	30	5	20	1.76315	0.17616	95%	0.8	0.1	18.7	1.9
Work Truck (all trades)	onroad MD			G	20	9	8	20	20	1.16343	0.11619	95%				
Pickup/SUV (managers/engineers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	- 1
Pickup/SUV (operators/drivers)	onroad LD	4	917	G	20	9	3	20	20	0.84222	0.08407	95%	0.2	0.0	36.5	3.6
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	G	20	9	3	20	20	0.84222	0.08407	95%	-	-	-	- 1
Special Note: Daily maximums do not incl	lude importing eq	uipment fron	n other areas	in state (loc	al emissions (	only)				U	npaved Roa	ds	lbs/day	lbs/day	tons	tons
										Al	TERNATIVE	1	2.2	0.2	0.06	0.01
										Al	TERNATIVE	2	2.2	0.2	0.06	0.01
										Al	TERNATIVE	3	1.3	0.1	0.05	0.00
										Al	TERNATIVE	E 4	1.3	0.1	0.05	0.00
									Ī	Al	TERNATIVE	5	1.7	0.2	0.05	0.01

		Act	ivity			Required	Variables			Uncon	trolled		Cont	rolled Emiss	sions	
Paved Road Dust	Vehicle	Pk. Daily	Project	EET	Moist (M)	Silt (sL)	Weight (W)	Speed (S)	Precip (P)	<b>PM</b> 10	PM <sub>2.5</sub>	Control	<b>PM</b> 10	PM <sub>2.5</sub>	<b>PM</b> 10	PM <sub>2.5</sub>
	Calegory	VMT	VMT	code	percent	g/m²	tons	mph	days/yr	lb/VMT	lb/VMT	%	lb/day	lb/day	lbs	lbs
ALTERNATIVE 1		•					•		•					•		
Tractor Trailer (materials/hauling)	onroad HHD	89	3,293	Н		0.2	30		20	0.01633	0.00401		1.5	0.4	53.0	13.0
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	Н		0.015	30		20	0.00155	0.00038		-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			Н		0.2	30		20	0.01633	0.00401					1
Dump Truck (soil/sand/gravel transport)	onroad HHD			Н		0.2	30		20	0.01633	0.00401					1
Water Truck (dust control)	onroad HHD	1	25	Н		0.2	30		20	0.01633	0.00401		0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			Н		0.2	8		20	0.00424	0.00104					
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	Н		0.2	3		20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	Н		0.2	3		20	0.00156	0.00038		-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	Н		0.2	3		20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	Н		0.2	3		20	0.00156	0.00038		-	-	- 1	-
ALTERNATIVE 2																
Tractor Trailer (materials/hauling)	onroad HHD	89	3,026	Н		0.2	30		20	0.01633	0.00401		1.5	0.4	48.7	12.0

ALTERNATIVE 6

1.7

0.2

0.05

0.01

Tractor Trailer (equipment/supplies)	onroad HHD	0	0	Н		0.015	30	 20	0.00155	0.00038		-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Dump Truck (soil/sand/gravel transport)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Water Truck (dust control)	onroad HHD	1	25	Н		0.2	30	 20	0.01633	0.00401		0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			Н		0.2	8	 20	0.00424	0.00104					
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
ALTERNATIVE 3															
Tractor Trailer (materials/hauling)	onroad HHD	98	4,410	Н		0.2	30	 20	0.01633	0.00401		1.6	0.4	71.0	17.4
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	Н		0.015	30	 20	0.00155	0.00038		-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Dump Truck (soil/sand/gravel transport)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Water Truck (dust control)	onroad HHD	1	25	Н		0.2	30	 20	0.01633	0.00401		0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			Н		0.2	8	 20	0.00424	0.00104					
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
ALTERNATIVE 4															
Tractor Trailer (materials/hauling)	onroad HHD	98	1,960	Н		0.2	30	 20	0.01633	0.00401		1.6	0.4	31.6	7.7
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	Н		0.015	30	 20	0.00155	0.00038		-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Dump Truck (soil/sand/gravel transport)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Water Truck (dust control)	onroad HHD	1	25	Н		0.2	30	 20	0.01633	0.00401		0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			Н		0.2	8	 20	0.00424	0.00104					
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
ALTERNATIVE 5					1						P	1			
Tractor Trailer (materials/hauling)	onroad HHD	94	1,880	Н		0.2	30	 20	0.01633	0.00401		1.5	0.4	30.3	7.4
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	Н		0.015	30	 20	0.00155	0.00038		-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Dump Truck (soil/sand/gravel transport)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					
Water Truck (dust control)	onroad HHD	1	25	Н		0.2	30	 20	0.01633	0.00401		0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			Н		0.2	8	 20	0.00424	0.00104					
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	H		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
ALTERNATIVE 6															
Tractor Trailer (materials/hauling)	onroad HHD	94	2,444	H		0.2	30	 20	0.01633	0.00401		1.5	0.4	39.4	9.7
Tractor Trailer (equipment/supplies)	onroad HHD	0	0	H		0.015	30	 20	0.00155	0.00038		-	-	-	-
Cement Truck (concrete/pumping)	onroad HHD			H		0.2	30	 20	0.01633	0.00401					
Dump Truck (soil/sand/gravel transport)	onroad HHD			Н		0.2	30	 20	0.01633	0.00401					

Water Truck (dust control)	onroad HHD	1	25	Н		0.2	30	 20	0.01633	0.00401		0.0	0.0	0.4	0.1
Work Truck (all trades)	onroad MD			Н		0.2	8	 20	0.00424	0.00104					
Pickup/SUV (managers/engineers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (supervisors/foremen)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
Pickup/SUV (operators/drivers)	onroad LD	61	14,359	Н		0.2	3	 20	0.00156	0.00038		0.1	0.0	22.1	5.4
Pickup/SUV (tradesmen/laborers)	onroad LD	0	0	Н		0.2	3	 20	0.00156	0.00038		-	-	-	-
Special Note: Daily maximums do not incl	ude importing eq	uipment from	other areas	in state (loca	al emissions o	only)			Р	aved Roads		lbs/day	lbs/day	tons	tons
									AL	TERNATIVE	1	1.7	0.4	0.05	0.01
									AL	TERNATIVE	2	1.7	0.4	0.05	0.01
									AL	TERNATIVE	3	1.8	0.4	0.06	0.01
EET Code G									AL	TERNATIVE	4	1.8	0.4	0.04	0.01
Unpaved Road Dust (AP-42 Section 13.2.	.2):								AL	TERNATIVE	5	1.7	0.4	0.04	0.01
E = [1.5 *(s/12) <sup>0.9</sup> * (W/3) <sup>0.45</sup> ] * P <sub>C</sub> * (1-CE	) for PM <sub>10</sub>								AL	TERNATIVE	6	1.7	0.4	0.04	0.01

All Roads	lbs/day	lbs/day	tons	tons
ALTERNATIVE 1	3.8	0.6	0.11	0.02
ALTERNATIVE 2	3.8	0.6	0.11	0.02
ALTERNATIVE 3	3.1	0.6	0.11	0.02
ALTERNATIVE 4	3.1	0.6	0.09	0.01
ALTERNATIVE 5	3.4	0.6	0.09	0.01
ALTERNATIVE 6	3.4	0.6	0.09	0.02

 $E = [1.8 * (s/12)^{1.0} * (S/30)^{0.5} / (M/0.5)^{0.2} - 0.00047 ] * P_{C} * (1-CE) \text{ for } PM_{10}$ 

E = [0.15 \*(s/12)<sup>0.9</sup> \* (W/3)<sup>0.45</sup>] \* Pc \* (1-CE) for PM<sub>2.5</sub>

E = [0.18 \*(s/12)<sup>1.0</sup> \* (S/30)<sup>0.5</sup> / (M/0.5)<sup>0.2</sup> - 0.00036 ] \* Pc \* (1-CE) for PM<sub>2.5</sub>

Equation pairs calculated for average factoring of both vehicle weight and speed s = silt content, percent

W = average vehicle weight (see below)

M = moisture content, percent

S = mean vehicle speed = 5-10 mph for watering trucks

S = mean vehicle speed = 15 mph for haul roads (general mitigation measure)

S = mean vehicle speed = 20 mph for graded dirt/gravel roads

E = Ib/VMT fugitive

Pc = (365-P)/365

P = Number of wet days over 0.01 in precipitation for averaging period (from AP-42 Figure 13.2.1-2 Note: precipitation correction not used (Pc = 1) for worst case day calculations CE = control efficiency for watering (moisture content) Light Duty = 3 tons average Medium Duty = 8 tons average Heavy Heavy Duty = 30 tons average (loaded 40 tons, unloaded 20 tons)

#### EET Code H

Paved Road Dust (New AP-42 Section 13.2.1): E = 0.0022 \* (sL)<sup>0.91</sup> \* (W)<sup>1.02</sup> \* P<sub>C</sub> for PM<sub>10</sub> E = 0.00054 \* (sL)<sup>0.91</sup> \* (W)<sup>1.02</sup> \* P<sub>C</sub> for PM<sub>2.5</sub> E = Ib/VMT fugitive sL = Silt Loading from Table 13.2.1-2 W = Average weight of vehicles in tons (below)  $P_{c} = (1 - P/4N)$ P = Number of wet days over 0.01 in precipitation for averaging period (from AP-42 Figure 13.2.1-2) N = days of period = 365 days (4N = 1460)Note: precipitation correction not used (Pc = 1) for worst case day calculations Light Duty = 3 tons average (loaded) Medium Duty = 8 tons average (loaded) Heavy Heavy Duty = 30 tons average (loaded 40 tons, unloaded 20 tons)

## Apdx G - Indirect GHG Emissions

Table (	G-14
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Table G-14 Operational Indirect GHG Emi	ssions from Ele	ctric Power Co	onsumption (	water pumping	g)		
Parameter	Unite	1	2	3 Alteri	native 4	5	6
Faranieter	onits						
Total Pumping Ouput Power	BHP	975	838	1,288	600	350	1,013
Conversion Efficiency	percent	92%	92%	92%	92%	92%	92%
Input Power	KW	791	679	1,044	487	284	821
Daily Schedule	hours	24	24	24	24	24	24
Daily Power Requirement	KW-hrs	18,974	16,298	25,055	11,676	6,811	19,704
Annual Schedule	hours	8,760	8,760	8,760	8,760	8,760	8,760
Annual Power Requirement	MW-hrs	6,925	5,949	9,145	4,262	2,486	7,192
Carbon Dioxide (GHG - CO <sub>2</sub> )	lb/MW-hr	724.12	724.12	724.12	724.12	724.12	724.12
Methane (GHG - CH <sub>4</sub> )	lb/MW-hr	0.0302	0.0302	0.0302	0.0302	0.0302	0.0302
Nitrous Oxide (GHG - N2O)	lb/MW-hr	0.0081	0.0081	0.0081	0.0081	0.0081	0.0081
Carbon Dioxide Equivalents (CO2 eqv)	lb/MW-hr	727.27	727.27	727.27	727.27	727.27	727.27
Carbon Dioxide (GHG - CO <sub>2</sub> )	tonnes/yr	2,275	1,954	3,004	1,120	817	2,362
Methane (GHG - CH <sub>4</sub> )	tonnes/yr	0.05	0.08	0.05	0.13	0.03	0.10
Nitrous Oxide (GHG - N <sub>2</sub> O)	tonnes/yr	0.03	0.02	0.01	0.03	0.01	0.03
Carbon Dioxide Equivalents (CO <sub>2</sub> eqv)	tonnes/yr	2,284	1,962	1,324	1,406	820	2,373
Source: CCAR 2009 (CAMX - California); US	SEPA 2011	1					

## Apdx G - Offroad 2013 Table G-15

Extrapolation (down) Interpolation Extrapolation (up)

Table G-15 SCAB Fleet Average Emission Factors (Diesel)

A-19 Offroad 2013	
Air Basin	SC

		(lb/hr)									
Equipment	MaxHP	ROG	CO	NOX	SOX	PM10	PM2.5	CO2	CH4	N2O	CO2 eqv
	10	0.0068	0.0352	0.0424	0.0001	0.0018	0.0017	5.8	0.0006	0.0003	5.9
Aerial Lifts	15	0.0101	0.0528	0.0637	0.0001	0.0027	0.0025	8.7	0.0009	0.0004	8.8
	25	0.0166	0.0503	0.0937	0.0001	0.0051	0.0047	11.0	0.0015	0.0007	11.2
	50	0.0592	0.1757	0.1840	0.0003	0.0156	0.0143	19.6	0.0053	0.0024	20.5
	85	0.0575	0.2091	0.2799	0.0004	0.0227	0.0209	28.8	0.0052	0.0023	29.7
	120	0.0558	0.2425	0.3758	0.0004	0.0299	0.0275	38.1	0.0050	0.0022	38.9
	500	0.1191	0.4671	1.5310	0.0021	0.0448	0.0413	213	0.0107	0.0048	214.6
	750	0.2221	0.8443	2.8534	0.0039	0.0825	0.0759	385	0.0200	0.0089	387.9
	800	0.2369	0.9006	3.0436	0.0041	0.0880	0.0810	410.4	0.0214	0.0095	413.8
Aerial Lifts Composite		0.0529	0.1925	0.3059	0.0004	0.0202	0.0186	34.7	0.0048	0.0021	35.5
Air Compressors	15	0.0122	0.0484	0.0732	0.0001	0.0048	0.0044	7.2	0.0011	0.0005	7.4
	25	0.0266	0.0744	0.1306	0.0002	0.0081	0.0074	14.4	0.0024	0.0011	14.8
	50	0.0921	0.2546	0.2221	0.0003	0.0220	0.0203	22.3	0.0083	0.0037	23.6
	120	0.0825	0.3251	0.4991	0.0006	0.0456	0.0419	47.0	0.0074	0.0033	48.1
	175	0.1059	0.5054	0.8385	0.0010	0.0472	0.0434	88.5	0.0096	0.0042	90.0
	250	0.1007	0.2955	1.1320	0.0015	0.0347	0.0319	131	0.0091	0.0040	132.7
	500	0.1626	0.5399	1.7639	0.0023	0.0570	0.0525	232	0.0147	0.0065	234.1
	750	0.2547	0.8344	2.8139	0.0036	0.0898	0.0826	358	0.0230	0.0102	361.8
	1000	0.4190	1.4213	5.0841	0.0049	0.1474	0.1356	486	0.0378	0.0168	492.4
Air Compressors Composite		0.0913	0.3376	0.6065	0.0007	0.0434	0.0399	63.6	0.0082	0.0037	64.9
Bore/Drill Rigs	15	0.0120	0.0632	0.0754	0.0002	0.0029	0.0027	10.3	0.0011	0.0005	10.5
-	25	0.0193	0.0658	0.1226	0.0002	0.0049	0.0045	16.0	0.0017	0.0008	16.3
	50	0.0289	0.2282	0.2568	0.0004	0.0120	0.0110	31.0	0.0026	0.0012	31.5
	120	0.0447	0.4698	0.4583	0.0009	0.0257	0.0237	77.1	0.0040	0.0018	77.8
	175	0.0704	0.7538	0.6931	0.0016	0.0302	0.0277	141	0.0063	0.0028	142.1
	250	0.0795	0.3429	0.7632	0.0021	0.0221	0.0203	188	0.0072	0.0032	189.2
	500	0.1295	0.5517	1.1717	0.0031	0.0361	0.0332	311	0.0117	0.0052	313.2
	750	0.2565	1.0899	2.3376	0.0062	0.0715	0.0658	615	0.0231	0.0103	618.8
	1000	0.4163	1.6675	5.9553	0.0093	0.1544	0.1420	928	0.0376	0.0167	934.2
Bore/Drill Rigs Composite		0.0786	0.5044	0.8125	0.0017	0.0302	0.0278	165	0.0071	0.0032	166.1
Cement and Mortar Mixers	15	0.0074	0.0386	0.0470	0.0001	0.0021	0.0020	6.3	0.0007	0.0003	6.4
	25	0.0270	0.0813	0.1510	0.0002	0.0083	0.0076	17.6	0.0024	0.0011	17.9
Cement and Mortar Mixers Composite		0.0091	0.0421	0.0556	0.0001	0.0026	0.0024	7.2	0.0008	0.0004	7.4
Concrete/Industrial Saws	25	0.0199	0.0678	0.1257	0.0002	0.0049	0.0045	16.5	0.0018	0.0008	16.8
	50	0.0955	0.2918	0.2858	0.0004	0.0247	0.0227	30.2	0.0086	0.0038	31.6
	120	0.1065	0.4836	0.7154	0.0009	0.0589	0.0542	74.1	0.0096	0.0043	75.7
	175	0.1569	0.8701	1.3612	0.0018	0.0706	0.0649	160	0.0142	0.0063	162.4
Concrete/Industrial Saws Composite		0.1002	0.4088	0.5572	0.0007	0.0452	0.0416	58.5	0.0090	0.0040	59.9
Cranes	50	0.1015	0.2892	0.2394	0.0003	0.0239	0.0220	23.2	0.0092	0.0041	24.6
	120	0.0919	0.3618	0.5508	0.0006	0.0493	0.0453	50.1	0.0083	0.0037	51.5
	175	0.1031	0.4821	0.7769	0.0009	0.0445	0.0410	80.3	0.0093	0.0041	81.8

Table G-15

	250	0.1040	0.2948	0.9948	0.0013	0.0351	0.0323	112	0.0094	0.0042	113.6
	350	0.1245	0.3886	1.1661	0.0015	0.0418	0.0384	139.3	0.0112	0.0050	141.1
	500	0.1551	0.5292	1.4230	0.0018	0.0518	0.0477	180	0.0140	0.0062	182.3
	750	0.2625	0.8887	2.4614	0.0030	0.0885	0.0814	303	0.0237	0.0105	306.8
	1000	0.9491	3.3249	10.3665	0.0098	0.3189	0.2934	971	0.0856	0.0381	984.2
Cranes Composite		0.1348	0.4737	1.1934	0.0014	0.0508	0.0468	129	0.0122	0.0054	130.6
Crawler Tractors	50	0.1176	0.3246	0.2627	0.0003	0.0270	0.0248	24.9	0.0106	0.0047	26.6
	120	0.1293	0.4858	0.7686	0.0008	0.0677	0.0623	65.8	0.0117	0.0052	67.7
	125	0.1328	0.5093	0.8127	0.0008	0.0681	0.0626	70.8	0.0120	0.0053	72.7
	175	0.1674	0.7448	1.2529	0.0014	0.0713	0.0656	121	0.0151	0.0067	123.6
	250	0.1764	0.5000	1.5945	0.0019	0.0613	0.0564	166	0.0159	0.0071	168.7
	500	0.2542	0.9504	2.2389	0.0025	0.0868	0.0799	259	0.0229	0.0102	262.9
	750	0.4574	1.6983	4.1042	0.0047	0.1573	0.1447	465	0.0413	0.0183	471.2
	1000	0.6901	2.6950	7.3731	0.0066	0.2361	0.2172	658	0.0623	0.0277	668.0
Crawler Tractors Composite		0.1584	0.5900	1.1593	0.0013	0.0697	0.0641	114	0.0143	0.0064	116.3
Crushing/Proc. Equipment	50	0.1741	0.5009	0.4359	0.0006	0.0422	0.0389	44.0	0.0157	0.0070	46.5
	120	0.1402	0.5764	0.8552	0.0010	0.0779	0.0717	83.1	0.0127	0.0056	85.2
	175	0.1942	0.9615	1.5237	0.0019	0.0864	0.0795	167	0.0175	0.0078	1/0.0
	250	0.1848	0.5425	2.0202	0.0028	0.0620	0.0571	245	0.0167	0.0074	247.2
	500	0.2608	0.8480	2.7097	0.0037	0.0884	0.0813	374	0.0235	0.0105	377.4
	750	0.4147	1.3191	4.4498	0.0059	0.1418	0.1305	589	0.0374	0.0166	594.8
Cruching/Proc. Equipment Composite	1000	0.1722	3.0752	13.3218	0.0131	0.3880	0.3569	1,308	0.1017	0.0452	1323.9
Crushing/Proc. Equipment Composite	25	0.1733	0.0773	1.1752	0.0015	0.0748	0.0688	132	0.0156	0.0070	134.8
Dumpers/Tenders	25	0.0097	0.0320	0.0001	0.0001	0.0029	0.0027	7.0	0.0009	0.0004	7.0
	25	0.0097	0.0320	0.0001	0.0001	0.0029	0.0027	16.4	0.0009	0.0004	1.0
Excavalors	50	0.0190	0.0077	0.1255	0.0002	0.0047	0.0045	25.0	0.0010	0.0000	26.2
	120	0.0010	0.2041	0.2430	0.0003	0.0212	0.0193	Z3.0 73.6	0.0074	0.0033	75.2
	120	0.1000	0.6668	0.0731	0.0003	0.0500	0.0333	112	0.0000	0.0044	114.0
	200	0.1200	0.5626	0.0002	0.0014	0.0466	0.0428	127 7	0.0110	0.0049	129.5
	250	0 1242	0.3541	1 1360	0.0018	0.0372	0.0343	159	0.0112	0.0050	160.5
	500	0.1735	0.5271	1.4763	0.0023	0.0516	0.0475	234	0.0157	0.0070	236.2
	750	0.2895	0.8731	2.5290	0.0039	0.0871	0.0802	387	0.0261	0.0116	391.6
Excavators Composite		0.1220	0.5338	0.9071	0.0013	0.0481	0.0442	120	0.0110	0.0049	121.3
Forklifts	50	0.0445	0.1623	0.1431	0.0002	0.0121	0.0111	14.7	0.0040	0.0018	15.3
	120	0.0438	0.2176	0.2788	0.0004	0.0241	0.0222	31.2	0.0040	0.0018	31.9
	175	0.0572	0.3307	0.4261	0.0006	0.0246	0.0226	56.1	0.0052	0.0023	56.9
	250	0.0570	0.1614	0.5281	0.0009	0.0168	0.0154	77.1	0.0051	0.0023	77.9
	500	0.0781	0.2208	0.6592	0.0011	0.0228	0.0210	111	0.0070	0.0031	112.1
Forklifts Composite		0.0541	0.2235	0.3950	0.0006	0.0204	0.0188	54.4	0.0049	0.0022	55.2
Generator Sets	15	0.0149	0.0684	0.1016	0.0002	0.0058	0.0053	10.2	0.0013	0.0006	10.4
	25	0.0266	0.0908	0.1594	0.0002	0.0091	0.0083	17.6	0.0024	0.0011	18.0
	50	0.0872	0.2639	0.2847	0.0004	0.0234	0.0215	30.6	0.0079	0.0035	31.9
	120	0.1106	0.4905	0.7587	0.0009	0.0590	0.0543	77.9	0.0100	0.0044	79.5
	175	0.1347	0.7388	1.2314	0.0016	0.0592	0.0544	142	0.0122	0.0054	143.9
	250	0.1277	0.4365	1.6763	0.0024	0.0464	0.0427	213	0.0115	0.0051	214.3
	500	0.1818	0.7230	2.3955	0.0033	0.0690	0.0635	337	0.0164	0.0073	339.5
	750	0.3035	1.1671	3.9863	0.0055	0.1134	0.1044	544	0.0274	0.0122	548.1
	1000	0.7957	2.8065	10.2314	0.0105	0.2844	0.2616	1,049	0.0718	0.0319	1060.0

Table G-15

Generator Sets Composite	0.0767	0.3045	0.5430	0.0007	0.0324	0.0298	61.0	0.0069	0.0031	62.1
Graders	50 0.1080	0.3263	0.2772	0.0004	0.0262	0.0241	27.5	0.0097	0.0043	29.1
1.	0.1254	0.5310	0.7729	0.0009	0.0676	0.0622	75.0	0.0113	0.0050	76.8
1.	40 0.1331	0.6050	0.8989	0.0011	0.0660	0.0607	92.8	0.0120	0.0053	94.7
1	75 0.1467	0.7345	1.1193	0.0014	0.0631	0.0581	124	0.0132	0.0059	126.0
2	50 0.1492	0.4331	1.4184	0.0019	0.0494	0.0454	172	0.0135	0.0060	174.3
5	0.1855	0.6289	1.6842	0.0023	0.0608	0.0559	229	0.0167	0.0074	232.1
7	50 0.3952	1.3289	3.6674	0.0049	0.1306	0.1202	486	0.0357	0.0158	491.4
Graders Composite	0.1446	0.6053	1.1663	0.0015	0.0593	0.0546	133	0.0130	0.0058	134.8
Off-Highway Tractors 1:	20 0.2113	0.7191	1.2368	0.0011	0.1078	0.0992	93.7	0.0191	0.0085	96.8
1	75 0.2045	0.8335	1.5337	0.0015	0.0871	0.0801	130	0.0185	0.0082	133.3
2	50 0.1641	0.4691	1.4453	0.0015	0.0601	0.0553	130	0.0148	0.0066	132.8
7	50 0.6538	2.8815	5.8130	0.0057	0.2353	0.2165	568	0.0590	0.0262	577.5
10	0.9818	4.4978	10.0554	0.0082	0.3436	0.3161	814	0.0886	0.0394	828.4
Off-Highway Tractors Composite	0.2077	0.7649	1.7062	0.0017	0.0818	0.0753	151	0.0187	0.0083	154.4
Off-Highway Trucks 1	75 0.1441	0.7580	1.0305	0.0014	0.0602	0.0554	125	0.0130	0.0058	127.2
2	50 0.1400	0.3837	1.2373	0.0019	0.0412	0.0379	167	0.0126	0.0056	168.6
3	0.1554	0.4342	1.3471	0.0020	0.0457	0.0420	187.7	0.0140	0.0062	189.9
5	0.2170	0.6362	1.7865	0.0027	0.0634	0.0583	272	0.0196	0.0087	275.4
7	50 0.3542	1.0311	2.9938	0.0044	0.1046	0.0962	442	0.0320	0.0142	446.8
10	00 0.5484	1.6691	5.9808	0.0063	0.1796	0.1652	625	0.0495	0.0220	632.6
Off-Highway Trucks Composite	0.2141	0.6361	1.8543	0.0027	0.0644	0.0593	260	0.0193	0.0086	263.1
Other Construction Equipment	15 0.0118	0.0617	0.0737	0.0002	0.0029	0.0026	10.1	0.0011	0.0005	10.3
	25 0.0160	0.0544	0.1013	0.0002	0.0041	0.0037	13.2	0.0014	0.0006	13.4
	0.0753	0.2653	0.2585	0.0004	0.0205	0.0189	28.0	0.0068	0.0030	29.1
1	20 0.1006	0.5277	0.7025	0.0009	0.0567	0.0522	80.9	0.0091	0.0040	82.3
1	0.0935	0.5873	0.8011	0.0012	0.0420	0.0386	107	0.0084	0.0038	107.9
Other Orgetriefier Environment Orgen exite	0.1452	0.5234	1.5187	0.0025	0.0491	0.0452	254	0.0131	0.0058	256.3
	0.0872	0.3765	0.7938	0.0013	0.0330	0.0304	123	0.0079	0.0035	123.9
Other General Industrial Equipmen	0.0066	0.0391	0.0466	0.0001	0.0018	0.0017	6.4	0.0006	0.0003	6.5
		0.0632	0.1170	0.0002	0.0044	0.0040	15.3	0.0017	0.0007	15.0
1	0.0960	0.2730	0.2243	0.0003	0.0232	0.0214	21.7	0.0066	0.0039	23.1
1	20 0.1177	0.4407	0.0769	0.0007	0.0644	0.0595	02.0	0.0108	0.0047	03.7
	5 0.1201	0.3120	1 2012	0.0011	0.0349	0.0303	126	0.0114	0.0031	127.2
5	0.1174	0.5177	2 0642	0.0015	0.0500	0.0530	265	0.0100	0.0047	268.5
7	50 0.2133	1 0522	3 51/6	0.0020	0.0095	0.0030	203 //37	0.0193	0.0000	200.5
10	0 0 5246	1.0022	6 0067	0.0044	0.1100	0.1660	560	0.0020	0.0142	567.1
Other General Industrial Equipmen Composite	0 1542	0.5159	1 3484	0.0000	0.0580	0.0533	152	0.0470	0.0210	154.4
Other Material Handling Equipment	50 0 1361	0.3789	0.3119	0.0004	0.0323	0.0297	30.3	0.0123	0.0055	32.3
	0 1144	0 4370	0.6628	0 0007	0.0628	0.0578	60.7	0.0103	0.0046	62.3
1	75 0 1591	0 7257	1 1860	0.0014	0.0696	0.0640	122	0.0144	0.0064	124.4
2	50 0.1241	0.3385	1.2829	0.0016	0.0405	0.0372	145	0.0112	0.0050	146 8
2	75 0.1269	0.3506	1.3035	0.0017	0.0414	0.0381	149.7	0.0114	0.0051	151.5
5	0.1521	0.4596	1.4883	0.0019	0.0498	0.0458	192	0.0137	0.0061	193.8
10	0.7021	2.2197	7.9424	0.0073	0.2379	0.2188	741	0.0634	0.0282	751.4
Other Material Handling Equipment Composite	0.1473	0.4951	1.3132	0.0015	0.0562	0.0517	141	0.0133	0.0059	143.3
Pavers	0.0247	0.0799	0.1500	0.0002	0.0075	0.0069	18.7	0.0022	0.0010	19.0
	50 0.1366	0.3592	0.2948	0.0004	0.0308	0.0283	28.0	0.0123	0.0055	29.9

	120	0.1387	0.5057	0.8357	0.0008	0.0729	0.0671	69.2	0.0125	0.0056	71.2
	175	0.1777	0.7784	1.3769	0.0014	0.0769	0.0707	128	0.0160	0.0071	130.8
	250	0.2072	0.6081	1.9469	0.0022	0.0756	0.0695	194	0.0187	0.0083	197.3
	500	0.2275	0.9254	2.1080	0.0023	0.0818	0.0752	233	0.0205	0.0091	236.5
Pavers Composite		0.1511	0.5357	0.8542	0.0009	0.0603	0.0555	77.9	0.0136	0.0061	80.1
Paving Equipment	25	0.0153	0.0520	0.0968	0.0002	0.0039	0.0036	12.6	0.0014	0.0006	12.8
	50	0.1166	0.3049	0.2514	0.0003	0.0263	0.0242	23.9	0.0105	0.0047	25.6
	120	0.1087	0.3958	0.6561	0.0006	0.0574	0.0528	54.5	0.0098	0.0044	56.1
	175	0.1387	0.6079	1.0816	0.0011	0.0602	0.0554	101	0.0125	0.0056	103.0
	250	0.1277	0.3763	1.2206	0.0014	0.0467	0.0430	122	0.0115	0.0051	124.1
Paving Equipment Composite		0.1142	0.4316	0.7709	0.0008	0.0536	0.0493	68.9	0.0103	0.0046	70.6
Plate Compactors	15	0.0050	0.0263	0.0314	0.0001	0.0012	0.0011	4.3	0.0005	0.0002	4.4
Plate Compactors Composite		0.0050	0.0263	0.0314	0.0001	0.0012	0.0011	4.3	0.0005	0.0002	4.4
Pressure Washers	15	0.0071	0.0328	0.0487	0.0001	0.0028	0.0025	4.9	0.0006	0.0003	5.0
	25	0.0108	0.0368	0.0646	0.0001	0.0037	0.0034	7.1	0.0010	0.0004	7.3
	50	0.0315	0.1037	0.1284	0.0002	0.0094	0.0086	14.3	0.0028	0.0013	14.7
	120	0.0302	0.1443	0.2235	0.0003	0.0157	0.0145	24.1	0.0027	0.0012	24.5
Pressure Washers Composite		0.0159	0.0619	0.0878	0.0001	0.0058	0.0053	9.4	0.0014	0.0006	9.6
Pumps	15	0.0125	0.0497	0.0752	0.0001	0.0049	0.0046	7.4	0.0011	0.0005	7.6
	25	0.0359	0.1004	0.1761	0.0002	0.0109	0.0100	19.5	0.0032	0.0014	20.0
	50	0.1052	0.3116	0.3228	0.0004	0.0275	0.0253	34.3	0.0095	0.0042	35.8
	120	0.1149	0.4984	0.7706	0.0009	0.0617	0.0568	77.9	0.0104	0.0046	79.6
	175	0.1385	0.7405	1.2344	0.0016	0.0611	0.0562	140	0.0125	0.0056	142.1
	250	0.1266	0.4210	1.6140	0.0023	0.0457	0.0421	201	0.0114	0.0051	203.2
	500	0.1952	0.7595	2.4849	0.0034	0.0734	0.0675	345	0.0176	0.0078	348.0
	750	0.3326	1.2556	4.2353	0.0057	0.1235	0.1136	571	0.0300	0.0133	575.5
	1000	1.0536	3.7127	13.3750	0.0136	0.3744	0.3444	1,355	0.0951	0.0423	1369.9
Pumps Composite		0.0748	0.2926	0.4705	0.0006	0.0323	0.0297	49.6	0.0067	0.0030	50.7
Rollers	15	0.0074	0.0386	0.0461	0.0001	0.0018	0.0016	6.3	0.0007	0.0003	6.4
	25	0.0161	0.0549	0.1023	0.0002	0.0041	0.0038	13.3	0.0015	0.0006	13.6
	50	0.1025	0.2911	0.2583	0.0003	0.0245	0.0225	26.0	0.0092	0.0041	27.5
	120	0.0986	0.4063	0.6253	0.0007	0.0534	0.0491	59.0	0.0089	0.0040	60.4
	175	0.1247	0.6199	1.0114	0.0012	0.0550	0.0506	108	0.0113	0.0050	109.9
	250	0.1262	0.3887	1.3124	0.0017	0.0451	0.0415	153	0.0114	0.0051	154.9
	500	0.1654	0.6313	1.6820	0.0022	0.0593	0.0545	219	0.0149	0.0066	221.5
Rollers Composite		0.0973	0.4060	0.6546	0.0008	0.0453	0.0417	67.1	0.0088	0.0039	68.4
Rough Terrain Forklifts	50	0.1181	0.3778	0.3316	0.0004	0.0300	0.0276	33.9	0.0107	0.0047	35.6
	120	0.0955	0.4327	0.5995	0.0007	0.0529	0.0487	62.4	0.0086	0.0038	63.8
	175	0.1352	0.7256	1.0448	0.0014	0.0592	0.0545	125	0.0122	0.0054	126.8
	250	0.1294	0.3798	1.2955	0.0019	0.0416	0.0382	171	0.0117	0.0052	172.7
	500	0.1824	0.5717	1.7096	0.0025	0.0584	0.0537	257	0.0165	0.0073	259.2
Rough Terrain Forklifts Composite		0.1009	0.4642	0.6526	0.0008	0.0532	0.0489	70.3	0.0091	0.0040	71.7
Rubber Tired Dozers	175	0.2119	0.8457	1.5561	0.0015	0.0893	0.0821	129	0.0191	0.0085	132.5
	250	0.2435	0.6833	2.0817	0.0021	0.0881	0.0810	183	0.0220	0.0098	187.0
	500	0.3211	1.4228	2.7305	0.0026	0.1133	0.1043	265	0.0290	0.0129	269.5
	750	0.4843	2.1329	4.1797	0.0040	0.1716	0.1579	399	0.0437	0.0194	405.7
	1000	0.7496	3.4322	7.4509	0.0060	0.2591	0.2384	592	0.0676	0.0301	602.6
Rubber Tired Dozers Composite		0.2986	1.1749	2.5452	0.0025	0.1064	0.0979	239	0.0269	0.0120	243.4
Rubber Tired Loaders	25	0.0204	0.0697	0.1292	0.0002	0.0050	0.0046	16.9	0.0018	0.0008	17.2

Table G-15

	50	0.1200	0.3641	0.3118	0.0004	0.0292	0.0269	31.1	0.0108	0.0048	32.9
	120	0.0971	0.4152	0.6015	0.0007	0.0525	0.0483	58.9	0.0088	0.0039	60.3
	175	0.1238	0.6274	0.9501	0.0012	0.0535	0.0492	106	0.0112	0.0050	108.1
	250	0.1259	0.3685	1.2125	0.0017	0.0417	0.0384	149	0.0114	0.0050	150.8
	500	0.1867	0.6397	1.7158	0.0023	0.0613	0.0564	237	0.0168	0.0075	239.7
	750	0.3850	1.3084	3.6184	0.0049	0.1276	0.1174	486	0.0347	0.0154	491.0
	1000	0.5190	1.8389	5.9660	0.0060	0.1795	0.1651	594	0.0468	0.0208	601.3
Rubber Tired Loaders Composite		0.1195	0.4763	0.9346	0.0012	0.0508	0.0467	109	0.0108	0.0048	110.3
Scrapers	120	0.1877	0.6943	1.1141	0.0011	0.0983	0.0904	93.9	0.0169	0.0075	96.6
	175	0.2070	0.9107	1.5564	0.0017	0.0884	0.0813	148	0.0187	0.0083	151.0
	250	0.2252	0.6408	2.0481	0.0024	0.0791	0.0727	209	0.0203	0.0090	212.7
	400	0.2813	0.9831	2.5165	0.0028	0.0976	0.0898	276.6	0.0254	0.0113	280.7
	500	0.3186	1.2113	2.8288	0.0032	0.1099	0.1011	321	0.0287	0.0128	326.0
	750	0.5525	2.0861	4.9949	0.0056	0.1918	0.1764	555	0.0499	0.0222	563.2
Scrapers Composite		0.2783	1.0395	2.4118	0.0027	0.1005	0.0925	262	0.0251	0.0112	266.5
Signal Boards	15	0.0072	0.0377	0.0450	0.0001	0.0018	0.0016	6.2	0.0006	0.0003	6.3
	50	0.1151	0.3456	0.3415	0.0005	0.0296	0.0272	36.2	0.0104	0.0046	37.8
	120	0.1176	0.5214	0.7807	0.0009	0.0644	0.0593	80.2	0.0106	0.0047	81.9
	175	0.1535	0.8341	1.3333	0.0017	0.0685	0.0630	155	0.0139	0.0062	156.7
	250	0.1632	0.5350	1.9963	0.0029	0.0580	0.0534	255	0.0147	0.0065	257.6
Signal Boards Composite	05	0.0192	0.0934	0.1399	0.0002	0.0077	0.0071	16.7	0.0017	0.0008	17.0
Skid Steer Loaders	25	0.0202	0.0620	0.1166	0.0002	0.0063	0.0058	13.8	0.0018	0.0008	14.1
	50	0.0517	0.2263	0.2279	0.0003	0.0157	0.0144	25.5	0.0047	0.0021	26.3
Skid Stoor Loadors Composito	120	0.0429	0.2740	0.3207	0.0005	0.0243	0.0225	42.0	0.0039	0.0017	43.4
Skid Steel Loaders Composite	50	0.0400	0.2309	0.2322	0.0004	0.0179	0.0105	30.3	0.0042	0.0019	30.9 14 9
Surfacing Equipment	120	0.0477	0.1403	0.1339	0.0002	0.0119	0.0109	63.8	0.0043	0.0019	65.2
	120	0.0970	0.4213	0.0323	0.0007	0.0317	0.0473	85.8	0.0080	0.0039	87.1
	250	0.0034	0.4730	1 1177	0.0010	0.0376	0.0346	135	0.0001	0.0030	136.3
	500	0.1020	0.6418	1 6597	0.0010	0.0567	0.0040	221	0.0002	0.0041	223.4
	750	0.2443	1.0046	2.6697	0.0035	0.0900	0.0828	347	0.0220	0.0098	350.5
Surfacing Equipment Composite		0.1277	0.5182	1.2760	0.0017	0.0468	0.0431	166	0.0115	0.0051	167.8
Sweepers/Scrubbers	15	0.0124	0.0729	0.0870	0.0002	0.0034	0.0031	11.9	0.0011	0.0005	12.1
	25	0.0237	0.0808	0.1496	0.0002	0.0058	0.0054	19.6	0.0021	0.0009	20.0
	50	0.1048	0.3425	0.3055	0.0004	0.0271	0.0249	31.6	0.0095	0.0042	33.1
	120	0.1107	0.5147	0.6989	0.0009	0.0622	0.0573	75.0	0.0100	0.0044	76.6
	175	0.1439	0.7997	1.1204	0.0016	0.0637	0.0586	139	0.0130	0.0058	141.1
	250	0.1146	0.3382	1.1784	0.0018	0.0362	0.0333	162	0.0103	0.0046	163.7
Sweepers/Scrubbers Composite		0.1148	0.5145	0.6862	0.0009	0.0510	0.0469	78.5	0.0104	0.0046	80.2
Tractors/Loaders/Backhoes	25	0.0195	0.0657	0.1237	0.0002	0.0056	0.0052	15.9	0.0018	0.0008	16.1
	50	0.0893	0.3199	0.2893	0.0004	0.0238	0.0219	30.3	0.0081	0.0036	31.6
	100	0.0751	0.3434	0.4087	0.0005	0.0342	0.0314	45.6	0.0068	0.0030	46.7
	120	0.0694	0.3529	0.4565	0.0006	0.0383	0.0352	51.7	0.0063	0.0028	52.7
	175	0.0988	0.5861	0.7696	0.0011	0.0428	0.0394	101	0.0089	0.0040	102.8
	250	0.1204	0.3666	1.1658	0.0019	0.0370	0.0340	172	0.0109	0.0048	173.5
	500	0.2290	0.7443	2.0659	0.0039	0.0701	0.0645	345	0.0207	0.0092	348.1
	750	0.3462	1.1159	3.2041	0.0058	0.1072	0.0986	517	0.0312	0.0139	522.2
Tractors/Loaders/Backhoes Composite		0.0792	0.3782	0.5392	0.0008	0.0387	0.0356	66.8	0.0071	0.0032	67.9
Trenchers	15	0.0099	0.0517	0.0617	0.0001	0.0024	0.0022	8.5	0.0009	0.0004	8.6

Table G-15

	25	0 0397	0 1355	0 2511	0 0004	0 0097	0 0090	32.9	0.0036	0.0016	33 5
	20	0.0001	0.1000	0.2011	0.0004	0.0001	0.0000	02.0	0.0000	0.0010	00.0
	50	0.1566	0.4082	0.3432	0.0004	0.0353	0.0325	32.9	0.0141	0.0063	35.2
	120	0.1281	0.4684	0.7862	0.0008	0.0669	0.0615	64.9	0.0116	0.0051	66.7
	175	0.1955	0.8632	1.5520	0.0016	0.0849	0.0781	144	0.0176	0.0078	146.7
	250	0.2354	0.7089	2.2485	0.0025	0.0880	0.0810	223	0.0212	0.0094	226.3
	500	0.2985	1.3011	2.8470	0.0031	0.1105	0.1016	311	0.0269	0.0120	315.6
	750	0.5663	2.4440	5.4715	0.0059	0.2099	0.1931	587	0.0511	0.0227	595.0
Trenchers Composite		0.1427	0.4675	0.6684	0.0007	0.0549	0.0505	58.7	0.0129	0.0057	60.8
Welders	15	0.0104	0.0416	0.0629	0.0001	0.0041	0.0038	6.2	0.0009	0.0004	6.4
	25	0.0208	0.0581	0.1020	0.0001	0.0063	0.0058	11.3	0.0019	0.0008	11.6
	50	0.0979	0.2753	0.2535	0.0003	0.0240	0.0221	26.0	0.0088	0.0039	27.4
	120	0.0654	0.2659	0.4099	0.0005	0.0358	0.0330	39.5	0.0059	0.0026	40.4
	175	0.1101	0.5455	0.9083	0.0011	0.0490	0.0451	98.2	0.0099	0.0044	99.8
	250	0.0855	0.2618	1.0026	0.0013	0.0301	0.0277	119	0.0077	0.0034	120.3
	500	0.1092	0.3838	1.2526	0.0016	0.0394	0.0363	168	0.0098	0.0044	169.2
Welders Composite		0.0646	0.2096	0.2564	0.0003	0.0225	0.0207	25.6	0.0058	0.0026	26.5

Notes:

SCAQMD emission factors for 2014 (SCAQMD 2008)

Offroad diesel exhaust PM<sub>2.5</sub> = 92% of PM<sub>10</sub> per EMFAC 2007 version 2.3 (SCAQMD 2008)

Offroad N<sub>2</sub>O per Annex 3, Table A-101 (USEPA 2011)

Non-matching application-specific values interpolated or extrapolated

USEPA GWPs for CO  $_2$  eqv (1, 21, 310)

## Apdx G - Onroad 2013 Table G-16

#### Table G-16 SCAB Fleet Average Emission Factors

A-20 Onroad 2013

Air Basin	SC

	(lb/mi)									
Vehicle Type	ROG	CO	NOX	SOX	PM10	PM2.5	CO2	CH4	N2O	CO2 eqv
Light Duty (pickup trucks)	0.00075	0.00709	0.00071	0.00001	0.00009	0.00006	1.10087	0.00007	0.00003	1.11070
Medium Duty (work trucks)	0.00206	0.01408	0.01577	0.00003	0.00060	0.00050	2.78163	0.00010	0.00015	2.83046
Heavy Heavy Duty (tractor/trailers)	0.00226	0.00932	0.02743	0.00004	0.00134	0.00115	4.21519	0.00010	0.00010	4.24784

Notes:

SCAQMD 2008 HHD includes tire & brake wear Onroad N<sub>2</sub>O per Annex 3, Table A-99



## Table G-17 Highest (Most Conservative) EMFAC2007 (version 2.3) Emission Factors for On-Road Passenger Vehicles & Delivery Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026)

Derived from Peak Emissions Inventory (Winter, Annual, Summer)

Vehicle Class:

Passenger Vehicles (<8500 pounds) & Delivery Trucks (>8500 pounds)

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model, taking the weighted average of vehicle types and simplifying into two categories: **Passenger Vehicles & Delivery Trucks.** 

These emission factors can be used to calculate on-road mobile source emissions for the vehicle categories listed in the tables below, by use of the following equation:

#### Emissions (pounds per day) = N x TL x EF

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

This methodology replaces the old EMFAC emission factors in Tables A-9-5-J-1 through A-9-5-L in Appendix A9 of the current SCAQMD CEQA Handbook. All the emission factors account for the emissions from start, running and idling exhaust. In addition, the ROG emission factors include diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors include tire and brake wear.

Scenario Year: **2007** All model years in the range 1965 to 2007

Passenger Vehicles (pounds/mile)			Deliv (poι	ery Trucks Inds/mile)
CO	0.01155158		CO	0.02407553
NOx	0.00121328		NOx	0.02508445
ROG	0.00118234		ROG	0.00323145
SOx	0.00001078		SOx	0.00002626
PM10	0.00008447		PM10	0.00091020
PM2.5	0.00005243		PM2.5	0.00078884
CO2	1.10672236		CO2	2.72245619
CH4	0.00010306		CH4	0.00016030
N2O	0.00004173		N2O	0.00024936
CO2 eqv	1.12182256		CO2 eqv	2.80312488

#### Scenario Year: 2009

All model	vears i	in the	range	1965	to 2009	

	model years in t		ange 1905	10 2009
Passenger Vehicles (pounds/mile)			Deliv (pou	ery Trucks Inds/mile)
CO	0.00968562		CO	0.02016075
NOx	0.00100518		NOx	0.02236636
ROG	0.00099245		ROG	0.00278899
SOx	0.00001066		SOx	0.00002679
PM10	0.00008601		PM10	0.00080550
PM2.5	0.00005384		PM2.5	0.00069228
CO2	1.09755398		CO2	2.72330496
CH4	0.00008767		CH4	0.00013655
N20	0.00003550		N2O	0.00021242
CO2 eqv	1.11039937		CO2 eqv	2.79202205

Scenario Year: **2011** All model years in the range 1967 to 2011 Scenario Year: **2008** All model years in the range 1965 to 2008

Passen (pou	ger Vehicles Inds/mile)	Deliv (poι	ery Trucks Inds/mile)
CO	0.01054844	CO	0.02194915
NOx	0.00110288	NOx	0.02371258
ROG	0.00107919	ROG	0.00299270
SOx	0.00001075	SOx	0.00002565
PM10	0.00008505	PM10	0.00085607
PM2.5	0.00005293	PM2.5	0.00073933
CO2	1.09953226	CO2	2.71943400
CH4	0.00009465	CH4	0.00014769
N2O	0.00003832	N2O	0.0002297
CO2 eqv	1.11340004	CO2 eqv	2.7937546

#### Scenario Year: 2010

All model years in the range 1966 to 2010							
Passenger Vehicles (pounds/mile)			Deliv (pou	ery Trucks nds/mile)			
CO	0.00826276		CO	0.01843765			
NOx	0.00091814		NOx	0.02062460			
ROG	0.00091399		ROG	0.00258958			
SOx	0.00001077		SOx	0.00002701			
PM10	0.00008698		PM10	0.00075121			
PM2.5	0.00005478		PM2.5	0.00064233			
CO2	1.09568235		CO2	2.73222199			
CH4	0.00008146		CH4	0.00012576			
N2O	0.00003298		N2O	0.00019563			
CO2 eqv	1,10761811		CO2 eav	2,79550969			

Scenario Year: **2012** All model years in the range 1968 to 2012



Passenger Vehicles (pounds/mile)		Delive (pou	ery Trucks nds/mile)
CO	0.00826276	CO	0.01693242
NOx	0.00084460	NOx	0.01893366
ROG	0.00085233	ROG	0.00241868
SOx	0.00001077	SOx	0.00002728
PM10	0.00008879	PM10	0.00070097
PM2.5	0.00005653	PM2.5	0.00059682
CO2	1.10235154	CO2	2.75180822
CH4	0.00007678	CH4	0.00011655
N2O	0.00003109	N2O	0.00018130
CO2 eqv	1.11360103	CO2 eqv	2.81046029

Scenario Year: 2013

All model years in the range 1969 to 2013				
Passenger Vehicles (pounds/mile)			Deliv (poι	ery Trucks Inds/mile)
CO	0.00709228		CO	0.01407778
NOx	0.00071158		NOx	0.01577311
ROG	0.00074567		ROG	0.00206295
SOx	0.00001072		SOx	0.00002682
PM10	0.00009067		PM10	0.00059956
PM2.5	0.00005834		PM2.5	0.00050174
CO2	1.10087435		CO2	2.78163459
CH4	0.00006707		CH4	0.00009703
N2O	0.00002716		N2O	0.00015094
CO2 eqv	1.11070222		CO2 eqv	2.83046413

#### Scenario Year: 2015

All model years in the range 1971 to 2015

Passenger Vehicles (pounds/mile)		Deliv (pou	ery Trucks Inds/mile)
CO	0.00614108	CO	0.01169445
NOx	0.00060188	NOx	0.01285026
ROG	0.00066355	ROG	0.00173890
SOx	0.00001070	SOx	0.00002741
PM10	0.00009259	PM10	0.00050307
PM2.5	0.00006015	PM2.5	0.00041268
CO2	1.10192837	CO2	2.81247685
CH4	0.00005923	CH4	0.00008076
N2O	0.00002398	N2O	0.00012562
CO2 eqv	1.11060625	CO2 eqv	2.85311641

Scenario Year: 2017 All model years in the range 1973 to 2017

Passenger Vehicles (pounds/mile)		Delive (pou	ery Trucks inds/mile)
CO	0.00537891	CO	0.00998101
NOx	0.00051297	NOx	0.01070034
ROG	0.00060109	ROG	0.00150242
SOx	0.00001079	SOx	0.00002723
PM10	0.00009446	PM10	0.00043131
PM2.5	0.00006192	PM2.5	0.00034605
CO2	1.10627489	CO2	2.84005015

Passer (pol		
CO	0.00765475	
NOx	0.00077583	
ROG	0.00079628	
SOx	0.00001073	
PM10	0.00008979	
PM2.5	0.00005750	
CO2	1.10152540	
CH4	0.00007169	
N2O	0.00002903	
CO2 eqv	1.11202923	C

Delivery Trucks (pounds/mile)				
CO	0.01545741			
NOx	0.01732423			
ROG	0.00223776			
SOx	0.00002667			
PM10	0.00064975			
PM2.5	0.00054954			
CO2	2.76628414			
CH4	0.00010668			
N2O	0.00016594			
CO2 eqv	2.81996552			

0.01284321 0.01425162 0.00189649 0.00002754 0.00054929 0.00045519 2.79845465 0.00008798 0.00013685 2.84272697

#### Scenario Year: 2014

All model years in the range 1970 to 2014					
Passenger Vehicles (pounds/mile)			Deliv (pou	ery Trucks Inds/mile)	
CO	0.00660353		CO	0.012843	
NOx	0.00065484		NOx	0.014251	
ROG	0.00070227		ROG	0.001896	
SOx	0.00001069		SOx	0.000027	
PM10	0.00009185		PM10	0.000549	
PM2.5	0.00005939		PM2.5	0.000455	
CO2	1.10257205		CO2	2.798454	
CH4	0.00006312		CH4	0.000087	
N2O	0.00002556		N2O	0.0001	
CO2 eqv	1.11181980		CO2 eqv	2.8427	

#### Scenario Year: 2016 in th 70.4- 0040

All model years in the range 1972 to 2016				
Passenger Vehicles (pounds/mile)			Deliv (pou	ery Trucks Inds/mile)
CO	0.00575800		CO	0.01080542
NOx	0.00055658		NOx	0.01172881
ROG	0.00063254		ROG	0.00161521
SOx	0.00001071		SOx	0.00002767
PM10	0.00009392		PM10	0.00046606
PM2.5	0.00006131		PM2.5	0.00037868
CO2	1.10677664		CO2	2.83134285
CH4	0.00005623		CH4	0.00007355
N2O	0.00002277		N2O	0.00011441
CO2 eqv	1.11501568		CO2 eqv	2.86835526

#### Scenario Year: 2018 All model years in the range 1974 to 2018

Passenger Vehicles (pounds/mile)		Deliv (poι	ery Trucks Inds/mile)
CO	0.00502881	CO	0.00923234
NOx	0.00047300	NOx	0.00979416
ROG	0.00057178	ROG	0.00139856
SOx	0.00001071	SOx	0.00002749
PM10	0.00009494	PM10	0.00040110
PM2.5	0.00006234	PM2.5	0.00031792
CO2	1.10562643	CO2	2.84646835



CH4	0.00005300	CH4	0.00006663
N2O	0.00002146	N2O	0.00010365
CO2 eqv	1.11404119	CO2 eqv	2.87358027

Scenario Year: 2019

All model	years in	the range	1975 to	2019

Passen (pou	Passenger Vehicles (pounds/mile)		Deliv (poι	ery Trucks Inds/mile)
CO	0.00471820		CO	0.00857192
NOx	0.00043716		NOx	0.00900205
ROG	0.00054654		ROG	0.00130563
SOx	0.00001072		SOx	0.00002706
PM10	0.00009523		PM10	0.00037393
PM2.5	0.00006259		PM2.5	0.00029276
CO2	1.10496100		CO2	2.85060182
CH4	0.00004743		CH4	0.00005619
N2O	0.00001920		N2O	0.00008741
CO2 eqv	1.11191031		CO2 eqv	2.87887960

#### Scenario Year: 2021

All model years in the range 1977 to 2021

Passenger Vehicles (pounds/mile)		Deliv (poι	ery Trucks Inds/mile)
CO	0.00421218	CO	0.00748303
NOx	0.00037757	NOx	0.00773500
ROG	0.00050573	ROG	0.00115568
SOx	0.00001073	SOx	0.00002755
PM10	0.00009640	PM10	0.00033125
PM2.5	0.00006364	PM2.5	0.00025331
CO2	1.11009559	CO2	2.86434187
CH4	0.00004322	CH4	0.00004905
N2O	0.00001750	N2O	0.00007630
CO2 eqv	1.11642895	CO2 eqv	2.88902454

#### Scenario Year: 2023

All model years in the range 1979 to 2023

Passen (pou	ger Vehicles Inds/mile)	Delivery Trucks (pounds/mile)	
CO	0.00377527	CO	0.00658123
NOx	0.00032851	NOx	0.00679147
ROG	0.00046900	ROG	0.00102852
SOx	0.00001070	SOx	0.00002790
PM10	0.00009676	PM10	0.00030109
PM2.5	0.00006405	PM2.5	0.00022582
CO2	1.11023373	CO2	2.87466338
CH4	0.00003951	CH4	0.00004218
N2O	0.00001600	N2O	0.00006561
CO2 eqv	1.11602249	CO2 eqv	2.89588881

Scenario Year: 2025 All model years in the range 1981 to 2025



	CH4	0.00005003	CH4	0.00006203
	N2O	0.00002026	N2O	0.00009650
C	CO2 eqv	1.11295662	CO2 eqv	2.87768473

Scenario Year: 2020
All model years in the range 1976 to 2020

All model years in the range 1970 to 2020				10 2020
Passenger Vehicles			Delivery Trucks	
(pou	ınds/mile)		(ροι	ınds/mile)
CO	0.00444247		CO	0.00799617
NOx	0.00040506		NOx	0.00831802
ROG	0.00052463		ROG	0.00122382
SOx	0.00001073		SOx	0.00002733
PM10	0.00009550		PM10	0.00035054
PM2.5	0.00006279		PM2.5	0.00027128
CO2	1.10456157		CO2	2.85148109
CH4	0.00004495		CH4	0.00005330
N2O	0.00001820		N2O	0.00008291
CO2 eqv	1.11114749		CO2 eqv	2.87830219

#### Scenario Year: 2022

All model years	in t	he	range	1978	to 2022
-----------------	------	----	-------	------	---------

		<u> </u>	
Passer (pou	nger Vehicles unds/mile)	Delivery Trucks (pounds/mile)	
CO	0.00397866	CO	0.00699290
NOx	0.00035150	NOx	0.00722470
ROG	0.00048658	ROG	0.00108569
SOx	0.00001072	SOx	0.00002774
PM10	0.00009661	PM10	0.00031501
PM2.5	0.00006389	PM2.5	0.00023906
CO2	1.11019931	CO2	2.87006769
CH4	0.00004121	CH4	0.00004557
N2O	0.00001669	N2O	0.0000708
CO2 eqv	1.11623782	CO2 eqv	2.8929980

#### Scenario Year: 2024

0.00625076

0.00647083 0.00096578

0.00002807

0.00029407

0.00021880

2.88010717

0.00004019

0.00006251 2.90033043

All model years in the range 1980 to 2024					
Passenger Vehicles			Delivery Trucks		
(pot	inas/mile)		(pol	inas/mile)	
CO	0.00358611		CO	0.006250	
NOx	0.00030721		NOx	0.006470	
ROG	0.00045136		ROG	0.000965	
SOx	0.00001080		SOx	0.000028	
PM10	0.00009676		PM10	0.000294	
PM2.5	0.00006410		PM2.5	0.000218	
CO2	1.11061572		CO2	2.880107	
CH4	0.00003781		CH4	0.000040	
N2O	0.00001531		N2O	0.0000	
CO2 eqv	1.11615549		CO2 eqv	2.90033	

#### Scenario Year: 2026

All model years in the range 1982 to 2026

Passenger Vehicles	Delivery Trucks
(pounds/mile)	(pounds/mile)
CO <b>0.00328779</b>	CO 0.0056943



NOx	0.00028846	NOx	0.00615945
ROG	0.00043545	ROG	0.00092178
SOx	0.00001070	SOx	0.00002761
PM10	0.00009679	PM10	0.00028425
PM2.5	0.00006418	PM2.5	0.00020958
CO2	1.11078571	CO2	2.88143570
CH4	0.00003641	CH4	0.00003765
N2O	0.00001474	N2O	0.00005857
CO2 eqv	1.11611985	CO2 eqv	2.90038172

NOx	0.00027141	NOx	0.00589869
ROG	0.00042052	ROG	0.00088403
SOx	0.00001076	SOx	0.00002716
PM10	0.00009687	PM10	0.00027657
PM2.5	0.00006415	PM2.5	0.00020187
CO2	1.11105829	CO2	2.88298299
CH4	0.00003518	CH4	0.00003581
N2O	0.00001424	N2O	0.00005570
CO2 eqv	1.11621250	CO2 eqv	2.90100126

<u>Notes:</u> SCAQMD 2008

HHD-DSL composite includes tire & brake wear Onroad N $_2$ O per Annex 3, Table A-99



# Table G-18 Highest (Most Conservative) EMFAC2007 (version 2.3)Emission Factors for On-Road Heavy-Heavy-Duty Diesel Trucks

Projects in the SCAQMD (Scenario Years 2007 - 2026) Derived from Peak Emissions Inventory (**Winter**, **Annual**, **Summer**)

#### Vehicle Class: Heavy-Heavy-Duty Diesel Trucks (33,001 to 60,000 pounds)

The following emission factors were compiled by running the California Air Resources Board's EMFAC2007 (version 2.3) Burden Model and extracting the **Heavy-Heavy-Duty Diesel Truck (HHDT)** Emission Factors.

These emission factors can be used to calculate on-road mobile source emissions for the vehicle/emission categories listed in the tables below, by use of the following equation:

Emissions (pounds per day) = N x TL x EF

where N = number of trips, TL = trip length (miles/day), and EF = emission factor (pounds per mile)

The **HHDT-DSL** vehicle/emission category accounts for all emissions from heavy-heavy-duty diesel trucks, including start, running and idling exhaust. In addition, ROG emission factors account for diurnal, hot soak, running and resting emissions, and the PM10 & PM2.5 emission factors account for tire and brake wear.

The **HHDT-DSL, Exh** vehicle/emission category includes only the exhaust portion of PM10 & PM2.5 emissions from heavy-heavy-duty diesel trucks.

Scenario Year: **2007** All model years in the range 1965 to 2007

Scenario Year: **2009** All model years in the range 1965 to 2009

	,	 
HI (pot		
CO	0.01446237	F
NOx	0.04718166	Ρ
ROG	0.00372949	
SOx	0.00003962	
PM10	0.00230900	
PM2.5	0.00204018	
CO2	4.22184493	
CH4	0.00016312	
N2O	0.00015353	
CO2 eqv	4.27286406	

range 1965	to 2007
HHD	T-DSL, Exh
(pou	unds/mile)
PM10	0.00216752
PM2.5	0.00199491

Scenario Year: 2008				
All	model years in th	ne	range 1965	5 to 2008
HHDT-DSL (pounds/mile)			HHD (pou	T-DSL, Exh unds/mile)
CO	0.01361368		PM10	0.002012
NOx	0.04458017		PM2.5	0.001853
ROG	0.00351579			
SOx	0.00004136			
PM10	0.00215635			
PM2.5	0.00189990			
CO2	4.21067145			
CH4	0.00016269			
N2O	0.00015312			
CO2 eqv	4.26155554			

Scenario Year: **2010** All model years in the range 1966 to 2010

HHDT-DSL (pounds/mile)				
CO	0.01282236			
NOx	0.04184591			
ROG	0.00329320			
SOx	0.00004013			
PM10	0.00199572			
PM2.5	0.00175227			
CO2	4.21080792			
CH4	0.00015249			
N2O	0.00014352			
CO2 eqv	4.25850077			

HHD (po	T-DSL, Exh unds/mile)
PM10	0.00185393
PM2.5	0.00170680

HHDT-DSL						
(pounds/mile)						
CO	0.01195456					
NOx	0.03822102					
ROG	0.00304157					
SOx	0.00004131					
PM10	0.00183062					
PM2.5	0.00160083					
CO2	4.21120578					
CH4	0.00014201					
N2O	0.00013366					
CO2 eqv	4.25562112					

HHD <sup>.</sup> (pou	T-DSL, Exh unds/mile)
PM10	0.00168861
PM2.5	0.00155435



### Scenario Year: 2011

All model years in the range 1967 to 2011

		_	
Hł (pou	HDT-DSL unds/mile)	HHD (pou	T-DSL, Exh unds/mile)
CO	0.01112463	PM10	0.00151936
NOx	0.03455809	PM2.5	0.00139772
ROG	0.00279543		
SOx	0.00003972		
PM10	0.00166087		
PM2.5	0.00144489		
CO2	4.22045680		
CH4	0.00012910		
N2O	0.00012150		
CO2 eqv	4.26083358		

#### Scenario Year: 2012 All model years in the range 1968 to 2012 HHDT-DSL HHDT-DSL, Exh (pounds/mile) (pounds/mile) CO 0.01021519 PM10 0.00135537 NOx 0.03092379 PM2.5 0.00124837 0.00252764 ROG SOx 0.00004042 PM10 0.00149566 PM2.5 0.00129354 CO2 4.21590774 CH4 0.00011651 N20 0.00010966

#### Scenario Year: 2014 All model years in the range 1970 to 2014

Scenario Year: 2013 All model years in the range 1969 to 2013

Hł (pou	HDT-DSL unds/mile)	HHD <sup>.</sup> (pou	T-DSL, Ex Inds/mile
CO	0.00931790	PM10	0.0011
NOx	0.02742935	PM2.5	0.0010
ROG	0.00226308		
SOx	0.00004086		
PM10	0.00133697		
PM2.5	0.00114629		
CO2	4.21518556		
CH4	0.00010441		
N2O	0 00009827		

4.24784287

CO2 eqv

PM10 0.00119623	HHD (pou	T-DSL, Exh unds/mile)
	PM10	0.00119623
PIVIZ.3 0.00109863	PM2.5	0.00109863

#### Scenario Year: 2015

All model years in the range 1971 to 2015

HHDT-DSL (pounds/mile)		HHD <sup>.</sup> (pou	T-DSL, Exh Inds/mile)
CO	0.00766891	PM10	0.00090631
NOx	0.02122678	PM2.5	0.00083282
ROG	0.00178608		
SOx	0.00004082		
PM10	0.00104715		
PM2.5	0.00087977		
CO2	4.20902225		
CH4	0.00008369		
N2O	0.00007877		
CO2 eqv	4.23519770		

Scenario Year: 2017 All model years in the range 1973 to 2017

HHDT-DSL (pounds/mile)		HHD (pou	Г-DSL, Exh Inds/mile)
CO	0.00650533	PM10	0.00070873
NOx	0.01690387	PM2.5	0.00065111
ROG	0.00145203		
SOv	0 00004033		

CO 0.00846435 PM10 0.00104   NOx 0.02418049 PM2.5 0.00096   ROG 0.00201594 PM2.5 0.00096	(h )
NOx 0.02418049 PM2.5 0.00096   ROG 0.00201594 <th>42</th>	42
ROG 0.00201594	60
0.0	
SUX 0.0004092	
PM10 0.00118458	
PM2.5 0.00100582	
CO2 <b>4.21279345</b>	
CH4 0.0009261	
N2O 0.0008716	
CO2 eqv 4.24175938	

4.25234923

CO2 eqv

#### Scenario Year: 2016

All model years in the range 1972 to 2016

HHDT-DSL (pounds/mile)		HHD <sup>-</sup> (pou	T-DSL, Exh ınds/mile)
CO	0.00704604	PM10	0.00080419
NOx	0.01887374	PM2.5	0.00073898
ROG	0.00161035		
SOx	0.00003952		
PM10	0.00094448		
PM2.5	0.00078443		
CO2	4.21063031		
CH4	0.00007508		
N2O	0.00007067		
CO2 eqv	4.23411393		

#### Scenario Year: 2018 All model years in the range 1974 to 2018

HHDT-DSL (pounds/mile)						
CO	0.00604721					
NOx 0.01526414						
ROG 0.0013169						
SOx 0.00003934						
PM10	PM10 0.00076808					

HHDT-DSL, Exh (pounds/mile)				
PM10 0.00062758				
PM2.5	0.00057700			

0.00104243 0.00096059

0.00084894

PM10



PM2.5	0.00069721
CO2	4.20820129
CH4	0.00006722
N2O	0.00006327
CO2 eqv	4.22922648

CO2

CH4

N20

CO2 eqv

#### Scenario Year: 2019

All model years in the range 1975 to 2019				
HHDT-DSL (pounds/mile)			HHD (pou	T-DSL, Exh unds/mile)
CO	0.00565433		PM10	0.0005608
NOx	0.01389113		PM2.5	0.00051320
ROG	0.00120235			
SOx	0.00004032			
PM10	0.00070198			
PM2.5	0.00056085			

<u> </u>		0004
Scenario	Year:	2021

4.20637830

0.00005499

0.00005175

4.22357577

All model years in the range 1977 to 2021

HHDT-DSL (pounds/mile)		HHDT-DSL, Exh (pounds/mile)		
CO	0.00503726	PM10	0.00045411	
NOx	0.01179977	PM2.5	0.00041729	
ROG	0.00103095			
SOx	0.00004033			
PM10	0.00059437			
PM2.5	0.00046287			
CO2	4.21495573			
CH4	0.00004734			
N2O	0.00004455			
CO2 eqv	4.22976181			

#### Scenario Year: 2023

All model years in the range 1979 to 2023

HH (pou	IDT-DSL unds/mile)	HHDT-DSL, Exh (pounds/mile)	
CO	0.00457902	PM10	0.00037922
NOx	0.01031407	PM2.5	0.00034915
ROG	0.00090210		
SOx	0.00004009		
PM10	0.00052122		
PM2.5	0.00039592		
CO2	4.21483461		
CH4	0.00004176		
N2O	0.00003931		
CO2 eqv	4.22789696		

Scenario Year: 2025 All model years in the range 1981 to 2025

PM2.5	0.00062383
CO2	4.20756838
CH4	0.00006182
N2O	0.00005818
CO2 eqv	4.22690378

#### Scenario Year: 2020 . .

27

All model years in the range 1976 to 2020				6 to 2020
HHDT-DSL (pounds/mile)			HHD (pou	T-DSL, Exh unds/mile)
CO	0.00532242		PM10	0.000503
NOx	0.01274755		PM2.5	0.000462
ROG	0.00110621			
SOx	0.00003957			
PM10	0.00064574			
PM2.5	0.00050904			
CO2	4.20541416			
CH4	0.00005216			
N2O	0.00004909			
CO2 eqv	4.22172889			

#### Scenario Year: 2022

All model years in the range 1978 to 2022

		 0	
HH (pou	IDT-DSL unds/mile)	HHD <sup>-</sup> (pou	T-DSL, Exh unds/mile)
CO	0.00478830	PM10	0.00041399
NOx	0.01098794	PM2.5	0.00037807
ROG	0.00096142		
SOx	0.00004106		
PM10	0.00055427		
PM2.5	0.00042597		
CO2	4.21520828		
CH4	0.00004448		
N2O	0.00004186		
CO2 eqv	4.22911963		

#### Scenario Year: 2024

All model years in the range 1980 to 2024

HHDT-DSL (pounds/mile)			HHD (pou	T-DSL, Exh unds/mile)
CO	0.00444444		PM10	0.00036682
NOx	0.00974372		PM2.5	0.00033735
ROG	0.00084009			
SOx	0.00003930			
PM10	0.00050766			
PM2.5	0.00038320			
CO2	4.19552935			
CH4	0.00003930			
N2O	0.00003699			
CO2 eqv	4.20782175			

Scenario Year: 2026 All model years in the range 1982 to 2026



HH (pou	НН (р	
CO	0.00431086	PM10
NOx	0.00932573	PM2.5
ROG	0.00080206	
SOx	0.00004018	
PM10	0.00048541	
PM2.5	0.00036326	
CO2	4.19512979	
CH4	0.00003697	
N2O	0.00003479	
CO2 eqv	4.20669226	

HHDT-DSL, Exh (pounds/mile)			
PM10	0.00034397		
PM2.5	0.00031664		

HH (pol	HHDT-DSL (nounds/mile)				
CO	0.00420297				
NOx	0.00898990				
ROG	0.00077178				
SOx	0.00003946				
PM10	0.00046717				
PM2.5	0.00034564				
CO2	4.19349747				
CH4	0.00003630				
N2O	0.00003417				
CO2 eqv	4.20485099				

HHDT-DSL, Exh (pounds/mile)				
PM10 0.00032670				
PM2.5	0.00029830			

Notes:

SCAQMD 2008

HHD-DSL composite includes tire & brake wear Onroad N<sub>2</sub>O per Annex 3, Table A-99

## Apdx G - Dry Air Composition

### Table G-19 Standard Composition of Dry Air

Dringing Coo	Chemical	MW	Concentration	Fraction	MW
Principai Gas	Symbol	g/mole	ppmv	percent	g/mole
Nitrogen	N <sub>2</sub>	28.014	780,805.00	78.080500	21.873471
Oxygen	O <sub>2</sub>	31.998	209,450.00	20.945000	6.701981
Argon	Ar	39.948	9,340.00	0.934000	0.373114
Carbon Dioxide	CO <sub>2</sub>	44.009	377.76	0.037776	0.016625
Neon	Ne	20.183	18.21	0.001821	0.000368
Helium	He	4.003	5.24	0.000524	0.000021
Methane	CH <sub>4</sub>	16.043	1.75	0.000175	0.000028
Krypton	Kr	83.800	1.14	0.000114	0.000096
Hydrogen	H <sub>2</sub>	2.016	0.50	0.000050	0.000001
Nitrous Oxide	N <sub>2</sub> O	44.013	0.31	0.000031	0.000014
Xenon	Xe	131.300	0.09	0.000009	0.000012
Fotals			1,000,000.00	100.000	28.966

<u>Notes:</u> MW = molecular weight, g/mole

ppmv = parts per million by volume (10<sup>-6</sup>)

USEPA GHG Inventory 2011

Universal Industrial Gases, Inc., http://www.uigi.com/air.html

Condensed Laboratory Handbook, E.I. du Pont du Nemours & Co., Inc., Wilmington, DE, 1971

Environmental Engineering – Analysis and Practice, B. H. Jennings, International Textbook Company, 1970

Carbon dioxide varies with uptake by removal mechanisms, 365 (IPCC) to 380 ppmv (UIG)

APPENDIX H

# Special-Status Species Evaluated but not Affected by the SCH Project

Table H-1	Special-Status	s Species Evalu	ated but not Affected by the SCH Project
Common Name	Scientific Name	Status (Fed/State/ CNPS)	Habit, Habitat, and Reason for Exclusion
Plants		·	
Abrams' spurge	Chamaesyce abramsiana	-1-12	Prostrate annual herb in sandy sites in desert scrub. Sandy areas and scrub are not present in the Project area. Last reports were from Old Beach and Brawley in 1912 (California Natural Diversity Database 2010). Not expected to occur due to lack of suitable habitat and likely extirpation from the Project area.
Brown turbans	Malperia tenuis	-1-12	Grows in sandy places in creosote bush scrub. Sandy areas and scrub are not present in the Project area. Last record from the Project area was at Fish Mountain in 1926. Not expected to occur due to lack of suitable habitat and likely extirpation from the Project area.
Chaparral sand- verbena	<i>Abronia villosa</i> var. <i>aurita</i>	-/-/1B	Annual herb known from sandy areas, such as dune areas southwest of the Salton Sea. Sandy areas are not present in the Project area. Has been indentified north, southeast, and southwest of the Sea. Last record in the Sea's vicinity is 1949. Not expected to occur due to lack of suitable habitat.
Flat-seeded spurge	Chamaesyce platysperma	<i>-\-\</i> 1B	Prostrate annual herb known from sandy places and dunes in Sonoran desert scrub. Sandy areas and scrub are not present in the Project area. Known from near Superstition Mountain. Not expected to occur due to lack of suitable habitat.
Glandular ditaxis	Ditaxis claryana	-1-12	Perennial herb that grows in sandy places and rocky slopes in Sonoran desert scrub. Sandy or rocky areas are not present in the Project area. Last record in Project area is a 1906 collection in Indio. Not expected to occur due to lack of suitable habitat and likely extirpation from the Project area.
Harwood's milk- vetch	Astragalus insularis var. harwoodii	-/-/2	Annual herb that occurs in desert dunes and stony washes. Sandy and rocky areas are not present in the Project area. Not expected to occur due to lack of suitable habitat.
Las Animas colubrina	Colubrina californica	-/-/2	Deciduous shrub that grows in desert scrub in narrow, steep, rocky ravines or washes. Not expected to occur due to lack of suitable habitat.
Munz's cholla	Opuntia munzii	-/-/1B	Grows in sandy or rocky desert flats and hills. Sandy or rocky areas are not present in the Project area. Known from the Chocolate Mountains. Not expected to occur due to lack of suitable habitat.
Orcutt's woody- aster	Xylorhiza orcuttii	-/-/1B	Occurs in arid canyons and washes. Although drainages are present, they are not typical desert wash but rather, are composed of agricultural fields next to marsh and mudflat. Not expected to occur due to lack of suitable habitat.
Orocopia sage	Salvia greatae	-/-/1B	Known from alluvial bajadas and fans adjacent to desert washes in rocky or gravely soil. Although drainages are present, they are not typical desert wash, but rather are composed of agricultural fields next to marsh and mudflat. All locations in Project vicinity

Table H-1	Special-Status	s Species Evalu	ated but not Affected by the SCH Project
Common Name	Scientific Name	Status (Fed/State/ CNPS)	Habit, Habitat, and Reason for Exclusion
			are near Salt Creek (California Natural Diversity Database 2010). Not expected to occur due to lack of suitable habitat.
Sand evening- primrose	Camissonia arenaria	-1-12	Annual or perennial herb that grows in sandy or rocky sites in Sonoran desert scrub. Sandy and rocky areas are not present in the Project area. Not expected to occur due to lack of suitable habitat.
Sand food	Pholisma sonorae	-/-/1B	Grows in desert dunes. Parasitic on Eriogonum, Tiquilia, Ambrosia, and Pluchea spp. Dune areas are not present in the Project area. Not expected to occur due to lack of suitable habitat.
Reptiles and Amp	hibians		
Colorado River toad	Ancilius alvarius	-/SSC/-	Although this species occurred historically within irrigation ditches in Imperial Valley, it has been extirpated from California (California Herps 2010).
Lowland leopard frog	Lathobates yavapaiensis	-/SSC/-	Although this species occurred historically within streams, ponds, and irrigation ditches in Imperial Valley, it has been extirpated from California (California Herps 2010).
Coachella Valley fringe-toed lizard	Uma inornata	T/E/-	This species does not occur within the Project area; its range is in Coachella Valley, north of the Salton Sea (California Herps 2010).
Colorado desert fringe-toed lizard	Uma notata	-/SSC/-	Suitable habitat, which includes fine, loose, wind-blown sand dunes, is not present (California Herps 2010).
Flat-tailed horned lizard	Phrynosoma mcallii	-/SSC-	Suitable habitat, which includes sandy desert hardpan or gravel flats with fine windblown sand, is not present (California Herps 2010).
Desert tortoise	Gopherus agassizii	T/T/-	Range of this species is east of the Salton Sea and does not occur within the Project area. Suitable desert habitat is not present (California Herps 2010).
Sonoran mud turtle	Kinosternon sonoriense	-/SSC/-	Although this species historically occurred within agricultural canals in Imperial Valley, it has been extirpated from California (California Herps 2010).
Birds			
American white pelican	Pelecanus erythrorhynchos	-/SSC/- (breeding)*	Historically bred at the Salton Sea up until the 1950s but now uses the region for wintering and loafing (Patten et al. 2003).
Brant	Branta bernicla	-/SSC/- (wintering/ staging)*	Wintering and staging areas are located along the coast. The species requires eelgrass for foraging. Records of the species at Salton Sea are from migration when they stop at the Sea's northern end (Patten et al. 2003).
Fulvous whistling-duck	Dendrocygna bicolor	-/SSC/- (breeding)*	Has been extirpated from California as a breeding bird; however, may still be recorded as a winter visitor at locations such as Finney Lake and Sonny Bono Salton Sea National Wildlife Refuge (Patten et al. 2003).

Table H-1	Special-Status Species Evaluated but not Affected by the SCH Project			
Common Name	Scientific Name	Status (Fed/State/ CNPS)	Habit, Habitat, and Reason for Exclusion	
Northern harrier	Circus cyaneus	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at Salton Sea are of wintering individuals (Patten et al. 2003).	
Swainson's hawk	Buteo swainsoni	-/T/-	Salton Sea is not located within their current breeding range. Records of the species at Salton Sea are during migration (Patten et al. 2002).	
Golden eagle	Aquila chrysaetos	-/FP/-	Although the Salton Sea is designated as a wintering area by DFG (2010), this species has been observed only 5 times in the past century and the species is considered a vagrant and unlikely as a wintering occurrence.	
Black tern	Chlidonias niger	-/SSC/- (breeding)*	Although this species is regularly observed at the Salton Sea, it does not breed there. The Salton Sea is a migratory stopover for the species and no evidence exists that it has ever bred there (Patten et al. 2003).	
Yellow-billed cuckoo	Coccyzus americanus occidentalis	C/E/-	Has been recorded 6 times within the Salton Sink but not as a breeding bird (Patten et al. 2003).	
Long-eared owl	Asio otus	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at Salton Sea are during migration or for wintering (Patten et al. 2003).	
Short-eared owl	Asio flammeus	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at Salton Sea are during migration or as a winter visitor (Patten et al. 2003).	
Elfowl	Micrathene whitneyi	-/E/-	A few pairs occur along the Colorado River, and otherwise, this species is extirpated from California as a breeding bird (Patten et al. 2003).	
Vaux's swift	Chaetura vauxi	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at Salton Sea are during migration (Patten et al. 2003).	
Gilded flicker	Colaptes chrysoides	-/E/-	Has been reported as a vagrant in areas south of the Salton Sea but has not been recorded at the Sea (Patten et al. 2003).	
Vermilion flycatcher	Pyrocephalus rubinus	-/SSC/- (breeding)*	Historically present as a breeding bird in Imperial Valley but currently only known from the region of the Highline Canal near Holtville approximately 30 miles southeast of the Salton Sea (Patten et al. 2003).	
Southwestern willow flycatcher	Empidonax traillii extimus	E/E/-	Protocol surveys conducted for this species in 2010 were negative (Dudek 2010). Observations of willow flycatcher within riparian habitat along the New and Alamo rivers are of the little willow flycatcher.	
Olive-sided flycatcher	Contopus cooperi	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at the Sea are of migrating individuals (Patten et al. 2003).	
Bank swallow	Riparia riparia	-/T/-	Salton Sea is not located within their current breeding range.	

Table H-1	Special-Status	s Species Evalu	ated but not Affected by the SCH Project
Common Name	Scientific Name	Status (Fed/State/ CNPS)	Habit, Habitat, and Reason for Exclusion
			Records of the species at the Sea are of migrating individuals (Patten et al. 2003).
Purple martin	Progne subis	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at the Sea are of migrating individuals (Patten et al. 2003).
Bendire's thrasher	Toxostoma bendirei	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at the Sea are of rare migrating or wintering individuals (Patten et al. 2003).
Gray vireo	Vireo vicinor	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at Salton Sea are of wintering individuals (Patten et al. 2003).
Least Bell's vireo	Vireo bellii pusillus	E/E/-	Surveys conducted for this species in 2010 were negative (Dudek 2010). Seven recent records of the species are all from fall migration or wintering individuals and were recorded at Ramer Lake, Brawley, Sonny Bono Salton Sea National Wildlife Refuge, Sheldon Reservoir, and Willow Hole from 1963 to 2002.
Arizona Bell's vireo	Vireo bellii arizonae	-/E/-	Breeds along the Colorado River and would not occur at the Salton Sea because the subspecies is confined to the lower Colorado River in Nevada and California (Patten et al. 2003).
Lucy's warbler	Vermivora luciae	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at the Sea are of wintering individuals (Patten et al. 2003).
Yellow warbler	Dendroica petechia brewsteri	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at the Sea are of migrating individuals (Patten et al. 2003).
Summer tanager	Piranga rubra	-/SSC/- (breeding)*	Salton Sea is not located within their current breeding range. Records of the species at the Sea are of migrating individuals (Patten et al. 2003).
Mammals			
California leaf- nosed bat	Macrotus californicus	-/SSC/-	Although suitable foraging habitat (desert riparian, wash, scrub, succulent shrub, alkali scrub, and palm oasis) is present, suitable roosting areas are not. Requires mine tunnels or caves, occasionally buildings for roosting, and shelter from heat and aridity (DFG 2010).
Pallid bat	Antrozous pallidus	-/SSC/-	Although suitable foraging habitat (dry open grasslands, shrublands, and woodlands) is present, suitable roosting areas are not. Requires caves, crevices, or mines that protect them from high temperatures (DFG 2010).
Pocketed free- tailed bat	Nyctinomops femorosaccus	-/SSC/-	Although suitable foraging habitat (desert scrub and riparian) is present, suitable roosting areas are not. Requires rock crevices in cliffs for roosting (DFG 2010).
Spotted bat	Euderma maculatum	-/SSC/-	Although suitable foraging habitat (arid desert, grasslands) is present, suitable roosting areas are not present. Requires rock

Common Name	Scientific Name	Status (Fed/State/ CNPS)	Habit, Habitat, and Reason for Exclusion
			crevices, caves, or buildings for roosting (DFG 2010).
Townsend's big- eared bat	Corynorhinus townsendii	-/SSC/-	Although suitable foraging habitat (mesic habitats, brush, and trees) is present, suitable roosting areas are not. Requires caves, mines, and other human-made structures for roosting (DFG 2010).
Western mastiff bat	Eumops perotis californicus	-/SSC/-	Although suitable foraging habitat (open semiarid and arid habitats) is present, suitable roosting areas are not. Requires crevices in cliff faces, high buildings, trees, and tunnels for roosting (DFG 2010).
Yuma hispid cotton rat	Sigmodon hispidus eremicus	-/SSC/-	Not expected to occur based on distribution. Occurs in the lower Colorado River Valley and Colorado River delta (DFG 2010).
Ringtail	Bassariscus astulus	-/FP/-	Although Salton Sea is within their distribution, suitable hollow trees and rocky areas are not present within the Project area (DFG 2010).
Peninsular bighorn sheep	Ovis canadensis nelsoni DPS	E/T,FP/-	Not expected to occur based on distribution. Occurs in areas east of the Salton Sea (DFG 2010).

Notes:

\* "Season of concern" as addressed for SSC species by Shuford, W.D., and T. Gardali, eds. 2008. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds No. 1. Western Field Ornithologists, Camarillo, CA, and California Department of Fish and Game, Sacramento, CA..

### Federal Designations:

- C Candidate for listing
- E Endangered. In danger of extinction throughout all or a significant portion of its range
- T Threatened. Likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

### State Designations:

- E Endangered
- T Threatened
- FP Fully protected
- SSC Species of Special Concern

### California Native Plant Society (CNPS) List:

- 1B Plants considered rare or endangered in California and elsewhere
- 2 Plants considered rare, threatened, or endangered in California, but more common elsewhere
- Sources:

California Department of Fish and Game (DFG). 2010. California wildlife habitat relationships system. Website (http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx) accessed December 2 through 28, 2010.

California Herps. 2010. A guide to the amphibians and reptiles of California. Available online at: http://www.californiaherps.com. California Natural Diversity Database (CNDDB). 2010. Nine quad search for USGS quadrangles Kane Spring, Westmoreland West, Obsidian Butte, Niland, and Wister. Full condensed text report.Dudek. 2010. Focused least Bell's vireo and southwestern willow flycatcher survey report for the Salton Sea Species Conservation Habitat Project, Imperial County, California. Prepared for the California Department of Fish and Game and Department of Water Resources. Submitted to the USFWS, December 3.

Patten, M.A., G. McCaskie, and P. Unitt. 2003. Birds of the Salton Sea. London: University of California Press, Ltd.

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APPENDIX I

# **Selenium Management Strategies**

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7
# Appendix I Selenium Management Strategies

### 3 I.1 INTRODUCTION

1

2

#### 4 I.1.1 Purpose and Need

5 The Salton Sea Species Conservation Habitat Project (SCH Project), proposed by the California Natural 6 Resources Agency, would create up to approximately 2,080 to 3,770 acres of shallow ponds at the Salton 7 Sea's edge (final acreage would depend on the alternative selected and funds available for construction). 8 The ponds would be designed to provide appropriate foraging habitat for piscivorous (fish-eating) birds

9 that depend on the Salton Sea.

10 Selenium is a naturally occurring element and an essential nutrient. However, when it is present at 11 elevated concentrations in the food web, selenium can cause adverse effects, especially on reproduction of birds and fish. Selenium is already present in the water, sediments, and biota of the Salton Sea ecosystem 12 (DWR and DFG 2007). The question is whether the SCH Project would increase the probability and 13 14 magnitude of selenium impacts relative to existing and expected future conditions. Thus, it is necessary to evaluate the potential selenium exposure and risks to ecological receptors (primarily aquatic and benthic 15 invertebrates, fish, and birds) and to develop appropriate measures to avoid, reduce, and mitigate potential 16 17 impacts.

- 18 The purpose of this report is to:
- Evaluate the scope of the selenium problem for the proposed SCH Project;
- Identify a range of potential management strategies for the SCH Project's design and initial
   operations to minimize potential ecological impacts; and
- Outline a monitoring framework that would support adaptive management of SCH Project once operational.

#### 24 **I.1.2 Approach**

The SCH Project is using the following approach to evaluate selenium risk and develop management strategies:

- Evaluate the scope of the selenium problem;
- Characterize sources and concentrations of selenium at the Project area under existing conditions and
   proposed operations;
- Identify potential ecological receptors likely to be affected (i.e., species using the SCH ponds) and
   target goals;
- Understand pathways to receptors, given the proposed design and operations;
- Estimate the probability, severity, and extent of potential risks from Project implementation;
- Identify a range of potential management strategies;
- Identify source control and mitigation strategies to minimize exposure of ecological receptors; and

 Identify treatment strategies if applicable and feasible (only if source control and mitigation strategies are not sufficient).

3 Information and insights for selenium evaluation and management were obtained from various sources. Background information and initial screening-level analysis of selenium risk came from the Salton Sea 4 Ecosystem Restoration Program Final Programmatic Environmental Impact Report (DWR and DFG 5 6 2007), in particular Appendix F – Ecological Risk Assessment. The Bureau of Reclamation (Reclamation) 7 measured water quality of Salton Sea and influent rivers quarterly in 2004–2009 (C. Holdren, Reclamation, unpublished data). The U.S. Geological Survey (USGS) conducted studies of selenium 8 9 bioaccumulation at the experimental Saline Habitat Ponds (SHP) complex (Miles et al. 2009) and 10 agricultural drains at the Sea's southern end (Saiki et al. 2010). University of California Riverside (UCR) 11 conducted site-specific sampling in 2010 at alternative SCH Project sites (Amrhein et al. 2010) and ecological risk modeling of receptors, pathways, and bioaccumulation potential (Sickman et al. 2011). 12 Potential water treatment technologies were reviewed for their effectiveness, feasibility, and applicability 13 to the SCH Project (Cardno ENTRIX 2010). Finally, a science panel<sup>1</sup> reviewed the selenium ecological 14 risk modeling data and provided input on strategies for source control, mitigation, and treatment. 15

#### 16 I.1.3 <u>Regulatory Standards and Toxicity Thresholds</u>

Water quality guidelines for selenium in the Salton Sea Basin are 5 micrograms per liter<sup>2</sup> ( $\mu$ g/L) for chronic exposure and 20  $\mu$ g/L for acute (1-hour average) exposure (Colorado River Basin Regional Water Quality Control Board 2006). For sediment, the United States Department of the Interior (1998) and Hamilton (2004) classified selenium concentrations between 1 and 4 micrograms per gram ( $\mu$ g/g) (or milligrams per kilogram [mg/kg]) as "elevated above background" or "level of concern," and concentrations >4  $\mu$ g/g as the "toxicity threshold."

23 Selenium concentrations in biota considered to pose a potential toxicity risk vary depending on species and studies (Amrhein and Smith 2011; Ohlendorf and Heinz 2011). Lemly (2002) considered the effect of 24 bioaccumulation within a food chain and recommended somewhat lower selenium thresholds of 2 µg/L of 25 26 inorganic selenium in water, 2  $\mu$ g/g in sediments, and 3  $\mu$ g/g dry weight (dw) in food-chain organisms such as invertebrates. To avoid toxic effects on sensitive fish species, Lemly (2002) recommended a 27 28 threshold of 4  $\mu$ g/g dw in whole fish. Available evidence from the Salton Sea area indicates that tilapia, 29 poeciliids (mosquitofish and mollies) and desert pupfish are not likely to be seriously affected at tissue concentrations of 4 µg/g dw (Saiki et al. 2010). For bird eggs, which may exhibit reduced hatching 30 31 success or embryo deformities (teratogenesis) from selenium exposure, a conservative and widely 32 reported toxicity reference value is 6 µg/g dw, although selenium sensitivity can vary widely depending on species and the chemical form of selenium in the diet (Ohlendorf and Heinz 2011). 33

<sup>&</sup>lt;sup>1</sup> The panel convened on September 21, 2010, included scientists and resource managers with expertise in selenium environmental toxicology, geochemistry, treatment, and Salton Sea issues. Panel members included Chris Amrhein (UCR), Doug Barnum (USGS Salton Sea Science Office), Rick Gersberg (San Diego State University), Chris Holdren (Reclamation), Chen Huang (University of California Berkeley [UCB]), Keith Miles (USGS), Harry Ohlendorf (CH2M Hill), Theresa Presser (USGS), Carol Roberts (U.S. Fish and Wildlife Service [USFWS]), Mike Saiki (USGS), James Sickman (UCR), Joe Skorupa (USFWS), and Norman Terry (UCB).

<sup>&</sup>lt;sup>2</sup> Concentrations of selenium can be expressed in various ways. Water concentrations are typically expressed as  $\mu g/L$ , or sometimes as parts per billion. Sediment concentrations can be expressed as either  $\mu g/g$  or mg/kg. Concentrations in biota are expressed as  $\mu g/g$ , or sometimes parts per million. Sediment and biota samples are typically dried before measuring, and concentrations are reported as  $\mu g/g$  dw.

### 1I.2SELENIUM SOURCES

2 Selenium is present in the water, sediments, and biota of the Salton Sea ecosystem (DWR and DFG 3 2007). Most of the selenium originally comes from the upper Colorado River in irrigation water used in 4 the Imperial and Coachella valleys. Irrigation of seleniferous soils can also dissolve and transport 5 selenium to drains (Ohlendorf 2003, as cited in DWR and DFG 2007). Selenium becomes concentrated 6 by agricultural usage and is discharged from subsurface tile drains into surface drains that flow into the 7 Sea either directly or via tributaries (Saiki et al. 2010).

#### 8 I.2.1 <u>Selenium Cycling</u>

The biogeochemistry of selenium in aquatic systems is complex and controlled by several factors. Both the biotic and abiotic activity of selenium depends on its physiochemical form or species. Selenium chemistry resembles that of sulfur (Masscheleyn and Patrick 1993). Selenium, like sulfur, can exist in four different oxidation states: selenide (Se -II), elemental selenium (Se 0), selenite (Se IV or  $\text{SeO}_3^{2^-}$ ), and selenate (Se VI or  $\text{SeO}_4^{2^-}$ ) (Robberecht and Van Grieken 1982). Alterations in the oxidation state of selenium greatly affect solubility and play a major role in mobility, transport, fate, and effects of selenium species in wetland environments (Masscheleyn and Patrick 1993; Lemly 2002).

16 Inorganic forms of selenium (selenate and selenite) usually predominate in water, but inorganic as well as

17 organic forms of selenium occur in water, sediment, and biological tissues. In an aquatic system, most

selenium is associated with sediments (acting as a sink and reservoir) or plants and animals. In bottom

19 sediments, metal and organic selenides are most common (Hamilton 2004). In water, selenate is reduced 20 to selenite and both forms are removed from the aqueous phase into sediment. Once in sediment, selenite

is reduced to elemental selenium, which may make up 99 percent of the selenium found in sediments.

22 Various biological, chemical, and physical processes can move selenium into or out of sediments; therefore, sediments may serve as only a temporary repository for selenium (Masscheleyn and Patrick 23 24 1993). Transport and partitioning of selenium in soils is highly influenced by pH (measure of the acidity 25 or alkalinity of a substance) and Eh (oxidation/reduction conditions). Elemental selenium is essentially insoluble and stable in soils when anaerobic conditions occur. Heavy metal selenides and selenium 26 27 sulfides are insoluble and will remain in soils with low pH or high organic matter (Kabata-Pendias 2001, as cited in DWR and DFG 2007). In contrast, selenates are very mobile and easily taken up by plants or 28 leached through the soil due to their high solubility and low adsorption potential (onto soil particles). 29 30 Selenates dominate in alkaline, well-oxidized soil environments and some (e.g., sodium selenate and potassium selenate) dominate in neutral, well-drained, mineral soils. While soluble selenates are 31 32 responsible for the naturally occurring accumulation of high levels of selenium by plants, much of the 33 total selenium measured in soils may be present in other forms. Under alkaline and oxidizing conditions, 34 plants can accumulate the soluble forms of selenium, although selenate seems to be the preferred form for uptake (DWR and DFG 2007). 35

After selenium enters the sediment, further chemical and microbial reduction may occur, resulting in 36 insoluble organic, mineral, elemental, or adsorbed selenium (Lemly 2002). Microscopic planktonic 37 organisms, such as bacteria, protozoa, phytoplankton, and zooplankton, are a major component of the 38 39 particulate matter in the water column. The particulate matter, in turn, forms the basis for detrital 40 materials that settle onto the sediment and become the food source for sediment organisms, such as 41 benthic macroinvertebrates. In addition, waterborne selenite can be physically adsorbed onto the sediment particles, ingested, absorbed, and transformed by the sediment organisms. Sediment-bound selenite can be 42 43 reduced to insoluble elemental selenium by anaerobic microbial activities. Elemental selenium can be 44 reduced further to inorganic and organic selenides and/or reoxidized to selenite and selenate by microorganisms in the sediment and/or in the digestive tracts of sediment macroinvertebrates. Selenides 45 can enter the food chain via uptake into sediment organisms or be oxidized to selenite and selenate. 46

Selenium of different oxidation states can be further biotransformed by sediment organisms and transferred up the food chain (Fan et al. 2002; Hamilton 2004). Over time, most of the selenium associated with plant and animal tissues is deposited as detritus and eventually incorporated into the sediments. Some selenium forms may be volatilized to the atmosphere through microbial activity in the water and sediments or through direct release by aquatic plants (Lemly 2002).

6 Speciation affects transformation from dissolved forms to living organisms (e.g., algae, microbes) and nonliving particulate material at the base of the food webs. Selenate in the water column is taken up only 7 slowly, especially if competition with sulfate  $(SO_4^{2^-})$  is involved. Selenite and organoselenides are much 8 9 more reactive. When any form of selenium is taken up at the base of the food web by plants and microbes, 10 it is converted to organoselenide. With extended residence times in a system the result is a buildup of 11 proportionately more organoselenides and selenite as selenium is recycled through the base of food webs. In general, selenium concentrations in algae, microbes, sediments, or suspended particulates are 100 to 12 500 times higher than dissolved concentrations in selenate-dominated environments such as streams and 13 14 rivers. However, when selenite or organoselenide are proportionately more abundant, the ratio can be 1,000 to10,000, such as in wetlands (Luoma and Presser 2009). 15

Wetting and drying cycles, as normally found in wetlands, are important factors that contribute to 16 selenium mobilization and potential toxicity. Diffusive flux between water and sediments, in general, is 17 18 highly influenced by the chemistry of both water and sediment (e.g., oxygen and selenium concentrations) 19 (Byron and Ohlendorf 2007). Selenium is often present in chemically reduced forms when wetlands are submerged and have high organic matter. This condition favors volatilization (Masschelevn and Patrick 20 1993, as cited in DWR and DFG 2007). When water levels decline and sediments are exposed, as seen 21 22 with the exposed playa along the receding shoreline of the Salton Sea, selenium becomes more oxidized 23 and bioavailable. As a result, the initial wetting as the SCH ponds are first filled has the potential to 24 increase selenium bioavailability in sediments and organic matter (DWR and DFG 2007; Amrhein et al. 25 2011).

#### 26 I.2.2 <u>Selenium in Water</u>

The Salton Sea receives flow from three rivers (Alamo, New, and Whitewater rivers), agricultural 27 drainages, and ephemeral desert creeks. Reclamation has monitored seasonal water quality in the Salton 28 29 Sea and its tributaries in 1999 and 2004–2009 (C. Holdren, Reclamation, unpublished data). Average waterborne concentrations of total selenium vary depending on water body (Table I-1). The Salton Sea 30 31 has the lowest levels (mean 1.16  $\mu$ g/L) because the deeper areas function as a sink for selenium (DWR 32 and DFG 2007). For the period 2004–2009, mean annual total selenium concentrations in the rivers 33 averaged 2.23  $\mu$ g/L in the Whitewater River, 3.18  $\mu$ g/L in the New River, and 5.09  $\mu$ g/L in the Alamo 34 River (C. Holdren, Reclamation, unpublished data). Summer 2010 sampling near the Project alternative sites found selenium concentrations of 1.2  $\mu$ g/L in the Salton Sea, 4.1  $\mu$ g/L in the Alamo River, and 1.8 35 µg/L in the New River (Amrhein and Smith 2011). By 2075, concentrations of selenium in New and 36 Alamo rivers would not likely exceed 10  $\mu$ g/L, as modeled in the Programmatic Environmental Impact 37 38 Report (DWR and DFG 2007, Appendix H2).

39 Selenium concentrations in agricultural drains vary widely and are often higher. In 2005–2009, USGS measured total selenium in 29 drains or ponds operated by the Imperial Irrigation District (IID) along the 40 Salton Sea's southern border (Saiki et al. 2010). Total selenium in unfiltered samples averaged 4.18 µg/L 41 42 (range 0.79 to 79.1  $\mu$ g/L). Total selenium concentrations in water were directly correlated with salinity 43 and inversely correlated with total suspended solids concentrations. The total selenium in a subset of 44 samples (n=7 drains, range 0.70 to 32.8  $\mu$ g/L) was partitioned into the various selenium species. The mean proportions of each selenium species were 82 percent dissolved selenate, 9 percent dissolved 45 selenite, 8 percent dissolved organic selenium, and 1 percent particulate selenium (Saiki et al. 2010). 46

- 1 Selenium enters the Salton Sea as highly soluble salt (primarily selenate and selenite) and accumulates in
- 2 the anoxic sediments on the Sea floor (DWR and DFG 2007). Waterborne concentrations are rapidly
- 3 reduced to less than 2  $\mu$ g/L as selenium assimilates into biota and settles into organically rich sediments.
- 4 The anoxic nature of the Sea's sediments is important in trapping selenium in insoluble, nonbioavailable
- 5 forms of selenite, elemental selenium, and selenide.

Table I-1         Selenium Concentrations in Water							
Location	Selenium (	Concentration (µg/L)	Year(s)	Notes and Source			
	Mean	Range					
Salton Sea	1.16	0.98 - 2.94	2004–2009	Three surface samples near middle of the Salton Sea. Mean calculated from annual means for 6 years (2004–2009) Reclamation (unpublished data, C. Holdren)			
	2.46	1.9 – 3.2	2006–2008	Near southern shore Miles et al. 2009			
Whitewater River	2.23	1.27 – 2.86	2004–2009	Mean calculated from annual means for 6 years (2004–2009) Reclamation (unpublished data, C. Holdren)			
	5.09	4.22 - 6.78	2004–2009	Mean calculated from annual means for 6 years (2004–2009) Reclamation (unpublished data, C. Holdren)			
Alamo River	5.88	5.2 – 7.0	2006–2008	Miles et al. 2009			
	4.1		2010	Amrhein and Smith 2011			
New River	3.18	2.88 - 4.21	2004–2009	Mean calculated from annual means for 6 years (2004–2009) Reclamation (unpublished data, C. Holdren)			
	1.8		2010	Amrhein and Smith 2011			
New River (upstream) Imperial Wetlands Brawley Wetlands		2.7-5.4 2.2 – 3.9	2006–2007	River inflow to treatment wetlands Johnson et al. 2009			
Agricultural drains into southern Salton Sea	4.18	0.79 – 79.1	2005–2009	29 drains and ponds Saiki et al. 2010			

6

In 2006, Reclamation constructed a 50-hectare experimental SHP complex of four interconnected shallow saline ponds on the Sea's southern end. The USGS monitored water quality and biota at this site during 2006–2008 (Miles et al. 2009). The ponds were filled in 2006 with waters blended from the Alamo River ( $5.2 - to 7.0 \mu g/L$  selenium) and the Salton Sea ( $1.9 to 3.2 \mu g/L$  selenium). The blended waters had a selenium concentration of less than  $5 \mu g/L$  flowing into the ponds. The water from the final pond (Pond 4) was sometimes recirculated to the first pond.

Salinity and selenium concentrations varied among these ponds and over time (Table I-2). The highest concentration measured was in Pond 4 (5.7  $\mu$ g/L, Spring 2008). The effect of time was not consistent across all ponds. Sediment selenium concentrations increased over time in Ponds 1 and 2, relative to a slight decrease at Pond 4 (Miles et al. 2009). Selenium concentrations were typically below the Basin

Table I-2	Salinity Habitat	and Seleniu Ponds	m Concentra	tions at Re	clamation/US	GS Saline
Constituent	Pond	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008
Salinity (parts per	1	6.5	24.1	4.2	13.0	21.2
thousand [ppt])	2	16.8	29.8	9.1	29.0	24.9
	3	30.9	58.9	29.9	70.7	47.6
	4	>70 *	174.0	153.3	335.0	398.0
Total Selenium in	1	3.9	1.9	2.0	3.0	2.6
Water (µg/L)	2	2.4	1.9	0.9	1.9	1.5
	3	2.7	2.7	1.2	1.6	1.7
	4	3.8	3.0	3.4	5.7	3.2
Total Selenium in Sediments (ug/g dw)	1	1.03	1.38	2.15	2.32	2.22
	2	0.94	1.25	1.37	1.31	1.61
	3	1.83	2.99	3.00	2.06	2.12
	4	1.67	2.44	2.35	1.97	1.92

1 Plan water standard (5  $\mu$ g/L), but often exceeded Lemly's (2002) more conservative toxicity threshold 2 (2.0  $\mu$ g/L).

3

#### 4 I.2.3 <u>Selenium in Sediment</u>

5 The SCH ponds would be constructed on recently exposed or soon-to-be exposed playa. Selenium 6 concentrations in sediment were measured in 2010 at proposed Project sites adjacent to the mouths of the 7 Alamo and New rivers. Mean sediment selenium concentrations were 1.1 mg/kg (range 0.54 to 2.3 8 mg/kg). The majority of sediment samples (63 percent) were less than 1 mg/kg of selenium and would be 9 considered "low risk." The remaining 37 percent of the samples were between 1 and 4 mg/kg (only two 10 samples exceeded 2.5 mg/kg) and were considered in the "level-of-concern" category. No sample 11 exceeded the "toxicity threshold" value of 4 mg/kg (Amrhein and Smith 2011).

Selenium could accumulate and concentrate in the SCH pond sediments over time. USGS monitored the experimental SHPs that were flooded in 2006 with water from the Alamo River and Salton Sea (Miles et al. 2009). Mean selenium concentrations in sediment were 1.03 to 2.32 mg/kg in Pond 1, 0.94 to 1.61 mg/kg in Pond 2, 1.73 to 3.00 mg/kg in Pond 3, and 1.67 to 2.35 mg/kg in Pond 4. Sediment selenium concentrations increased in Ponds 1 and 2 and decreased in Pond 4. Sediment concentrations did not exceed the 4.0 mg/kg toxicity threshold after nearly 3 years of operation. It was uncertain, however, whether the system had reached equilibrium (personal communication, R. Gersberg 2010).

Rewetting of the dried sediments when filling the newly constructed SCH ponds has the potential to solubilize and release selenium into the water (Byron and Ohlendorf 2007). Oxidized selenium is present in the exposed playa sediments that would be inundated. Experiments have measured selenium release from newly wetted sediment samples from the mouths of the New and Alamo rivers (Byron and Ohlendorf 2007, Amrhein et al 2011). Byron and Ohlendorf (2007) conducted a laboratory experiment

using intact cores of Sea sediment with overlying Sea water and documented the effects of dissolved 1 oxygen level (oxic, anoxic) and salinity (2, 20, or 35 parts per thousand [ppt]) on selenium flux. Higher 2 3 positive flux from sediments into water was observed under oxic conditions and at the lowest salinity 4 values. Selenium flux from the water to the sediment dominated at salinities of 20 and 35 ppt. Dissolved selenite (Se IV) and organic selenium compounds predominated in the overlying water. Results imply that 5 selenium in overlying water is likely to be sequestered to the sediment under future highly saline 6 7 conditions, as it is today, but may be released into the overlying water if water salinity is very low or if 8 oxygenation is enhanced over current conditions.

9 Amrhein and others (2011) incubated sediment taken near the mouth of Alamo River for up to 235 days with well-aerated water at salinities approximating 2.1 and 13.7 ppt. This experiment was designed to 10 maximize sediment oxidation (well-mixed, well-aerated, high solution/sediment ratio). The amount of 11 selenium in sediments was positively related to organic carbon, suggesting the primary pathway for 12 selenium accumulation in the Salton Sea is algal uptake of soluble selenium from the water and 13 deposition of algal detritus in sediments, as previously described in the PEIR (DWR and DFG 2007). 14 Cumulative release of selenium from playa sediments over 194 and 235 days ranged widely (6 to 50 15 micrograms per kilogram, 1 to 21 percent of total sediment selenium). However, oxidation rates and 16 17 amount solubilized did not appear affected by carbon content, salinity, location, or depth of sample core. Rather, the release of selenium appeared controlled by the amount of oxidizable iron present in sediments. 18 If iron was present, the oxidized selenium adsorbed onto the iron and remained in the sediment, and less 19 20 selenium would dissolve into pondwater. Therefore, water-soluble selenium (selenate) concentrations 21 over high-iron sediments would be lower compared to low-iron sediments, and less selenium would be 22 available for uptake into the food web via the algal pathway. This particulate-bound selenium (selenite) 23 could still get into the food web through ingestion by benthic organisms and, subsequently, by fish and birds. Nevertheless, the volume of dissolved selenium from inflow water would likely pose a greater 24 25 relative risk to wildlife bioaccumulation than selenium from sediment (Amrhein et al. 2011).

To compare selenium release from flooded and exposed sediments, Amrhein and others (2011) also 26 27 measured selenium concentrations after 1 hour of wetting 3 different sediment samples (currently flooded, drained for about 1 month and 2 months due to the receding Salton Sea). Water-soluble selenium 28 concentrations were twice as high from sites drained for 1 month (about 4 µg/L) and 3-4 times higher 29 30 from sediments drained for 2 months (about 6 to 8  $\mu$ g/L), compared to flooded sites (about 2  $\mu$ g/L). This result is consistent with the concept of an initial "flush" following inundation. Because this experiment 31 32 was well mixed and well aerated, undisturbed sediments should release selenium more slowly. SCH managers could decrease residence times (i.e., more flow-through) to flush soluble selenium out of the 33 ponds. Selenium solubilization from sediments likely declines over time, as suggested by findings from 34 35 the SHP complex, where the frequency of elevated egg selenium concentrations declined after the 1st year (Miles et al. 2009). The volume of dissolved selenium from inflow water would likely pose a greater 36 relative risk to wildlife bioaccumulation than selenium from sediment (Amrhein et al. 2011). 37

### 38 I.3 ECOLOGICAL RISK ASSESSMENT

#### 39 I.3.1 Ecological Receptors and Exposure Pathways

Selenium can adsorb onto organic particulate matter such as detritus, be ingested by invertebrates or fish, and bioaccumulate within aquatic food webs (Figure I-1). Selenium in the water or sediment may be transferred up the food web through attached or free-floating microorganisms or rooted submerged and emergent plants (primary producers or consumers). As selenium is transferred into the benthic or watercolumn invertebrates, fish or birds (secondary or tertiary consumers) may then consume it. Alternatively, the selenium pathway to higher-order aquatic and benthic invertebrates, fish, and birds may also occur directly through contact with or ingestion of water and sediment (DWR and DFG 2007).



#### Figure I-1 Selenium Cycling and Transport Pathways

3 4

1 2

5

6 Selenium concentrations have been measured in various biota at the Salton Sea area, including algae, 7 vegetation, invertebrates, fish, and bird eggs (Table I-3) (DWR and DFG 2007; Johnson et al. 2009; Miles

7 vegetation, invertebrates, fish, a8 et al. 2009; Saiki et al. 2010).

#### 9 *Invertebrates*

10 Aquatic (water-column) and benthic invertebrates (including zooplankton) are found in marine, estuarine, 11 and freshwater habitats. Aquatic and benthic invertebrates can include primary consumers that ingest sediment and surface water during feeding or burrowing. Aquatic and benthic invertebrates are a major 12 route of food-chain transfer in the Salton Sea food chain (DWR and DFG 2007). The suggested toxicity 13 14 threshold for invertebrates as prey (to avoid bioaccumulation in birds) is 3 to  $4 \mu g/g dw$  (Hamilton 2004). However, selenium concentrations observed at the Salton Sea vary widely among locations and taxa 15 (Table I-3) and frequently exceed this threshold. At the SHP complex, mean concentrations exceeded 16 4.0 µg/g dw in 67 to 80 percent of corixid samples and 0 to 30 percent of chironomid samples (Miles et 17 al. 2009). In the IID agricultural drains, selenium concentrations in chironomids were an order of 18 19 magnitude higher (Saiki et al. 2010).

Table I-3         Mean Selenium Concentrations in Water, Sediment and Biota							
Location	Water (µg/L)	Sediment (µg/g dw)	Aquatic Plant µg/g dw	Invertebrate (μg/g dw)	Fish (µg/g dw)	Bird Eggs (µg/g dw)	
Salton Sea - Open Water <sup>1</sup> (mean and range)	-	-	0.83 (0.2-1.1)	-	10.4 (4.37 - 25.7)		
Salton Sea - Shoreline and Shallow Water <sup>1</sup> (mean and range)	-	-	0.72 (0.4-1.3)	6.64 (0.82-12.1)	-	5.98 (0.54-14.2)	
Salton Sea <sup>2</sup> (range of means)	1.9-3.2	1.42-2.42	-	2.37 - 3.64	-	5.41 (Morton Bay)	
Alamo River Estuary <sup>1</sup> (mean and range)	-	-	-	4.25 (0.7-5.7)	11.5 (4.3 - 27.9)		
New River Estuary <sup>1</sup> (mean and range)	-	-	-	2.7 (2.5-2.9)	9.67 (3.5-17.0)	2.81 (1.9- 3.7)	
Saline Habitat Ponds <sup>2</sup> (range of means)	1.2-3.9	0.94-2.44	-	2.16 - 8.50	-	4.52 - 9.09	
Sonny Bono National Wildlife Refuge <sup>2</sup> (range of means)	0.7-1.1	0.38-0.61	-	0.92 - 2.31	-	2.18 - 4.42	
Freshwater Marsh <sup>2</sup> (range of means)	2.0-4.2	1.73-2.67	-	2.05 - 2.83	-	5.6 - 7.05	
Agricultural Drains <sup>3</sup> (mean and range)	5.62 (0.70-32.8)	1.43 (0.33-10.0)	2.22 (0.75-8.26)	Chironomid 6.50 (1.39-50.6)	Mosquitofish 6.81 (3.66-20.2) Salfin molly 6.89 (3.09-30.4)	-	
New River Imperial Wetlands <sup>4</sup> (median and range)	(2.7-5.4)	0.3 (0.2-0.8)	-	Corixid, glass shrimp, Odonate, 4.1 (2.8-5.2)	Carp 4.4 Shad 4.7 (3.3-20.0)	-	
New River Brawley Wetlands <sup>4</sup> (median and range)	(2.2-3.9)	0.4 (0.4-0.5)	-	Corixid, Odonate, glass shrimp, crayfish 2.6-3.8 (1.5-8.2)	Carp 4.0 Shad 2.8 Tilapia 4.5 (1.9-7.3)	-	

1. DWR and DFG 2007, Appendix F

2. Miles et al. 2009. Saline Habitat Ponds supplied with Salton Sea and Alamo River waters, Sonny Bono National Wildlife Refuge supplied by Colorado River water, Freshwater Marsh supplied with agricultural drainwater.

- 3. Saiki et al. 2010. Seven IID agricultural drains in southern Salton Sea.
- 4. Johnson et al. 2009.

#### 1

#### 2 *Fish*

Fish may be exposed to selenium in sediment or surface water through ingestion, dermal contact, uptake through gills, and by feeding on contaminated plants, aquatic invertebrates or smaller fish. Likely fish

5 species at the SCH ponds include tilapia, sailfin molly, western mosquitofish, and desert pupfish. Fish can

- 1 be primary, secondary or tertiary consumers. Tilapia are omnivorous and forage on detritus, algae,
- 2 phytoplankton and invertebrates. The food-chain pathway is the most important route of exposure for fish,
- 3 which also are a major route of food-chain transfer to higher trophic levels such as birds.

4 Mean whole-body fish selenium concentrations were 10.4  $\mu$ g/g dw in the open Salton Sea, 9.67  $\mu$ g/g dw

- 5 in the New River Estuary, 11.5  $\mu$ g/g dw in the Alamo River Estuary (DWR and DFG 2007, Appendix F), 6 6.81 to 6.89  $\mu$ g/g dw in IID agricultural drains (Saiki et al. 2010), and 2.8 to 4.7  $\mu$ g/g dw in New River
- 7 wetlands upstream (Johnson et al. 2009). Sailfin mollies and moguitofish did not appear to be adversely
- affected at concentrations of 3.1 to 30.4  $\mu$ g/g dw, and pupfish in laboratory experiments did not exhibit
- 9 negative health effects from such levels of selenium exposure (Saiki et al. 2010).

#### 10 *Birds*

Selenium's most substantial effects occur in bird embryos, such as reduced hatching success and teratogenesis. While many bird species use the Salton Sea ecosystem for a part or all of their lives (summer breeding, wintering, or migratory stopover), the target bird species for this ecological risk analysis are those species that both breed at the Salton Sea and feed on aquatic invertebrates and fish

expected to occur in the SCH ponds. The effects of selenium exposure from the SCH Project on species

- breeding elsewhere would be temporary and likely to be negligible, based on laboratory feeding studies
- that showed that selenium is depurated (lost) from the birds within about 2 weeks once selenium-treated
- 18 food is removed (Ohlendorf and Heinz 2011). Breeding species that could be exposed at the SCH ponds

19 include California brown pelican, double-crested cormorant, Caspian tern, black skimmer, gull-billed

20 tern, black-necked stilt, and western snowy plover.

21 Mean egg selenium concentrations were 4.52 to 9.09  $\mu$ g/g dw at the SHP complex (black-necked stilt,

- 22 Miles et al. 2009), 5.98  $\mu$ g/g dw at Salton Sea shoreline (DWR and DFG 2007), and 2.81  $\mu$ g/g dw at New
- 23 River estuary (DWR and DFG 2007).

#### 24 California Brown Pelican

25 The California brown pelican occurs at the Salton Sea as newly fledged young and post-breeding adults as they disperse from nesting areas in Baja California. During summer, brown pelicans forage around the 26 27 Sea's margin. In recent years, brown pelicans have nested in small numbers, especially at the Sea's 28 southern end at the mouth of the Alamo River (Molina and Sturm 2004). In 2009, California brown pelicans were most abundant in August with almost 3,000 individuals recorded near and within the 29 Project area; numbers declined in the fall but the species remained a consistent visitor throughout the year 30 31 (USFWS 2010). This species was observed during Summer 2010 surveys foraging within the Sea at the mouths of the New and Alamo rivers and along the shoreline (Dudek 2010); suitable roosting and loafing 32

- habitat includes sandbars, islands, and rocky areas within the Project area.
- Brown pelicans are expected to forage often at the SCH ponds for fish, as well as at the mouths of nearby rivers where fish may persist in the deltas.

#### 36 Double-Crested Cormorant

The double-crested cormorant is a California Species of Special Concern. Cormorants are yearlong residents along the California coast and the Salton Sea. They feed primarily on fish, but also crustaceans and aquatic insects. Nesting habitat requirements include undisturbed areas near water and may consist of rock ledges on cliffs, rugged slopes, and live or dead trees. Breeding at the Salton Sea begins with nest

41 building in late January (Patten et al. 2003) and may extend to July or August, though only one brood is

- produced (Zeiner et al. 1990, as cited in DWR and DFG 2007). Double-crested cormorants nest in
   colonies and usually lay three or four eggs (Udvardy 1993, as cited in DWR and DFG 2007).
  - Salton Sea SCH Project Draft EIS/EIR

1 Double-crested cormorants are expected to forage often at the SCH ponds, as well as at the mouths of

2 nearby rivers where fish may persist in the deltas.

#### 3 Black Skimmer

The black skimmer is a California Species of Special Concern. It is a fairly common summer resident and 4 5 breeder at the Salton Sea, arriving by late April and departing by October. Nesting at the Sea's southern 6 end begins in May and continues into the early fall, depending on the Sea's water levels (Patten et al. 7 2003). They typically breed on sandy islands or sandy areas in salt marshes and they can breed on isolated sections of eroded impoundment levees. They nest in colonies and produce one clutch per year with one 8 9 to five eggs (four or five are most common) (Zeiner et al. 1990, as cited in DWR and DFG 2007). Black 10 skimmers forage on small fish and crustaceans and prefer areas near river mouths and other water channels at the Salton Sea. 11

Black skimmers are expected to forage often at the SCH ponds for fish, as well as at the mouths of nearby rivers where fish may persist in the deltas.

#### 14 Caspian Tern

15 The Caspian tern is a common breeding bird that occurs within the Salton Sea region from mid-April 16 through October. It is most abundant at the Sea from late summer through fall. Most Caspian terns depart from the region by the end of October, but some remain through the winter (Patten et al. 2003). Caspian 17 18 terns forage primarily or exclusively for fish but may occasionally take crayfish and insects (Cuthbert and Wires 1999). Approximately 25 percent of the North American population of the Caspian tern breeds at 19 the Salton Sea (Cuthbert and Wires 1999; personal communication, K. Molina 2010). In 2009, the 20 21 population size within the Project area was in the hundreds for the winter months and in the thousands for the breeding season (USFWS 2010). In 2010, nesting numbers of Caspian terns were up to several 22 thousand breeding pairs, predominantly on Mullet Island and the D pond islands but also along Morton 23 24 Bay's shore (personal communication, K. Molina 2010).

Caspian terns are expected to forage often at the SCH ponds for fish, as well as at the mouths of nearby rivers where fish may persist in the deltas.

#### 27 Gull-Billed Tern

28 The gull-billed tern is a California Species of Special Concern. They arrive at the Salton Sea in mid-29 March and remain until October. Gull-billed terns nest on protected spits, berms, and islands composed of 30 sand or barnacle shells; at the Salton Sea, they also nest on earthen levees and on constructed islands in shallow brackish impoundments. For Salton Sea colonies, available nesting substrates include fine, poorly 31 drained, clay soils devoid of all vegetation with cobbles and boulders located sparsely. Nests are often 32 33 located adjacent to cobbles, boulders, or other debris. Gull-billed terns forage primarily in freshwater ponds and flooded agricultural fields. Foraging habitat within the Project area would likely include 34 agricultural fields, marshes, mudflats, drainage ditches, and fresh or saline open water. At the Salton Sea, 35 the species forages for small fish, crayfish, lizards, butterflies, beetles, crickets, weevils, and occasionally, 36 the young chicks of other shorebirds (DWR and DFG 2007). 37

38 Gull-billed terns are expected to forage occasionally at the SCH ponds, but their diet will be 39 predominantly from other sources in the surrounding landscape.

#### 40 Black-Necked Stilt

The black-necked stilt is a yearlong, fairly common resident at the Salton Sea (Patten et al. 2003). This shorebird prefers lakeshores, flooded alkali flats, saltponds, coastal estuaries, and flooded fields. Nesting

43 habitat includes friable soil, mudflats, levees, or dry lakeshores near water. Nesting mainly occurs April

through June (Patten et al. 2003). The clutch size averages four, with a range of three to five (Zeiner et al. 1990, as cited in DWR and DFG 2007). Black-necked stilt forages in shallow water for insects, crustaceans, mollusks, and other aquatic organisms, including some small fish.

Recent studies at the experimental SHP complex measured selenium in black-necked stilt eggs (2006, 4 2007, 2008) (Miles et al. 2009). Black-necked stilt are considered moderately sensitive to selenium 5 (Skorupa 1998). Selenium concentrations in black-necked stilt eggs (2-8 µg/g dw, mean 5 µg/g dw) at the 6 7 SHP complex were significantly higher than eggs from reference sites for 2 out of the 3 years, and 47 percent of the eggs exceeded the selenium toxicity threshold of 6.0 µg/g dw (Miles et al. 2009). Anderson 8 9 (2008) reported that selenium concentrations in stilt eggs in SHP ponds were elevated, but concentrations were similar to those found in other stilt nesting habitats in the Salton Sea. Stilts were tracked feeding in 10 both ponds and the Salton Sea, however, and therefore the egg selenium concentrations reflect a 11 composite of prey from multiple sources and potentially different selenium levels. Miles and others 12 (2009) "did not detect any relationship between selenium and embryonic malpositioning or post-hatch 13 survival of stilt chicks, or a high frequency of embryonic deformities associated with selenium toxicity. 14 Therefore, although a selenium risk was indicated at the SHP complex, it was not manifested by a 15 reduction in the productivity parameters measured in [stilts]". 16

Black-necked stilts are expected to forage for invertebrates and some fish at the SCH ponds in the shallowmargins, as well as at other shoreline habitats that persist nearby.

#### 19 Western Snowy Plover

The snowy plover is a California Species of Special Concern. The western snowy plover regularly winters 20 21 and breeds along the Salton Sea's shoreline. It nests during the spring and summer on open beaches with 22 sand and barnacle substrates and in close proximity to standing water. Nesting occurs within about 1,000 23 feet of the Sea's edge (personal communication, K. Molina 2010). Breeding has been noted to be concentrated on the Sea's western side from Desert Shores to the mouth of San Felipe Creek and on the 24 eastern side from Bombay Beach to Wister Unit (Patten et al. 2003). The western snowy plover also 25 forages along the Sea's shoreline, mostly on the sand and barnacle beaches. It will also forage in shallow 26 impoundments with exposed mud. Suitable habitat for foraging and breeding within the Project area 27 28 includes the mudflats along the Sea's shoreline. Snowy plovers eat terrestrial and aquatic invertebrates, 29 utilizing beaches, tideflats, saltflats, and salt ponds while foraging above and below the high water line (Page et al. 1995, as cited in DWR and DFG 2007). 30

31 Western snowy plovers are expected to forage for invertebrates at the SCH ponds in those areas shallow 32 enough for this small shorebird.

#### 33 I.3.2 <u>Toxicity Reference Values</u>

Designation of toxicity thresholds for selenium in biota has varied (Amrhein and Smith 2011; Ohlendorf and Heinz 2011). Lemly (2002) proposed no more than 3  $\mu$ g/g dw in food-chain organisms, and 4  $\mu$ g/g dw in whole-body fish. This fish threshold is a general standard protective of the most sensitive fish species; the fish species likely to colonize the SCH ponds are less sensitive to selenium (Saiki et al. 2010; personal communication, M. Saiki, 2011).

In bird eggs,  $6 \mu g/g$  dw is a conservative and widely reported toxicity reference value (Ohlendorf and Heinz 2011). The responses to selenium vary among bird species, ranging from "sensitive" (mallard) to "average" (stilt) and "tolerant" (avocet) (Skorupa 1998, as cited in Ohlendorf and Heinz 2011). Risk of impaired reproduction can start to occur at egg concentrations of 6 to 12  $\mu g/g$  dw (Table I-4). The risk of teratogenesis starts to occur above 12  $\mu g/g$  dw for sensitive species and above 20  $\mu g/g$  dw for moderately sensitive species (Ohlendorf and Heinz 2011). Cormorants and terns are likely to be fairly tolerant of

- 1 selenium, in keeping with greater tolerance of other saltwater-adapted species such as avocets and snowy
- plover, compared to freshwater-adapted species such as mallards (personal communication, H. Ohlendorf,
   2010).

Table I-4         Selenium Thresholds and Effects on Birds								
Selenium	Probability of Effects on Birds							
Concentration (µg/g dw)	Reproductive Impairment (reduced hatching success)	Teratogenic Effects						
<3.0 mean, <5.0 individual eggs	None - Background level	None - background level						
<6	None	None						
6 to <8	Low probability	None						
8 to <12	Elevated probability for sensitive species (mallard)	None						
12 to <20	Elevated for sensitive (mallard) and "average sensitivity" species (black-necked stilt)	Low probability						
>20 to 35	Elevated probability	Elevated probability for sensitive species (mallard)						
>35	Elevated probability	Elevated for "average sensitivity" species (black-necked stilt)						

4

#### 5 I.3.3 Ecological Risk Modeling

Modeling of selenium bioaccumulation within food webs of the SCH ponds was used to predict the selenium levels in water and sediments of the SCH ponds and the range of concentrations of selenium in the tissues of fish and birds utilizing the SCH habitats. This section summarizes results of ecological risk modeling performed by UCR (Sickman et al. 2011)

9 modeling performed by UCR (Sickman et al. 2011).

#### 10 Approach and Methodology

11 Sickman and others (2011) used the modeling approach of Presser and Luoma (2010) to simulate transformation of dissolved selenium into particulate organic matter and selenium bioaccumulation rates 12 among trophic levels. The SCH selenium conceptual model simulates the mixing of river and Sea water to 13 14 attain a specified salinity level and assumes that selenium mixing is conservative. Next, the model transforms dissolved selenium into particulate matter using a partitioning coefficient (K<sub>d</sub> value [Presser 15 and Luoma 2010]). Particulate selenium pools included sediments and organic detritus (including 16 associated microbial biomass) and algae and phytoplankton. Once selenium becomes bound to organic 17 18 particulate matter it is consumed by invertebrates and the bioaccumulation rate is estimated using a trophic transfer factor (TTF) derived from field measurements. Within the model, the particulate selenium 19 20 pool was conceptualized to be the first level of the food web. Invertebrates (chironomids, corixids) 21 represent the second level of the food web. Invertebrates are in turn preyed upon by fish (tilapia, mosquitofish and sailfin mollies) or invertebrate-consuming birds (black-necked stilts), which represent 22 23 the third level of the food web. The fourth level of the food web represents predation of fish by piscivorous birds (terns, cormorants). Understanding of selenium transfer into particulate matter and 24 25 bioaccumulation and effects in piscivorous birds are major knowledge gaps at the Salton Sea (Sickman et 26 al. 2011).

The assessment endpoint for all birds was reproduction, since reproductive effects are the most sensitive indicator of selenium toxicosis (Ohlendorf and Heinz 2011). The metric used was the selenium concentration of bird eggs (Sickman et al. 2011). These models are progressive in structure since they simulate and track the movement of selenium as it progresses from dissolved forms into particulate matter through the food chain.

Parameters used in the General Models were computed from all available studies in and around the Salton Sea. Given significant differences in waterborne selenium concentrations, separate General Models were made for SCH ponds utilizing either Alamo River or New River water, blended with Salton Sea water to achieve operational salinity targets of 20 and 35 ppt. Separate General Models were constructed for food webs containing invertebrate-consuming birds and food webs containing fish-consuming birds (Sickman et al. 2011). Different questions were addressed with various simulations using different K<sub>d</sub>s and TTFs, and the most applicable simulations are reported here:

Expected Water Quality. This simulation answers the question: "How much selenium would be in the biota from SCH ponds, given different sources and salinities of water supplying the ponds?" The model was run in a "forward" direction starting from initial selenium concentrations in water to produce estimates of selenium concentrations in whole-body fish and in bird eggs. This scenario utilized median values for  $K_d$  and TTFs and the median water quality parameters.

**Future Scenario/River Only - 10 \mug/L Rivers**. This scenario simulates conditions in the future after the Salton Sea has reached excessively high salinity levels and is no longer used to supply SCH ponds with water.<sup>3</sup> In this hypothetical future worst case scenario, the ponds would instead be supplied only by river water, which has a total selenium concentration of up to 10  $\mu$ g/L. Median K<sub>d</sub> values were used in this future scenario.

**Inverse Modeling.** This simulation answers the question: "How much river water can be used in the SCH ponds before birds exhibit reduced egg viability?" Because the dissolved selenium concentrations in the Alamo and New rivers are substantially higher than in the Salton Sea, all things being equal, the selenium risk increases with decreasing SCH salinity because more river water is required to reach the target salinity. The model was run backwards to compute the maximum acceptable dissolved selenium concentration and ultimately the mixture of Sea and river water necessary to not exceed various selenium concentrations in bird eggs (6, 8, or  $12 \mu g/g dw$ ).

#### 30 *Results*

#### 31 Expected Water Quality Simulation

Overall, the models suggest that fish and bird eggs in SCH ponds utilizing Alamo River water will have about 50 percent higher selenium concentrations than with the same salinity in SCH ponds utilizing New River water (Table I-5). This result is due to higher dissolved selenium levels in the Alamo River water relative to the New River. Similarly, risk increases as salinity decreases, with about 25 to 30 percent higher selenium concentrations predicted at a salinity of 20 ppt relative to 35 ppt. Recall that higher risk at lower salinity is simply the outcome of greater water contributions of river water (higher total selenium concentrations) to reach lower salinity mixtures in the SCH ponds (Sickman et al. 2011).

<sup>&</sup>lt;sup>3</sup> Salinity in the Salton Sea is projected to reach 250 ppt by the year 2068 (Appendix H-2, DWR and DFG 2007 If Sea and river water were then blended to achieve saline conditions, inflow for the SCH ponds would be 13 percent Sea water to achieve 35 ppt (selenium concentration 8.9  $\mu$ g/L) or 7 percent Sea water to achieve 20 ppt (9.4  $\mu$ g/L). Simulation 3 represents a worst-case scenario of all-river water (10  $\mu$ g/L).

Table I-5       Modeled Selenium Concentrations in Biota								
River Source	Salinity	Water (µg/L)	Macroinverteb rates	Fish (whole)	Bird Eggs (Invertebrate Eaters)	Bird Eggs (Fish Eaters)		
New River	20 ppt	2.6	4.2	5.5	7.6	8.3		
	35 ppt	2.0	3.3	4.3	6.0	6.5		
Alamo River	20 ppt	4.0	6.6	8.5	11.6	12.7		
	35 ppt	2.8	4.5	5.9	8.1	8.9		
Selenium concentrations in biota = micrograms per gram dry weight (µg/g dw) Source: Sickman et al. 2011 (General Model simulation)								

1

2 Using expected water quality and median  $K_d$  values, the only modeling scenarios that produced egg selenium concentrations at or below the 6 µg/g effects level were SCH ponds supplied by the New River 3 and operated at salinity of 35 ppt for those birds that eat primarily invertebrates (Table I-5). Less than 4 5  $8 \,\mu g/g$  dw was predicted, under the expected water quality simulation, for invertebrate-consuming birds 6 in New River SCH ponds at 20 ppt salinity, and in fish-consuming birds in New River SCH ponds at 35 ppt salinity. For Alamo River-supplied SCH ponds modeled under the expected water quality 7 simulation, egg selenium concentrations of 8.1 to 12.7  $\mu$ g/g dw were predicted depending on salinity 8 9 (Sickman et al. 2011). Egg selenium concentrations would be greater in ponds operated at a lower salinity 10 (20 ppt) than higher salinity (35 ppt) (Sickman et al. 2011). Therefore, it is anticipated that egg selenium 11 concentrations of birds foraging at the SCH ponds would be greater than  $6 \mu g/g$  dw but less than  $12 \mu g/g$ 12 dw, potentially resulting in reduced hatching success but not teratogenesis.

#### 13 Future (River Water Only) Simulation

<sup>14</sup> Under future, "worst-case" water quality conditions, using just river water if the Salton Sea becomes too <sup>15</sup> salty to be mixed into the SCH ponds at any appreciable concentration, the models estimated egg <sup>16</sup> selenium concentrations of 29.1  $\mu$ g/g dw for invertebrate-eating birds and 31.8  $\mu$ g/g dw for fish-eating <sup>17</sup> birds. Selenium concentration estimates in the future scenario/river-only simulation suggest that serious <sup>18</sup> reproductive effects would occur across a range of avian species and some species would experience <sup>19</sup> teratogenic effects from selenium (comparing to effect levels in Table I-4) (Sickman et al. 2011).

#### 20 Inverse Modeling Results

Results from the inverse modeling runs provide useful information for establishing salinity levels in the 21 22 SCH ponds (Table I-6). Under expected water quality conditions, the Inverse Models predict that in order to keep egg selenium concentrations in invertebrate-consuming birds equal to or less than  $6 \mu g/g dw$ , 23 ponds supplied with New River water would have to be operated at salinities above 35 ppt and ponds 24 supplied with Alamo River water would have to be operated above 44 ppt. To keep egg selenium 25 26 concentrations of fish-eating birds equal to or less than 6 µg/g dw, ponds supplied with New River water would have to be operated above 39 ppt and ponds supplied with Alamo River water would have to be 27 28 operated above 46 ppt (Sickman et al. 2011). A greater proportion of river water could be used if higher 29 selenium concentrations would be tolerated in bird eggs, which would consequently result in lower salinity of water supplying the SCH ponds. For example, if egg selenium concentrations in both 30 31 invertebrate-eating and fish-eating birds could be allowed reach up to 12  $\mu$ g/g dw, then the SCH ponds 32 using Alamo River water could be operated at 23 ppt, and SCH ponds using New River water could be

33 operated with pure river water (Table I-6).

# Table I-6 Predicted Salinity of SCH Ponds Necessary to Meet Target Selenium Concentrations in Bird Eggs

			55	-					
Target Selenium Concentration in Bird Eggs (dry weight)	Po	nds Operated wi	th New River W	/ater	Ponds Operated with Alamo River Water				
	Invertebrate-Eating Birds Fish-			Eating Birds Inverteb		nvertebrate-Eating Birds		Fish-Eating Birds	
	Selenium in Blended Water	Minimum Salinity of Blended Water	Selenium in Blended Water	Minimum Salinity of Blended Water	Selenium in Blended Water	Minimum Salinity of Blended Water	Selenium in Blended Water	Minimum Salinity of Blended Water	
6 µg/g	2.06 µg/L	35 ppt	1.89 µg/L	39 ppt	2.06 µg/L	44 ppt	1.89 µg/L	46 ppt	
8 µg/g	2.75 µg/L	17 ppt	2.52 µg/L	23 ppt	2.75 µg/L	36 ppt	2.52 µg/L	39 ppt	
12 µg/g	4.12 µg/L	All-river source okay	3.78 µg/L	All-river source okay	4.12 µg/L	18 ppt	3.78 µg/L	23 ppt	
Source: Sickman	et al. 2011 (Inv	erse Model simula	ation. Appendix	Tables 10a, 10b	11a and 11b)				

1

#### 2 Reclamation/USGS SHP Pond Simulation

3 Data from the Reclamation/USGS SHP study (Miles et al. 2009) was also used to compute values for Kd and TTF to simulate selenium dynamics in experimental saline habitats, which are similar in design to the 4 5 SCH ponds (Sickman et al. 2011). When the Reclamation/USGS SHP ponds model results are compared 6 to the observed egg selenium concentrations of invertebrate-consuming birds in the Reclamation/USGS SHP complex (Table I-7), it can be seen that the modeled egg selenium concentrations are actually higher 7 8 than those observed in the experimental ponds. Therefore, it is possible that the actual levels of selenium 9 in the SCH ponds would be lower than those predicted by the model. Further, the observed levels of egg selenium concentrations of invertebrate-consuming birds from the reference sites were within the same 10 11 range as those from the Reclamation/USGS SHP complex, suggesting that SCH ponds operated with comparable salinity levels would not significantly increase selenium ecological risk at the Salton Sea. 12

# Table I-7Observed and Modeled Selenium Concentrations in Invertebrate-EatingBirds at Reference Sites and SHP Complex

Site		Observed S	Selenium Cor	Modeled Selenium					
		Water (µg/L) Range			Black-Necked Stilt Eggs			Water <sup>2</sup>	Invert-Eating
		2006	2007	2008	2006	2007	2008	(µg/L)	bird eggs
Reference	Freshwater Marsh	2.5	2.0-4.1	2.6-4.2	7.05	6.11	5.26	n/a	n/a
Sites	D-Pond	0.9	0.7-0.8	0.9-1.1	3.62	2.18	4.42	n/a	n/a
SHP Ponds	Pond 1	3.9	1.9-2.0	2.6-3.0	7.85	6.18	5.45	2.7	13.1
	Pond 2	2.4	0.9-1.9	1.5-1.9	9.09	5.45	5.73	1.7	12.5
	Pond 3	2.7	1.2-2.7	1.7		6.06	6.99	2.0	6.2

1. Reference sites at Sonny Bono Salton Sea National Wildlife Refuge.

2. Model used mean values for selenium concentrations in water from each pond 2006–2008 (Miles et al. 2009).

Sources: Miles et al. 2009; Sickman et al. 2011

13

#### 1 I.3.4 <u>Conclusions</u>

2 The modeling results yield several findings with relevance to SCH design and operation. First, the selenium risk in SCH ponds supplied with Alamo River water would likely be substantially higher than in 3 4 ponds utilizing New River water. Risk characterization indices suggest moderate to high risk for reduced 5 egg viability in black-necked stilts would occur in Alamo River-supplied SCH ponds and that the risks would be elevated above current risk levels (Sickman et al. 2011). Second, inverse modeling supports the 6 7 premise that higher salinity levels would result in lower risk from selenium. Salinity of 35 ppt is 8 recommended to reduce risk of reproductive effects (<6  $\mu$ g/g dw). If low to moderate levels of reduced 9 hatching success are deemed acceptable, then salinity levels closer to 20 ppt would be adequate for New River-supplied SCH ponds. 10

11 The magnitude of selenium impacts for the implemented Project could be lower than predicted by modeling. First, the ecological risk model assumed all diet comes from the SCH ponds, which could be 12 true for species such as black-necked stilts and snowy plovers. The foraging range for many other birds 13 14 (especially piscivores) would likely include other habitats beyond the SCH ponds, and those habitats (such as the freshwater ponds at the Sonny Bono Salton Sea National Wildlife Refuge, which receives 15 16 Colorado River water) may have lower selenium levels. Thus, the true dietary exposure concentrations could be lower because the birds' foraging range would likely include other habitats beyond the SCH 17 ponds. Second, when the model was run using parameters estimated from the SHP complex, the modeled 18 19 egg selenium concentrations were greater than the actual measured egg concentrations (Miles et al. 2009), indicating that this model is a very conservative estimator of risk. 20

21 The model assumed that water residence time in the SCH ponds would be less than 32 weeks and that 22 target salinity levels (20 and 35 ppt) would be reached primarily by mixing Salton Sea water with river water. Selenium concentrations in the Sea are lower than in the rivers and SCH salinity levels near the 23 24 current condition in the Sea would produce the lowest dissolved selenium concentrations in the SCH ponds. Some evapoconcentration of constituents in water would occur with residence times near 32 25 weeks, although this is not expected to be true of selenium (personal communication, H. Ohlendorf, 26 27 2011). The data from Miles and others (2009) and the models suggest that residence times on the order of 28 months would not appreciably increase selenium risk in the SCH ponds. While longer residence time 29 could favor the conversion of selenate into more bioavailable forms of selenium, selenium concentrations 30 decreased over time at other constructed habitats in the region, both in sediment of freshwater treatment wetlands (Johnson et al. 2009) and eggs from saline ponds (Miles et al. 2009), which suggests that 31 32 selenium removal pathways could develop within the first 1 to 2 years after construction (Sickman et al. 33 2011).

#### 34 I.4 MANAGEMENT STRATEGIES

The SCH ponds would be managed through a combination of source control and pond management to reduce selenium exposure and risk to biota, depending on the alternative chosen and Project operations. The levels of selenium at the SCH ponds would be monitored, at a minimum in the water, sediment, fish and bird eggs; and when feasible also particulate matter and invertebrates. If these measures do not reduce or mitigate risk to acceptable levels, then other measures including water treatment techniques would be considered; such potential actions, however, would not be part of this SCH Project.

#### 41 I.4.1 Source Control and Minimization

#### 42 Blend Waters to Reduce Selenium in Water Supply

43 Current selenium concentrations are greater in the Alamo River (5.1 to 5.8  $\mu$ g/L) than the New River (3.2 44 to 3.5  $\mu$ g/L). The modeling results suggest that selenium risk in SCH ponds would be reduced if New River water were used instead of Alamo River water (Sickman et al. 2011). Another approach would be to "dilute" the river water with Salton Sea water (1 to 2  $\mu$ g/L selenium). Therefore, the water supplied to the SCH ponds would be a blend of Salton Sea water and river water, which would be managed typically between 20 and 40 ppt and occasionally allowed up to 50 ppt with evaporation. The upper limit was selected based on expected tolerances of fish such as tilapia. Salinity of Salton Sea water is currently 53 ppt. However, low winter water temperatures can decrease the salinity tolerance of tilapia (Appendix J), so operational scenarios would likely have to balance these habitat requirements (Appendix D).

#### 8 *Control Vegetation to Reduce Bioaccumulation*

9 Emergent and submerged vegetation can exacerbate selenium bioaccumulation because bioavailable 10 forms of selenium can bioaccumulate in algae and phytoplankton or adsorb onto organic and/or 11 particulate matter, where it is incorporated into the food web through uptake by benthic invertebrates and 12 other detritivores. Plants such as pondweeds (e.g. *Ruppia*), cattail and bulrush can contribute appreciable 13 amounts of organic matter that becomes detritus (Lemly 1998).

14 Higher salinity levels could be used in the SCH ponds to reduce or prevent the growth of emergent

vegetation. For example, broad leaf cattail (*Typha latifolia*) has a typical salinity preference of 0 to 0.5

ppt, but has been found in intermediate marshes where salinities range up to 3.5 ppt (Stutzenbaker 1999).

17 If salinity levels in the ponds were kept above 10 ppt, then many emergent vegetation species would be 18 excluded from the ponds, reducing the risk of increased selenium bioaccumulation. Table I-8 presents

excluded from the ponds, reducing the risk of increased selenium bioaccumulation. Table salinity tolerances of several emergent plant species that could be present in the Project area.

20 The sedimentation basins would have very low-salinity water, which could support emergent vegetation

as well as algae, phytoplankton and submerged vegetation. To discourage establishment of extensive

22 emergent vegetation, they would be designed with steep sides and greater depths. Periodic maintenance of

the sedimentation basins would include removal of accumulated sediment and organic matter that settled

24 out from the river water and removal of any vegetation.

#### 25 Flush the Ponds Following Initial Filling

It may be possible to flush some soluble selenium out of the ponds following initial filling of the ponds by 26 27 decreasing the residence time (i.e., increasing flow-through rate) (Amrhein et al. 2011). Some evidence 28 exists of selenium mobilization upon initial wetting of playa sediment (Amrhein et al. 2011). Sickman 29 and others (2011) suggested that constructed freshwater and saline wetlands at the Salton Sea appear to 30 develop selenium removal pathways within the first 1 to 2 years after construction. For example, at the Brawley and Imperial wetlands, appreciable amounts of selenium were sequestered or volatilized from the 31 wetlands (Johnson et al. 2009). At the SHP complex, the percentage of stilt eggs that exceeded  $6 \mu g/g dw$ 32 33 declined from 77 percent during the 1st year of operation to an average of 44 percent in the 2nd and 3rd

34 years (Miles et al. 2009).

#### 35 *Prevent Wildlife Access to Sedimentation Basins*

The first pond where sediment would settle out is likely to have the highest concentrations of selenium (Miles et al. 2009). For the SCH Project, this location would be the sedimentation basin where river water is first diverted. Therefore, the sedimentation basin would be constructed and maintained to be deep with steep sides to discourage foraging and nesting by birds such as black-necked stilts. If necessary, other bird deterrent methods (e.g., Gorenzel and Salmon 2008) would be considered if selenium concentrations in the basins are at levels of concern and bird use is high.

42

Table I-8     Salinity Tolerances of Local Plant Species							
Species	Habitat	Typical Salinity Preference	Widest Salinity Tolerated	Comments			
American Bulrush ( <i>Scirpus americanus</i> ) Olney's Three-Square Bulrush <i>Schoenoplectus americanus</i> )	Fresh to intermediate marshes	0-3.5 ppt	50% reduction at 4 ppt and no germination above 13 ppt.	Stutzenbaker 1999; Uchytil 1992 Management and maintenance depends primarily on maintenance of water levels and secondarily on salinity levels (Uchytil 1992).			
California Bulrush ( <i>Schoenoplectus californicus</i> )	Widespread in fresh and intermediate marsh zone	0-3.5 ppt	Approximately 10 ppt or greater will control populations.	Stutzenbaker 1999 Prolonged exposure to extreme conditions (15 to 20 ppt) exceeds the typical salinity tolerance and populations decline (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2002).			
Saltmarsh Bulrush ( <i>Scirpus maritimus</i> or <i>Scirpus</i> <i>robustus</i> )	Intermediate to brackish marshes, often on soils subject to tidal influence	3.5-10 ppt	Has been found in hypersaline lakes (~60 ppt). Germination reduced 50% at salinity = 9 ppt. No germination at salinity = 21 ppt.	Stutzenbaker 1999; International Lake Environment Committee 1998; Snyder 1991			
Broad Leaf Cattail ( <i>Typha latifolia</i> )	Freshwater aquatic normally, but also found in intermediate marshes	0-0.5 ppt	Found in intermediate marshes with salinity up to 3.5 ppt . In marshes of southeastern Louisiana, occurred at salt levels up to 1.13%.	Stutzenbaker 1999			
Narrow Leaf Cattail ( <i>Typha angustifolia</i> )	Freshwater aquatic normally, but also found in intermediate marshes; coastal	0-0.5 ppt	15-30 ppt.	Stutzenbaker 1999; Reed et al. 1995			
Southern Cattail ( <i>Typha domingensis</i> )	Wetlands ranging from fresh to brackish	0-10 ppt	75% mortality occurred at 15 ppt.	Stutzenbaker 1999; Glenn et al. 1995			

#### 1 I.4.2 <u>Water Treatment</u>

If the various source control and mitigation measures outlined above do not sufficiently reduce ecological
risk from selenium, it may be necessary to consider water treatment techniques as part of adaptive
management. However, water treatment would not be implemented as part of the SCH Project.

5 Further evaluation would be required for any consideration of water treatment. Any process used would have to be capable of treating large water volumes with low concentrations of selenium (less than 10 6 7  $\mu$ g/L) to achieve selenium concentrations less than 5  $\mu$ g/L in inflow water, based on the Colorado River 8 Basin Regional Water Quality Control Board (2006) standard, and possibly less than 2 µg/L. The amount 9 of river water that would require treatment would depend on the Project alternative chosen, the number and size (volume) of ponds constructed, and the salinity of pond operations (typically 20 - 40 ppt). An 10 average diversion rate of 50 cubic feet per second (approximately 32.3 million gallons per day or 22,500 11 12 gallons per minute) would accommodate some flow-through (outflow) as well as evaporation. Only river water would need to be treated, since Salton Sea water has selenium concentrations less than  $2 \mu g/L$ . 13

The effectiveness and costs of a variety of physical, chemical, and biological technologies were evaluated 14 in the Selenium Treatment Technologies Report (Cardno ENTRIX 2010). Although several treatment 15 technologies have the potential to remove selenium, few have reliably reduced selenium concentrations to 16 17 less than 5  $\mu$ g/L at any scale, and still fewer have been successfully implemented at full-scale for sufficient time to demonstrate the long-term feasibility of selenium removal technology (CH2M Hill 18 2010). Physical treatments (reverse osmosis, nanofiltration) can be very effective, but are cost prohibitive 19 20 for the SCH Project. Biological treatment (e.g., constructed treatment wetlands, controlled eutrophication 21 using algae) appears to have the most applicability, although consensus is lacking among experts and in 22 the literature (Cardno ENTRIX 2010).

Many questions would need to be resolved if constructed treatment wetlands were considered as a future 23 24 management strategy. A primary issue is whether treatment wetlands at this scale could reliably reduce water selenium concentrations to less than 5  $\mu$ g/L or even 2  $\mu$ g/L. The removal of selenium by biological 25 26 volatilization to the atmosphere is highly desirable because it leads to a net loss from the aquatic system, 27 thereby preventing its entry into the food chain. One approach is to investigate ways to enhance volatilization (Lin and Terry 2003) either by selecting wetland plant species that are more effective at 28 29 volatilization or by adding a carbon source (e.g., molasses) to the treatment wetland to stimulate bacterial 30 processes and, thus, enhance volatilization. A study currently underway by UCB is evaluating the effectiveness of using a water treatment system that incorporates constructed wetlands to manage 31 32 selenium (personal communication, N. Terry 2011). Preliminary laboratory mesocosm experiments suggest that different wetland designs and management techniques have the potential to reduce selenium 33 concentrations to levels substantially lower than 5 ug/L. The next phase of the work will include a pilot 34 35 wetland study to see if laboratory results could be transferred into the field. The Brawley and Imperial 36 constructed wetlands provide another opportunity to test enhancement methodologies that could be scaled 37 up to treat river flows before discharge to the SCH ponds (e.g., Johnson et al. 2009). Other biological treatment technologies such as algal treatment (e.g., Controlled Eutrophication Process) may further 38 39 remove selenium and could be combined with constructed wetlands as a polishing step.

Another issue would be the potential ecological risk to wildlife from exposure at the treatment wetland itself, which would sequester and likely accumulate selenium within its sediments, detritus, and biota. Dense vegetation would increase the amount of particulate detritus in the system that could adsorb selenium. Design features and strategies to reduce wildlife exposure would need to be included. For example, wetlands could be designed with dense plantings to reduce the amount of open water habitat. This may deter open water species such as waterfowl and terns, but is likely to be less effective for other 1 marsh species such as rails. Other bird deterrent methods (e.g., Gorenzel and Salmon 2008) may be 2 necessary to dissuade birds from utilizing the treatment wetlands.

### 3 I.5 MONITORING AND STUDY

The SCH Project includes a monitoring and adaptive management framework (Appendix E) to guide evaluation and improved management of the newly created habitat, as well as to inform future restoration. Monitoring is a necessary component to obtain information on progress in meeting Project objectives, such as minimizing ecological risk from selenium. This section briefly outlines monitoring specifically for selenium, and identifies remaining uncertainties that are priorities for future study. Although monitoring is a part of the SCH Project, these potential studies, are not currently included.

#### 10 I.5.1 <u>Monitoring</u>

#### 11 Selenium in Water and Sediments

Selenium concentrations in water would be measured at various representative locations including the 12 source waters for the ponds (both Salton Sea and river), in the sedimentation basin, blended influent water 13 14 to the ponds after the sedimentation basin, habitat ponds, and outfalls. Surficial sediment samples (top 5 cm) and particulate matter from the sedimentation basin and habitat ponds would be tested for selenium. 15 16 Sampling would be conducted quarterly for water and once or twice a year for sediment, and/or when water operations change, such as seasonal adjustments in salinity of inflow water. Speciation of selenium 17 would be conducted for selected subsamples. Monitoring would be conducted for multiple years to track 18 19 any seasonal or interannual variation, as well as changes as the SCH pond complex develops from first wetting of ponds to a more mature aquatic ecosystem. 20

#### 21 Selenium in Bird Eggs

22 Monitoring selenium in bird eggs is the best indicator of potential selenium hazard for several reasons, as reviewed by Ohlendorf and Heinz (2011). First, birds are a principal management target for the SCH 23 24 Project. As tertiary consumers of fish and invertebrates, they also integrate the selenium pathways and 25 bioaccumulation into a high trophic level receptor. Furthermore, it is selenium in the egg, rather than the 26 parent bird, that causes developmental abnormalities and death of embryos. Bird eggs best represent 27 current contamination in the local environment, given the rapid accumulation (about 2 weeks) and loss (about 10 days) of selenium in eggs from adult females fed selenium-laden food days or weeks before 28 29 egg-laving. Finally, eggs are easier to collect than adults and the loss of one egg from a nest probably has 30 minimal effect on a population.

- Bird eggs would be collected from representative SCH ponds and egg selenium concentration measured.
- Black-necked stilt is a logical choice for the monitoring, given existing comparable data from nearby and many other sites.

#### 34 Selenium in Aquatic Biota

Monitoring selenium in aquatic invertebrates and fish would also be useful to better understand bioaccumulation and trophic transfer. Invertebrates and fish would be collected from representative SCH ponds and the sedimentation basin for selenium testing. Fish species would include tilapia, the largest and most important prey for many piscivorous birds, and salifin mollies, a smaller prey fish. Sailfin mollies are also good ecological surrogates for monitoring selenium concentrations in desert pupfish because of

#### 1 I.5.2 Suggestions for Future Study

Recent studies have improved understanding of selenium bioaccumulation, impacts, minimization, and treatment. At the Salton Sea, focused studies conducted as part of the SCH Project's development have reduced uncertainty about the amount of selenium in the environment at alternative SCH sites (Arnhem and Smith 2010; Amrhein et al. 2011), ecological risk potential for bioaccumulation in the food web (Sickman et al. 2011), and options for removing selenium from water using wetland vegetation (personal communication, N. Terry 2011). Nevertheless, data gaps remain (Sickman et al. 2011). This section identifies some topics for further study, both independently and in association with the SCH ponds once

9 implemented. However, as noted above, these potential studies are not currently part of the SCH Project.

#### 10 Food-Web Transfer Relationships

11 Several topics have been suggested by others for further investigation of selenium bioaccumulation 12 (Miles et al. 2009; Sickman et al. 2011). For example, selenium speciation in water and particulates would be useful to establish appropriate coefficients of bioaccumulation, especially K<sub>d</sub> factors. Study of 13 stable isotopes (<sup>34</sup>S, <sup>15</sup>N, <sup>13</sup>C) would improve understanding of food-web structure and contributions from 14 different prey, which would improve the TTFs used to estimate selenium bioaccumulation in the 15 16 ecological risk model. Isotopes could also identify spatially explicit sources of contaminant exposure. 17 Selection of target piscivorous birds for use in the SCH ecological risk model should be revisited. Black 18 skimmers would likely be more representative of SCH pond users than others that were considered. In 19 contrast, gull-billed terns feed off site from drains and have a more varied diet than simply fish, while 20 black-crowned night herons would likely be only occasional users of the SCH ponds. Finally, better 21 understanding of local-scale movements and local foraging ecology of birds using the SCH ponds could 22 be important to determine how much of their diet is coming from SCH ponds, and how much is coming 23 from the surrounding areas.

#### 24 *Effects of Residence Time in Ponds*

25 The potential effect of retention time in the ponds on selenium deposition or removal is not well understood (Johnson et al. 2009) and subject to varying opinions among experts (personal 26 communications, H. Ohlendorf and R. Gersberg 2010). On the one hand, shorter retention time in the 27 28 ponds (i.e., increased rate of flow) could result in increased loading of selenium to the SCH ponds from 29 river water. On the other hand, prolonged retention time could facilitate transformation of selenium into 30 more bioavailable forms. Monitoring of the SCH ponds under varying operational scenarios would help address this question, which has ramifications for costs of long-term operations due to water pumping 31 32 rates.

#### 33 Selenium Treatment Technologies

As the Salton Sea progressively becomes more saline, water treatment to remove selenium may become necessary as more river water is used to maintain suitable salinities for the fish community. As discussed above, more information about performance and feasibility of biological treatment techniques would be required to determine whether they would be an appropriate selenium control measure at a future phase of SCH Project implementation. Studies underway by UCB (N. Terry, unpublished data) would refine understanding of constructed treatment wetlands. Other treatment alternatives (reviewed by Cardno ENTRIX 2010, CH2M Hill 2010) also may receive further consideration.

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APPENDIX J

# Summary of Special Studies Supporting the EIS/EIR Impact Analysis

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# J.1 Introduction

6 The environmental conditions at the Salton Sea are often extreme and can be challenging for building habitat and maintaining fish and wildlife populations. The SCH Project is being designed to support shallow-water 7 8 wildlife dependent on the Salton Sea (particularly fish-eating birds) and to minimize any negative impacts on 9 wildlife or humans (from contaminants or disease vectors). The SCH Project would consist of a series of 10 shallow ponds, several hundred acres in size and constructed on playa exposed as the Salton Sea recedes. 11 Depending on the slope of the playa and extent of sea level decline, the ponds would have a mean depth of about 2 to 4 feet and a maximum depth of 6 feet at the outer berm. While some deeper swales would be 12 13 excavated to create habitat diversity, these would not substantially affect average depths or water volume over 14 the total pond. A range of operational scenarios have been proposed for the initial proof-of-concept phase to 15 test which regime would best balance ecological productivity, sustainability, and potential impacts(Appendix 16 D). Initial operations would manage the ponds as saline habitat, with salinity between 20-40 parts per 17 thousand (ppt).

Summary of Special Studies Supporting the

18 While much has been learned about the Salton Sea over the last decade, uncertainties remained for the site-

19 specific engineering design, effects analysis, construction, and proposed operation of a restoration project.

20 Several studies to address key uncertainties for the SCH Project were conducted for the State by researchers at

21 the University of California Riverside (UCR) and University of California Berkeley (UCB):

- 22 1) Contaminants in water and sediment at proposed sites for SCH Alternatives
- 23 2) Hydrological and water quality modeling of SCH alternative designs and operations
- 24 3) Salinity and temperature tolerances of fish species considered for SCH ponds
- 25 4) Ecorisk modeling of potential selenium bioaccumulation
- 26 5) Selenium treatment of water supply using wetland vegetation

27 This document summarizes key findings of the special studies and their application to the SCH Project. For

selenium ecorisk modeling study, detailed discussions are in Appendix I Selenium Management Strategies.
 For the remaining studies, the study approach and results to date are summarized below from the researchers'

reports. The SCH Project team then evaluated the potential implications and application to the SCH Project,

31 which have been considered in the proposed design, operations, and impact analysis.

# 32 J.2 Contaminants in Water and Sediment

# 33 J.2.1 Purpose and Need

The SCH Project ponds would be constructed on recently exposed or soon-to-be exposed playa, and supplied with water blended from the Salton Sea and either New River or Alamo River. One issue is potential toxicity impacts from contaminants in sediments or water at the proposed SCH ponds. Water quality in the Salton Sea

Appendix J

**EIS/EIR Impact Analysis** 

and its tributaries is influenced primarily by the quality of Colorado River water imported into the watershed and land use activities, principally agriculture, that contribute salts and other constituents to the Salton Sea inflows (DWR and DFG 2007). Some of those constituents, such as selenium, may contribute to toxicity risks to the ecosystem and humans through accumulation in the sediment and cycling through the food web. Sediment and water samples were collected from the alternative SCH sites and tested for contaminants.

#### 6 J.2.2 Approach

7 Chris Amrhein and colleagues at UCR collected samples of sediment and water in summer 2010 within the 8 footprint of the proposed alternative sites at the New and Alamo rivers. Sediment samples were collected 9 from the surface (0-5 cm), as well as subsurface (5-15 cm deep and 15-30 cm deep) to look at historic 10 deposition. Sediment samples were taken from exposed playa sediments and from submerged sediments, 11 although submerged samples were not evenly collected across the potential pond sites. The samples were 12 tested for phosphorus, trace metals and metalloids (selenium, boron, arsenic), PCBs, and organochlorine insecticides (including DDT), pyrethroid insecticides, organophosphorus insecticides, and other contaminants 13 14 (Amrhein and Smith 2011; Wang et al. 2011).

15 An experiment was conducted to examine the release of selenium from sediments (Amrhein et al. 2011). Selenium is often present in reduced forms (less bioavailable and therefore less toxic) when wetlands are 16 submerged and have high organic matter. When the water level is lowered, selenium can become oxidized 17 and more bioavailable. The initial wetting period could increase selenium bioavailability by allowing 18 19 solubilization of oxidized selenium into the water (DWR and DFG 2007). This experiment was designed to 20 represent a worst-case scenario where a relatively high concentration of sediment (50:50 wet sediment to water) is mixed into the overlying, aerobic water and selenium is oxidized. These samples were incubated for 21 22 up to 235 days with well-aerated water at salinities 21 ppt and 13.7 ppt. Water was periodically decanted from 23 samples and selenium concentrations measured.

The researchers also evaluated the relationship between aeration time due to the receding Salton Sea shoreline and soluble selenium in sediment pore water. Samples were collected from three areas in Red Hill Bay at varying distances from the shoreline. The researchers estimated the "time exposed" based on the distance to the water, the slope of the land, and the elevation of the Sea over time.

#### 28 J.2.3 Results

#### 29 Selenium

Mean water selenium concentrations were 1.2 micrograms per liter (µg/L) in Salton Sea, 1.8 µg/L in the New River, and 4.1 µg/L in Alamo River (Amrhein and Smith 2011). Mean sediment selenium concentrations at proposed Project sites were 1.1 milligrams per kilogram dry weight (mg/kg dw) (range 0.54–2.3 mg/kg dw). The majority of sediment samples (63 percent) were less than 1 mg/kg dw and would be considered "low risk." The remaining 37 percent of the samples were between 1 and 4 mg/kg dw (only two samples exceeded 2.5 mg/kg dw) and were considered in the "level of concern" category. No sample exceeded the "toxicity threshold" value of 4 mg/kg dw.

The solubilization data indicate that oxidation due to draining and aeration of the sediments, as the Sea recedes, can increase the water-soluble selenium (Amrhein et al. 2011). Mean water selenium concentrations after 131 days incubation were  $6.5 - 8.2 \mu g/L$  at Alamo River playa sites (n=15), 11.9  $\mu g/L$  in Alamo River, and 12.8 at New River playa (Table J-1). Cumulative release of sediment selenium ranged from 18.9  $\mu g/kg$ (8.1 percent of total sediment selenium) after 194 days in Morton Bay, up to 48.8  $\mu g/kg$  (37 percent of total sediment selenium) after 235 days) in the Alamo River channel (Table J-1). The rate of release was mostly decreasing over time, suggesting the sediments will be a decreasing source of selenium.

44

Table J-1         Selenium Released from Oxidized Sediments									
Location	Samples	Total Sediment Selenium (mg/kg)	Water Selenium (μg/L) after 131 Days	Cumulative Selenium Released from Sediments (μg/kg and Percent Oxidized)					
				194 Days Incubation	235 Days Incubation				
Alamo River	2	0.18	11.9		48.8 (36.9%)				
Alamo River - Red Hill Bay	6	1.26	6.5		27.9 (4.5 %)				
Alamo River - Delta	4	0.36	8.2	19.6 (8.0 %)					
Alamo River - North Morton Bay	5	0.46	6.8	18.9 (8.1%)					
New River Bay	2	0.23	12.8	29.9 (14.9%)					
Source: Amrhein et al. 2011 (mean values reported)									

1

2 Anaerobic conditions in the sediments result in very low selenium concentrations because reduced forms of 3 selenium have the lowest solubility. Sediment selenium concentrations were positively related to organic 4 carbon, but the oxidation rates and amount released into water did not appear affected by carbon content, 5 salinity, location, or depth of sample core. Rather, the release of selenium appeared controlled by the amount 6 of oxidizable iron present in sediments. The amount of released was most strongly linked to presence of 7 oxidizable iron (Fe [III]), which adsorbs selenium (in the form of selenite) in the sediment, resulting in less

8 selenium dissolving into the water.

9 Selenium concentrations were also measured along a transect representing sediments that are currently

10 flooded, drained for approximately 1 month, and drained approximately 2 months due to the receding Salton

Sea. Water-soluble selenium concentrations were twice as high from sites drained 1 month (approximately 4 11

ug/L) and three to four times higher from sediments drained two months (approximately 6-8 ug/L), compared 12

13 to flooded sites (approximately  $2 \mu g/L$ ).

14 Amrhein calculated the amount of selenium potentially released to the overlying water in a pond system, 15 assuming pond sediments were aerobic to a depth of 5 cm, the overlying water averaged 1 meter deep with no 16 water exchanges, wet bulk density of the sediments 1.8 g/cm3, and 10 µg/L selenium (85th percentile of all 17 water samples). Based on these assumptions, the contribution from the sediments would increase the selenium in the overlying water by 0.9 µg/L (C. Amrhein, personal communication 2011). This is a conservative 18 19 estimate, since water would be exchanged in the SCH ponds at a rate dependent on flow operations (likely 20 range of residence times 4 to 32 weeks) (Appendix D).

21 In conclusion, aerated conditions can produce oxidized selenium, which is more soluble, although the amount 22 dissolved into water will depend on several factors, most particularly the presence of iron (Fe [III]). This 23 suggests an initial "flush" of selenium from the sediments could occur and is consistent with observations at 24 the Reclamation/USGS Saline Habitat Ponds (Miles et al. 2009). However, dissolved selenium in inflow 25 water would likely pose a greater relative risk to wildlife bioaccumulation than selenium released from 26 sediment (Amrhein et al. 2011).

#### Pesticides 27

28 Levels of chlorinated insecticides and pyrethroids were measured in water of the New and Alamo rivers and 29 in the bed sediments at potential SCH pond sites (Wang et al. 2011). In the water (four samples per river), 30 most organochlorine pesticides were below 1.5 nanograms per liter (ng/L) or were not detected. Chlorpyrifos 31 was the most frequently detected, but only one sample at the New River was elevated (80 ng/L). The most commonly detected pyrethroid was permethrin (3.3-7.5 ng/L) with fenpropathrin detected once at elevated 32

levels (New River, 11.6 ng/L). The number of samples was deemed too small to allow concrete conclusions
 about ongoing contributions of pesticides to the SCH ponds (Wang et al. 2011).

3 Sediment samples were taken at three depths (0-5 centimeters [cm], 5-15 cm, and 15-30 cm below the 4 surface) in order to discriminate potential differences in deposition of legacy (i.e., organochlorines) and 5 current-use pesticides (i.e., pyrethroids). Total sediment pesticide concentrations detected ranged from 0.2 to 6 120 nanograms per gram [ng/g]. Sediment pesticide concentrations, particularly organochlorines, were 7 greatest at the mouth of both the New and Alamo rivers. Dichlorodiphenvltrichloroethane (DDT) and its 8 metabolites were detected in all samples, and dichlorodiphenyldichloroethylene (DDE) was the predominant 9 pesticide residue. In general, the concentrations of organochlorine pesticides were higher in the 5-30 cm depth interval than in the 0-5 cm depth interval (more recent deposition). This pattern correlates with the 10 banning of most organochlorine pesticides, including DDT, in the United States in the 1970s. Mean DDE 11 12 concentrations in air-exposed sediments at 0-5 cm deep and 15-30 cm deep were 2.6 ng/g surface and 10.9 ng/g subsurface at New River sites, and 12.1 ng/g surface and 25.5 ng/g subsurface at Alamo River sites. 13 14 Organochlorine pesticide concentrations showed a pattern of decreasing concentration with distance from the river mouths. The highest DDE concentrations were found immediately adjacent to the Alamo River mouth in 15 Morton Bay and in New River East. Lower concentrations of DDE were found at the Alamo River-Davis 16 17 Road (north of Morton Bay) and New River Middle sites. The lowest DDE concentrations were found at the 18 New River Far West sites. This spatial pattern is consistent with the overall circulation pattern in the Salton 19 Sea, which tends to move counterclockwise.

The submerged samples typically had lower DDE concentrations than air-exposed sediments (Wang et al. 2011). The researchers hypothesized that this could be due to more extensive degradation in the submerged areas under reduced conditions. However, this could be an artifact of uneven sampling distribution. The samples from Red Hill Bay (southwest side of Alamo River) and Morton Bay (northeast side of Alamo River) were grouped into a single "Alamo River - Red Hill" region. All the submerged samples were from Red Hill Bay, which is upcurrent of the prevailing circulation that would carry river-borne sediment toward Morton Bay and northward.

27 A screening criterion of 31.3 ng/g DDE was identified as a Probable Effects Concentration (PEC) for general 28 ecotoxicity, based on sediment guidelines developed by MacDonald and others (2000) and suggested by the 29 Colorado River Basin Regional Water Quality Control Board (CRBRWOCB 2010) to prevent direct toxicity 30 to the macroinvertebrate population, which serves as a food base for fish and insectivorous birds. The 31 frequency of surface sediment samples exceeding this guideline was 18 percent at Alamo River-Morton Bay 32 (32.41 ng/g maximum); 14 percent at Alamo River-Davis Road (34.40 ng/g maximum); and none at New 33 River sites. The frequency of subsurface samples exceeding the PEC was 37 percent at Alamo River-Morton Bay (102.60 ng/g maximum); 7 percent at Alamo River-Davis Road (38.26 ng/g maximum); and 10 percent at 34 35 New River East (41.16 ng/g maximum); 3 percent at New River Middle (33.51 ng/g maximum); and none at New River West. 36

Chlordane (organochlorine, < 3 ng/g Alamo River, < 1.2 ng/g New River) and bifenthrin (pyrethroid, < 1.9</li>
ng/g Alamo River, < 0.5 ng/g New River) were also detected, but at lower levels than DDE. Other pesticides</li>
were infrequently detected (Wang et al. 2011). It is worth noting that bifenthrin, a pesticide first registered for
use in the late 1980s -- early 1990s, also increased concentrations with depth, which could indicate that the
deepest sediments sampled in the study represent relatively young sediments (personal communication, J.
Orlando 2011).

#### 43 J.2.4 Application to SCH Project

#### 44 Selenium

The relative pattern of water selenium concentrations showed highest concentrations in the Alamo River, then the New River, and lowest in the Salton Sea. Although concentrations measured by Amrhein and Smith

- 1 (2011) were slightly lower than those reported by the U.S. Bureau of Reclamation (C. Holdren, Reclamation,
- 2 unpublished data, quarterly sampling 2004-2010), the pattern is consistent. Therefore, options to reduce
- 3 selenium inputs would include operating the SCH ponds with New River water instead of Alamo River and/or
- 4 operating the ponds at higher salinities (i.e., less river water and more Salton Sea water).
- 5 The solubilization experiment suggests that an initial "flush" of selenium released from the rewetted 6 sediments could occur. Selenium solubilization from sediments would be temporary and would decline over 7 time. Reducing water retention time and increasing flow-through of the ponds for several weeks or months 8 following initial filling could be used to flush soluble selenium from the ponds (Amrhein et al. 2011). The 9 volume of dissolved selenium from inflow water would likely pose a greater relative risk to wildlife
- 10 bioaccumulation than selenium released from sediment.

#### 11 *Pesticides*

12 To apply these data to the current SCH Project alternatives, mean DDE concentrations were recalculated from

13 the raw data in Wang and others (2011) by combining air-exposed and submerged samples into geographic

14 categories that matched the SCH Project alternatives (Red Hill Bay samples southwest of Alamo River were

15 excluded because this area is no longer under consideration for Alternatives 4-6). Also, nondetects or

16 undetected levels of DDE were defined as 0.01 ng/g for purposes of avoiding zeroes and allowing those

17 extremely low values to be reflected in the means (Table J-2).

Table J-2         DDE Concentrations in Sediment at SCH Project Area (ng/g)								
Location	Surface Mean (# samples)	Surface Maximum	Subsurface Mean (# samples)	Subsurface Maximum				
New River - East	6.52 (11)	23.71	9.10 (21)	41.16				
New River - Middle	2.78 (15)	7.99	5.44 (29)	33.51				
New River - Far West	1.14 (6)	2.90	0.89 (13)	2.41				
Alamo River - Morton Bay	13.66 (11)	32.41	25.02 (19)	102.60				
Alamo River - North (Davis Road)	13.41 (7)	34.40	9.16 (14)	38.26				
Course Coloulated from now date in Wang at al. 2011. Curface (0.E. an dean) and subsurface (E.1E. an and 1E.20. an								

Source: Calculated from raw data in Wang et al. 2011. Surface (0-5 cm deep) and subsurface (5-15 cm and 15-30 cm deep). Nondetect values were defined as 0.01 ng/g for purpose of calculating means. Samples were pooled for air-exposed and submerged sites within each location.

18

19 Mean DDE concentrations in sediments at New River were 1.14 to 6.52 ng/g at the surface (0 to 5 cm deep) and 0.89 to 9.10 ng/g subsurface (5 to 15 cm and 15 to 30 cm deep). Mean DDE concentrations in sediments 20 21 at Alamo River were 13.41 to 13.66 ng/g at the surface (0 to 5 cm deep) and 9.16 to 25.02 ng/g subsurface (5 22 to 15 cm and 15 to 30 cm deep) (Table J-2). Current DDE concentrations in surface sediments (0 to 5 cm 23 deep) represent undisturbed existing conditions. For comparison, mean sediment DDE levels were measured at nearby sites (0-5 cm deep) by USGS in 2006-2008 (Miles et al. 2009): 4-48 ng/g at their saline habitat 24 25 ponds (SHP), 41-56 ng/g in Alamo River, 15-41 ng/g in the Salton Sea near Alamo River, 60-98 ng/g at the 26 Freshwater Marsh near Morton Bay, and 2-6 ng/g at the D-Pond on the Sonny Bono Salton Sea National 27 Wildlife Refuge (NWR) (Miles et al. 2009). With the exception of the D-Pond, these concentrations are 28 similar or higher than the levels measured at the SCH alternative sites.

Exposure to the more contaminated subsurface sediments would occur only in those areas disturbed by excavation for berms, swales, and islands, and would be averaged across the entire pond area including undisturbed areas. Therefore, expected DDE concentrations were calculated for each SCH alternative, based on field measurements of surface sediments (0 to 5 cms) and subsurface sediments (5 to 15 and 15 to 30 cm 1 deep) (Wang et al. 2011), and weighted according to proportion of pond area that would remain undisturbed 2 but inundated (surface 0- to 5-cm concentrations) and area disturbed by construction [borrow ditches for 3 berms, excavated swales and channels, borrow for habitat islands) (subsurface 5- to 30-cm concentrations)]. "Mean" is the area weighted average calculated using mean values for surface and subsurface sediment. 4 5 Because DDE concentrations below 30 cm are unknown and construction could disturb deeper sediments. hypothetical "maximum" concentrations were also calculated using maximum observed values of surface and 6 7 subsurface sediments, as a hypothetical upper bound of potential risk (Table J-3). The incremental increase in 8 DDE concentration across the pond unit compared to existing levels was minor.

9

Table J-3	Area-Weighted Mean Sediment DDE Concentrations (ng/g) for Existing Conditions and SCH Project Alternatives								
		Existing Conditions <sup>1</sup>		SCH Project					
		Estimated for Undisturbed Surface Sediments		Estimated for Constructed Ponds					
River	Pond units	Calculated from mean	Calculated from maximum	Calculated from mean	Calculated from maximum				
New River	New East	6.5	23.7	7.1	27.6				
	New Middle	2.8	8.0	3.6	15.7				
	New Far West	1.1	2.9	1.0	2.7				
Alamo River	Alamo Morton Bay	13.7	32.4	15.7	45.0				
	Alamo - north (Davis Road)	13.4	34.4	12.9	34.8				

1. DDE concentrations (mean and maximum values) in undisturbed surface sediments (0 to 5 cm deep) measured at each location (Amrhein and Smith 2011; Wang et al. 2011)

10

11 Because the concentrations of DDE and bifenthrin increased with depth sampled, it is possible that deeper 12 sediments potentially exposed during SCH construction (excavation of playa sediments for berms and islands) could contain higher concentrations of organochlorine pesticides than reported by Wang et al. (2011). The 13 14 fact that a current use pesticide like bifenthrin also increased with depth could indicate that the deepest sediments sampled could represent relatively young sediments (personal communication, J. Orlando 2011). 15 16 Also, concentrations of DDE in suspended sediments collected from the Alamo River and New River in 2006-07 (Orlando et al. 2008) are comparable to concentrations seen in bed sediments in this study. 17 suggesting that the current influx of DDE (and likely current-use pesticides) associated with suspended 18 19 sediments to the Salton Sea may be of concern with respect to SCH construction and operations (personal 20 communication, J. Orlando 2011). Targeted sampling of sites that would be actually be disturbed by 21 construction may be warranted.

### 22 J.3 Hydrological Modeling

#### 23 J.3.1 Purpose and Need

To provide suitable habitat, a shallow water system should maintain stable water balance, well-oxygenated conditions, productive food web, suitable salinity and temperature for fishery resources, limited resuspension of sediments, and flexible management practices. Salinity is an important water quality parameter that would be managed to maximize biological productivity and minimize adverse effects from water quality constituents (i.e., selenium loading, bioaccumulation through emergent vegetation) and other factors (vector control).
1 Options considered for establishing a salinity gradient in ponds include evapoconcentration of salts as water

2 flows through the ponds, or blending river water with saltwater. The inflow to the SCH ponds would be a

3 blend of nutrient-rich agricultural runoff (New or Alamo Rivers) and Salton Sea water. This has the potential

4 for high algal production, anoxic conditions, and accumulations of ammonia and sulfide. Finally, because the

- 5 shallow ponds would be located in a desert environment, water temperatures would range widely both
- 6 seasonally and diurnally.

7 The purpose of this special study was to inform the engineering design and operational guidelines by 8 addressing several key questions. First, what is the most effective means to achieve the desired salinity range 9 for the ponds? Second, would the expected pond design and operations result in water quality conditions that 10 could support a productive fish community and therefore meet project goals (support fish-eating birds)?

Finally, are there particular periods or situations where conditions could exceed biological tolerances? 11

12 Hydrologic modeling by Barbara Barry and Michael Anderson (UCR) was used to explore how different 13 potential pond configurations, source waters, and water operations could affect the expected physical, chemical, and biologic conditions in SCH ponds. This analysis involved successive iterations between UCR 14 15 and the SCH Project design team to refine design alternatives and model parameters.

#### J.3.2 **Approach and Results** 16

17 The SCH Project would consist of a series of shallow ponds, several hundred acres in size and constructed on

18 playa exposed as the Salton Sea recedes. Pond design parameters included depth, morphometry (pond shape,

19 which affects water volume), and fetch (potential for wind mixing). Operational parameters included 20 hydraulic residence time (4 and 16 weeks), source water (New River, Alamo River, and Salton Sea), and

21 influent salinity.

22 UCR applied two models to simulate the physical, chemical, and ecological conditions in the SCH ponds. The 23 first modeling exercise examined the water and salt balance of two pond designs: (1) interconnected ponds 24 with flow cascading serially from one to another downslope ("sequential" ponds), and (2) independent ponds 25 each receiving direct delivery of input water ("concurrent" ponds). Water column temperatures and salinities 26 were predicted by DYRESM, a 1-dimensional thermodynamic-hydrodynamic model that uses meteorological 27 data (2006-2008) combined with basin characteristics, hydrological inputs and outflows, and influent salinity 28 and temperature. The second modeling exercise predicted vertical profiles of water temperature and dissolved 29 oxygen (DO) for different pond designs and operations. This analysis used the Computational Aquatic 30 Ecosystem Dynamics Model (CAEDYM), a 1-dimensional model that uses DYRESM outputs to model a 31 wide range of water quality conditions (temperature, DO, nutrients, chlorophyll) and biological conditions 32 (phytoplankton, zooplankton and fish).

33 Blending Sea and river water is the only feasible means to achieve the desired salinity range (20-40 ppt) 34 across all ponds. Evaporation would increase salinity over time, depending on mean depth (indicative of water 35 volume) and residence time. With an inflow salinity of 20 ppt and hydraulic residence time of 60 days, the 36 resulting pond salinity would be 30 ppt in a 0.5 m deep pond and 23 ppt in a 1.5 m deep pond. However, 37 relying solely on evapoconcentration of river water (2 ppt) would never achieve target salinities, and would 38 increase selenium loading to ponds because water selenium concentrations are greater in the rivers than the 39 Salton Sea.

40 The water quality modeling provided one-dimensional vertical profiles of temperature and DO, hourly over a three-year simulation period. Temperature profiles were very similar across scenarios. Water temperatures 41 42 would periodically drop below tilapia tolerances (11-13°C [52-55°F]) during December through February. 43 Thermal stratification occurred in ponds with smaller surface area (200 acres), which have less fetch and 44 therefore less wind mixing, than larger pond areas. Deeper ponds (1.5 m mean depth) would experience stratification more frequently than shallower ponds (0.76 m mean depth). 45

Nutrient concentrations are high in the New and Alamo rivers due to contributions from agricultural runoff. Elevated nutrients would produce eutrophic conditions and algal blooms that could lead to anoxia. Modeling results suggested that ponds would become stratified in summer (May-October). Bottom waters would experience anoxia, particularly during periods of algal blooms in spring (March-May) and fall (October). Depending on the pond scenario, increasing residence time (ranging from 4 weeks to 32 weeks) had no effect or increased somewhat the frequency of anoxia. River source (New or Alamo) for blended water supply had little effect on stratification or anoxia. Phytoplankton was more abundant with Alamo River blended water.

8 Zooplankton did better with New River blended water and consequently reduced phytoplankton slightly.

## 9 J.3.3 Application to SCH Project

In general, this 1-D modeling validated the conceptual understanding of how these ponds would function.
 While the models are not sufficiently site specific or complex to truly answer questions of pond sustainability,

12 they did highlight some issues for consideration.

The most effective means of achieving the desired salinity range for the ponds would be blending sea and river water, not evapoconcentration. Salinity within a pond would increase over time due to high evaporative losses in this climate (7-10 ppt increase with a 60 day residence time), which would require additional input of river water to offset to maintain a target salinity. If a sequential pond design is used (water flowing through a series of ponds), then a salinity gradient increasing from first to last ponds would be expected.

18 The models, as limited as they are, confirmed assumptions that a productive aquatic system could be 19 developed that would include fish for birds. This exercise proved useful to look for trends and periods of 20 concern. Stressful conditions would occur periodically. Water temperatures would be too cold for tilapia to 21 tolerate for periods during December to February. Anoxia would occur near the bottom and occasionally 22 complete anoxia through the water column when phytoplankton blooms occur in spring and fall. Stratification 23 would maintain a layer of oxygenated water near the surface. Bottom anoxia is more of a concern for benthic 24 invertebrates than for tilapia, which can tolerate conditions of 1  $\mu$ g/L DO and can move upwards to oxygenated water near the surface. Model results have guided development of the proposed operations and 25 26 have focused the number of operational scenarios to be validated in the proof-of-concept phase (Appendix D).

## 27 J.4 Fish Tolerance

## 28 J.4.1 Purpose and Need

29 The fish species that would be stocked in the ponds would have to survive and reproduce given the expected water quality conditions, both managed (salinity) and uncontrolled (air temperature, wind mixing, dissolved 30 31 oxygen). Tilapia appear to meet many of the requirements for a productive, sustainable fishery resource for 32 piscivorous birds (DFG 2011). Tilapia are currently in the Salton Sea, are an important forage species for birds, and have impressively wide tolerances for salinity (currently persisting in the Sea at 53 ppt) and low 33 34 dissolved oxygen. Their main drawback, other than potential competition with desert pupfish, is whether they 35 could handle the lowest water temperatures predicted for SCH ponds. While the SCH ponds could be operated to adjust salinity (proposed range 20-40 ppt, Appendix D), it will be difficult if not impossible to 36 37 control water temperatures that naturally fluctuate widely in this desert climate.

38 This laboratory experiment by Dan Schlenk and Varenka Lorenzi of UCR tested the survival tolerances of 39 different tilapia species exposed to various combinations of salinity and temperature in order to inform design 40 of operational scenarios and selection of fish species for stocking.

## 41 J.4.2 Approach and Results

Among the fish that currently live in the Salton Sea area, three forms of tilapia (*Cichlidae, Perciformes*) have been identified as potential candidates to stock the SCH ponds (DFG 2011): California Mozambique hybrid tilapia Oreochromis mossambicus x O. urolepis hornorum ("Mozambique hybrid tilapia"), an unidentified species resembling blue tilapia Oreochromis aureus, and redbelly tilapia Tilapia zillii. Blue are considered more cold tolerant than other tilapia species in general (Popma and Masser 1999). In addition, Mozambique hybrid tilapia raised in aquaculture were also considered because of its availability from local hatcheries, in anticipation of the wild stocks in the Salton Sea eventually failing with increasing salinity.

6 The tested fish included Mozambique hybrid tilapia (two strains: wild fish from Salton Sea and an 7 aquaculture strain from a local fish farm), fish from a blue tilapia assemblage in the New River ("New River 8 blue tilapia"), and redbelly tilapia collected from an agricultural drain at the northeast Salton Sea (Lorenzi and 9 Schlenk in preparation). Juvenile fish were collected, acclimated in the lab, and then exposed to different 10 combinations of salinity and temperature. The three salinity concentrations (20, 45, and 60 ppt) were obtained 11 by blending water from the Salton Sea and New River, similar to the approach that would be used to operate 12 the SCH ponds. The three temperature regimes mimicked daily fluctuation of 5 degrees Celsius (°C): cold 11-16°C (52-61 degrees Fahrenheit [°F]), warm 23-28°C (73-82 °F), and hot 33-38°C (91-100°F). After an 13 14 acclimation period, survival and condition of fish was tested over a 30-day period.

When maintained at 20 ppt salinity, the New River blue tilapia had the best overall survival across all temperature regimes (80 percent survival at cold, 40 percent at warm, and 27 percent at hot) (Lorenzi and Schlenk in preparation). Redbelly tilapia survival was very poor in the lab, but this likely was due to other stressful conditions in captivity, namely aggression. It does not appear appropriate to draw conclusions about this species' thermal and salinity tolerances from such data. While most strains and species had moderately good survival in 45 ppt and 60 ppt conditions at warm temperatures, all species showed poor survival in hot

21 high-salinity (60 ppt) conditions.

In the cold treatment (11-16°C), the fishes were less active and fed less. The Mozambique hybrid collected from the Sea had the best overall survival at cold temperatures, with excellent survival at 20 ppt (100%) and 45 ppt (85 percent), and even some survival at 60 ppt (27 percent) (Figure J-1). The California Mozambique hybrid from aquaculture (67 percent) and the blue tilapia (80 percent) were able to survive only when the salinity was low (20 ppt), indicating that the cold temperature represents a stressor for osmoregulation. Surprisingly, the New River blue tilapia did not have better survival than Mozambique tilapia in cold conditions.

In the warm treatment (23 - 28°C), some individuals in all four species and strains of tilapia managed to tolerate salinities up to 60ppt. Remarkably, some of the blue and redbelly tilapia also survived these extreme salinities, thus demonstrating the broad osmoregulatory ability typical of tilapia in general, even in these two species typically found in freshwater. At medium temperatures California Mozambique hybrid from aquaculture showed the best survival at all salinities (85-90 percent), while the wild type did well only at 45ppt. This salinity is the closest to current Sea salinity (51 ppt), so these fish were probably best adapted to osmoregulate at this salinity.

- 36 At hot temperatures (33 38°C), all fishes showed sign of stress and the final survival rate was quite low. The
- 37 California hybrid from aquaculture did best overall and in particular at 20 ppt salinity. Only 17 percent of the
- 38 California hybrid from the field survived, and only at 45 ppt salinity.









Source: Lorenzi and Schlenk (in preparation)

## Figure J-1 Survival Rates of Tilapia (Aquaculture and Wild Strains of California Mozambique Hybrid Tilapia, and New River Blue Tilapia)

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## 1 J.4.3 Application to SCH Project

Stocking different tilapia species or strains (individually or in combination) among the SCH ponds could be employed to increase enhance stability of the fishery resource in the ponds in the face of seasonal and annual fluctuations in water quality parameters. The Mozambique hybrid tilapia seemed to be the most resistant species across all treatments. The wild-type from the Salton Sea was most likely to survive the cold, and the aquaculturetype is the most likely to survive at high and medium temperatures. The New River blue tilapia also had good survival in cold, but only when salinities are lower (20 ppt). Redbelly tilapia are still candidates, because their poor experimental survival appeared to be due in part to lab conditions.

9 These results also suggest that pond operations should be adjusted to maintain lower salinities during the winter, 10 when cold temperatures stress fish and presumably reduce osmoregulatory abilities and tolerance. Such seasonal 11 variation in pond salinity regime has been incorporated in proposed operational scenarios (Appendix D).

## 12 J.5 Selenium Ecorisk Modeling

### 13 J.5.1 Purpose and Need

Selenium in river water supplying the SCH ponds could bioaccumulate through the food web (discussed in detail in Appendix J). The most serious toxic impacts of selenium manifest themselves in bird reproduction, namely reduced hatchability of eggs and embryo deformities (Ohlendorf and Heinz 2011). Selenium ecorisk modeling was conducted by James Sickman and colleagues at UCR to evaluate the potential risk of transfer and bioaccumulation in the foodweb under different SCH alternatives and operational scenarios (Sickman et al. 2011).

## 19 J.5.2 Approach and Results

20 Sickman et al. (2011) used the progressive modeling approach of Presser and Luoma (2010) to simulate 21 transformation of dissolved selenium into particulate organic matter and selenium bioaccumulation in 22 invertebrates, fish and birds. Since reproductive effects in birds are the most sensitive indicator of selenium 23 toxicity (Ohlendorf and Heinz 2010), the assessment end-point was egg selenium concentration. In bird eggs, 24 6 µg/g dw is a conservative and widely reported toxicity reference value (Ohlendorf and Heinz 2011). The 25 responses to selenium vary among bird species, ranging from "sensitive" (mallard) to "average" (stilt), and 26 "tolerant" (avocet) (Skorupa 1998, as cited in Ohlendorf and Heinz 2010). Risk of impaired reproduction (reduced 27 hatching success) can start to occur at egg concentrations of 6-12 µg/g dw. The risk of teratogenesis (deformed 28 embryos) starts to occur above 12 µg/g dw for sensitive species, and above 20 µg/g dw for moderately sensitive 29 species (Ohlendorf and Heinz 2010).

The model tested different operational parameters, including New or Alamo River water blended with Salton Sea water to achieve operational salinity of 20 ppt or 35 ppt, and a worst case future scenario of only river water

32 (water selenium concentration up to 10 µg/L).

Overall, model results suggest that fish and bird eggs in SCH ponds utilizing Alamo River water would have about 50 percent higher selenium concentration compared to SCH ponds utilizing New River water (Table J-4). This is due to higher dissolved selenium levels in the Alamo River water relative to the New River. Similarly, risk increases as salinity decreases, with about 25-30 percent higher selenium concentrations predicted at a salinity of 20 ppt relative to 35 ppt. Further details on various model scenarios and results are provided in Appendix I.

38

Table J-4      Modeled Selenium Concentrations in Biota							
River Source	Salinity	Water (µg/L)	Macro Invertebrates	Fish (Whole)	Bird Eggs (Invertebrate Eaters)	Bird Eggs (Fish Eaters)	
New River	20 ppt	2.6	4.2	5.5	7.6	8.3	
	35 ppt	2.0	3.3	4.3	6.0	6.5	
Alamo River	20 ppt	4.0	6.6	8.5	11.6	12.7	
	35 ppt	2.8	4.5	5.9	8.1	8.9	
Selenium concentrations in biota = micrograms per gram dry weight (µg/g dw). Source: Sickman et al. 2011 (General Model simulation)							

1

## 2 J.5.3 Application to SCH Project

3 The modeling results yield several findings with relevance to SCH design and operation. First, the selenium risk 4 in SCH ponds constructed with Alamo River water would likely be substantially higher than in ponds utilizing 5 New River water. Risk characterization indices suggest there would be moderate to high risk for reduced egg 6 viability in black-necked stilts in Alamo River SCH ponds and that the risks would be elevated above current risk 7 levels. Second, inverse modeling supports the premise that higher salinity levels would result in lower risk from 8 selenium. Salinity of 35 ppt is recommended to reduce risk of reproductive effects (< 6  $\mu$ g/g dw). If low to 9 moderate levels of reduced hatching success are deemed acceptable, then salinity levels closer to 20 ppt would be 10 adequate for New River SCH ponds.

The actual magnitude of selenium impacts for the implemented Project could be lower than modeled. First, the actual concentrations could be lower because birds' foraging range would likely extend beyond the SCH ponds to include other habitats that have lower selenium levels (i.e., freshwater ponds at the Sonny Bono Refuge). Second, when the model was run using parameters estimated from the SHP complex, the modeled egg selenium concentrations were greater than the actual measured egg concentrations (Miles et al. 2009), indicating that this ecorisk model is a very conservative estimator of risk.

## **J.6** Selenium Treatment by Wetland Vegetation

## 18 J.6.1 Purpose and Need

One approach to reducing selenium risk to wildlife would be treating the river water supplying the SCH ponds to reduce water selenium concentrations. Only river water would need to be treated, since Salton Sea water is less than 2  $\mu$ g/L. Biological treatment, such as constructed wetlands or algal treatment, appears to have the most applicability, although there is lack of consensus among experts and in the literature (Cardno ENTRIX 2010). In the New River, the constructed Imperial and Brawley Wetlands were designed to reduce nutrients as well as selenium (Johnson et al. 2009). A key uncertainty is whether constructed wetlands could reliably reduce water selenium concentrations to less than 5  $\mu$ g/L (CRBRWQCB 2006) or even 2  $\mu$ g/L.

A study currently underway by Norman Terry of UC Berkeley is evaluating the effectiveness of using a water treatment system that incorporates constructed wetlands to manage selenium. Phytoremediation (biological treatment by wetland plants and the microbial community they support) is a potential technique to reduce selenium. The removal of selenium by biological volatilization to the atmosphere is highly desirable because it leads to a net loss from the aquatic system, thereby preventing its entry into the food chain.

## 1 J.6.2 Approach and Interim Results

This study is investigating approaches to enhance volatilization (Lin and Terry 2003), either by selecting wetland plant species that are more effective at volatilization, or by adding a carbon source (e.g., molasses) to stimulate bacterial processes and thus enhance volatilization. Criteria for selecting plants include ability to sequester or volatilize selenium, rapid growth and spread, and suitability for the Salton Sea climate and habitat. Preliminary fresults from laboratory mesocosm experiments suggest that different wetland designs and management techniques have the potential to reduce selenium concentrations to levels substantially lower than 5 µg/L.

8 The next phase of the work will include building a pilot constructed wetland water treatment system in the south 9 Salton Sea area to see if laboratory results could be transferred into the field. In addition, further monitoring of 10 selenium removal is planned for the Brawley and Imperial constructed wetlands.

## 11 J.6.3 Application to SCH Project

The SCH ponds would be managed through a combination of source control and pond management to reduce selenium exposure and risk to biota, depending on the alternative chosen and project operations (Appendix I). The levels of selenium in the water, sediment, and bird eggs from the ponds would be monitored. If these measures do not reduce or mitigate risk to acceptable levels, it may be necessary to consider water treatment techniques as part of adaptive management. However, water treatment would not be implemented as part of the SCH Project.

17 In the future, as the Salton Sea becomes more saline, water treatment to remove selenium may become necessary 18 as more river water is used to maintain suitable salinities for the fish community. More information about 19 performance and feasibility of biological treatment techniques would be required to determine whether this would 20 be an appropriate selenium control measure at a future phase of SCH Project implementation. This set of studies 21 currently underway would refine understanding of constructed treatment wetlands.

## 22 J.7 References

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- Colorado River Basin Regional Water Quality Control Board (CRBRWQCB). 2010. Section 303(d) list for
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34

APPENDIX K

# Corps Section 404 Permit Projects in the HUC 8 Watershed

### APPENDIX K CORPS SECTION 404 PERMIT PROJECTS IN THE HUC 8 WATERSHED

GENERAL PERMITS (GP)		Permit Type	Impacts		Mitigation		
DA Number	Project Name		Waters	Wetlands	waters	wetlands	Description
							drill approximately 50 to 100 exploration b
SPL-1995-26500	KENNECOTT CAHUILLA PROJECT EXPANDED EXPL	NWP	0.1	-	0.1	-	Rainbow Rock
							discharge fill material to construct a dike a
SPI -1995-31200	ΚΕΝΝΕΓΩΤΤ CAHLIILLA PROJECT EXPANDED EXPL	NWP	_	-	-	_	parcel) and Federal Wildlife Refuge land to
SPL-1997-2004100	CALIFORNIA DESERT FISH FARM/DIVERSION DI	NWP	0.03	_	_		to construct an 8 foot wide earthen ditch
512 1557 2004100			0.05				to replace the existing Norrish Road timbe
SPL-1997-2007700	NORRISH ROAD BRIDGE REPLACEMENT-EAST HIG	NWP	0.02	-	-	-	concrete bridge
SPL-1997-2010800	MESQUITE REGIONAL LANDFILL/ARID OPERATIO)	NWP	33.8	-	-	-	construct facilities ancillary to operation o
							drill exploration holes for determining the
							mineralization on State lands. Up to 385 e
SPL-1998-2000400	MESQUITE MINE/EXPLORATORY PROGRAM	NWP	3	-	9		program
SPL-1998-2000900	AGGREGATE PRODUCTS, INC./ATF BERM REPAIR	UnAuth/NWP	0.24	-	0		the project is to repair and stabilize an exist
SPL-1998-2012800	EL CENTRO BRANCH BRIDGE REPLACEMENT/ UNI	NWP	-	-	-	-	Bridge replacement
SPL-1998-2018300	JACKSON GULCH MINE ORLOSKY INC	NWP	-	-	-	-	Project involves resumption of placer mini
							expand aggregate mining operations at th
SPL-1999-15222	AGGREGATE PRODUCTS MINE EXPANSION	NWP	-	-	-	-	Pit II"
							designed to enhance the water quality of t
SPL-2000-00590	NEW RIVER AERATION PROJECT US BUREAU OF RECLAMATION	NWP	0.03	-	-	-	of a 50 x 25 foot concrete rubble wier acro
CDL 2000 01740							Fiber Optic project extending from Yuma t
SPL-2000-01749	YUMA TO SAN DIEGO FIBER OPTIC LINE (WD04)	IN VV P		-	-	-	construct and operate a buried fiber optic
							between Blythe and Los Angeles by way of
SPL-2000-01757	AT&T FIBER OPTIC SYSTEM FROM BLYTHE TO SAN DIEGO	NWP	4.7	-	4.7	-	conduits will be installed along a majority
SPL-2001-00852	BRANDT ROAD BRIDGE COUNTY OF IMPERIAL	NWP	-	-	-	-	replace the Brandt Road Bridge
SPL-2001-00981	ANZA VERDE WASH (ANZA DITCH) SEWERLINE PIPELINE	UnAuth	-	-	-	-	placement of demolition debris
							widen Bridge No. 58-124 along State Route
							total of 60 new piles will be driven into the
SPL-2002-01110	SAN FELIPE CREEK BRIDGE WIDENING	NWP	0.002	-	0.002	-	new sections of the bridge
							Construction of a Geothermal plant and tr
SPL-2002-01393	SALTON SEA UNIT 6 GEOTHERMAL PROJECT	NWP	0.08*	0.1*	-	0.54*	
SPL-2003-01163	GEOTECHNICAL STUDIES AT THE NEW RIVER FO	NWP	-	-	-	-	conduct geotechnical drilling explorations
SPL-2003-01514	SALTON SEA UNIT 6 GEOTHERMAL POWER PLANT	NWP	*	*	*	*	*Previously issued under 2002-1392 now I
							create a new concrete lined channel adjac
SPL-2004-01084	COACHELLA CANAL LINING PROJECT	NWP	-	-	-	-	locations where ephemeral washes interse
							construct 3.1 miles of a four-lane, divided
SPL-2005-00168	BRAWLEY BYPASS AT SR-78 & SR-111	NWP	0 4 1 4	_	-	_	County California The major features of t
51 2 2003 00100			0.111				conduct emergency repairs along the west
SPL-2005-00444	SCG CLASS II PROJECT: PIPELINE EROSION REPAIR	RGP	0.032	-	-	-	northeast of the town of Niland
							the replacement of two bridges at railroad
SPL-2005-01042	BRIDGES 678.90 AND 679.11	NWP	0.092	-	0.092	-	County
SPL-2005-01651	HOLTVILLE TREATMENT WETLAND	NWP	0.1	-	-	-	construct treatment wetlands on a 30 acre
SPL-2006-00035	SR-78 SAN FELIPE CREEK BRIDGE WIDENING	NWP	0.35	-	0.29	-	to widen Bridge No. 58-124 along State Ro
							A sediment cell and two wetland cells will
SPL-2006-00309	SHANK ROAD WETLAND PROJECT	NWP	0.37	-	-	-	approximately 8 acres and each wetland c
			0.27		0.74		near Torres Martinez Desort Cobuilla India
34F-5000-01190	LI ORKES WARTINEZ CRUSSING OF DARUCA WASH	INVVP	0.37	-	0.74	-	Thear Torres wartinez Desert Canulla India

poreholes in a pattern within Wonderstone Wash south of

long approximately 0.25 miles of private property (Kalin prevent further intrusion of the Salton Sea

that will be approximately 2000 feet long

r bridge at the East Highline Canal with a new reinforced

f the proposed Mesquite Regional Landfill extent of known mineralization and to locate additional xploration holes are proposed during the exploration

sting berm which surrounds an existing mining pit

ng operation within Jackson Gulch e existing "Wright Pit I" and initiate operations at "Wright

the New River by creating an aeration structure consisting oss the River

o Santee. Most channel crossings will be driectionally e trenched and backfilled

telecommunications system in southern California

f San Diego. Six (6) 1.5-inch high-density polyethylene

of the route

e 78 (SR-78) on both the north and south side by 8.2 feet. A e ground on both sides of the existing deck to support the

ansmission line. \*Now Pending Corps file No. 2010-00024-

(borings) at the New River in Imperial County, California

Pending Corps file No. 2010-00024-LLC

ent to the existing Coachella Canal and install siphons at ect the canal alignment

expressway northeast of the City of Brawley in Imperial he project include nine bridge structures terly shoulder of Cuff Road approximately 1.5 miles

mileposts 678.90 and 679.11 near Tortuga, in Imperial

parcel adjacent to the Alamo River

oute 78 (SR-78) at San Felipe Creek

be created on the site. The sediment cell will be

ell will be about 9 acres

crossing and the widening of Highway 86 at Daroca Wash Ins tribal land

GENERAL PERMITS (GP)		Permit Type	Impacts		Mitigation		]
DA Number	Project Name		Waters	Wetlands	waters	wetlands	Description
SPL-2006-01187	TORRES MARTINEZ CROSSING OF TONALEE WASH	NWP	0.332	-	0.652	-	the construction of a linear transportation
SPL-2007-00704	Sunrise Powerlink Project	NWP	9.96	-	115	-	120 mile transmission corridor from Imper
SPL-2007-01270	Picacho State Recreation Area - Taylor Lake Boat Ramp	NWP		0.06	-	0.2	Construct a concrete boat ramp. Materials 100 cy of gravel for the base layer the construction of a new 0.5 MGD wastew construction pands, two clarifiers, four parcels
SPL-2007-01364	Salton City Wastewater Treatment Plant	NWP	0.928	-	1.225		valves and electrical equipment, landscapir enclosing the site
SPL-2008-00979	Worthington Road Intersection Improvement	NWP	0.1	-	-		Project is to construct a turn lane at the int County. For the minor road widening, the r
SPL-2009-00445	Clean up Activities at Calexico Solid Waste Site	NWP		2.37	-	2.37	to clean up the illegally disposed waste alo
SPL-2010-00413	Seeley County Water District, Hydrogeologic Study Equipment Ins	NWP	0.0003	-	-	-	Install two, 2" diameter drive point wells (h unnamed tributary to the New River
		Total Impact	57.4003		Total Mitigation	134.371	

STANDARD INDIVIDUAL PERMITS (SIP)		Permit Type	Impacts		Mitigation		]
DA Number	Project Name		Waters	Wetlands	waters	wetlands	Description
SPL-2007-01031	Sunbeam Lake Improvement Project	SIP	1.39	0.42	1.16	1.23	proposal to renovate, rehabilitate, and imp
							The IVSP would be a concentrating solar er
SPL-2008-01244	SES Solar Two	SIP	52.2	-	253	-	utilizing a maximum of 28,360, 25-kilowatt
-	·					-	
		Total Impact	54.01		<b>Total Mitigaiton</b>	255.39	

CD's and SID's combined	Total Impact	111.41
GP's and SIP's combined	Total Mitigaiton	389.761
		T
Nationwide Permit	NWP	
Regional General Permit	RGP	
Unauthorized permit	UnAuth	
Standard Individual Permit	SIP	
No Information Available	-	I

#### APPENDIX K CORPS SECTION 404 PERMIT PROJECTS IN THE HUC 8 WATERSHED

crossing

ial County to San Diego County

used would be 105 cy of riprap, 100 cy of concrete, and

vater treatment plant consisting of headworks, two tion/evaporation ponds, site piping, miscellaneous pumps, ng along the outer perimeter of the ponds, and a fence

ersection of Worthington Rd and McConnel Rd in Imperial road crossing pipe needs to be replaced

ng the west boundary along New River Floodplain ollow steel pipes) within and adjacent to adjacent to an

prove Sunbeam Park and its associated lake nergy facility generating up to 709-megawatts (MW) (kW) SunCatchers

APPENDIX L

## **Tribal Consultation and Coordination**

APPENDIX L-1

# Correspondence from U.S. Army Corps of Engineers to Tribal Representatives



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLY TO ATTENTION OF: Office of the Chief Regulatory Division

Diana L. Chihuahua, Cultural Resources Torres-Martinez Desert Cahuilla Indians P.O. Box 1160 Thermal, California 92274

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Ms. Chihuahua,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

Maps depicting the project area are enclosed. We respectfully request any comments you may have regarding this area's role in your tribal history, and we will address any concerns that may arise in this regard. In an effort to address Native American concerns, the Corps is requesting any information that you are willing to share regarding the nature of cultural and Native American resources within the proposed project area.

The Corps is currently gathering additional information to make a determination if resources within the area are eligible for listing. In addition, the Native American Heritage Commission's record search of the Sacred Lands File did not indicate the presence of Native American cultural resources in the vicinity of the project area (see enclosure).

Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

Office of the Chief Regulatory Division

Bridget Nash-Chrabascz, THPO Quenchan Indian Nation P.O. Box 1899 Yuma, Arizona 85366

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Ms. Nash-Chrabascz,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern **p**ortion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carisbad, CA 92011

April 27, 2011

REPLY TO ATTENTION OF: Office of the Chief Regulatory Division

Leroy J Elliott, Chairperson Manzanita Band of Kumeyaay Nation P.O. Box 1302 Boulevard, California 91905

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Chairperson Elliott,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Robert Smith

Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLY TO ATTENTION OF: Office of the Chief Regulatory Division

Gwendolyn Parada, Chairperson La Posta Band of Mission Indians P.O. Box 1120 Boulevard, California 91905

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Chairperson Parada,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Sincerely,

Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

Office of the Chief Regulatory Division

Carmen Lucas Kwaaymii Laguna Band of Mission Indians P.O. Box 775 Pine Valley, California 91962

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Ms. Lucas,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLY TO ATTENTION OF: Office of the Chief Regulatory Division

Paul Cuero Kumeyaay Cultural Heritage Preservation 36190 Church Road, Suite 5 Campo, California 91906

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Mr. Cuero,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLYTO ATTENTION OF Office of the Chief Regulatory Division

Mike Jackson, Sr., President Fort Yuma Quechan Indian Nation P.O. Box 1899 Yuma, Arizona 85366

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Mr. Jackson,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

Maps depicting the project area are enclosed. We respectfully request any comments you may have regarding this area's role in your tribal history, and we will address any concerns that may arise in this regard. In an effort to address Native American concerns, the Corps is requesting any information that you are willing to share regarding the nature of cultural and Native American resources within the proposed project area.

The Corps is currently gathering additional information to make a determination if resources within the area are eligible for listing. In addition, the Native American Heritage Commission's record search of the Sacred Lands File did not indicate the presence of Native American cultural resources in the vicinity of the project area (see enclosure).

Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLY TO ATTENTION OF: Office of the Chief Regulatory Division

Michael Garcia, Vice Chairperson Ewiiaapaayp Tribal Office 4054 Willows Road Alpine, California 91901

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Vice Chairperson Garcia,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLYTO ATTENTION OF Office of the Chief Regulatory Division

Will Micklin, Executive Director Ewiiaapaayp Tribal Office 4054 Willows Road Alpine, California 91901

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Mr. Micklin,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLY TO ATTENTION OF. Office of the Chief Regulatory Division

Jill McCormick, Tribal Archaeologist Cocopah Museum County 15<sup>th</sup> & Avenue G Sommerton, Arizona 85350

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Ms. McCormick,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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The Corps is currently gathering additional information to make a determination if resources within the area are eligible for listing. In addition, the Native American Heritage Commission's record search of the Sacred Lands File did not indicate the presence of Native American cultural resources in the vicinity of the project area (see enclosure).

Sincerely,

Robert Smith

Senior Project Manager South Coast Branch San Diego Field Office


## **DEPARTMENT OF THE ARMY**

Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLY TO ATTENTION OF: Office of the Chief Regulatory Division

Monique LaChappa, Chairperson Campo Kumeyaay Nation 36190 Church Road, Suite 1 Campo, California 91906

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Chairperson LaChappa,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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The Corps is currently gathering additional information to make a determination if resources within the area are eligible for listing. In addition, the Native American Heritage Commission's record search of the Sacred Lands File did not indicate the presence of Native American cultural resources in the vicinity of the project area (see enclosure).

Please review the enclosed information and let us know if you are willing to share information or have concerns relevant to the proposed project within 30 days of receipt of this letter.

If you have any questions, please contact Lanika Cervantes at 760.602.4838 or via e-mail at Lanika.L.Cervantes@usace.army.mil. Please refer to this letter and SPL-2010-00142-LLC in your reply.

Sincerely,

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Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



## DEPARTMENT OF THE ARMY

LOS ANGELES DISTRICT, SOUTH COAST BRANCH SAN DIEGO FIELD OFFICE 6010 Hidden Valley Road, Suite 105 Carlsbad, CALIFORNIA 92011

April 27, 2011

REPLY TO ATTENTION OF: Office of the Chief Regulatory Division

Karen Kupcha Augustine Band of Cahuilla Mission Indians P.O. Box 846 Coachella, California 92236

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Ms. Kupcha,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Please review the enclosed information and let us know if you are willing to share information or have concerns relevant to the proposed project within 30 days of receipt of this letter.

If you have any questions, please contact Lanika Cervantes at 760.602.4838 or via e-mail at Lanika.L.Cervantes@usace.army.mil. Please refer to this letter and SPL-2010-00142-LLC in your reply.

Sincerely,

Robert Smith Senior Project Manager South Coast Branch San Diego Field Office



## **DEPARTMENT OF THE ARMY**

Los Angeles District, Corps of Engineers Regulatory Division, South Coast Branch 6010 Hidden Valley Road, Suite 105 Carlsbad, CA 92011

April 27, 2011

REPLYTOATTENTIONOF: Office of the Chief Regulatory Division

Preston J. Arrow-weed Ah-Mut-Pipa Foundation P.O. Box 160 Bard, California 92222

SUBJECT: Section 106 National Historic Preservation Act Consultation- Salton Sea Species Conservation Habitat Project (Corps File No. SPL-2010-00142-LLC).

Dear Mr. Arrow-weed,

The U.S. Army Corps of Engineers, Los Angeles District (Corps) is evaluating a permit application from the California Department of Fish and Game for an approximate 2,400-acre restoration project. This project would require a Department of the Army authorization to discharge fill within the Salton Sea and its adjacent wetlands in order to create a series of shallow water habitats. The proposed Project will be located in the southern portion of the Salton Sea near the mouths of the New River and Alamo River, within Imperial County, California.

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Please review the enclosed information and let us know if you are willing to share information or have concerns relevant to the proposed project within 30 days of receipt of this letter.

If you have any questions, please contact Lanika Cervantes at 760.602.4838 or via e-mail at Lanika.L.Cervantes@usace.army.mil. Please refer to this letter and SPL-2010-00142-LLC in your reply.

Sincerely,

Robert Smith Senior Project Manager South Coast Branch San Diego Field Office

APPENDIX L-2

## Correspondence from Tribes to the U.S. Army Corps of Engineers



CCR-040-11-001

THE COCOPAH INDIAN TRIBE Cultural Resource Department 14515 S. Veterans Drive Somerton, Arizona 85350 Telephone (928) 627-4849 Cell (928) 503-2291 Fax (928) 627-3173

RECEIVED

MAY 24 2011

REGULATORY BRANCH CARLSBAD FIELD OFFICE

May 17, 2011

Robert Smith Senior Project Manager San Diego Field Office 6010 Hidden Valley Road Suite 105 Carlsbad, California 92011

RE: Section 106 Consultation – Salton Sea Species Conservation Habitat Project – SPL-2010-000142-LLC

Dear Mr. Smith:

The Cultural Resources Department of the Cocopah Indian Tribe appreciates your consultation efforts on this project. We are pleased that you contacted our department on this issue for the purpose of solicitation of our input and to address our concerns on this matter. At this time, we wish to make no comment on the development of the project at this time.

We would like to continue to be kept informed progression of the project and be a part of the consultation process in the future. Additionally, we expect to be provided with all pertinent documents for this project in both draft and final format. If you have any questions or need additional information please feel free to contact the cultural resource department. We will be happy to assist you with any future concerns or questions.

Sincerely. H. Jill McCormick, M.A

Cultural Resource Manager

From:	Bridget Nash
То:	Cervantes, Lanika L SPL
Subject:	SPL-2010-00142-LLC
Date:	Tuesday, May 31, 2011 10:13:35 AM

Thank you for notifying us of the proposed Salton Sea Species Conservation Habitat Project.

While the Cultural Committee supports the project as it will create additional habitat for the animals located within the area, there is some concern as to whether or not the discharged fill would impact Obsidian Butte. Looking at the maps it appears that Obsidian Butte is located just outside of the project area but there were questions about indirect impacts as a result of the proposed discharge.

If you have any questions please do not hesitate to call or email.

Bridget R. Nash-Chrabascz

Quechan Tribe Historic Preservation Officer

Quechan Indian Tribe

PO Box 1899

Yuma, AZ 85366

760-572-2423