Appendix I

COMMENTS ON THE JULY 2010 DRAFT EIR

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STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Arnold Schwarzenegger
Governor

Cathleen Cox
Acting Director

September 28, 2010

Christopher Huitt
California State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825

Subject: San Francisco Bay and Delta San Mining
SCH#: 2007072036

Dear Christopher Huitt:

The State Clearinghouse submitted the above named Draft EIR to selected state agencies for review. The review period closed on September 27, 2010, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Please call the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process. If you have a question about the above-named project, please refer to the ten-digit State Clearinghouse number when contacting this office.

Sincerely,

Scott Morgan
Director, State Clearinghouse

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
TEL (916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH, STATE CLEARINGHOUSE

Document Details Report
State Clearinghouse Data Base

SCH#	2007072036
Project Title	San Francisco Bay and Delta San Mining
Lead Agency	California State Lands Commission

Type	EIR Draft EIR
Description	NOTE: Extended Review Per Lead to end on September 27, 2010.

Hanson Marine Operations and Suisun Associates have applied for renewed leases and related permits that would allow them to continue mining sand for 10 years following the end of the regular 10-year term that ends in June, 2008. Mining occurs in Central San Francisco Bay, Middle Ground Shoal and within the navigation channels of Suisun Bay. The purpose of this sand mining is to obtain marine aggregate, which is primarily used for construction purposes within the greater San Francisco Bay Area.

Lead Agency Contact

Name	Christopher Huitt		
Agency	California State Lands Commission		
Phone	(916) 574-1938	*Fax*	
email			
Address	100 Howe Avenue, Suite 100-South		
City	Sacramento	*State* CA	*Zip* 95825

Project Location

County	San Francisco, Marin, Contra Costa, Solano						
City	San Francisco, Pittsburg, Oakland						
Region							
Lat / Long							
Cross Streets							
Parcel No.							
Township		*Range*		*Section*		*Base*	

Proximity to:

Highways	
Airports	
Railways	
Waterways	Central San Francisco Bay, Suisun Bay, and the Middle Ground Shoals
Schools	
Land Use	Sand Mining

Project Issues	Air Quality; Archaeologic-Historic; Biological Resources; Economics/Jobs; Geologic/Seismic; Minerals; Noise; Public Services; Population/Housing Balance; Recreation/Parks; Toxic/Hazardous; Traffic/Circulation; Water Quality; Wildlife; Growth Inducing; Landuse; Cumulative Effects; Other Issues

Reviewing Agencies	Resources Agency; California Coastal Commission; Department of Conservation; Department of Fish and Game, Region 3; Office of Historic Preservation; Department of Parks and Recreation; San Francisco Bay Conservation and Development Commission; Department of Water Resources; Resources, Recycling and Recovery; California Highway Patrol; Caltrans, District 4; Air Resources Board, Major Industrial Projects; Regional Water Quality Control Board, Region 2; Department of Toxic Substances Control; Native American Heritage Commission

Date Received	07/28/2010	*Start of Review*	07/28/2010	*End of Review*	09/27/2010

Note: Blanks in data fields result from insufficient information provided by lead agency.

California Regional Water Quality Control Board
Central Valley Region
Katherine Hart, Chair

Linda S. Adams
Secretary for Environmental Protection

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Arnold Schwarzenegger
Governor

18 August 2010

Christopher Huitt
Project Manager
California State Lands Commission
100 Howe Avenue, Suite 100 South
SACRAMENTO, CA
95825

CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD COMMENTS ON THE SAN FRANCISCO BAY AND DELTA SAND MINING ENVIRONMENTAL IMPACT REPORT.

Central Valley Regional Water Quality Control Board (Central Valley Water Board) staff has reviewed the San Francisco Bay and Delta Environmental Impact Report (EIR), and offer the following comments:

The EIR is for a continuation of a land lease from the California State Land Commission. All areas of the lease are outside of the Central Valley Water Board jurisdiction, except for *perhaps* a small easternmost section of Parcel PRC 7881 (East). A section of this parcel is located near the boundary line of the Central Valley Region running between Winter Island and Sherman Island. It is not possible to determine the exact coordinates of this parcel from the information provided. However, data provided in the EIR indicate that this section of the Parcel has no record of sand mining by the project proponents. 1-1

The Central Valley Water Board requests clarification of exact boundaries of parcel PRC7881 (East). If a section of the parcel is located in the Central Valley Water Board jurisdiction, and if sand mining occurs within that section, a dredging waste discharge permit, or waiver thereof, will be required from this Board.

VICTOR J IZZO
Senior Engineering Geologist
Title 27 and Mining Unit

From: orville magoon [omagoon@sbcglobal.net]
Sent: Sunday, September 12, 2010 4:46 PM
To: Christopher Huitt
Cc: Christopher Huitt; brendag@bcdc.ca.gov
Subject: San francisco Bay Sand Mining

Categories: Sand Mining

Christopher Huitt, Project Manager
California State Lands Commission
huittc@slc.ca.gov
Dear Mr. Huitt:
Comments on SCH No. 2007072036, CSLC EIR No. 742 are:

1. Proposed sand mining from Central San Francisco Bay Lease Areas could have a major impact on:
A. Coastal processes and sediment supply to the San Francisco Ocean Bar area, B. Accelerating the current erosion of the City of San Francisco Ocean Beach area, and
C. Beach areas of the City of Pacifica. 2-1

2. In order to quantify the potential impacts described in item 1. above, the model limits (i.e.. see figures Appendix 4-25 to 4-29) should be extended to include the entire San Francisco Bar area, the San Francisco Ocean Beach area, and the City of Pacifica beaches. 2-2

3. A table should be generated showing the annual quantities of sand mined
from the Central San Francisco Bay Area from approximately 1915 to date, and the total quantity of sand mined from the Central San Francisco Bay Area. 2-3

3. Comments on this document should be obtained from the California Coastal Commission, and also the City of San Francisco, if those entities have not already commented on this document. 2-4

Sincerely,
Orville T. Magoon
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ANTHROPOGENIC REDUCTION OF THE NATURAL SUPPLY OF SEDIMENTS TO THE COASTS OF WASHINGTON, OREGON, AND CALIFORNIA

Orville T. Magoon[1] and Donald D. Treadwell[2]

Abstract

The general increase of human activities, including the exploitation of the hydraulic and sediment resources of rivers, has caused extensive coastal erosion throughout the world, especially during the last 150 years or so. The true costs and impacts of this erosion have not been reflected in the price of providing commodities such as sand and gravel. These impacts and their estimated costs are presented using information from the states of Washington, Oregon, and California on the Pacific Coast of the United States of America.

Key words: coastal erosion, sediment transport, sand and gravel mining, dredging, unpriced externalities

Introduction

In addition to the ongoing natural attack on coastlines by waves and currents, anthropogenic activities have produced serious impacts on coasts, resulting in both short-term and long-term erosion. This is almost invariably caused by the reduction of sediment supplies to coastlines (Douglass, Bobe, and Chen, 2003).

2-5 cont.

In early published literature, Gilbert (1917) reported on the deleterious effects of hydraulic gold mining on the supply of sediment to San Francisco Bay and the nearby beaches. In discussing sediment supply to California beaches, O'Brien (1936) stated, "Instead of being static, a beach is merely part of a stream of material in process of being transported from the land surfaces to the ocean depths. Measures which interfere with this movement are almost certain to upset the equilibrium and the only question is how serious the damage will be".

The problems associated with interfering with the natural supply of sediments to the coast are clearly evidenced worldwide. For example, in discussing the causes, effects, and solutions associated with coastal erosion near the mouth of the Tenryu River on the coast of Japan, Uda (2007) stated, "New measures, based on comprehensive sediment management, must be taken instead of local optimization using hard structures at a site".

Rivers and streams are the main sources of sediment for the beaches of the Pacific Coast. Along the northern portion of the coast, in Washington, Oregon and northern California, the rivers and streams tend to be large watershed systems, such as the Columbia, the Klamath, the Eel, the Sacramento, and the San Joaquin. These systems provide many millions of cubic meters of sediments to the coast. In Southern California, the watersheds are smaller in area but are still the key contributors of new beach material.

The long-term sustainability of Pacific Coast beaches depends on continuing deliveries of sand and gravel from coastal rivers and streams. The anthropogenic activities that have altered fluvial sediment regimes and contributed to erosion of the coasts of Washington, Oregon, and California include:

- sand and gravel mining operations that remove sediments,
- dams that intercept and store sediments,
- dredging operations that remove sediments, and
- debris basins that intercept and store sediments.

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Sand and Gravel Mining

Many beaches are impacted by reduction of sediment delivery to the coastal zone caused by sand and gravel mining within coastal watersheds. Streams and rivers are the transportation systems that deliver sediments to the coast. The streams and rivers move sediment from areas of weathering and erosion in the headwaters regions through middle reaches where little erosion or deposition occurs to regions of deposition in the lower reaches of rivers and then ultimately to coastal sites.

The time scale of sediment movement down these river systems is measured in terms of decades to centuries (Kondolf, Smeltzer, and Kimball, 2001). Movement of sediments is not constant, but rather is controlled by episodic peak flows during extreme rainfall events that often trigger floods. The reduction of peak flows by dams further reduces the ability of the river systems to move sediment.

The concept of "safe yield" of aggregate mining locations encompasses the argument that as long as the volume of sand and gravel that is mined annually from river channels is less than the annual replenishment of sediment from natural erosion then the effect on river channels is negligible. This argument may or may not hold true for local reaches of rivers close to the extraction sites. However, the volume of sediment in the fluvial system is reduced and thus less volume is ultimately delivered to the coast.

Based on available local information, sand and gravel mining in northern California from the Russian River to the Oregon border is approximately 6.1 million cubic meters per year. It has been reported that sand and gravel mining in southern California (Figure 1) produces an annual average 30.6 million cubic meters of material.

It is estimated that 50 percent of this material may be from or associated with coastal watercourses in the first flood plain. Thus, the annual sand and gravel extraction in coastal watersheds in southern California is perhaps about 15.3 million cubic meters and in northern California is perhaps about 3.1 million cubic meters. 2-5 cont.

Although coastal sand mining was occurring along the coasts of California and Oregon as early as the late 1800s, coastal sand mining along the Pacific Coast reportedly ended by 1991. However, some questionable coastal sand mining operations are still active on the shore of Monterey Bay (Figure 2).

Komar (1998) reports that some 84,100 cubic meters of sand were removed from the beach near the mouth of the Siletz River in Oregon between 1965 and 1971. Hotten (1988) reports that between 7,700 and 11,500 cubic meters of sand were removed from the Mission Bay littoral (near San Diego) in conjunction with removal of kelp from beaches.

The major northern California coastal sand mining operations have been along the shore of Monterey Bay and on the floor of San Francisco Bay near the Golden Gate. Based on the estimates of Magoon, Hagen, and Sloan (1972) and Kendall, Vick, and Forsman (1991), about 6.3 million cubic meters of coastal sand had been mined in the vicinity of Monterey Bay before coastal sand mining seaward of the shore was reportedly terminated in 1991.

Recent multi-beam survey work by the United States Geological Survey (Barnard, 2005) outside the entrance to San Francisco Bay shows that more than 90 million cubic meters of sediment has been lost from the mouth of the bay since the 1950s, about the same amount that has been removed by sand mining within the bay during the same period. Their sand wave maps show a clear net seaward transport of sediment through the Golden Gate.

For the present, the total sediment loss to the coastlines attributable to sand and gravel mining in California, Oregon, and Washington is estimated to be about 1.3 billion cubic meters since 1950.

Figure 1. Coastal Watershed Sand and Gravel Mining at Irwindale, California, USA

Figure 2. Mining Sand from the Shore of Monterey Bay, California, USA.

2-5 cont.

Dams

A substantial reduction of the supply of sediments to the California coast is due to the construction and operation of dams. Willis and Griggs (2003) have noted that "The long-term sustainability of California's beaches depends on periodic deliveries of sand and gravel from coastal rivers and streams. To assess the long-term health of California's beaches, this study characterized the current state of fluvial sediments delivery and quantified on a littoral cell basis, the cumulative impacts of dams on decreasing annual discharge. Presently, more than 500 dams impound more than 42,000 square kilometers or 38 percent of California's coastal watershed area. Flow modeling suggests that by diminishing flood hydrographs, these dams have reduced the average annual sand and gravel flux to 20 major littoral cells by 2.8 million cubic meters per year or 25 percent." An estimated cumulative loss in California since 1963 of 120 million cubic meters has been used herein.

The Columbia River is the dominant watershed for the coastlines of Washington and Oregon. Research estimates suggest a range of 1.4 to 4.4 million cubic meters of sediment transport per year. Kaminsky (2004) reports that "Flow regulation has been estimated to reduce the sand carrying capacity of the river by two-thirds, and the present estimated rate of supply of sand from the lower river to the estuary is 1.4 million cubic meters per year (or less as estimated by the Corps of Engineers). Komar (2004) notes that "other than the effects of the dams on the Columbia River, this is not a particular issue on the coasts of Oregon and Washington."

There are more than 219 dams in the Columbia River watershed, including the Grand Coulee (Figure 3). The Washington Department of Ecology (2005) estimates that "Dams on the Columbia River have reduced the sand supply to coastal beaches by two thirds". As a conservative estimate, this study assumes that the reduction has been about 2 million cubic meters annually, due to dams and regulated dredging for navigation. The total sediment loss to the coastlines attributable to dams in the coastal watersheds of California, Oregon, and Washington is estimated at about 210 million cubic meters since 1950.

Figure 3. Grand Coulee Dam on the Columbia River, USA.

2-5 cont.

Dredging

The modern practices of navigation channel maintenance (see Figures 4 and 5) generally include the placement of suitable beach material on the nearby shores or in sufficiently shallow water that keeps the dredged material in the littoral system. The two major exceptions to this practice are the navigation channels at the entrances of Humboldt Bay and the Columbia River (the latter was considered earlier herein). The fairly recent placements of sediments dredged from San Francisco Bay on the bar offshore the Golden Gate have not yet been fully evaluated as to whether such placements have had a beneficial impact on Ocean Beach.

Since 1990, material removed from the entrance and navigation channel of Humboldt Bay in northern California has been deposited in deep water, thereby removing the material from the littoral system. By 1998, approximately 10.7 million cubic meters of material had been deposited in water depths of 49 to 55 meters and lost to the coastal system (Nicholls et al, 1998). The cumulative loss through 2006 is an estimated 20.8 million cubic meters, while the ongoing annual rate of loss is 1.3 million cubic meters. The total sediment loss attributable to dredging is estimated at about 110 million cubic meters since 1950.

Figure 4. Maintenance Dredging in San Francisco Bay, California, USA.

2-5 cont.

Figure 5. Corps of Engineers Hopper Dredge ESSAYONS on the Columbia River, USA.

Debris Basins

Debris basins (Figure 5) are typically used in southern California to protect urban development from the damaging effects of periodic intense rainfall. As stated in Ellis et al (2001), "Debris basins are designed to trap sediments being transported by debris flows…. As of 2000, 162 debris basins trapped a total of more than 13,761,900 cubic meters of debris… Assuming a 50 percent sand content for these deposits, the basins have trapped about 6,881,000 cubic meters of sand. It is assumed that little of this sand is returned to the drainage system, and therefore this impoundment represents a loss of sand from the coastal budget." The sediment loss (adjusted to 2009) attributable to debris basins is estimated to be 8 million cubic meters.

Figure 5. Debris Basin in Riverside, California, USA.

Seawalls and Revetments

Although the loss of sediments to the coast due to construction of seawalls, revetments, or other coastal armoring (Figures 6 and 7) is locally important (Komar, 2004; Hampton and Griggs, 2004), it has a relatively minor impact on the Pacific Coast of the coterminous United States. The California Department of Boating and Waterways (2002) estimated that for the Santa Barbara and Oceanside littoral cells in Southern California, coastal armoring reduced the supply of sediments by 2,000 cubic meters and 9,500 cubic meters per year, respectively, resulting from 68.6 kilometers of armoring.

Averaging and projecting the sediment reduction from these reaches of coast to the entire state in order to estimate the effect of armoring on approximately 260 kilometers of armoring in California (seawalls and breakwaters) would result in about 53,000 cubic meters per year lost due to armoring. For the present purposes, coastal sediment loss due to armoring in California is estimated to be 38,230 cubic meters per year; for Oregon, the estimate is 2,290 cubic meters per year (Komar 2004). The total sediment loss to the coastlines attributable to sea walls and revetments in California, Oregon, and Washington is thus estimated at about 1.5 million cubic meters since 1950.

2-5 cont.

Figure 6. O'Shaughnessy Seawall at the Great Highway, San Francisco, California, USA.

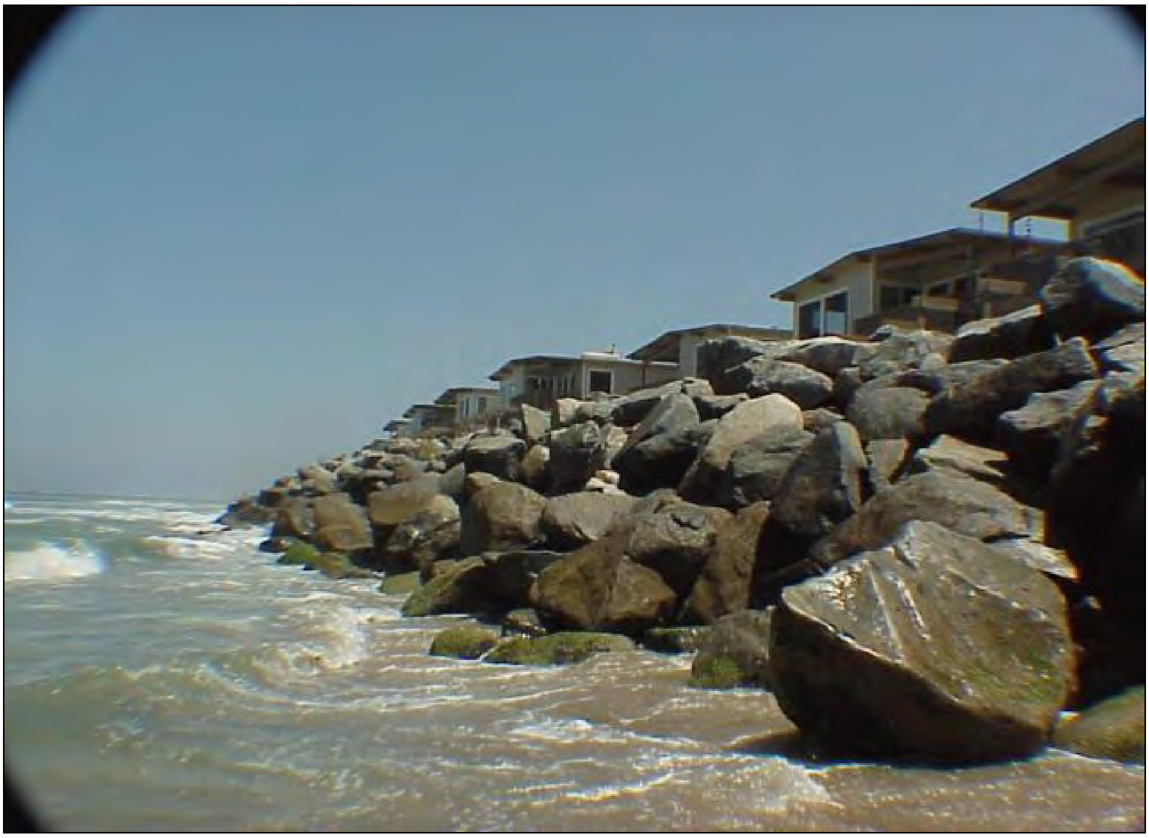

Figure 7. Armor Stone Revetment at San Clemente, California, USA.

2-5
cont.

Unintended Consequences and Unpriced Externalities

To reiterate, O'Brien (1936) stated that, "Instead of being static, a beach is merely part of a stream of material in process of being transported from the land surfaces to the ocean depths. Measures which interfere with this movement are almost certain to upset the equilibrium and the only question is how serious the damage will be."

Sediment continues to be removed to clear channels for commercial shipping, sediment continues to be contained behind dams that provide water and power and flood control, and sediment continues to be mined as input to construction and to various manufactured materials. While each of these activities was and is undertaken at some expense, the cost of the activity traditionally does not include the cost to the coastline due to removal of the sediment.

The controlling concept in understanding the economics of these activities focuses on unpriced externalities (Lent, Magoon, and Richmond, 2005). The failure of the market to include the cost of interference in the natural supply of sediment to the shoreline effectively results in a subsidy to the action, as the activity is being undertaken at less than the real cost. The cost is external to the decision to undertake the activity, resulting in the potential over-consumption of sediment, thus further compounding the problem.

A simple approach (Magoon et al, 2004) may be used to estimate the replacement value of the lost sediment. In Table 1, the loss of sediment from debris basins, dams and flow regulation, sand and gravel mining, seawalls and other armoring, and harbor dredging are valued based on a present (and inexact) estimate of US $20 per cubic meter. 2-5 cont.

Table 1. Estimated replacement cost of sediments lost to the coastlines of California, Oregon, and Washington since 1950.

FACTOR	Estimated Loss (cu m)	Estimated Cost (US$)	Percent
Sand and Gravel Mining	1,300,000,000	$ 26,000,000,000	79.7%
Dams	210,000,000	$ 4,200,000,000	12.9%
Dredging	110,000,000	$ 2,200,000,000	6.8%
Debris Basins	8,000,000	$ 160,000,000	0.5%
Sea Walls and Revetments	1,500,000	$ 30,000,000	0.1%
TOTALS	**1,629,500,000**	**$ 32,590,000,000**	**100.0%**

As shown in Table 1, the estimated total sediment loss to the coast in these five categories since 1950 is more than 1.6 billion cubic meters. Sand and gravel mining is the largest factor by far, accounting for nearly 80 percent of the estimated loss.

The estimated replacement value of this sediment using estimated current (2009) prices is almost US $32.6 billion. The ongoing annual loss of sediment is estimated to be about 30 million cubic meters, presently valued at about US $600 million.

In reality, if there were to be sizeable efforts initiated to mitigate the cumulative or annual sediment losses, the actual cost per cubic meter would be much higher as the tremendous demand for sediment would drive up the cost significantly. Two other factors relevant to economic considerations are the repair and replacement costs for structures damaged and benefits lost and the value of what minor beach nourishment has taken place.

Very little information is available for repair costs, as only a very limited portion of the shoreline has actually undergone repair. Separate reports (e.g., Heinz Center, 2000) estimate as much as US $3.1 billion in lost structures, damaged infrastructure, and lost recreation benefits in the study region.

In addition, very little work has been done to replenish the sediments lost to the coastlines. The U.S. Army Corps of Engineers has undertaken five nourishment projects beginning in 1959 'putting back' about 56 million cubic yards along the California coast. Note that most of the sand that was 'put back' utilized near shore dredged material which was simply replacing what would otherwise have been counted as a loss to the system. The reported costs for these nourishment projects have totaled US $258 million (U. S. Army Corps of Engineers, 2003), a small fraction of the estimated damages.

Conclusions

The information presented herein indicates that 1.6 billion cubic meters or more of sediment has been lost to the coastlines of Washington, Oregon, and California since 1950. The replacement value of these lost sediments is conservatively estimated to be at least US $32.6 billion. About 80 percent of the loss is attributable to sand and gravel mining in coastal watersheds and from the beaches.

Further, it is believed that most of these losses continue unabated, at a rate of about 30 million cubic meters per year. The annual replacement value of these sediments is thus believed to be at least US $600 million.

These estimates, even with limitations, provide a useful understanding of the economic effects of sediment loss along the coastlines. Although the focus of this work was on a specific region of the United States, the anthropogenic factors discussed herein are most surely among those impacting coastlines around the world. 2-5 cont.

Acknowledgements

The authors acknowledge the assistance and support of many colleagues in this effort, including Linda Lent, Jeff Williams, Jim Richmond, Lesley Ewing, Tony Pratt, Scott Douglass, Billy Edge, Katherine Stone, Ron Noble, Patrick Barnard, Gary Griggs, Tom Kendall, Cope Willis, Paul Komar, Monte Hampton, and Bob Wiegel. The support and enthusiasm of friends and family is also very much appreciated.

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2-5 cont.

STATE OF CALIFORNIA, NATURAL RESOURCES AGENCY — ARNOLD SCHWARZENEGGER, GOVERNOR

STATE MINING AND GEOLOGY BOARD

DEPARTMENT OF CONSERVATION

801 K Street • Suite 2015 • Sacramento, California 95814

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September 13, 2010

Christopher Huitt, Project Manager
California State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, California 95825

Re: San Francisco Bay and Delta Sand Mining Draft Environmental Impact Report, SCH No. 2007072036; CSLC EIR No. 742

Dear Mr. Huitt:

Staff of the State Mining and Geology Board (SMGB) has completed review of the Draft Environmental Impact Report (DEIR) for the above referenced project. It is our understanding that the California State Lands Commission (CSLC) is considering granting of new leases for ongoing marine sand mining operations for an additional 10-year period. We appreciate the opportunity to comment on the subject DEIR, as the SMGB will rely on the final EIR in order to approve amended reclamation plans for the affected marine sand mining operations per the requirements of the Surface Mining and Reclamation Act of 1975 (SMARA, Public Resources Code (PRC) Section 2710 et seq.).

At this time the SMGB has no specific comments regarding the DEIRs analysis of environmental impacts and mitigations. However, we offer the following comments for your consideration in preparing the final EIR;

- Discussion under the final bullet on Page 1-15 should be revised to clarify that the SMGB, which is a part of the Department of Conservation (DOC), is a responsible agency for the project. The DOC's Office of Mine Reclamation (OMR) is also responsible for reviewing the reclamation plans for the subject sand mining sites, but it is the SMGB that grants approval for each of these reclamation plans. 3-1

- Discussion of the makeup of the DOC beginning on Page 4.2-5 should be revised to more accurately reflect the current program divisions. Note that the Division of Mines and Geology has been renamed to the California Geological Survey (CGS), and that the Division of Recycling is no longer part of the DOC. 3-2

- The sentence on lines 12 to 14 on Page 4.2-6 is erroneous and should be revised to state the following: "*The lead agency under SMARA is the jurisdiction which has the principal responsibility for approving a reclamation plan applicable to the surface mining operation – in this case the SMGB.*" In addition, the final sentence of this paragraph (on lines 16 through 19) may be deleted, as the SMGB is not required to adopt a surface mining ordinance in this case. 3-3

- The paragraph on lines 9 through 12 on Page 4.2-7 should be corrected so that the second sentence becomes the heading for the following paragraph. 3-4

-o0o-

Thank you for the opportunity to comment on the DEIR for the San Francisco Bay and Delta Sand Mining project. We look forward to receiving the final EIR. If you have questions regarding the above comments or the SMGBs role in this matter, please do not hesitate to contact Will Arcand or myself at the SMGB office.

Sincerely,

Stephen M. Testa.
Executive Officer

cc: Dennis O'Bryant, Assistant Director, Office of Mine Reclamation

SAN FRANCISCO
BAYKEEPER®

Christopher Huitt, Project Manager
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100 Howe Avenue, Suite 100-South
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sent via electronic mail: huittc@slc.ca.gov

August 13, 2010

Re: San Francisco Bay and Delta Sand Mining DEIR, SCH # 2007072036

Dear Mr. Huitt:

Please accept these comments, submitted on behalf of San Francisco Baykeeper, in opposition to the proposed San Francisco Bay and Delta Sand Mining ("Project") Draft Environmental Impact Report ("DEIR"). Baykeeper is particularly concerned that significant adverse impacts to biological resources, water quality and mineral resources, which have been assessed in a manner inconsistent with significance criteria stated within the Project DEIR. It is our sincere hope that the State Lands Commission and all other responsible agencies seize this environmental review process as an opportunity to ensure the best possible protections of public waters and wildlife resources during the ten year duration of this proposed Project. We look forward to your further review and analysis based on these comments. 4-1

I. The assessment of impacts to biological resources is inconsistent with stated significance criteria. 4-2

Conclusions contained in §4.1.4 of the DEIR fail to adhere to stated thresholds of significance, which claim that a biological resource impact is considered significant if (4.1-40):

- There is a potential for any part of the population of a special status species (such as State or federally endangered species) to be directly affected or indirectly harmed through the disturbance or loss of its habitat;
- A net loss occurs in the functional habitat value of a sensitive biological habitat, or any area of special biological significance;
- There is a potential for the movement or migration of fish to be impeded; or,
- A substantial loss occurs in the population or habitat of any native fish or vegetation or in there is an overall loss of biological diversity, with substantial defined as any change that could be detected over natural variability.

The DEIR states that "noise levels generated by sand mining at the location of the hydraulic dredge are within the sound range that can result in the behavioral responses by fish and marine

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mammals," and that "[b]ehavioral responses can include avoidance behavior, such as change in swimming direction and speed" (4.1-44), and "altered foraging" (4.1-43). The DEIR concludes that these impacts are less than significant, but fails to explain how noise impacts that change the behavior of fish and swimming patterns could not (1) directly affect or indirectly disturb the fish habitat, (2) reduce the value of the habitat by resulting in avoidance, or (3) change the movement or migration of sensitive fish species. In addition, the DEIR fails to consider how *increasing* noise through increased sand extraction could exacerbate these effects. The DEIR offers no mitigation measures for this impact, which therefore must be considered to be significant and unmitigated.

4-2 cont.

Similarly, the DEIR describes in detail numerous impacts to foraging habitat that will likely occur as a result of sand mining but, inexplicably, the DEIR concludes that this impact will be less than significant because "these changes do not appear to last more than a few years." (4.1-46.) However, nothing in the significance criteria suggests that an impact may be less than significant if it lasts "only" a few years. This conclusion is at odds with the significant threats faced by endangered, threatened, and sensitive species whose populations could pass a tipping point over the course of a few years, nor does this evaluation account for the increased production proposed by the project that would increase the scope and duration of this multi-year impact above baseline levels. The DEIR offers no mitigation measures for this impact, which therefore must be considered to be significant and unmitigated.

II. The Project's impacts to delta smelt and other special status fish should be considered significant and unavoidable.

Based on entrainment estimates the DEIR admits the Project would result in direct take of at least nine individual delta smelt per year (4.1-52), which clearly qualifies as a significant impact pursuant to the DEIR's stated thresholds significance. However, the DEIR concludes this impact will be less than significant, despite the absence of mitigation measures intended to avoid direct take of listed species. Mitigation of this impact is deferred by delaying consultation with California Department of Fish and Game ("CDFG") to determine whether an Incidental Take Permit ("ITP") under Section 2081 of CDFG code is required. (4.1-53.) Nothing in the DEIR's evaluation shows that this impact will be less than any of the significance criteria provided by the DEIR. 4-3

Similarly, the DEIR admits the project will cause mortality to other special status fish and implements mitigation measures to reduce the impact, yet fails to provide any comparison of the reduced impacts to the DEIR's standards of significance. Merely implementing some mitigation measures does not necessarily reduce an impact to a less than significant level. Awaiting further review and advice from state and federal wildlife agencies impermissibly defers the evaluation and mitigation of these impacts that must occur in the DEIR. 4-4

III. Impacts to longfin smelt are inadequately assessed and formulation of mitigation measures are illegally deferred.

Based on projected impacts to longfin smelt and other special status species, CSLC should deny the project and suspend any ongoing activities that cannot be mitigated to less-than-significant levels. The DEIR notes that formal CDFG consultation has not been initiated over likely take of longfin smelt during project operations and that formulation of mitigation measures is deferred pending further unknown recommendations from CDFG after closure of the public review and comment period on the EIR. Because these mitigation measures are wholly uncertain and would not take effect for a year or more after the project begins, the project should be denied and not permitted to operate in any way that would result in illegal take of longfin smelt.

Informal consultation with CDFG regarding longfin smelt appears to have been initiated, resulting in the inclusion of MM BIO-9d. However, this mitigation measure fails to meet minimum standards for environmental review. In *Gentry v. City of Murrieta*, the Court of Appeal stated that mitigation measures may be formalized after project approval *only if*, the lead agency has circulated an environmental review document that (1) identifies and discloses with particularity the project's potentially significant impacts, (2) establishes measurable performance standards that will clearly reduce all of the identified impacts to less-than-significant levels, and (3) describes a range of particularized mitigation measures that, when taken in combination, are able to meet the specified performance standards. (*Gentry v. City of Murrieta* (1995) 36 Cal.App.4th 1359, 1394-1395; see also CEQA Guidelines § 15126.4.) However, the DEIR simply recommends that Applicants consult with CDFG to determine whether an ITP is required after the CEQA review process is over and public review and comment period closed. (4.1-55.) 4-5

Mitigation measures for impact BIO-9 fail to meet the standards established by *Gentry* for deferral of mitigation measures for several reasons. First, the mitigation measure fails to include any "measurable performance standards"; second, the DEIR fails to describe any "particularized mitigation measures"; and third, the DEIR offers no evidence to support its conclusion that MM BIO-9d would serve to reduce impacts to longfin smelt to less-than-significant levels.

IV. Significance criteria are inappropriately applied with regards to impacts to mineral resources.

As stated in § 4.2.3, adverse impacts on mineral resources are considered significant under the following conditions: 4-6

- The loss of availability of a known mineral resource that would be of value to the region and the residents of the State; or
- The loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other use plan.

The DEIR interprets these criteria to "mean that depletion of the resource through mining does not constitute a significant impact; an impact could only occur where a project prevented or inhibited access to a known mineral resource" (4.2-8). Under this interpretation, no mining operation could ever pose a significant impact to mineral resources unless operations prevented future access to other mineral resources. Under this flawed interpretation sand mining should be allowed to occur at an unrestricted rate since access to other valuable mineral resources would presumably not be restricted as a result of sand extraction in the San Francisco Estuary. Since sand mining can and should be conducted in a sustainable manner the DEIR should more appropriately assess whether the project has the potential for resource depletion, thereby threatening the availability of a resource of value to the region and the residents of the State. 4-6 cont.

V. The proposed extraction rate is unsustainable, resulting in foreseeable significant impacts.

Through assessment of Impact MIN-3: Depletion of the sand resource, the DEIR suggests that Central Bay lease areas could suffer from resource depletion since deposition of new sand resources have not been observed over the last ten years. (4.2-9) This is consistent with a 2004 USGS report which concludes that "the total volume of sand in the west-central bay shoals that are in active sand mining leases is unknown… The volume of commercially extractable sand and gravel in these shoals needs to be known to prevent resource depletion. Additionally, it is not known whether the sand shoals in west-central bay are being naturally replenished, are in equilibrium, or are eroding".[1] In the absence of appropriate evidence, further study should be conducted to determine the appropriate level and locations of sand extraction. Alternatively, extraction volumes should be reduced significantly to permit monitoring and adaptive management over the ten year lease cycle. 4-7

As cited from Porterfield (1980), the DEIR states that estimates of sand loads from the Delta to the Bay range from 1.7 to 3.3 million cubic yards.[2] Under the proposed Project, leaseholders would be permitted to extract up to 2,040,000 cubic yards of sand per year, which exceeds the lower bound estimate of total sand loads and is a majority of the upper bound estimate. In reality, proposed extraction levels likely approximate the total annual sand load to San Francisco Estuary.

The likely fact that extraction rates approximate total sand inputs from the Delta is consistent with comments to the Notice of Preparation ("NOP") for this Project received from Patrick Bernard of the USGS. Dr. Bernard pointed out that over 100 million cubic yards of sediment has been lost from the Mouth of San Francisco Bay in the last 50 years, a time period broadly coincident with major sand mining activities in Central San Francisco Bay. This is also

[1] Chin, J.L., F.L. Wong and P.R. Charlton. 2004. *Shifting Shoals and Shattered Rocks – How Man Has Transformed the Floor of West-Central San Francisco Bay*. Circular 1259, U.S. Geological Survey, Menlo Park, CA.
[2] Porterfield, G. 1980. *Sediment Transport of Streams Tributary to San Francisco, San Pablo and Suisun Bays, California, 1909-66*. U.S. Geological Survey, Water Resource Investigations 80-64, 92 p.

consistent with the CHE report prepared in support of this Project, which found that the volume of material mined from 1997 to 2008 is nearly equivalent to the measured erosion inside and surrounding the lease areas. Authors of the CHE report indicated that only approximately 5 percent of the mined sands are replaced under natural processes, suggesting an entirely unsustainable practice that could result in significant erosion and other geomorphological impacts to areas within and outside San Francisco Bay.[3] Accordingly, the DEIR should develop a project alternative that satisfies the project objectives through sustainable practices. 4-7 cont.

VI. Inadequate assessment of potential geomophological impacts indicates an under-representation of impacts to hydrology or water quality.

Among other criteria, a hydrology- or water quality-related impact is considered significant if the Project "…altered the topography in a manner that would result in substantial erosion or sedimentation" (4.3-24). The fact that the DEIR states that depletion of sand resources "is not considered a significant impact of the Project" (4.2-11) suggests a lack of understanding regarding sediment dynamics and potential impacts to coastal geomorphology in the region. Numerical modeling conducted in support of this project did not adequately assess potential geomorphology impacts to beaches and coastlines north and south of the Golden Gate and concerns still exist over whether on-going sand mining operations are exacerbating known erosion issues. 4-8

Continuation of sand mining operations at unsustainable extraction rates could result in significant erosion of beaches and bluffs located north and south of the Golden Gate. Unsustainable sand mining operations have occurred in other areas of California, such as Monterey Bay, where accelerated erosion of beaches and bluffs resulted in the termination of sand mining in the area during the 1980s.[4] Baykeeper shares the concerns of USGS that without a reliable supply of course sediment from the Delta to the mouth of San Francisco Bay coastal geomorphology in the region. As a result, permanent alterations to beaches and coastlines may occur, requiring public investment in coastal revetment and restoration. In addition, reliable sediment loads from the San Francisco Estuary are required in efforts to mitigate the effects of sea level rise over the next century. 4-9

VII. Evidence is not provided to support assertions regarding the No Project alternative.

Under the no project alternative, or the reduced project alternative, the DEIR asserts that air quality impacts would increase because demand would be met by transporting materials acquired in more distant locations (p. ES-5). However, the DEIR fails to provide any evidence to support this assertion, including no information to indicate that the local demand for sand is fixed, and no 4-10

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[3] Coast and Harbor Engineering (CHE). 2009. *Sand Mining Resource Evaluation and Impact Analysis*. Included in the DEIR as appendix G.
[4] Griggs, G., K. Patsch and L. Savoy. 2005. *Living with the Changing California Coast*. University of California Press, Berkeley.

information regarding the current distribution and demand for sand beyond San Francisco Bay sufficient to understand how a decrease in sand production from the Bay could or would affect supply and transportation, either beneficially or adversely. 4-10 cont.

VIII. The DEIR inaccurately forecasts future sand demand.

Mineral demand forecasts appear to be based on data from a report published in 2006 at the onset of the current housing crisis.[5] (4.2-3) Recent housing data indicates that demand for construction services and material is down significantly; housing starts in September 2010 are down 70% compared with 2006 data from the same month.[6] Since economic forecasts over the 10-year lease period indicate prolonged strain on the construction sector it would appear that forecasts for sand over a similar period may be overestimated. Accordingly, assessment of potential impacts to air quality and mineral resources appears to be based on outdated information. 4-11

IX. The DEIR should evaluate project alternatives that demonstrate minimum extraction rates to achieve economic viability

Project Applicants have identified the objective for the San Francisco Bay and Delta Sand Mining Project to "…continue sand mining at an economically viable level in San Francisco Bay for the next 10 years". (ES-2) However, the DEIR fails to provide any evidence to determine economic viability or unacceptability. While the DEIR evaluates an alternative to cut production by half, this alternative could be seen as too drastic a reduction to be viable, although the DEIR provides no information with which to assess whether this or other project alternatives could meet the only stated project objective. If the 50% reduction alternative is deemed not viable, a different reduced project alternative should be considered, as it would significantly lessen the project's adverse impacts (by, for example, 25% for a 3/4 production alternative) while achieving the project objectives. 4-12

X. Foreseeable impacts arising from inevitable sand mining operations beyond the 10-year lease term should be evaluated.

More information should be provided in the DEIR the Applicant's potential option to extend the proposed project for an additional 10 years beyond the proposed 10 year lease period. (2-1) The DEIR states that further CEQA review will be required at that time, yet further CEQA review will only occur in the event the option to extend the lease is discretionary, which is not stated in the DEIR. Furthermore, by the very terms of the project proposal, the project intends to continue for another 20 years. Therefore, the DEIR must evaluate the impacts of this project term. 4-13

[5] Kohler, S. 2006. *Aggregate Availability in California*. Department of Conservation, California Geological Survey.
[6] Housing start data available through the California Building Industry Association at www.cbia.org

XI. Foreseeable impacts from ancillary sand and gravel facilities must be considered in the DEIR.

The DEIR inconsistently describes on-shore sand and gravel facilities as part of the Project, and not part of the Project. (2-18.) The DEIR admits that activities at sand and gravel facilities occur as a totally foreseeable indirect result of the Project mining. However, the DEIR chooses to omit evaluation of impacts from on-shore facilities, noting that those facilities are required to obtain separate approvals. This approach contradicts CEQA's well established principle that a project is the whole of an action that has a potential to result in a direct or reasonably foreseeable indirect physical impact; a project is not each separate governmental approval required for each foreseeable impact.

To effort to help protect water quality in the Bay, San Francisco Baykeeper has resorted to litigation against permit holders in violation of storm water permits, including sand and gravel storage facilities. Such suits have highlighted the reasonably foreseeable indirect physical impacts associated with sand mining in San Francisco Bay and Delta, despite the fact that such facilities have obtained the required Clean Water Act permits. Baykeeper has brought several lawsuits against on-shore facilities that store sand, including the Tidewater Sand & Gravel Co. (now Hanson Oakland Marine), the Granite Rock Company, and Cemex, Inc.

4-14

At the time of Baykeeper's suit against Tidewater Company, sand and gravel stored at facilities immediately adjacent to the Bay was acting as a source of storm water pollution. Permit violations for high suspended sediment concentrations were a direct result of sediment from the sand piles directly contaminating storm water flowing from the facility. Similarly, Baykeeper filed suit against the Granite Rock Company due to storm water violations associated with on-shore storage of sand and other construction materials. Granite Rock operates several concrete and asphalt facilities and maintains large piles of crushed concrete, sand, and rubble at its facilities. In addition to being a source of wind-borne dust, these uncovered piles were also causing storm water pollution. Granite Rock's own storm water sampling results reported exceedances of EPA Benchmarks for total suspended solids, pH, and iron. Prior to Baykeeper's lawsuit, every storm water sample collected at the site exceeded the benchmark for total suspended solids.

Baykeeper brought a third similar storm water pollution-related lawsuit against Cemex, a corporation specializing in concrete and building supplies. Cemex owns and operates nine concrete ready mix supply facilities in the Bay Area. Raw materials, including sand used in the manufacturing of various ready mix products, are stored and transported at the facilities. Baykeeper's site investigation revealed extensive tracking of dust, sediment, and debris from Cemex's facilities. In addition to air-borne contamination, Cemex's storm water was found to be in violation of EPA Benchmarks for total suspended solids, pH, and iron.

These three facilities are only a small fraction of the many facilities in the Bay Area that store mined sand. On-shore storage of mined sand can cause significant storm water pollution, which can cumulatively have a significant impact on water quality in the Bay. To fully understand the water quality impacts of sand mining, the effects of on-shore storage of the mined material must be considered in the DEIR for public review and comment. 4-14 cont.

XII. Reasonably foreseeable impacts associated with indirect emissions of greenhouse gases and mercury should be adequately assessed.

The DEIR must evaluate the significant environmental impacts that will occur as a result of concrete manufacturing using the mined sand materials. Presumably, the sole, or most significant, outlet for sand mined from this project will be concrete production. This DEIR fails to mention this as a reasonably foreseeable indirect impact of the Project. However, the concrete production that will be fueled by this mining project will have significant and unmitigated impacts to the environment, all of which must be analyzed in a revised DEIR. In particular, the DEIR must evaluate and analyze mitigation measure for the project's indirect effects of increasing emissions of greenhouse gasses, and mercury.

Concrete production is among the most greenhouse gas intensive activities occurring today, responsible for up to 5% of global greenhouse gas emissions annually.[7] . The DEIR must evaluate the amount of greenhouse gas production that will occur as a result of the cement production using the sand from this mining project (including the available amount of sand proposed to be increased by this project). The DEIR should evaluate mitigation measures such as funding greenhouse gas controls or sequestration for cement manufacturers, or sponsoring greenhouse gas offset projects at a ratio of at least 3:1. 4-15

In addition, cement production also results in a substantial amount of mercury emissions, accounting for the third largest source of mercury emissions in the United States. In addition, the San Francisco Bay is impaired for mercury, and cement production in the Bay Area contributes additional mercury loads to this already impaired water body. The DEIR fails to analyze this significant indirect impact or mitigation measures for it.

XIII. Conclusion.

The DEIR should be revised for each of the foregoing reasons, and recirculated to provide the public and governmental decision-makers with an opportunity to review each of the project's significant environmental impacts, and the additional mitigation measures and project alternatives that must be considered to reduce or avoid these impacts. 4-16

[7] The Cement Sustainability Initiative: Progress report, World Business Council for Sustainable Development, published 2002-06-01.

Thank you for your consideration of these comments.

Sincerely,

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September 24, 2010

Paul D. Thayer, Executive Officer
California State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202
Attention: Christopher Huitt, Project Manager

RE: DEIR for San Francisco Bay and Delta Sand Mining

Dear Mr. Thayer:

We appreciate the opportunity to comment on the Draft Environmental Impact Report for San Francisco Bay and Delta Sand Mining. Save The Bay is the largest and oldest organization working exclusively to protect, restore and celebrate the San Francisco Bay and Delta. Since 1961, we have helped to reduce pollution and landfill in San Francisco Bay-Delta, restore habitat for fish and wildlife, and increase public access to the Bay and shoreline. We helped establish the San Francisco Bay Conservation and Development Commission (BCDC) as the first coastal zone management agency to regulate Bay and shoreline uses and to increase public access.

In our previous comments to the State Lands Commission regarding proposals to increase sand mining, we noted that the EIR provided a mechanism for addressing the impacts of sand mining on in-bay habitat, as well as beach replenishment inside and outside of the Golden Gate. The Bay once had many miles of sandy beaches, most of them no longer in existence.

The DEIR does indicate that sand mining in San Francisco Bay creates significant and persistent pits which are not replenished during the lease period, nor in the years following. These pits become traps for other sediment, intercepting its transportation to locations downstream, including those in the Bay and immediately outside the Golden Gate. This significant, detrimental impact underscores that the proposed project is not sustainable. Approval of additional sand mining would augment the sediment deficit the Bay is already experiencing and would increase the pits in number and size. 5-1

The DEIR's impacts analysis is not adequate, nor is it acceptable for the DEIR to dismiss additional analysis and conclusions as too complex to complete. The sediment deficit at the Golden Gate is similar in magnitude to the annual volume of sand removed from the Bay through mining; significant impacts of that deficit

SAVE THE BAY

are observed and are imposing continuing costs at ocean beaches near the
Golden Gate. It is not appropriate to conclude, as the DEIR does (p. ES-17), that
sand mining will not “affect sediment transport and deposition within the Bay and 5-1
ocean.” On the contrary, it is appropriate to conclude from the available facts cont.
that past and proposed sand mining is contributing to beach erosion and loss of
sandy bottom habitat, and the DEIR should be corrected to reflect a
precautionary approach that acknowledges the linkage.

The project applicants have not provided mitigation for this “significant
unavoidable impact on Biological Resources.” The DEIR does not propose
effective mitigation for future impacts. As a result, the DEIR’s proposed preferred
alternative would enshrine cumulative impacts that effectively make the Bay’s 5-2
sand deficit permanent and increasing from each successive approved mining
lease. The DEIR should be corrected to indicate that this is, in fact, a significant
cumulative impact.

The proposed preferred alternative is not sustainable for the Bay ecosystem and 5-3
should not be approved as characterized in the DEIR.

Thank you for your consideration of these comments.

Sincerely,

David Lewis
Executive Director

Making San Francisco Bay Better

September 27, 2010

Mr. Christopher Huitt
California State Lands Commission
100 Howe Avenue, Suite 100
Sacramento, CA 95825

SUBJECT: San Francisco Bay and Delta Sand Mining Draft Environmental Impact Report; State Clearing House No. 2007072036.CSLC EIR No. 742

Dear Mr. Huitt:

Thank you for the opportunity to comment on the San Francisco Bay and Delta Sand Mining Draft Environmental Impact Report (EIR). As described in the document, the California State Lands Commission (CSLC) previously granted mineral extraction leases to enable the continuation of sand mining of construction-grade sand from certain delineated areas of Central San Francisco Bay (Central Bay) and Suisun Bay as well as the western Sacramento-San Joaquin River Delta (Delta) area. These leases were valid for a 10-year period with an option to apply for new leases for an additional 10 years. The initial 10-year period expired on June 30, 2008. The CSLC is allowing the continuation of sand mining, however, on a month-to-month basis pending the completion of the environmental review and permitting process.

The Draft EIR was prepared to examine the potential environmental effects of the proposed new leases and continuing sand mining for an additional 10-year period. The proposed project includes the CSLC's issuance of new ten-year leases for aquatic sand mining of up to 1,840,000 cubic yards (cy) annually at six parcels, some of which have two or three components, for a total of 3,643 acres in Central San Francisco Bay, Suisun Bay, and Suisun Channel.

The Draft EIR considered many project alternatives but only analyzed the four most viable ones. The first alternative is the no action alternative under which the CSLC would not issue new mining leases. The second alternative is the Long-term Management Strategy Management Plan conformance alternative that would require sand mining to comply with temporal and spatial restrictions on dredging contained in the *Long-term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region Management Plan 200 (LTMS)* environmental work windows. The third alternative is the clamshell mining, which would employ a clamshell dredge rather than hydraulic mining of sand from the floor of the Bay and Delta. The fourth alternative is the reduced project alternative that would reduce the proposed project volume by half, limiting mining to 1,020,000 cy annually.

The Commission's jurisdiction includes all tidal areas of the Bay up to the line of mean high tide (up to five feet above mean sea level or the upper edge of marsh vegetation in marshland), all areas formerly subject to tidal action that have been filled since September 17, 1965, and the shoreline band, which extends 100 feet inland from and parallel to the Bay shoreline. All of these parcels are within either the Commission's Bay jurisdiction or Suisun Marsh Protection Act jurisdiction. Therefore, BCDC permits are required for sand mining activities within each of the lease areas, including Middle Ground Shoal (Tidelands Lot 39).

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Although the Commission itself has not reviewed San Francisco Bay and Delta Sand Mining Draft EIR, the staff comments discussed below are based on the Commission's law, the McAteer-Petris Act, the Commission's *San Francisco Bay Plan* (Bay Plan), the Suisun Marsh Preservation Act (Marsh Act), the Suisun Marsh Protection Plan (Marsh Protection Plan) and the Commission's federally–approved coastal management plan for the San Francisco Bay, pursuant to the amended federal Coastal Zone Management Act (CZMA).

General Comments

Area of Analysis. As discussed with the CSLC staff and the project consultants, the area of impact considered in the document, the hydrodynamic modeling and sediment transport analysis should include the San Francisco Bar and near shore San Francisco littoral cell. Patrick Barnard of U.S. Geological Survey has shown through both modeling and analysis of multibeam data that the net transport of sand from the Central Bay is outward towards the outer coast. This implies that some of the sand that is in the Central Bay may be feeding the nearshore coast of California, including Ocean Beach. Over the last five years, Ocean Beach has experienced serious coastal erosion that might be related to the reduction in sand transport out of the Bay due to sand mining within the Bay system. Therefore, an analysis of the connection between the outer ocean and the Central Bay should be examined to determine extent of potential impacts. 6-1

Characterization of Commission Laws and Policies. The Bay Plan and Marsh Protection Plan and their policies are characterized differently in each section of the document. While it is likely that this came about due to separate authors for each section, the Plans and policies should be accurately and consistently characterized throughout the entire document. The most complete and accurate policy descriptions are located in the Land Use and Recreation section of the document. 6-2

Executive Summary

The second paragraph of the Project Objectives, Purpose and Need section indicates that the Draft EIR examines the potential environmental impacts of the proposed project for a 10-year period. Although the leases issued by CSLC are valid for this length of time, the Draft EIR should consider a longer planning horizon, such as 20 years, so that the long-term environmental effects of sand mining could be better understood and re-evaluated every 10 years when CSLC re-issues leases. As stated in the Description of Proposed Project, the mining of sand within the Central Bay and Delta has occurred for more than seven decades. Therefore given this history, the Draft EIR should consider a planning horizon greater than 10 years. In fact, a Programmatic EIR might be more appropriate for a longer-term environmental review of sand mining in the Central and Suisun Bays as well as the Delta. 6-3

The LTMS Management Plan Conformance Alternative section on page ES-6 states that the LTMS Management Plan is a strategy and plan for ongoing maintenance dredging and some new dredging. More precisely, the LTMS Management Plan includes only maintenance dredging projects for navigation projects. New dredging projects are considered outside of the LTMS program and require their own California Environmental Quality Act (CEQA) evaluation. Once a new project is complete, the maintenance work may be included under the LTMS program if it complies with the program and project requirements. Further, the LTMS Management Plan does not cover sand mining as it was not evaluated in the Environmental Impact Statement/EIR process and is not navigational dredging. Both here and throughout the document, language regarding this alternative should be stated as "conformance with the LTMS Management Plan's environmental work windows," as it appears the alternative is only referring to that portion of the LTMS program. 6-4

On page ES-11, Section 4.1, it incorrectly states that conformance with the LTMS Management Plan would be protective of green sturgeon. The LTMS Management Plan and the environmental work windows were developed prior to the listing of the green sturgeon and therefore do not consider this species. A new biological opinion is expected out in late 2010, early 2011, which will include the green sturgeon. It is a benthic species that uses the Bay year round, so environmental work windows will not be developed for it. 6-5

1.0 Introduction. On Page 1-9, in Section 1.2.5 Definition of Baseline and Future Conditions, the Draft EIR establishes the baseline at the time the Notice of Preparation (NOP) was published on July 10, 2007. As the footnote on page 1-9 explains, under CEQA, the date that the NOP is published is the correct time to establish the baseline. It is also recommended that an environmental review document be completed within a year to a year and a half of this time to ensure that the baseline accurately reflects the existing environmental conditions. The Draft EIR was published in July 2010, three years after the NOP. The existing conditions have changed, and the baseline should be closer to the date that the Draft EIR was published. Commission staff note that in the last three years, annual sand mining volumes have decreased significantly and therefore, the existing conditions might have changed in the lease areas. 6-6

2.0 Project Description. The basic project purpose has changed since Commission staff's meetings with the CSLC. Our understanding was the basic project purpose was to mine sand for the construction industry and that the basic project purpose was subsequently changed to read: "to obtain renewal of all necessary permits and approvals necessary to continue mining sand at an economically viable level in the San Francisco Bay for the next ten years." Because of this change, importing sand from outside of the Bay was eliminated from the analysis. The rationale for not including this alternative included (1) not meeting the project purpose and (2) that importing sand would conflict with the state's greenhouse gas policies. Please explain the rationale for changing the project purpose. Please further explain which state climate change policies are applicable to this project. While we are unclear regarding the applicable policies, we suggest that an analysis comparing greenhouse gas production from importing large quantities of sand in single vessels to using multiple smaller vessels making multiple trips with the Bay. 6-7

In the description of the mining equipment on pages 2-11 through 2-15, it would be helpful to explain how the water is drawn into the Hanson draghead if it does not occur through an intake pipe. Also, please state the size of the grid on the draghead that is intended to exclude large objects. 6-8

On page 2-21, the Draft EIR states that information regarding the number of mining events was not available for 2007 so the 2002-2003 numbers were used. The Commission staff has this information on file and will provide it upon request. Please use the appropriate numbers in your analysis of mining year 2007. 6-9

3.0 Alternatives and Cumulative Impacts. A fourth alternative that should be evaluated would include a reduced volume of sand mined in conformance with the environmental work windows set forth in the LTMS Management Plan. This alternative would reduce the number of organisms entrained by reducing the volume and timing of mining, thereby reducing the overall risk to aquatic organisms. 6-10

In Section 3.2.2., Import of Sand Alternative, the document does not mention that large quanties of sand are already being imported by CEMEX and Hanson Aggregates, by ships that are already traversing the coast with other aggregates supplies. It is staff's understanding that vessels travel to Canada with aggregate products used in Canada, then return south with glacier sand which they offload in San Francisco Bay. This way, they take advantage of an 6-11 otherwise empty ship heading south from Canada. Commission's staff understanding of the project purpose was to provide sand to the aggregate industry. Unless this has somehow changed from the original discussions, this alternative should be thoroughly examined. 6-11 cont.

In Section 3.3.2.1, on page 3-9 (line 22), the LTMS environmental work windows do not cover longfin smelt presently. Similarly, the chart provided on page 3-10 is out of date. An updated version can be provided upon request from Commission's staff. In addition, on page 3-12 (line 3.3.2.2), the statement regarding the LTMS program conformance would streamline permitting is incorrect. Sand mining is not considered in the LTMS program and, therefore, the permitting process would remain same. The applicants could however, use a JARPA application. 6-12

In Section 3.5.1 Cumulative Impacts Projects Study Area, the study area should have included the nearshore coast and San Francisco littoral cell. Unless this area is included, the analysis would not take into account the recent work by Patrick Barnard that has determined the sandbed from the Central Bay has net outward flow and potential impact associated with decreasing that sediment supply. 6-13

Table 3-3 should state that the Oakland Fifty-foot deepening project has been completed and the installation of the TransBay Cable has been completed. 6-14

4.1 Biological Resources. In the description of longfin smelt it should be noted that longfin smelt move into cooler deeper waters during the summer months, which would likely put them in further risk of entrainment from sand mining operations in deep water during the summer months. In the description of least tern and brown pelican, there should be a discussion of whether or not sand mining, particularly the turbidity plume, would impact the foraging abilities of these endangered species since they identify their prey from the air. This information should be further analyzed and included in the discussion of potential impacts. 6-15

The Critical Habitat discussion on page 4.1-24 should be updated to include all of San Francisco Bay as critical habitat for the green sturgeon. 6-16

On page 4.1-29, the discussion on invasive species should include a discussion of the potential for sand mining barges to transport invasive clams or other non-native species to different parts of the Bay, particularly the offloading sites. 6-17

In the Magnuson-Stevens Fishery Management and Conservation Act section on page 4.1-31, the Draft EIR describes Essential Fish Habitat (EFH). This discussion should include the Draft EFH consultation that was issued on July 13, 2010. The EFH consultation recommendations should also be incorporated into the mitigation measures, especially as they relate to longfin smelt. 6-18

Page 4.1-34, line 28 incorrectly names the California Coastal Commission rather than the Commission as the authority that regulates wetlands in the Bay. Similarly, on page 4.1-36, line 3 and 4 state that habitats discussed in the Suisun Marsh Preservation Act do not occur within the sand mining lease areas. The Marsh Act and the Marsh Protection Plan include protection of waterways within the Marsh. Sand mining within the Suisun Channel is regulated, in some cases, only by the Marsh Act and Protection Plan. In the case of Middle Ground Shoal, sand mining is regulated by the Bay Plan and the Marsh Act and Protection Plan. This information should be included in all sections to which it relates. 6-19

Section 4.1.4 does not analyze the effects to least tern, an endangered species that is a visual forager in San Francisco Bay, that is generally in the Montezuma Wetlands project area in Collinsville. Any potential impacts to this species should also be considered and discussed. 6-20

In discussing the impacts for BIO-3, the document states in line 35 and 36 that impacts associated with entrainment of biota from the soft substrate is considered a short term impact. In other parts of the document it states that the benthic community would take between one and ten years to reestablish (page 4.1-45 lines 31 through 35) and that sand mining appears to take place in the same areas over time. Therefore, this impact appears to be a permanent impact because the biota would not have time to recover between mining events that are repetitious over ten years. 6-21

In the discussion regarding Dungeness crabs (page 4.1-51, lines 24 through 31), the terms juvenile and adult might have been interchanged, making the paragraph a bit unclear. Please review and revise as appropriate. 6-22

On page 4.1-52, lines 12 through -16, please clarify which permitting requirements would reduce impacts to these species. From the Commission's staff's understanding the permit conditions required by NOAA Fisheries and the U.S. Fish and Wildlife Service (USFWS) are specific to listed species and, therefore, would not necessarily apply to species with different life strategies and habitat usage. 6-23

Page 4.1-53, line 33-35, states that the applicants would need to apply for and receive a California Department of Fish and Game (DFG) incidental take permit within 12 months of a CSLC lease being issued. However, the Commission's policies prevent it from acting on a project that "takes" a listed species without receiving an incidental take permit from the appropriate agency. Therefore, the Commission would not be able to issue sand mining permits prior to the applicants receiving an incidental take permit. 6-24

Page 4.1-61, lines 19 through 29 should state that the southern distinct population of green sturgeon was also not considered by the LTMS program and therefore impacts to this species is not covered. As a result, this species was not evaluated, and this program only analyzed maintenance dredging projects. This issue needs to be clarified throughout this section. 6-25

The Biological Resources section should also include a discussion of the Mitigation policies of the Bay Plan. 6-26

4.2 Mineral Resources. The Mineral Resources section evaluates the potential loss of available sand and construction aggregate within the proposed sand mining areas. The Draft EIR states that there is no significant impact from sand mining to the mineral resources in the project area.

However, Impact MIN-3 describes that sand mining could deplete the amount of sand available for future mining. Furthermore, there may be additional long-term negative results, including removal of sandy bay habitat and increase of shoreline erosion in nearby areas. Further discussion on the loss and reduction of sandy habitat should be discussed. The Mineral Resources Section should include a discussion on how the depletion of the sand resource might increase the erosion of coastal areas adjacent to the San Francisco Bay, as Dr. Patrick Barnard's (USGS) studies have suggested. This document, furthermore, should include analysis of the comparative multibeam studies performed in the Central Bay in 1997 and 2008. 6-27

The Subtidal Areas Policy 2 of the Bay Plan states that subtidal areas that are scarce in the Bay or have an abundance and diversity of fish, other aquatic organisms and wildlife, including sandy deepwater or underwater pinnacles should be conserved. Policy 2 also states that filling, changes in use and dredging projects in such areas should be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits. Page 3-4 and 3-7 discuss the alternatives to local sand mining, including local active quarries and importation of sand from British Columbia and Mexico. Based on the Draft EIR, it appears that these alternatives are not feasible because of a "conflict with state climate change policy." This alludes 6-28 to the fact that long distances will be traveled that will contribute unnecessary green house gases to the environment. The Draft EIR should further explain and estimate, with numerical values, the emissions associated with the alternatives. It should also clarify that this importation of sand from British Columbia is already taking place and discuss how state climate policies might impact this current importation of sand. 6-28 cont.

On page 4.2-10, lines 3 through 9, the document discusses whether or not continued sand mining would result in an impact to mineral resources from depletion. There is evidence that this resource is already being depleted, and further mining of this area would exacerbate the depletion of the resource. Both Dr. Bruce Jaffee and Dr. Barnard have written studies that suggest that the Central Bay is in an erosional stage that is being exacerbated by sand mining. 6-29

4.3 Hydrology and Water Quality. The Hydrology and Water Quality section of the Draft EIR explains the known sediment dynamics, current bathymetry, and water and sediment quality within the project area. The Sediment Dynamics and Bathymetry sections on Pages 4.3-6 through 4.3-9 should discuss the potential connectivity to the outer ocean. In addition, reference should be made to Dr. Barnard's, of the USGS, research that includes detailed bathymetry of the Central San Francisco Bay that describes the Bay bottom in depth. Furthermore, it should be included that the morphology of Central Bay has been extensively modified by excavation and borrow pits.

The modeling efforts referenced in the Hydrology and Water Quality Section and explained in Appendix G indicate that the Central Bay and Middle Ground deep channel mining sites are not experiencing replenishment of sediment once it is removed, naturally or by sand mining. The modeling described in Appendix G also indicated that net bottom erosion due to sand mining has largely been contained within the lease and immediately adjacent areas and that sand mining in Central Bay is not causing measurable sediment depletion in areas outside the mining areas, such as the San Francisco Bar, Ocean Beach or other areas. These conclusions are based on data summarized in Figures 4-37, 4-38 and 4-39 that show the sand bed change differences between the two proposed sand mining scenarios in the Central Bay and Suisun Bay. Based on these figures, most of the sand bed changes are focused in the vicinity of the sand lease areas; however, the figures do not analyze other areas, such as Ocean Beach or the San Francisco Bar that may be affected by the proposed project. The Suisun Bay area does not show any area west or east of the sand lease areas that may be affected. In addition, Figures 4-26 and 4-27 show that the sediment in the region is in a state of flux, but the analysis focuses again only in the immediate sand mining lease areas. The document should also provide an evaluation of an increased tidal prism in the Bay as a result of continued sand mining and the cumulative impacts of this increase with consideration of sea level rise. 6-30

Appendix G also concludes that a reduced level of sediment is being transported from upstream into these areas. However on Page G-20, the report states that approximately 13.5 million cubic yards of sand was removed by sand mining lease areas. Figure 4-2 and Table 4-1 show the depth changes between 1997 and 2008 to be 11.6 million cubic yards, slightly less than the actual volume removed. The different might be the result of error or it might suggest that some sediment is making its way back into the system from upstream. 6-31

The Draft EIR does not include a discussion of potential long-term effects from sand mining to the region, because of its short planning horizon. It is important to recognize that the sediment moving through the system will likely be deposited in deeper areas after mining rather than moving through the system. This could cause less sediment to move to other areas within and outside of San Francisco Bay. 6-32

On page 4.3-23, the discussion of the CALFED program needs to be updated. 6-33

Please clarify whether the numerical modeling done for this project included bedload transport, as that is the most relevant mode of transportation for sand-sized particles. 6-34

On page 4.3-36 and -37, the discussion of the Cumulative Impacts needs to be updated per the comments above on projects completed such as the Port of Oakland deepening project. 6-35

4.4 Hazards and Hazardous Materials. Section 4.4 Hazards and Hazardous Materials should include a discussion of the Navigational Safety and Oil Spill Prevention Plan of the Bay Plan. 6-36

4.7 Land Use and Recreation. In the San Francisco Bay Conservation and Development Commission section of 4.7 Land Use and Recreation, the Water Related Industry and Other Uses of the Bay and Shoreline policies of the Bay Plan should be included in this section. These polices should be analyzed in the impact assessments section and especially as they relate to potential conflicts and/or inconsistencies. 6-37

7.0 Mitigation Monitoring Program. Table 7-1 needs to be updated to clarify that the Commission would be unable to issue a permit for sand mining prior to the DFG issuing an incidental take permit for the project. Similarly, if NOAA or USFWS determined that sand mining, as proposed, would "take" federally listed species beyond what was previously authorized, an incidental take permit from the federal agencies would be needed prior to issuance of a BCDC permit. 6-38

Thank you for providing staff with the opportunity to review the San Francisco Bay and Delta Sand Mining Draft EIR. We recognized the importance of this project and appreciate the efforts of the State Lands Commission and Environmental Sciences Associates, Coast Harbor Engineering and Marine Science Associates in its preparation. Please feel free to contact me at (415) 352-3623 or email me at brendag@bcdc.ca.gov if you have any questions regarding this letter or the Commission's policies and permitting process.

Sincerely,

aBoo For

BRENDA GOEDEN
Dredging Program Manager

BG/rca

State of California
Department of Fish and Game

Flex your POWER

Memorandum

Date: September 27, 2010

To: Mr. Christopher Huitt
California State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825

From: Charles Armor, Regional Manager
Department of Fish and Game – Bay Delta Region, 7329 Silverado Trail, Napa, California 94558

Subject: San Francisco Bay and Delta Sand Mining, Draft Environmental Impact Report, SCH #2007072036

The Department of Fish and Game (Department) has reviewed the San Francisco Bay and Delta Sand Mining draft Environmental Impact Report (EIR). The Department appreciates the opportunity to comment on the draft EIR and is providing the following comments to assist the California State Lands Commission (Commission) with appropriate measures to offset adverse impacts to sensitive resources. The draft EIR examines the potential environmental effects of proposed new leases and continuation of sand mining for an additional 10-year period in the San Francisco Bay and Delta. Sand mining occurs within the Central San Francisco Bay east of the Golden Gate Bridge, Middle Ground Shoal in Suisun Bay, and areas north of the federal navigation channels of Suisun Bay and western Delta. Sand mining does not occur uniformly within the region, but rather is clustered in specific areas, typically characterized by high river or tidal velocities and sand deposits that contain a low percentage of fine material (silts, clay, and mud). Mining events typically last approximately 3.0 to 4.5 hours, during which time approximately 1,500 to 2,500 cubic yards of sand are excavated. During mining, water is entrained into the suction head, creating a water and sand slurry that mobilizes the sand and allows it to be pumped into the barge. Sand mining within the Central Bay typically occurs at water depths ranging from 30 to 90 feet. Mining within the navigation channels of Middle Ground Shoal and the Suisun Bay/Delta parcel typically occurs in waters that are 15 to 45 feet deep. Approximately 19.2 million cubic meters of water is pumped during sand mining operations at the Central Bay parcels, 1.6 million cubic meters is pumped at Middle Ground Shoal, and 0.9 million cubic meters is pumped at the Suisun Bay/Delta parcel annually.

Since the issuance of the previous lease, the Delta has experienced significant declines in the abundance of Sacramento and San Joaquin Delta fishes including Central Valley steelhead (*Oncorhynchus mykiss*), Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon, Delta smelt (*Hypomesus transpacificus*), longfin smelt (*Spirinchus thaleichthys*), green sturgeon (*Acipenser medirostris*),and Sacramento splittail (*Pogonychthys macrolepidotus*). As a Trustee Agency for the State's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species. In this capacity, the Department administers the California Endangered Species Act, the Native Plant

Protection Act, and other provisions of the Fish and Game Code that afford protection to the State's fish and wildlife public trust resources. Pursuant to our jurisdiction, the Department submits the following comments and recommendations regarding the project.

1. The draft EIR states that the Project operations will likely "take" listed species including Delta smelt, longfin smelt, winter-run Chinook salmon and Central Valley spring-run Chinook salmon. As such, the Applicants will need an Incidental Take Permit (ITP) from the Department for all state-listed species to address impacts of the "taking" pursuant to Fish and Game Code sections 2080.1 or 2081(b), and California Code of Regulations, Title 14 Section 783 et seq. During the development of the ITP, the Department will assure that minimization and mitigation measures are consistent with the Department's issuance criteria as required under Fish and Game Code Section 2081(b) (1-4). Specifically, the ITP will include measures that fulfill the Department's requirement that all impacts of the taking of Covered Species be minimized and fully mitigated and to ensure adequate funding to implement those 7-1
measures and for monitoring compliance with, and effectiveness of, those measures. The Department recommends that the Applicant submit an ITP application to the Department for review. The ITP application should include a complete project description and the updated analysis provided in the EIR in addition to other required ITP application elements. The project description should be sufficient to evaluate the effects of the project on each Covered Species and will be used to evaluate and develop species-specific minimization and mitigation measures. During the ITP development process, the Department also recommends that the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) staff be included in discussions to assure that project mitigation measures are consistent with federal requirements.

2. The spatial extent of the overflow plume from a sand mining event is typically a few hundred feet wide by several hundred feet long. Suspended sediments in the water column have known to be a stress factor for spawning Pacific herring (*Clupea pallasi*) populations. Sediment loads cause larval mortality, smothering of eggs, and prevent oxygen exchange in the early development of herring eggs. Suspended sediments, if present in the water column as eggs descend, enhance egg aggregation which could have negative implications for natural spawns. Females may swim away from substrata during spawning and release eggs into the water 7-2
column (Stacey and Hourston, 1982; Aneer et al., 1983; Hay, 1985). When this occurs, eggs settle and attach to substrata or onto other eggs in a less organized manner, leading to aggregations of multiple layers or clusters. As egg layers increase in thickness, hypoxia, microbial growth, and retardation of embryonic development increase (Stacey and Hourston, 1982; Hay, 1985). Sediment-induced aggregation of eggs in the water column would exacerbate overall aggregation and clustering. The Department recommends that sand mining should be avoided in the Central Bay during the herring spawning season (December 1 through March 1).

3. Please be advised that for any activity that will divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of a river or stream, or use material from a streambed, the Department may require 7-3
an Lake or Streambed Alteration Agreement (LSAA), pursuant to Section 1600 et seq. of the Fish and Game Code, with the applicant. As such, based on Figure 1-1,

proposed dredging operations in the eastern portion of the Suisun Bay/Delta Lease Area are subject to Section 1600 et seq. of the Fish and Game Code and would require an LSAA. 7-3 cont.

4. Appendix F, Benthic survey: the Department questions the methodology described in the report for sub-sampling and collection of infauna less than 2.0 mm. The standard procedure for sampling benthic infauna is to wash the entire sediment sample through a 1.0 or 0.5 mm screen to capture the organisms. The report describes screening 1/2 the grab sample through a 2.0 mm screen, with a sub-sample screened down to 0.5 mm. However, the report does not explain what measurable quantity of sediment was used for the sub-samples. Therefore, the Department can not identify how large a sample was screened for benthic infauna. If the sub-samples that were screened to 0.5-1.0 mm were insignificant in size, then the survey needs to be repeated with correct methodology. 7-4

The Department appreciates the opportunity to provide comments on the draft EIR. As always, Department personnel are available to discuss our concerns, comments, and recommendations in greater detail. To arrange for discussion, please contact Mr. George Isaac, Environmental Scientist, at (831) 649-2813; or Ms. Vicki Frey, Senior Environmental Scientist, at (707) 445-7830 with our Marine Region. For activities east of the Carquinez Bridge, please contact Bay Delta Region staff members Ms. Corinne Gray, Staff Environmental Scientist, at (707) 944-5526; or Mr. Scott Wilson, Environmental Program Manager, at (707) 944-5584.

cc: State Clearinghouse

Mr. Michael Hoover
U.S. Fish and Wildlife Service
2800 Cottage Way, Suite W-2605
Sacramento, CA 95825-1846

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Ms. Brenda Goeden
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Mr. Mike Monroe
U.S. Environmental Protection Agency
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CITIZENS COMMITTEE TO COMPLETE THE REFUGE

453 Tennessee Lane, Palo Alto CA 94306 Tel 650 493-5540 Fax 650 494-7640 Florence@refuge.org

September 27, 2010

California State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825
Attn: Christopher Huitt
Phone: (916) 574-1938 or email: huittc@slc.ca.gov

RE: San Francisco Bay and Delta Sand Mining Draft EIR; CSLC EIR #742 and State Clearinghouse Number 2007072036

Dear Mr. Huitt:

The Citizens Committee to Complete the Refuge appreciates the opportunity to comment on the above referenced DEIR. Unfortunately, those comments must be entirely negative. Rarely have we seen a DEIR so manipulate the EIR process so as to ignore obvious and logical impacts in order to make findings of no significant impacts.

One of the most obvious cases of this is found on page 4.2-10 where the DEIR states, under section "Impact MIN-3: Depletion of the sand resource (pg. 4.2-9), "*Mining of a mineral resource can generally be expected to deplete the resource. The significance criteria used for this section state that loss of availability of a known mineral resource could cause a significant impact. This criterion is interpreted to mean that depletion of the resource through mining does not constitute a significant impact; an impact could only occur where a project prevented or inhibited access to a known mineral resource.* ***Therefore, even if the Project depletes the mineral resource over its 10-year lifespan, this is not considered a significant impact."(emphasis ours)*** 8-1

Well, this leaves one speechless (almost). If this is the criteria of significance one wonders why do an EIR at all. Under this rubric one can deplete the Bay's entire sand resource and find no impact. The only possible project impact that could be identified under this criteria of significance is to not sand-mine. This is perhaps unique in my experience in terms of crafting an EIR so as to obviate the possibility of identifying any potential impacts.

This approach is even more disappointing since the USGS specifically asked you to address the issue of sand depletion along the Golden Gate coastline, for example the attrition of ocean beach (page ES-17). 8-2

You respond with the study by citing *"[t]he Coast and Harbor Engineering (CHE) study conducted for this EIR (Appendix G) demonstrates conclusively that most of the areas being mined, including the Central Bay lease areas, are not being replenished. However, hydrodynamic modeling conducted by CHE demonstrates that sand mining is not expected to affect sediment transport and deposition within the Bay and ocean, except in areas within and immediately outside of the mining leases* (page ES-17) and also with citations in Sections 4-2 and 4-3. But these are not convincing. Does no sand go out of the Golden Gate anymore? The estimated annual sand budget deficit estimated at the Golden Gate is about the same magnitude as the annual mining rate: 2 million cubic yards per year. Is there really no connection whatsoever? The sand bar outside the Golden Gate has been decreasing as sand mining has taken place. Is there really no connection? The burden of proof should be on the sand mining industry to show that that the loss of coastal sand has nothing to do with Bay sand mining. And if there is a connection with sand mining resulting in decreased sand for beach replenishment that should be identified as an impact. 8-2 cont.

There are many other examples of flawed reasoning and analysis in this document. For example, the DEIR finds that noise from hydraulic dredging of sand may impact fish and result in the alteration of their path or even a loss of habitat as fish avoid the noisy location. The DEIR addresses this by stating, (page 4-44), *The noise levels generated by sand mining at the hydraulic suction dredge's location are within the sound range that can result in behavioral responses by fish and marine mammals but are below levels that are likely to cause physical damage to sensory receptors or other physiological effects (Hanson Environmental 2004). Behavioral responses can include avoidance behavior, such as change in swimming direction and speed. Such impacts are largely localized. Based on these findings, the temporary increase in noise above ambient levels due to sand mining activities is considered less than significant.*

Thus the DEIR does not really address why these impacts are not significant, unless it concludes that as long as the effects are not lethal or physically damaging there is no significant impact. But this ignores the criteria of significance identified by the EIR that includes: 8-3

- *A net loss occurs in the functional habitat value of a special biological significance;*
- *There is a potential for the movement or migration of fish to be impeded; (page 4.1-40)*

Perhaps it is because it finds these impacts to be local effects that it finds no significant impact. But if all local impacts are insignificant then no impacts to habitat will ever be significant since all habitat is local. And perhaps it is because the noise levels are intermittent. But intermittent or not, if a fish is forced to change its movement or not feed for a moment because of the noise at that moment-that is an impact and sand-mining takes place often enough for the likelihood of fish to be disturbed should be high. In any case, the DEIR should have provided some analysis, not just a brief dismissal of the potential impacts.

For all these reasons, we urge you to withdraw this DEIR and revise it with peer-reviewed studies and with specific input and assistance from the USGS in order to gain a true picture of the potential impacts to the Bay and coast from a continued sand-mining operation. At the very least, we urge you to adopt the Reduced Project Alternative. 8-4

Sincerely yours,

Arthur Feinstein
Conservation Coordinator
415-680-0643

COMMENT SET 9: MARIN AUDUBON SOCIETY

Post-it® Fax Note 7671	Date 9/27 # of pages ▶ 4
To Sarah Mongano	From Barbara Salzman
Co./Dept. CSLC	Co. Marin Audubon
Phone #	Phone # 415
Fax #	Fax # 924-6057

Marin Audubon So

P.O. Box 599 | Mill Valley, CA 94942-0599 | marinaudubon.org

September 27, 2010

VIA FACSIMILE AND US MAIL
Sarah Mongano, Environmental Scientist
State Lands Commission
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

RE: DRAFT ENVIRONMENTAL IMPACT REPORT ON SAND MINING

Dear Ms. Mongano,

The Marin Audubon Society appreciates the opportunity to submit comments on the DEIR for Sand Mining. We have a long-time interest in this activity and concern about its impact on the resources of the San Francisco Estuary. We are particularly interested in impacts on the Central Bay disposal sites because of their proximity to Marin County. The sand mining companies request continuation of their existing permits with a 60% increase in the quantity of sand mined in Central Bay. Inadequate information is presented to support issuing approval of such a request. Specifically, data documenting that significant environmental impacts of the proposed project would not occur, is not presented. Many of the analyses are simplistic and self serving, and the nature of the impacts minimized. 9-1

According to the DEIR, 11.6 million cubic yards of material have been mined from Central Bay over the last 10 years, or as measured in the barges, the total was actually 13. 5 million. Since commercial sand mining has been going on for 70 years, this means that approximately 70 million cubic yards has been removed from the bay. 9-2

It appears that agencies have done a less than responsible job of oversight in protecting the natural resources of the Estuary. Sand mining has been allowed to continue with basically no environmental information using Negative Declarations, and information collected has not been or retained and/or used in any way to evaluate impacts. Now we are in the very compromised position of declaring the 2007 condition as baseline, when clearly 2007 does not represent anything even close to natural conditions which is what should be considered the baseline condition. This is an artificial scenario created by repeated mining that has not been adequately monitored and evaluated, and legal analysis that is based on typical development projects. It is clearly not in the best interest of the Bay and the public. 9-3

Our comments and questions on the DEIR are:

1. The definition of the baseline conditions may be supportable according to one legal opinion,

however, it is clearly not in the interest of the Bay. To define and evaluate conditions as baseline after 70 years of commercial sand mining, accepts an already heavily impacted resource as acceptable. Has there been a thorough legal search conducted to determine whether there are any other legal opinions that would allow analysis that is more representative of the actual natural conditions of the Bay? If not, we suggest that the CSLC seek a court review of this interpretation of CEQA. 9-3 cont.

2. The project objectives are defined as: "To obtain renewal of all necessary permits and approvals necessary to continue mining sand at an economically viable level in San Francisco Bay for the next ten years."(p. ES-2) The objective should define the specific quantity requested. As presented, the applicants could change the quantity of sand mined on the basis of market conditions. 9-4

3. Technical Report on Resource Evaluation and Impact Analysis states (p. 10) that "only approximately 5% of the material in the lease areas that was mined has been replaced by natural processes." 95% of the material has not been replaced, that there has been a major loss of material from the Bay and large pits or holes remain for some period. The impacts of these holes and how they are mitigated are not adequately addressed. The characteristics of the holes, depths, and widths, should be presented. How long do the holes remain? If these answers are not known, a monitoring program that includes these questions should be required for any further permit issued. 9-5

4. A conclusion is presented: (Technical Report Resource Evaluation and Impact, p. 10) that "the vast majority of the mined material has been accounted for immediately adjacent to the lease areas, it appears sand mining in Central Bay is not likely to cause measurable sand depletion outside the mining areas...." misses the important concern about the loss of sand to the ecosystem. It is impossible for there to be sand deposits needed to replenish coastal and bay resources, under the current mining regime. The sand may be a resource for the mining industry, but it is an equally important resources for the estuary and coastal environmental and its biological resources. 9-6

5. The EIR should address sand as a resource for the Bay and coastal ecosystem, not just as a mineral resource to be mined. Include a discussion of the values and services sand provides for the Bay and coast. This discussion should address sand in-bay and coastal sand habitats, erosion and recreational uses and other functions sand may provide within coastal ecosystems.

6. The EIR needs to provide a more comprehensive analysis of the impacts of sand mining over a much broader scope. How broad an area was studied to make the claim that "no morphological impacts are likely outside the immediate vicinity of the sand mining areas"? The removal of such massive quantities logically would have a downstream impact by robbing beaches and other resources of sand. The EIR should address coastal and other downstream resources that depend on sand replenishment and that are not getting it. What are the areas that were studied? It is the loss of sand that must be studied. What impacts is mining having and will have on shoals, beach replenishment and other natural features that depend on replenishment by native material? Isn't there a problem with the sediment budget in the bay? The question to be asked is what downstream resources are being starved; deprived of sand resources? What shoreline erosion is taking place because of lack of sand material? 9-7

All areas of the Bay where it would be expected that sand would be carried by the currents and deposited under no-mining conditions, should be studied. This area would include the coastline outside the Golden Gate Bridge, north at least to Bolinas Lagoon and south to Devil's slide, in-bay areas such as Chrissy Field and the North and South Bay where, under no-mining conditions. 9-7 cont.

Unless proven otherwise the loss of sand to the ecosystem must be considered a significant impact.

7. Many impacts are dismissed as being localized 4.3-27. The DEIR is limited and inaccurate in its conclusion that the impacts of mining are localized. Simply because impacts affect one area of the Bay more than some others does not mean that they are not significant. Repeated impacts on water quality and biological resources due to increased levels of turbidity and modification of the substrate should be considered significant, even if temporary. One could excuse almost anything using these criteria. Under the assessment scenario used, there would have to be a catastrophic event for impacts to be significant. The localized impacts should be considered to be significant. 9-8

8. The analyses of biological impacts is simplistic and minimizes impacts. Species losses are reduced to specific numbers and minimized as being a very minimal percentage of the bay population. Only entrainment impacts of mining procedures on biological resources is discussed. Analysis concentrates on entrainment. What are the impacts of gigantic holes on bottom dwelling creatures particularly Dungeness crab? What happens to these bottom dwelling species when moving across the bay floor, they encounter, or find themselves in, one of the gigantic holes carved out by the mining ? Do they continue unaffected on their migratory routes? Can they get out easily, move through, find covered by sand that may be trapped? 9-9

9. The discussion of Longfin Smelt impacts should consider timing restrictions for dredging, or avoidance of a particularly sensitive location, to protect this endangered species. Is this species more likely to be in a particular mining area at a particular time of year? 9-10

10. Discuss the sustainability of sand mining and of ecosystem resources, under the currently proposed sand mining regime? How much longer could it be expected, under the proposed scenario, that coastal and bay resources that depend on sand replenishment could be sustained? 9-11

11. We agree that the Reduced Project Alternative should be the Preferred Alternative. This alternative would reduce the permitted annual mining volumes by half or 225,000 cubic yards less than that was mined in 2007. While this alternative would reduce mining revenues, it would reduce the quantity of material removed from the Bay and, therefore have significant benefits for resources, both by leaving material to benefit in-bay and coastal resources. We note that economics is not an issue that is addressed in EIRs. It is the adverse impact or benefit to the environmental, not the applicants, that is of interest. This alternative would also allow time for an adequate monitoring program to be prepared and carried out. 9-12

12. The applicants should be required to demonstrate that sand mining does not adversely impact the broad range of bay resources. Any permit issued should be conditioned to require specific studies on at least the following: 9-13

-the length of time to fill huge holes, more adequate assessment of coastal erosion, biological impacts by independent coastal experts
- broad area of the bay including the coast at least to Bolinas Lagoon and Devils Slide, where bay sediments have been detected, the south and north Bays, to better define impacts of the lack of sediment deposition.
- biological surveys to determine not only impacts at the time of mining and shortly thereafter, but subsequent impacts as a result of the huge pits left by the mining of the project, should be undertaken and analyses by independent consultants. 9-13 cont.

We suggest that consultants be funded by the applicants but be hired by CSTC with oversight by BCDC, and be subject to peer review. 9-14

Thank you for considering our comments, and for extending the comment deadline so that we were able to express our concerns.

Sincerely,

Barbara Salzman, Co-chair
Conservation Committee

Phil Peterson. Co-chair
Conservation Committee

COMMENT SET 10: HANSON HEIDELBERG CEMENT GROUP

Hanson
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Mr. Christopher Huitt
Project Manager
California State Lands Commission
100 Howe Avenue, Suite 100
Sacramento, CA 95825

September 27, 2010

RE: Comments Draft Environmental Impact Report – San Francisco Bay and Delta Sand Mining

Dear Mr. Huitt:

Attached and enclosed please find Hanson's comments on the Draft Environmental Report for San Francisco Bay and Delta Sand Mining (the DEIR). This letter outlines the content and organization of these comments.

Our comments address several areas of the DEIR. Detailed comments for each of these areas are attached, including supporting data and calculations where referenced. The organization of these detailed comments includes the following documents:

I. Executive Summary / Project Description – Characterization of Leases and Project Objective.
II. Baseline Issues (general)
III. Comments on the "Reduced Project Alternative"
   a. Trucking Emissions Summary for Reduced Project Alternative – TRC
IV. Comments on DEIR Biological Analysis
   a. USFWS Concurrence of Not Likely to Adversely Affect
V. Comments on DEIR Air Impacts Analysis
   a. Letter from TRC – TRC's review and comment of the Air Quality section of the DEIR
   b. TRC review supporting documentation in Appendix 1 and 2.
   c. TRC review - Appendix 3 Corrected EF Calculations.
   d. TRC review – Appendix 4 Emissions Modified Baseline Calculations.
VI. Comments regarding Mineral Resources and Hydrology and Water Quality
VII. Comments on Necessity and Feasibility of Proposed Mitigation Measures

10-1

Please contact me if you have any questions or wish to discuss these matters in more detail.

Sincerely,

William H. Butler
Vice President, General Manager
Hanson Aggregates / Hanson Marine Operations

CC: Mr. Mike Bishop, Hanson Aggregates / Hanson Marine Operations
Mr. Lee Cover, Hanson Aggregates / Hanson Marine Operations
Mr. Wayne Whitlock, Pillsbury Winthrop
Dr. Barry Keller, PhD, Hydrogeophysicist
Dr. Chuck Hanson, Hanson Environmental
Mr. John Gillan, Deputy General Counsel, Lehigh Hanson, Inc.
Mr. Christian Lind, Jerico Products / Morris Tug and Barge

Attachments

I. Executive Summary / Project Description – Characterization of Leases and Project Objective.

The EIR should clarify and emphasize that the proposed project is a renewal of leases for an existing, ongoing activity and not simply issuance of "new" leases that implies a new activity.

In the Executive Summary, Introduction and Project Description sections of the Draft EIR (DEIR), the renewals of the mineral extraction leases with the California State Lands Commission (CSLC) for sand mining are characterized as issuance of proposed "new" leases. The existing leases provide for one 10-year renewal, as follows:

> *Lessee is granted a right to renew this Lease for one (1) additional period of ten (10) years upon terms and conditions including, but not limited to, modification of the royalty or rental provisions, or any other provisions in a manner which, in the opinion of Lessor, will reasonably protect the interests of Lessor. Such renewal shall be subject to all applicable statutes and regulations then in effect including, but not limited to, a review and analysis under the California Environmental Quality Act and other pertinent environmental statutes and regulations.*

10-2

While we understand that, for business purposes, the renewal with renegotiation of business and other terms effectively may be called a "new" lease, we want to make sure that DEIR appropriately emphasizes that the process is a renewal of an existing, ongoing activity that has been occurring for decades – NOT the approval of a new activity. The representation of the process as issuance of "new" leases occurs in several places in the Executive Summary, Introduction and Project Description, and may confuse the reader. The Final EIR should consistently reflect the process as a renewal of existing leases.

II. Baseline Issues (general)

In this case, use of the 2007 production levels as the baseline condition is inconsistent with CEQA. The baseline should be revised to reflect the more representative average production for the years 1998-2008. Further, the baseline should include the volume mined by Cemex in the same areas during the same period.

The Draft EIR (DEIR) selected the baseline condition for analysis of the Project impacts as "the existing physical effects of mining operations occurring at the time the NOP was issued and the physical effects of past sand mining operations." The DEIR thus uses the volume of sand mined from the Project lease areas for the year 2007.

As indicated in the DEIR, pursuant to the CEQA Guidelines the conditions that exist at the time of NOP issuance "normally" constitute the baseline conditions. Despite this general rule, CEQA expressly recognizes that, when a proposed project alters the operations of an existing facility, past operational patterns may be appropriately included for purposes of establishing existing environmental conditions. *See e.g., County of Amador v. El Dorado County Water Agency*, 76 Cal.App.4th 931, 953 (1999). The California Supreme Court has rejected the use of previously permitted capacity as the baseline where it is not representative of baseline conditions. *CBE v. SCAQMD*, 226 P.3d 985 (2010). However, the Court's decision left intact, and indeed requires adherence to, the principle that it may be necessary for a lead agency to rely on a "historic usage" baseline, i.e., the average level of operation of an industrial facility over a representative period of time, as opposed to relying on a one-year snapshot of operations. The Court stated:

> CEQA Guidelines section 15125 (Cal.Code Regs., tit. 14, § 15125, subd. (a)) directs that the lead agency "normally" use a measure of physical conditions "at the time the notice of preparation [of an EIR] is published, or if no notice of preparation is published, at the time environmental analysis is commenced." But, as one appellate court observed, "the date for establishing baseline cannot be a rigid one. Environmental conditions may vary from year to year and in some cases it is necessary to consider conditions over a range of time periods." (*Save Our Peninsula Committee v. Monterey County Bd. of Supervisors, supra*, 87 Cal.App.4th at p. 125, 104 Cal.Rptr.2d 326.) In some circumstances, peak impacts or recurring periods of resource scarcity may be as important environmentally as average conditions. Where environmental conditions are expected to change quickly during the period of environmental review for reasons other than the proposed project, project effects might reasonably be compared to predicted conditions at the expected date of approval, rather than to conditions at the time analysis is begun. (*Id.* at pp. 125-126, 104 Cal.Rptr.2d 326.) A temporary lull or spike in operations that happens to occur at the time environmental review for a new project begins should not depress or elevate the baseline; overreliance on short-term activity averages might encourage companies to temporarily increase operations artificially, simply in order to establish a higher baseline.
>
> Neither CEQA nor the CEQA Guidelines mandates a uniform, inflexible rule for determination of the existing conditions baseline. Rather, an agency enjoys the discretion to decide, in the first instance, exactly how the existing physical

10-3

> conditions without the project can most realistically be measured, subject to review, as with all CEQA factual determinations, for support by substantial evidence. (See *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova*, *supra*, 40 Cal.4th at p. 435, 53 Cal.Rptr.3d 821, 150 P.3d 709.). Id. At 997-998.

Here, use of the 2007 year is not representative of historic conditions but, rather represents a "temporary lull" in production that has the effect of depressing the baseline. The result is that the DEIR exaggerates the physical differences between the proposed project and the existing conditions and, therefore, improperly exaggerates the environmental effects of the project. For example, simply comparing the 2007 Production Level to the Average Mined per Year between 1998-2008 shows that 2007 was not representative of existing conditions. See Table 2-3 Mined Volume 1998-2008 at page 2-30. The 1998-2008 average volume mined by Hanson and Jerico (1,478,131 cubic yards/yr.) was 232,813 cubic yards—nearly 19 percent—higher than the 2007 level. The average volume from this representative period should be used rather than the 2007 "snap-shot" level.

Furthermore, the DEIR's description of the environmental setting does not—but should—take account of other sand mining by Cemex (formerly Harbor Sand & Gravel, a subsidiary of RMC Pacific Materials) that was occurring in the same areas as that proposed during the same period the Hanson and Jerico leases were in effect. This sand mining activity contributed to the environmental conditions that existed at the time. Cemex elected not to apply for extensions of its leases and related permits. Nevertheless, these leases were in effect during the 1998-2008 period, and the sand mining activity was virtually the same as the sand mining by Hanson and Jerico. Therefore, Cemex's sand mining activity and its effects should be considered part of the environmental setting. Cemex had leases at Middle Ground, Alcatraz Shoal and Carquinez Straits. Considering only the volume mined from the Alcatraz Shoal and Middle Ground, Cemex mined an average of 71,528 cubic yards/yr. during the period the 1998 from 2008.[1] The DEIR should include that volume in the baseline. Accordingly, the baseline volume for the project should be 1,549,659 cubic yards/yr.—the average mined per year between 1998 and 2008 by Hanson, Jerico and Cemex in the project areas—Central Bay and the Suisun Bay. This baseline is 24 percent higher than the 2007 snapshot level used in the DEIR.

To summarize, the record provides substantial evidence that the historic usage in the lease areas was significantly higher than the 2007 single-year level used in the DEIR. As will be shown in our comments on other subjects, the use of this artificially low baseline has exaggerated the impacts of the project. Accordingly, the baseline should revised, using the more representative historic average levels of all three sand mining companies during that era, in order to satisfy the direction given by the California Supreme Court.

10-3 cont.

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[1] Cemex's Central Bay lease, Alcatraz Schoal, PRC 5871, lies directly between four Hanson leases (PRC 7779 WSest, PRC 709 East, PRC 7780 South and PRC 709 South). That lease had a permitted capacity of 100,000 cubic yards/year. According to the San Francisco Bay Conservation and Development Commission, between 1998 and 2008, Cemex actually mined a total of 571,875 cubic yards from this lease, with an average of 51,989 cubic yards/yr. Cemex's Middle Ground lease, with a permitted capacity of 250,000 cubic yards/year, covered the identical area covered by Hanson's and Jerico's Middle Ground leases. Between 1998 and 2008, Cemex actually mined a total of 214,928 cubic yards from this lease, with an average of 19,539 cubic yards/yr. Source: BCDC

In addition to correcting the baseline, we note that the baseline is not utilized consistently throughout the DEIR. The baseline should be the same for all areas of impact analysis, e.g., air and biological, but the DEIR uses different baselines. For example, the biological impact analysis and the underlying entrainment study, assumes a baseline of no sand mining. This inconsistency should be rectified in the Final EIR. 10-4

Finally, the sand mining carried out by Cemex should be considered as a "past project" that should be incorporated into the cumulative effects analysis; as currently drafted, the cumulative effects analysis does not acknowledge the higher levels of sand mining that were occurring in the past. 10-5

III. Comments on Reduced Project Alternative

The "Reduced Project Alternative" in the DEIR does not fulfill CEQA requirements for a feasible alternative, was not adequately or properly analyzed, and cannot be considered the environmentally superior alternative.

CEQA Guidelines Section 15126.6(c) provides:

> The range of potential alternatives to the proposed project shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects. . . . . An EIR is not required to consider alternatives which are infeasible.

The Reduced Project Alternative is inconsistent with all these requirements for alternatives.

A. The Reduced Project Alternative violates CEQA's requirement that an alternative selected for consideration must feasibly accomplish most of the basic project objectives.

As identified in the EIR, the project objective is:

> "To obtain renewal of all necessary permits and approvals necessary to continue mining sand at an economically viable level in San Francisco Bay for the next 10 years.

10-6

The DEIR acknowledges that this alternative would "impede" the project objective to some degree but speculates that the expected reduction in revenues and profitability is not enough to render this alternative infeasible. There is no evidence in the record to support an assertion that cutting sand mining by half could accomplish the project objective of maintaining sand mining at an economically viable level. In fact, all the evidence is to the contrary; this reduced alternative renders sand mining economically unsustainable.

Among the factors that render this alternative infeasible and inconsistent with the projective objectives are:

- Costs associated with maintenance, dry docking, engine upgrades, environmental cost and mitigation are essentially fixed. They do **not** scale down with project size and would likely be approximately the same under the Reduced Project alternative. The Reduced Project Alternative reduces the prospect that these costs can be paid for by sufficient volume and revenues;
- Potential costs associated with mitigation and monitoring as a result of the EIR findings may result in even higher expenses than under current operations, further reducing the prospect that these costs can be paid for with the reduced volume and revenues;
- A consistent, steady workforce is important for safety considerations, since competent, experienced crews are vital to safe operations. Experienced, qualified captains and crew are increasingly difficult to find because of strict and costly licensing requirements. With

reduced volumes, it would be extremely difficult for Jerico and Hanson to manage employee retention to insure these experience and safety requirements are met.

- In the case of Jerico, the reduced tonnage that would be transported up the Petaluma and Napa rivers may not be sufficient to trigger the federal funds for dredging these rivers (which the current volumes do now). This change would either necessitate more local taxpayer funding or result in the shallowing of the rivers, which itself would likely result in flooding problems and difficulties for other types of navigation. 10-6 cont.

Without substantial evidence in the record to support a conclusion that this alternative is feasible and meets the basic project objective of maintaining sand mining at economically viable levels, this alternative must be rejected.

B. The Reduced Project Alternative Cannot be the Environmentally Superior Alternative

The DEIR fails to adequately consider the significant increase in air emissions, including Greenhouse Gases, that would result from the Reduced Project Alternative. CEQA Guidelines Subsection 15126 (d) provides:

> If an alternative would cause one or more significant effects in addition to those that would be caused by the project as proposed, the significant effects of the alternative shall be discussed, but in less detail than the significant effects of the project as proposed.

The DEIR's only discussion of the issue of increased emissions related to sand transported into the Bay Area is in the conclusion that the Reduced Project Alternative is environmentally superior to the others:

> This Alternative would, however, require the Bay Area construction industry to acquire sand from other, likely more distant sources, with consequent increases in air emissions, including greenhouse gases. Among the other alternatives, the Reduced Project Alternative appears capable of reducing the intensity of the Project's significant impacts, and would likely render mitigation measures easier to implement and achieve. Similarly to the No Project Alternative, this Alternative would also likely require an increase in import of sand or sourcing of sand from more distant sources, with consequential increases in air emissions, including greenhouse gases. DEIR at ES-16, 6-5. 10-7

The DEIR gives short shrift to the environmental efficiency that results from producing sand in the Bay Area, rather than transporting it into the Bay Area. The DEIR properly recognizes the extensive evidence presented in the applicants' submissions that the demand for sand used in construction in the San Francisco Bay Area will necessitate the import of sand volumes from other sources if the volume of sand from sand mining is reduced. Importing sand from other, albeit more expensive and more distant, sources, would be a direct result of any reduction of San Francisco Bay sand mining or a denial of the project. However, the DEIR fails to analyze the clear increase in air emissions that would result from this alternative and would more than offset the emissions of the proposed project. Indeed, in the DEIR sections that CEQA requires to analyze the impacts of the proposed project and alternatives, the DEIR is silent on these offsetting transportation-related impacts. There is no analysis or even an attempt to estimate the increased emissions that would most certainly result from the import of the sand from other sources, including sources outside the Bay Area:

> The Reduced Project Alternative would reduce impacts associated with criteria air pollutants, GHGs, and diesel particulates compared to the Project because the amount of mining would be reduced by half. This Alternative would reduce the impacts related to GHG emissions to a less-than-significant level. Tables ES-4 and 6-1; see also DEIR at 4.5-27.

While the DEIR asserts that this alternative would reduce emissions associated with the project, it fails to analyze the corresponding increase in those same emissions that would clearly result from this alternative. In order to consider adequately the Reduced Project Alternative, the DEIR must consider the emissions that would necessarily result from satisfying the demand for sand from other sources.

Under the assumptions made in the EIR, one likely scenario for replacing the sand volume lost under this alternative is that the material could be supplied to Hanson's and Jerico's distribution facilities from other sources. Hanson and Jerico considered the most likely sources of replacement sand. The attached summary analyzes the number of truck trips that would be necessary in order to provide an equal volume of sand (to replace what would not be supplied under the Reduced Project Alternative) from the closest and most likely alternative sources. It is key to note that each 2,000 cubic yard barge load would require 108 truck loads to replace. TRE then calculated the emissions that would result from these additional truck trips; the increase in truck miles and the resulting emissions are shown in the table that follows. The table also shows the net differences in emissions that would result under the Proposed Project and the Reduced Project Alternative.

10-7 cont.

For Hanson to replace the volume lost under the Reduced Project Alternative, it would take approximately 47,000 truck trips at an average round trip distance of 88 miles to deliver sand from the closest alternative sources. This would result in 4,136,000 additional truck miles.

For Jerico to replace the volume lost to its distribution facilities under the Reduced Project Alternative, it would take approximately 8,100 truck trips at an average round trip of 200 miles. This replacement effort would produce approximately 1,620,000 truck miles.

The following table compares the emissions that would result from the Reduced Project Alternative (adding emissions from supplying the lost volume by trucking it to the Hanson/Jerico distribution facilities) with emissions that would result from the Proposed Project:

COMPARISON OF PROJECTED EMISSION REDUCTIONS FROM REDUCED PROJECT ALTERNATIVE WITH INCREASED EMISSIONS RESULTING FROM SATISFYING DEMAND BY TRANSPORTING SAND BY TRUCK TO HANSON/JERICO DISTRIBUTION FACILITIES FROM CLOSEST KNOWN ALTERNATIVE SOURCES						
	Add'l Truck Miles	NOx Tons/yr	PM Tons/yr	ROG Tons/yr	CO Tons/yr	CO2 Tons/yr
Proposed Project- 2,040,000 cy/yr	0	123.50	4.53	11.56	36.57	8536.70
Emission Reductions Reduced Project Alternative	-	-61.75	-2.26	-5.78	-18.29	-4268.36
Total Emissions Reduced Project Alternative	-	61.75	2.26	5.78	18.29	4268.36
Hanson Projected Increase Under Truck Transportation Scenario (making up sand supply from other sources)	+ 4,171,000	+79.71	+3.58	+6.34	+24.93	+8,782.01
Jerico Projected Increase Under Truck Transportation Scenario (making up sand supply from other sources)	+1,622,000	+30.99	+1.39	+2.47	+9.69	+3,414.49
TOTAL HANSON/JERICO INCREASE DUE TO TRUCKING	+5,792,000	+110.70	+4.97	+8.81	+34.62	+12,196.49
TOTAL NET INCREASE – REDUCED PROJECT ALTERNATIVE		+48.94	+2.71	+3.03	+16.34	+7,928.14
TOTAL NET % INCREASE		+40%	+60%	+26%	+45%	+93%

10-7 cont.

The attachment summarizes all the assumptions and the emission factors used to produce this comparison. It used the DEIR's assumptions for emissions from sand mining. This example is very conservative because it does not even take account of the emissions that would result from mining, processing and truck-loading at these alternative sources before delivering the sand to the Hanson and Jerico distribution facilities.

The differences are stark. As this example shows, any decrease in sand mining-related emissions, including GHGs, would be more than offset by the necessary increase in diesel emissions associated with mining the sand elsewhere and transporting that sand into and within the Bay Area.

As an aside, even the No Project Alternative, which at least acknowledges the increase of emissions that would be triggered by importing sand to replace that provided by sand mining, does not adequately describe the increase in emissions that would be associated with imports:

> "The transport of sand from distant sources would reduce impacts associated with criteria air pollutant emissions within the San Francisco Air Basin, since most of the emissions associated with transport would occur outside the air basin." DEIR Tables ES-4 and 6-1.

Contrary to this statement, the truck trips that would be necessitated to replace the sand required to fill the demand currently filled by sand mining would occur within the San Francisco Air Basin. As discussed above, this increase in import-related emissions would more than offset any emission reductions resulting from a reduction in sand mining.[2]

As this discussion reflects, the Reduced Project Alternative was not adequately analyzed in the DEIR. Adequate consideration of this alternative would show that it cannot be considered the environmentally superior alternative. The increased air quality impacts that would clearly result from this alternative render it environmentally inferior to the proposed project.

10-7 cont.

Further, as shown in the comments on the biological impacts section of the EIR, that analysis has so many substantive flaws that its conclusions, particularly regarding entrainment effects, must be thoroughly reexamined. Our analysis shows that a thorough reexamination will produce a very different conclusion, including the conclusion that the environmental effects of any entrainment, should it be found to be occurring, will be mitigated to less than significant levels by the issuance of an incidental take permit and compliance with its terms. Accordingly, in that regard, this Reduced Project Alternative will not be biologically superior to the Proposed Project.

10-8

[2] The evaluation of increased emissions that would result from substituting sand from other sources would also apply to the No Project Alternative. The Reduced Project Alternative would allow half of the sand mining production of the Proposed Project. Therefore, additional emissions that would result from implementing the No Project Alternative would be double what would occur under the Reduced Project Alternative.

IV. Comments on Section 4.1 Biological Analysis

Biological Impacts Are Vastly Overstated in the DEIR and the Appendix E Entrainment Study, based on faulty assumptions that effectively multiply their projections of impacts.

As reflected in the discussion below, the DEIR's entrainment analysis is highly speculative and, we believe, inconsistent with prior studies and actual data taken from San Francisco and Suisun Bay studies. For example, Hanson Environmental prepared an August 2006 entrainment study for Hanson Aggregates and Jerico pursuant to the requirements of the National Marine Fisheries Service 2006-2007 Biological/Conference Opinion. The 2006 entrainment study produced markedly different results, with no identified entrainment of longfin or delta smelt. Furthermore, this analysis is fundamentally inconsistent with CEQA requirements relating to baseline. 10-9

A. The DEIR Analysis Uses the Incorrect Baseline.

In our comments on baseline issues, we demonstrated that the DEIR used the wrong baseline and that the proper baseline is the 1998-2008 average volume of all the sand mining activity that was occurring in the project area during those years. However, the baseline used in the biological analysis, particularly that associated with entrainment impacts, is even more askew. The entrainment study prepared by AMS, included as Appendix E to the DEIR,[3] and the DEIR impacts analysis that relies on it, should be modified to be consistent with the comments below.

Sand mining has been conducted in the Bay and Delta for decades, and the proposed project is a continuation of these prior activities within the same lease areas and using the same basic mining equipment and methods as were in place under the leases that were in effect from 1998-2008. However, the entrainment study, and the resulting DEIR impacts analysis, inexplicably portray the project's entrainment impacts as an absolute loss rather than an incremental change from the baseline conditions. Put another way, they assume zero sand mining production (with a corresponding assumption regarding entrainment) for the baseline condition, and thereby characterize all the entrainment that the study projects, albeit speculatively, as associated with the project. 10-10

In other words, both the entrainment study and the DEIR's impact analysis ignore the fact that this project involves a proposed continuation of an existing activity.[4] This is a fundamental flaw in the entrainment analysis. CEQA requires these circumstances to be accounted for in the DEIR impacts analysis by setting the proper baseline. Furthermore, the DEIR must use the same baseline as that used in the rest of the DEIR. There is no basis under CEQA to use different baselines for different subject area analyses; therefore, the entrainment-related impact analysis should be revised based on the 1998-2008 baseline.

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3 The Entrainment Study contained in Apendix E is entitled. *Assessment and Evaluation of Fish and Invertebrate Entrainment Effects from Commercial Aggregate Sand Mining in San Francisco Estuary*, prepared by Applied Marine Sciences, Inc. February 2009.

4 With regard to the DEIR's projections of longfin smelt entrainment, we note that the longfin smelt was not a listed species during the years of 1998-2008. If any entrainment was occurring during this time it would be properly considered part of the baseline for purposes of analyzing projected differences in entrainment that would occur under the project vis-à-vis the baseline condition.

To summarize, the DEIR is required to analyze the change in the environment that would occur under the project. That must be done here by comparing conditions that would occur under the proposed project with the conditions occurring at the baseline. This would require the analysis of incremental changes in projected entrainment losses, if any, between the baseline condition (under a production level of 1,556,811 cubic yard/year (the 1998-2008 average) versus projected entrainment under the proposed project level of 2,040,000 cubic yards/yr for the species covered by the DEIR.

10-10 cont.

Many of the technical problems and assumptions discussed in our detailed comments below would be less significant if the impacts analysis were presented as the incremental change between a properly selected baseline and proposed project operations because the same assumptions would be included in the numerator and denominator of the relative comparison. Accordingly, the entire analysis and presentation of results should be redone to reflect the incremental change in risk of entrainment. These revised results should then reevaluated in developing the DEIR findings regarding significance of impacts and the conclusions regarding the necessity and scope of mitigation measures.

B. The Entrainment Study, and the Resulting DEIR Analyses, Are Based on Speculation and Questionable Methods that Result in Inflated Projections of Entrainment of all Species.

Hanson and Jerico dispute the conclusion in the DEIR and entrainment study that entrainment of any listed species is occurring beyond that authorized by the 2006 Biological Opinion/Incidental Take Statement/Consistency Determination issued by NMFS and California Fish and Game and identified in the Hanson Environmental Entrainment Study. 10-11

With regard to potential entrainment of longfin smelt, we submit a brief report prepared by Dr. Chuck Hanson and dated November 6, 2009.[5] This report addressed the potential of sand mining to result in entrainment of longfin smelt based on the actual location and methodology of sand mining, with all its regulatory restrictions, in relation to the life history, behavioral patterns and biological needs of the species. In contrast to the DEIR's Entrainment Study, this report concluded no significant risk that sand mining would entrain longfin smelt. It was submitted to SLC on November 6, 2009, but we understand it was not considered in the preparation of the DEIR. Therefore, we have attached that report to these comments. 10-12

The following are specific comments about the entrainment analysis contained in the DEIR and the AMS Entrainment Study contained in Exhibit E.

- The DEIR and the Entrainment Study characterize the Entrainment Study as a literature-based assessment and evaluation.[6] However, Appendix E and the Section 4.1 of the DEIR should clearly articulate that the results of these analyses are hypothetical, worst case loss estimates and that there has been no effort to validate these results against actual fish entrainment during actual sand mining events. Unfortunately, the DEIR relies extensively on these estimates as if they were well-established and well-supported, which they are not. The projections regarding entrainment are so speculative that they do not provide an adequate basis for the significant conclusions the DEIR reaches about effects of sand mining on fisheries, the necessity of mitigation and—based on a conclusion that impacts of longfin smelt entrainment cannot be sufficiently reduced to a level of insignificance—the necessity of considering issuance of a statement of overriding considerations. 10-13

- Fishery data used in the analysis were collected over the period from 2000 to 2007 although there is no discussion as to why or how these years were selected for use in this analysis.[7] The DEIR, however, identifies 2007 as the baseline for impact analysis, although it and the entrainment study actually perform the analysis in many places as if this is not a continuation of an existing activity (see our earlier comments on baseline). To be consistent with the CEQA requirements discussed in our comments on baseline issues, the fishery analysis should be revised to evaluate the changes to impacts on fisheries that would occur under the project from the DEIR baseline period (1998-2008). 10-14

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5 Hanson Marine Operations and Jerico Products, Inc.; Sand Mining in San Francisco and Suisun Bays, Potential Impacts to Longfin Smelt (Dr. Chuck Hanson November 6, 2009)

6 DEIR at 4.1-25; Exhibit E at E-8

7 Exhibit E at E-8.

As discussed above, there is no basis for utilizing a baseline here that is different from the baseline used elsewhere in the DEIR..

As discussed in our comments on baseline issues, the fishery analysis should be revised to include results of the analysis of the effects of using a longer multi-year (1998-2008) period of fishery data in the entrainment effects analysis; this is necessary to be consistent with the baseline period used in the DEIR Many of the fishery populations of concern have declined between 1998 and 2008. What is the effect of including years when fishery densities may have been higher than the 2007 base year used in the draft DEIR in the entrainment loss calculations? Our examination of results presented in Table 4-2, 4-3, and 4-4 suggest that the estimated losses in 2007 were lower for special status fish when compared to the 2000-2007 averages that are presented in the entrainment study and the DEIR. In addition, using multiple years of fishery density data adds to the variance of the loss estimates. The entrainment loss estimates do not, however, include 95% confidence intervals or other measures of uncertainty in the resulting entrainment loss estimates. 10-14 cont.

- The Entrainment Study presents the loss estimates in with four or five significant figures.[8] This method of presentation suggests a level of confidence and accuracy in the results that is clearly not justified by the data and methodology used here. The Entrainment Study and DEIR should present a discussion of the level of uncertainty in the entrainment estimates and appropriate description of the level of confidence that can be placed in the results. As currently drafted, the entrainment study should be recognized as having a very high level of variability and uncertainty.

  To demonstrate with an example, the DEIR estimates entrainment losses of sand lance as high as 700,000 fish per year—based on extrapolation of fish densities from sampling conducted in Grays Harbor Washington. The key assumption in these analyses is "**if** densities are comparable between the two locations" meaning the densities between Grays Harbor and San Francisco Bay. If these analyses are to be included in the DEIR, support should be provided for the assumptions that the underlying data are representative, appropriate for use in this analysis, provide meaningful estimates of actual entrainment losses, or should even be included in the documents or impact analyses. In the absence of scientific support that these extrapolations have justification and are reasonable or representative of actual losses resulting from sand mining within the Bay-Delta system they should be deleted from the entrainment analysis and DEIR impact analysis. <u>Please note that this comment applies to the entire fishery analysis presented in the DEIR and Appendix E</u>. It is <u>not</u> limited to the example used for sand lance alone (see comments below). 10-15

- Fish, crab, and shrimp entrainment loss estimates presented in Appendix E and used as the basis for the DEIR impact analysis rely on fishery sampling data collected by the California Department of Fish and Game (CDFG) Bay Fishery Study using an otter trawl for sampling. The otter trawl is a net that has been specifically designed to effectively collect fish and macroinvertebrates living on or near the bottom. The trawl moves 10-16

[8] Exhibit E at E-8.

horizontally across the bottom and has sufficient width and height to collect fish and macroinvertebrates that have been startled by the net and are attempting to behaviorally avoid the net. In contrast, the drag head used in sand mining is small (approximately 3 feet wide) and is oriented vertically into the sand substrate. The entrainment study's calculations assume that gear collection efficiency is the same between the trawl and drag head. In contrast to the otter trawl, these species are able to behaviorally avoid the sand mining drag head. Studies in other regions have demonstrated that behavioral avoidance of a drag head substantially reduces (by 80% or more) the numbers of fish actually entrained. Accordingly, rather than extrapolating directly from the otter trawl data, the entrainment study's entrainment loss estimates for the sand mining methods used here should include a correction factor to account for behavioral avoidance of the sand mining drag head. As presented in the current version of the entrainment study, the estimated losses represent an exaggerated, unrealistic worst case and are not representative of the actual risk of entrainment. 10-16 cont.

- Estimates of entrainment of the larval lifestage of species such as Pacific herring also are based on unsupported extrapolation. The referenced CDFG Bay Study discontinued collecting fish eggs and larvae and other planktonic organisms in the late 1980's. The entrainment estimates used in the DEIR were based on data on the seasonal distribution and density of planktonic lifestages collected as part of studies conducted at the Potrero Power Plant and the proposed Marin Desalination Project. The Potrero Power Plant is located in a backwater cove along the San Francisco waterfront in south San Francisco Bay. The Entrainment Study provides no technical support for the proposition that the species and densities of planktonic organisms observed at the power plant are representative or appropriate to use in estimating entrainment during sand mining that takes place in Central Bay—where tidal current patterns, habitat conditions, and other parameters are substantially different from those at the power plant site. The analysis should be revised to address these uncertainties and to clearly acknowledge that these are hypothetical estimates that may not be representative of the actual effects of entrainment resulting from sand mining. 10-17

  An alternative and likely more credible approach which could have been used in the analysis would involve a comparison of entrainment results from the Potrero Power Plant made in the late 1970's with data from the CDFG surveys when plankton sampling was actually occurring. The Entrainment Study should either include such a comparative analysis or discuss the high level of uncertainty in the entrainment estimates as presented. If it is confirmed that the data from the power plant site are not representative of the risk of entrainment in central San Francisco Bay where mining actually occurs the entrainment estimates should be deleted from the impact analysis.

- As discussed above, the entrainment loss estimates for planktonic lifestages also were based on extrapolation of results of plankton collections at the Marin Municipal Water District proposed desalination project site. The site is located in north Bay on the Marin coast adjacent to the Richmond-San Rafael Bridge. Data from this site was used to estimate entrainment losses from sand mining upstream in Suisun Bay. Habitat types are substantially different between these two regions with one of the greatest differences being salinity. Salinity in the Suisun Bay area is low while salinity at the desalination 10-18 project site is substantially higher. There are substantial differences in the species composition and densities of fish that occur in response to salinity gradients within the estuary. Based on the differences in salinity and other habitat characteristics it is unlikely that the species composition and seasonal densities of planktonic lifestages of fish and other organisms in the vicinity of the proposed desalination plant are not representative of the planktonic fish community in Suisun Bay where sand mining occurs. No data are presented in the appendix or DEIR to support the assumption that the species composition and densities of larval fish and other planktonic organisms are representative and appropriate for use in estimating entrainment risk associated with sand mining. The appendix uses caveats to characterize these estimates such as "if correct" but provides no discussion regarding the application of these data, the levels of uncertainty, or the magnitude of error associated with these fundamental assumptions. The appendix and DEIR should be revised to address these issues. Unless the data from the desalination project site are found to be representative of the risk of entrainment in Suisun Bay where mining actually occurs the entrainment estimates should be deleted from the impact analysis. 10-18 cont.

- The DEIR Entrainment Study describes sand mining occurring in Suisun Marsh and imply that laws, plans and policies applicable to Suisun Marsh govern sand mining under the proposed project.[9] No sand mining is permitted to occur within the marsh or areas adjacent to the marsh. Sand mining leases are located upstream in Suisun Bay. 10-19

- The Entrainment Study and DEIR assert that "Bay-wide, approximately 1.2 million <u>shrimp are entrained</u> by sand mining activities" (emphasis added). These are hypothetical estimates that have no verification. The assumptions used in deriving the loss estimates have not been tested and there are a number of reasons to believe that the approach and data used in these estimates substantially overestimate losses. However, the Entrainment Study implies that this impact is actually occurring. The Entrainment Study and DEIR should be revised to reflect the uncertainty in these estimates and should explain clearly that the results do not necessarily represent actual losses. <u>This comment applies throughout Appendix E and the DEIR</u>. 10-20

- Appendix E and the DEIR identify longfin smelt as the special status fish species that has the greatest risk of entrainment resulting from sand mining. As discussed above, there is a high level of uncertainty in the accuracy of these estimates. The Entrainment Study and DEIR should be revised to discuss the high level of uncertainty in these estimates based upon the type of analysis performed here. The DEIR also should acknowledge the fact that they are hypothetical estimates that do not represent actual documented losses. The Entrainment Study and DEIR also should be revised to provide 95% confidence intervals for these loss estimates. 10-21

- The entrainment study acknowledges that the entrainment loss estimates should be considered as "order-of-magnitude" estimates.[10] However, this characterization of the 10-22

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[9] See, e.g., DEIR at 4.7-12 through 4.7-25 and Exhibit E at E-9.

[10] Appendix E at E-15.

confidence and level of accuracy of the results of the analysis is inconsistent with the presentation of entrainment losses to five significant figures (e.g., midshipman 27,393, English sole 22,346, etc.). The presentation and discussion of results in the DEIR improperly implies a much higher level of confidence in the results than is justified by the analysis. In fact, one of the DEIR's most significant conclusions regarding potential impacts to longfin smelt is based on these projections, i.e., that there is a level of entrainment that cannot be mitigated to a level of less than significant. Appendix E and the DEIR should be revised to reflect the actual level of confidence supported by the available data and assumptions used in the analysis. 10-22 cont.

- The Entrainment Study presents information in Appendix A to Appendix E regarding the mining events recorded in 2002-2003 as well as total amounts of sand mined from each region between 2000 and 2007. During 2002-2003 there were three companies mining sand. As discussed in our comments on baseline, the total amount of sand mining in the project areas (Central and Suisun Bays) should be included in the baseline. This is consistent with the focus of the analysis which is on potential impacts to these areas generally, rather than individual lease areas. However, the proposed project includes only two companies. Were the data on past mining activity adjusted to only reflect the two companies included in the proposed project? As discussed above regarding baseline issues, the data relating to past mining activities (1998-2008) should definitely include the sand mining carried out by Cemex in the Central and Suisun Bays. Similarly, for purposes of making the projections, were the locations and timing of proposed mining events adjusted to reflect the proposed changes in mining volumes and locations in the future? The Entrainment Study and DEIR should clearly document the level of mining, by month and region that were assumed for the baseline conditions and for the proposed project, and it should be expanded as discussed above. As noted above, the selection of years used to reflect baseline mining (2000-2007) are not only inconsistent with the selection of only 2007 as the baseline for the DEIR but it is inconsistent with the proper baseline that should be used throughout the DEIR. 10-23

- Table 2-1 presents a comparison of annual water volumes diverted by the Potrero Power Plant, MMWD, and by sand mining.[11] It is not clear if the sand mining water volumes are only that portion of a mining event when water is being diverted or whether the sand mining volumes also include the sand-water slurry. Fish entrainment would be limited to the water volume diverted and not that portion that is sand. 10-24

- As discussed above for fish that would behaviorally avoid entrainment into the suction head, crabs and shrimp also have the ability to detect and avoid entrainment by an approaching drag head that is 3 feet wide. The analysis currently assumes that the capture efficiency of the CDFG otter trawl is the same as that for a sand mining drag head. There have been other studies that have compared captures in otter trawls and entrainment into suction dredges (similar but not the same as a sand mining drag head) that can be discussed and used to develop more realistic loss estimates. For example, page E-26 discusses the use of a regression approach in Grays Harbor to estimate the 10-25

[11] Exhibit E at E-19.

catch efficiency (slope of 0.27) between actual crab entrainment and catches in otter trawls. The Entrainment Study notes that these factors may be site specific and differ among equipment and therefore no correction was made to account for avoidance. Although even greater uncertainty exists, the Entrainment Study did extrapolate densities of sand lance from Grays Harbor to San Francisco Bay that are reported as part of the DEIR analysis. The Entrainment Study is not consistent in the treatment of data and results and should be revised. The Entrainment Study should, at a minimum, present a range of estimates that include the best information on issues like gear avoidance to give a better understanding of the effect of sand mining on entrainment risk. This flaw in the analysis would be corrected by using a relative comparison of results rather than the absolute estimated currently presented in the appendix and DEIR. 10-25 cont.

- Exhibit E, Table 3-1,presents the results of the analysis as being extremely precise (e.g., 6,294,141 bay goby projected to be entrained in central Bay mining).[12] This form of presentation gives the appearance of a high degree of accuracy and confidence. To be consistent with the limitations of the entrainment study, these should be presented as "order-of-magnitude" estimates as discussed above or should provide a discussion of the level of confidence (e.g., 95% confidence intervals) in these results. This applies to all of the data presented as results of the analysis. These tables and the results that they present should be re-structured to present the results in a meaningful way that reflects the actual uncertainty and number of assumptions needed for these estimates. 10-26

- Results presented in DEIR Table 3-5[13] illustrate the magnitude of error and uncertainty inherent in the entrainment analysis. An estimated annual abundance index (AI) is calculated based on extrapolation of data from the CDFG fishery sampling program. The annual abundance index for Chinook salmon in Middle Ground is 44,854 fish. All Chinook salmon produced in the Central Valley rivers (e.g., Sacramento, Feather, American, Mokelumne, Stanislaus, Tuolumne, Merced, and others) as well as a large number of juvenile Chinook salmon produced in hatcheries pass through Middle Ground during their migration to the ocean. It has been estimated that the total juvenile Chinook salmon abundance is tens of millions of fish (some estimates are 50 million juveniles). These estimates of juvenile Chinook salmon abundance are several orders of magnitude higher than the abundance index developed through the DEIR analyses. The entrainment study's abundance estimates directly affect the validity and interpretation of the significance of the entrainment estimates. As with other aspects of the analysis there is no discussion of the confidence that can be given to the Bay-wide estimates of population abundance for the various species included in the analysis. The Entrainment Study and DEIR should be revised to provide a more transparent description of the confidence that can be placed in these estimates. 10-27

- The Entrainment Study discusses results of a 2006 actual entrainment study conducted in various regions of the Bay-Delta.[14] The Entrainment Study describes the results for 10-28

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[12] Exhibit E at E-31

[13] Exhibit E at #-35

[14] Exhibit E at E-14, 52

juvenile Chinook salmon as showing higher entrainment at night than during the day. The Entrainment Study does not discuss the fact that only 8 juvenile Chinook salmon were collected during the entire study, that all 8 salmon were collected using CEMEX equipment (a stationary pothole method of mining that does not use a drag head such as those used by Morris Tug and Barge and Hanson), that no juvenile salmon were collected in tests using Morris Tug and Barge or Hanson equipment despite a higher sampling effort than that for CEMEX, or that CEMEX is no longer mining sand from the Bay and is not part of the proposed project. It should also be noted that these tests were performed by pumping 100% water at a depth several feet above the bottom and therefore would be expected to represent a worst case entrainment risk. No statistically significant difference was detected for all fish collected between day and night sampling and yet this data is used as the basis for a very burdensome mitigation measure prohibiting nighttime dredging. This very limited data cannot justify the conclusion that entrainment is higher at night and the DEIR's resulting recommended mitigation measure prohibiting nighttime sand mining. 10-28 cont.

- Results of a comparison of predicted juvenile salmon entrainment and actual entrainment showed that actual entrainment was significantly lower than that predicted by the risk model. The Entrainment Study and DEIR should be revised to provide a more detailed discussion of the results of these studies of actual entrainment using the sand mining equipment from the two companies that form the basis for the proposed project. The revised discussion would then help identify some of the assumptions that have been used in the hypothetical entrainment estimates and some level of validation based on results of actual field measurements. This discussion should also address the strengths and weaknesses in applying results of these calculations to identifying potential avoidance and minimization actions. For example, results of testing actual entrainment for the two companies included in the proposed project did not document entrainment of juvenile salmon during the tests and do not show that limiting mining to daylight hours would reduce the risk of entrainment as described in mitigation measure BIO-10b.[15] 10-29

- The DEIR concludes that the proposed sand mining will result in significant adverse impacts on green sturgeon, Chinook salmon, and steelhead (Impact BIO-10) and identifies mitigation measures it characterizes as necessary to reduce and avoid those impacts. In contrast, results of the entrainment loss calculations presented in Appendix E (page E-50 and E-51 for special status species) do not identify significant impacts to green sturgeon, Chinook salmon, or steelhead. Based on the results summarized in Tables 4-2, 4-3, and 4-4 no Chinook salmon were estimated to be entrained as a result of sand mining in Central Bay (Table 4-2), an average of 1 annually in Middle ground (Table 4-3; ranging from 0 to 5 annually) which is reported as 0.00% of the estimated abundance index, and 1 (Table 4-4; range 0 to 2 per year) in Suisun Bay. This level of impact was specifically addressed in the 2006 NMFS Biological and Conference Opinion for Sand Mining. That Biological Opinion found that sand mining as authorized would not jeopardize the continued existence of any of the federally listed species—steelhead, Chinook salmon and green sturgeon. Significantly, in its Biological Opinion, NMFS— 10-30

[15] DEIR at 4.1-58

the federal agency with direct jurisdiction over these species--did not find that the measures the DEIR recommends as BIO-10a and BIO-10b (prohibition on nighttime dredging and two-week halt of sand mining in the Delta and Suisun Bay lease areas) were necessary in order to reach that conclusion, which is comparable to a finding that the project will not result in significant impacts; NMFS suggested the provision relating to nighttime dredging as a "conservation recommendation" which is discretionary but not required in order to satisfy the federal Endangered Species Act. Contrary to the assertion in the DEIR, NMFS did not recommend a two-week halt to sand mining during the Chinook salmon smolt outmigration period. There is no basis to conclude that, on the one hand, the required measures in the federal Biological Opinion are sufficient to reduce project impacts to green sturgeon and steelhead to a less than significant level, but on the other hand conclude that additional measures beyond those required by the federal BO are required in order to sufficiently reduce impacts to Chinook salmon smolts.[16] 10-30 cont.

Similarly, no steelhead were estimated to be entrained in any of the three mining areas. No green sturgeon were estimated to be entrained in Central Bay or Middle Ground and less than 1 was estimated to be entrained in Suisun Bay (Table 4-4; range 0 to 1 annually). The estimated losses would be even lower when viewed as an incremental change from the baseline conditions. These results do not support, and are not consistent with a conclusion of significant impacts to these species or a requirement for mitigation measures. Accordingly, the BIO-10 finding should be less than significant based on results presented in Appendix E and the associated mitigation measures (BIO-10a and BIO-10b) should be removed from the DEIR.

In addition, it should be recognized that these measures are infeasible. Shutting down sand mining for an entire two weeks would unnecessarily impose a significant economic burden on the companies and would result in layoffs of employees during this time. Further, sand mining is dependant on the tides for mining and timing of deliveries to offloading locations. The tides are in 12 hour cycles, so limiting sand mining to daylight hours would effectively prohibit sand mining except for the very few days of the year when the tides align with daylight. These measures are infeasible. 10-31

- The DEIR identifies entrainment of delta smelt as a potentially significant impact that requires mitigation.[17] The results of entrainment loss calculations presented in Appendix E[18] show estimates of absolute losses but fail to account for the relative incremental change in losses from baseline. The DEIR selected 2007 as a baseline condition. Based on results of the entrainment loss calculations no delta smelt were estimated to be entrained in 2007 in Central Bay (Table 4-2), Middle Ground (Table 4-3), or Suisun Bay (Table 4-4). The losses presented in the DEIR reflect the average estimate over a period from 2000 to 2007. The two mining companies were operating in 2007 under the 10-32

[16] Furthermore, the Department of Fish and Game issued a Consistency Dits determination for this species, finding that the federal BO was consistent with the requirements of the California Endangered Species Act in connection with potential entrainment of Chinook salmon. As discussed below, CESA requires "full mitigation" of such impacts, a standard that exceeds the CEQA standard of mitigation to a less than significant level.

[17] DEIR at 4.1-52

[18] Exhibit E at E-50 and E-52

USFWS Letter of Concurrence with the Army Corps of Engineers' conclusion that no effect on delta smelt (including entrainment) was occurring that would trigger a formal ESA consultation. USFWS also concurred that, as required under appropriate permits, this condition would continue to occur in the future. (copy attached) Accordingly, based on USFWS' evaluation, no entrainment of delta smelt should be assumed. The incremental change in potential impacts in the future with the proposed project would be zero in contrast to what is presented in the DEIR and Appendix E. Therefore, mitigation measure BIO-8a is not necessary and should be deleted from the DEIR. 10-32 cont.

- Finally, with regard to mitigation measures BIO-8a and 9a, without a clear indication that entrainment is in fact occurring, these measures should not be imposed. The necessity of such measures should be considered in the context of discussions with DFG on the issue of entrainment of delta and longfin smelt and the necessity of an incidental take permit. If no entrainment is occurring, then there would be no significant impact and, therefore, no need for mitigation. Further, the proposal to prohibit sand mining from December 1 to June 30 downstream of the current water year's lowest X2 location is not feasible. This measure would effectively prohibit operations by Jerico and Hanson on Middle Ground and Suisun Associates for six months of the year if X2 is downstream of these areas for even one day during the water year – which it can be, and regularly is, during singular storm events. Running a sand mining operation for six months and shutting down sand mining for six months of the year simply is not feasible**.** See Section III – Comments on Reduced Project Alternative for a discussion of feasibility factors that affect sand mining. 10-33

C. The DEIR's assertion that impacts of entraining longfin smelt, if entrainment is occurring, cannot be mitigated to a level of insignificance is legally and factually incorrect. The DEIR's requirement to obtain a California Endangered Species Act Incidental Take Permit, if it is necessary, would ensure that all impacts of entrainment are mitigated to a level of insignificance. This condition properly imposes a "performance standard" which is sufficient to satisfy CEQA's requirements relating to mitigation of significant environmental effects.

The DEIR improperly concludes that potential entrainment impacts on longfin smelt cannot be mitigated to a level of insignificance with the measures imposed by the DEIR and, therefore, SLC would be required to issue a statement of overriding considerations in order to justify approval of this project. The DEIR states: 10-34

> Implementation of MM BIO-9a, BIO-9b, BIO-9c and BIO-9d would likely not reduce direct impacts to longfin smelt to a less than significant level due to sand mining operations. Although there are no current programs for offsetting sand mining impacts to longfin smelt, implementation of MM BIO-9a, BIO-9b, BIO-9c and BIO-9d would require actions intended to limit impacts to and compensate for take of longfin smelt. There are no other feasible mitigation measures available at this time, although it is anticipated that CDFG staff will establish recommended conditions that will be included in an ITP, if required. Because these measures have not yet been developed by the CDFG, approval of the project would be subject to a Statement of Overriding Considerations under CEQA by the CSLC. DEIR at 4.1-57.

This conclusion is legally inconsistent with CEQA. Here, the DEIR's mitigation measures (MM BIO-9a through 9c) would require the applicants to consult with Fish and Game and, upon confirmation by Fish and Game determines that entrainment is occurring, the applicants would be required to obtain that permit and comply with its terms as a condition of approving the project. By definition, compliance with the terms of an incidental take permit would reduce any impacts of taking (here impacts associated with entrainment) to a less than significant level. The California Endangered Species Act (CESA) requires that any impacts of taking must be "minimized and fully mitigated" in order to qualify for a permit. Fish and Game Code §2081(b). Therefore, the environmental effects of entrainment would be fully mitigated by the measures imposed by Fish and Game. Accordingly, satisfying the full mitigation standard of CESA for any entrainment impacts—which would be mandated in order to qualify for the incidental take permit—would satisfy CEQA's requirement to mitigate significant impacts to a less than significant level.

In essence, the take permit would be a performance standard imposed by the SLC (i.e., comply with the standards imposed by California Fish and Game as the expert agency), and the later specific conditions incorporated into the take permit are merely measures imposed to enforce that performance standard. Such an approach is expressly endorsed by CEQA Guidelines section 15126.4(a)(1)(B) (agency may commit to a specific performance standard or criterion that will ensure mitigation of the significant effect provided the mitigation measure disallows physical changes to the environment unless the performance standard is or will be satisfied). Here, this condition would require Jerico and Hanson to obtain and comply with the terms of any incidental take permit that is triggered as a result of the consultation with the Department of Fish and Game on the issue of potential entrainment. Accordingly, this mitigation measure satisfies the requirements of CEQA for adopting all feasible mitigation measures necessary to reduce the impacts of the project to a level of significance. As a result of implementing this measure, no significant environmental effects of the project would remain after the permit is issued, and there would be no necessity for a statement of overriding considerations issued by SLC.

10-34 cont.

For the record, Hanson and Jerico have initiated discussions with the Department of Fish and Game to begin the process called for in BIO 9b. In this process, Hanson and Jerico will also confer with the Department to confirm the Department's concurrence with USFWS' entrainment of Delta Smelt does not result from sand mining.

D. There is no necessity of imposing a separate requirement to help fund habitat improvements as that requirement, if necessary to mitigate impacts of longfin smelt entrainment, will be imposed during the incidental take permit process.

With regard to mitigation measure BIO-9d, there is no necessity to include the separate habitat funding requirement set forth there. If, pursuant to mitigation measures BIO-9b and 9c, Hanson and Jerico need obtain an incidental take permit, the permit terms will include funding any habitat improvements that are necessary to satisfy the "fully mitigate" standard of CESA. If it is not necessary to obtain an incidental take permit (because it is demonstrated that there is no risk of longfin smelt entrainment), there will be no other impact to longfin smelt that will require mitigation. Therefore, mitigation measure BIO-9d should be eliminated from the EIR.

10-35

V. Comments on Air Impacts, Mitigation and Conclusions

The DEIR Air Impacts analysis contains errors in emissions factors and calculations that overstate impacts for CO2 and NOX. The analysis utilizes the incorrect project baseline as discussed in the Baseline Issues comments, further overstating project impacts.

AIR IMPACTS -

The Draft EIR (DEIR) addresses Air Quality through evaluation of the impacts of sand mining activities on emissions of criteria pollutants, green house gases, and potential health risk from diesel particulate matter. The analyses found impacts from emissions of criteria pollutants and GHG emissions and proposed mitigation measures.

The emission calculation methodology presented in the draft EIR Table 4.5-7 presents the results under the scenario of Baseline at 2007 mining volumes, Future (2010) at requested volume increase, Future (2011) replacing pre-1985 manufactured Tier 0 diesel engines with Tier 2 engines to reduce criteria pollutant emissions according to CARB's compliance schedule for commercial harbor craft, and Future (2018) with all diesel engines upgraded to Tier 2 standards. The results indicate that the proposed project would result in a net increase in annual pollutant emissions for all criteria pollutants, and that reductions in NOx below the 15 tons per year threshold (BAAQMD 1999) would not be met until all the diesel engines are upgraded to Tier 2 standards.

The DEIR proposes Mitigation Measure AIR-1 to reduce the emission rates of NOx from tugboats and dredge main and auxiliary diesel engines, and Mitigation Measure AIR-2 to reduce GHG emissions. 10-36

The DEIR references CARB's compliance schedule for commercial harbor craft equipment replacement in Table 4.5-6. The table incorrectly lists the compliance date for Hanson's dredges TS&G and DS-10 pre-1985 manufactured Tier 0 diesel engines as 2011. The correct compliance date is 2013. MM AIR-1 proposes an accelerated engine replacement schedule based on CARB's compliance schedule. The compliance schedule is not the appropriate trigger for this mitigation measure.

TRC Solutions, Inc., was contracted to review the methodology used to conduct the emission calculations. The report detailing TRC's findings is attached. The report indicates that in general the evaluation methodology approach is valid; however there were identified errors in emission factors used that overstate the project impacts for CO_2 and NOx, as follows:

- The CO_2 emission factor for diesel powered sources was incorrectly entered, correction of which results in approximately a 3% reduction in the Project's CO_2 emission rates.
- The NOx emission factor for diesel engines upgraded to meet Tier II emission standards is incorrect, overestimating future NOx emissions.

In addition, the greenhouse gas analysis did not include CH_4 and N_2O that contribute to warming potential, inclusion of which can result in an approximate 0.6% increase in the CO_2 total.

The TRC report includes revisions to the calculation tables from Appendix 3 (attached) that incorporate the emission factor corrections and resulting revisions to the emissions. The corrected results show that, even under the baseline set forth in the DEIR, NOx emissions will, in fact, be less than the 15 tons per year threshold when the pre-1985 manufactured Tier 0 diesel engines are replaced with Tier 2 engines in 2011 according to the Mitigation Measures for Impact AIR-1 accelerated schedule. The DEIR should conclude that there will be no significant impacts associated with NOx emissions after the pre-1985 Tier 0 engines are replaced.

As discussed under the Baseline Issues Comments, utilization of the 2007 production levels as the baseline condition is inconsistent with CEQA, and significantly overstates the air impacts associated with the proposed project. Further, utilizing the more representative average production for the years 1998-2008, which includes the volume mined by Cemex during those years in the proposed lease areas, more accurately characterizes the level of impacts compared to the proposed project. TRC recalculated air emissions to reflect the new baseline. The revised emissions tables are attached as Appendix 4- Emissions Modified Baseline. The results show significant reduction in NOx and CO_2 emissions under the proposed project using the proper baseline, as compared to the emissions projected using the 2007 baseline condition assumption in the DEIR. Again, NOx emissions under the project as proposed would be less than the 15 tons per year threshold, so the EIR should conclude that there will be no significant impact associated with NOx emissions after the pre-1985 Tier 0 engines are replaced.

10-36 cont.

MITIGATION -

The DEIR concludes that there are significant impacts from criteria pollutants and GHG emissions that require mitigation. As discussed below, the mitigation measures proposed are either not necessary when the emissions calculations are corrected, or, in the case of greenhouse gases, mischaracterize the level of mitigation needed.

- Mitigation Measures for Impact AIR-1: Emissions of Criteria Pollutants -

The air quality analysis in the DEIR utilizing the incorrect emission factors indicates a net increase in annual emissions for all criteria pollutants. The DEIR analysis indicates that replacing pre-1985 manufactured Tier 0 diesel engines in 2011 with Tier 2 engines would reduce the criteria pollutant emissions below threshold except for NOx emissions – again, utilizing the incorrect emission factors. As a result, the draft DEIR proposes to implement an accelerated schedule to upgrade all the tugboat and barge engines to meet Tier 2 NOx standards within one year of issuance of the new leases. Utilizing the corrected emission factors for NOx demonstrates that replacing the pre-1985 manufactured Tier 0 diesel engines with Tier 2 engines in 2011 will be sufficient to ensure that emissions will be less than the threshold and, therefore, less than significant.

10-37

Furthermore, adoption of the proper baseline, the 1998-2008 average production volume, results in a net decrease in NOx emissions after the replacement of the pre-1985 manufactured Tier 0 diesel engines with Tier 2 engines in 2011. Emissions under current operating levels are considerably less than baseline, and emissions are correspondingly less compared to the mitigation criteria. MM AIR-1 should be revised to require implementation of the upgrade engines described in the measure at the point where ACTUAL NOx emissions will exceed the threshold. This would occur as economic conditions increase demand, and production levels rise to those anticipated under the Proposed Project. 10-37 cont.

- Mitigation Measure for Impact AIR-2: Emissions of Greenhouse Gases -

The TRC report calculation tables in Appendix 3 incorporate the emission factor corrections and resulting revisions to the emissions for CO_2. The corrected results yield a 3% reduction in CO_2 emissions from the originally calculated emissions.

MM AIR-2 proposes that a GHG reduction plan shall be prepared within three months of the issuance of new leases that demonstrates how project related GHG emissions will be lowered and/or offset, such that GHG emissions will not exceed 5,238 metric tons of CO2 equivalent in any calendar year during the 10-year lease period, or a total of 52,380 metric tons for the 10-year life of the project. Utilizing the proper baseline of the 1998-2008 average production volumes significantly decreases the change in greenhouse gas emissions from baseline to full proposed project levels. The GHG emission targets should be revised to not to exceed 6,362 metric tons in any calendar year, or a total of 63,620 metric tons for the 10-year life of the project to reflect the new baseline. 10-38

Emissions under current operating levels are considerably less than baseline, and emissions are correspondingly less compared to the mitigation criteria. MM AIR-2 should be revised to require implementation of the completed GHG reduction plan only at the point it has been verified that ACTUAL GHG emissions will exceed the baseline emissions.

VI. Comments on Mineral Resources and Hydrology and Water Quality

Although we are generally in agreement with the conclusion of the DEIR that no significant impacts are associated with localized changes of bathymetry associated with sand mining, the DEIR misinterprets the total amount of sand resource available and significantly underestimates the sand resource in Central Bay.

The project proponents are generally in agreement with the conclusions of the DEIR regarding Mineral Resources and Hydrology and Water Quality: there are no significant impacts, and that bathymetric changes due to mining are restricted to the immediate vicinity of the mining locations. 10-39

Regarding sand mining in Central Bay, an important result of the incorporated study is that no impacts are found to nearby beaches or to the San Francisco Bar. On the basis of a comparison of multibeam sonar surveys in 1997 and 2008 the DEIR concludes that the volumetric change due to bathymetric deepening (depletion) is approximately the same as the volume of sand mined during that period. On the basis of hydrodynamic modeling the DEIR concludes that this situation may persist during the proposed project duration, with no significant impact.

However, the DEIR misinterprets the total resource available. The DEIR estimates the total resource as extending to a depth of 90 feet. This is only an operating depth limit based on the equipment currently in use and could easily be exceeded. The total resource is much greater than this, and was listed for individual leases in Bathymetric Survey reports through 2007. As an example, the DEIR (Appendix G) estimated that mining in lease PRC 2036 removed "2.3% of its sediment on an annual basis". However, using the total sediment volume overlying bedrock from the 2007 Bathymetric Report, this should only be 0.45%. Central Bay sand is a very plentiful resource, and is NOT being quickly depleted by sand mining. 10-40

It should be noted that the Central Bay sand resource was studied in considerable detail, including borings and particle size analysis, in a 2000 study for expansion of the San Francisco Airport (ADEC, 2000), and inclusion of this information would improve the DEIR.

Regarding sand mining in Suisun Bay, including Middle Ground, as noted in the DEIR the bathymetric and hydrodynamic modeling analysis is less certain because only older single beam surveys were used. It should be noted that those surveys could have considerable uncertainty. A 2008 multibeam survey for the Suisun Associates lease was not used, due the difficulty of comparison to the older single beam surveys. Nevertheless, the DEIR reached the valid conclusion that there is no significant impact and that the proposed project would continue have only very localized bathymetric effects. 10-41

Regarding Middle Ground, the DEIR indicates somewhat inconsistently that modeling suggests significant deepening of the southern, mined part of the lease. The DEIR does not consider single beam Bathymetric Survey reports in the 2008 – 2010 time period, which indicate the opposite trend. These reports have been sent to SLC, and should be considered in the DEIR. Again, the total resource available is much greater than stated in the DEIR, and is explained in the Bathymetric Survey reports. 10-41 cont.

Reference

ADEC – Airfield Development Engineering Consultant. 2000. San Francisco International Airport, Airfield Development Program, Preliminary Report No. 5 (Task I), Evaluation of Potential Borrow Sites. 4 volumes.

VII. <u>Comments on Necessity and Feasibility of Mitigation Measures Proposed in DEIR</u>

For the reasons discussed in Section II – Comments on Baseline Issues above, the impacts analysis should be reviewed and revised using the proper baseline. The 2007 baseline used in the DEIR has significantly skewed the impacts analysis. In addition, other factors should be addressed in the impacts analysis as described in our comments. CEQA requires an EIR to "describe <u>feasible</u> measures which could minimize significant adverse impacts." 14 CalCode Regs. § 15126.4(a)(1). Conversely, "mitigation measures are not required for effects which are not found to be significant." Id. at § 15126.4(a)(3).

10-42

Many of the mitigation measures set forth in the DEIR are either unnecessary, infeasible or both.

In light of the flaws in the baseline and impacts analysis identified in these comments, the necessity of mitigation measures in the DEIR should be reexamined and certain measures should be eliminated as not necessary. The revised impacts analysis should find that many of the impacts originally identified as significant in the DEIR are, in fact, not significant. If the impacts are not significant, it would not be proper to require associated mitigation measures.

In addition to being unnecessary to mitigate environmental effects that are not significant, many of the mitigation measures are infeasible. Under, CEQA, "feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors. 14 Cal.Code Regs. §15364. CEQA imposes a duty on agencies to avoid significant environmental effects with measures that are *<u>feasible</u>*. (emphasis added) Id. §15021, 15041. Many of the measures proposed by the DEIR do not satisfy the feasibility standard, and should not be included. 10-43

The following table shows those measures proposed in the DEIR which should be found to be infeasible, unnecessary to mitigate environmental effects that are not significant, or both:

DEIR MITIGATION MEASURES THAT ARE NOT NECESSARY AND/OR NOT FEASIBLE

Potential Impact Identified in DEIR	Mitigation Proposed in DEIR	Is Proposed Mitigation Necessary in light of comments?	Is Proposed Mitigation Feasible?	
BIO-6: Sand mining could result in smothering or burial of, or mechanical damage to, infauna and epifauna, and reduced fish foraging.	**BIO-6.** Establish 100 foot buffer around hard bottom areas within and adjacent to Central Bay mining leases.	Unknown. As written, the DEIR does not adequately describe the basis for the conclusion that there are potentially significant effects and does not identify the areas this measure might refer to. Applicants are unaware of what areas the DEIR is referring to, and need more information to adequately assess the need for this condition.	Unknown. As written, the DEIR does not adequately describe the basis for the conclusion that there are potentially significant effects and does not identify the areas this measure might refer to. Applicants need more information to adequately assess the feasibility of this condition.	10-44
BIO-8: Regular operation of sand mining activities will impact delta smelt.	**BIO-8a.** Restrict timing of dredging relative to X2.	**No.** No risk of entrainment of delta smelt under project as proposed as per USFWS. (See Biological Impacts Comments)	**NO.** This measure would effectively prohibit operations by Jerico and Hanson on Middle Ground and Suisun Associates for six months of the year if X2 is downstream of these areas for even one day during the water year – which it can be during singular storm events. This would render the project infeasible**.**	
	BIO-8b. Consult with the CDFG.	**No.** But Hanson and Jerico will consult to confirm USFWS conclusions of no risk of entrainment. (See Biological Impacts Comments)	Jerico and Hanson are consulting with DFG	10-45
	BIO-8c. Obtain Incidental Take Permit(s) if required.	**No, B**ut Hanson and Jerico will verify with CDFG that such permits are not necessary (See Biological Impacts Comments)	Jerico and Hanson are consulting with DFG	

BIO-9: Regular operation of sand mining activities exceed regional thresholds for longfin smelt.	**BIO-9a.** Timing of dredging relative to X2.	**No.** Risk of entrainment in DEIR is highly speculative. (See Biological Impacts Comments)	**NO.** This measure would effectively prohibit operations by Jerico and Hanson on Middle Ground and Suisun Associates for six months of the year if X2 is downstream of these areas for even one day during the water year – which it can be during singular storm events. This would render the project infeasible.	
	BIO-9b. Consult with DFG.	**No** but Hanson and Jerico are consulting with DFG	Jerico and Hanson are consulting with DFG	10-46
	BIO-9c. Obtain Incidental Take Permit(s) if required.	**No** but Hanson and Jerico are consulting with DFG	Jerico and Hanson are consulting with DFG.	
	BIO-9d. Help fund habitat improvements.	**No.** Any requirement to fund habitat modification should be imposed if at all during the incidental take permit process in relation to actual impacts of entrainment if found.	**No.** Outside of the incidental take permit process, there is no relationship to the nature or extent of impact; imposing measure here would violate 14 Cal.Code Regs. § 15041(a).	
BIO-10: Green sturgeon, Chinook salmon, and steelhead trout will be impacted during sand mining.	**BIO-10a.** Sand mining halted during peak Chinook salmon migration. .	**No.** DEIR improperly concludes that measures beyond those required by NMFS Biological Opinion and DFG Consistency Determination are needed. NMFS did not recommend halt of sand mining during Chinook salmon migration. (See Biological Impacts Comments)	**No.** Halting sand mining for two weeks would necessitate layoff of employees and cause significant economic impacts—particularly when demand for sand mining increases to expected economic levels that are reflected in the project proposal.	10-47
	BIO-10b. Sand mining limited to daylight hours from January 1 to May 31	**No.** Risk of entrainment in DEIR is highly speculative. Further, as explained in comments, there is no statistically valid basis for assertion that nighttime dredging causes greater impacts. NMFS did not require this measure as necessary	**No.** Sand mining and delivery of sand to offloading facilities are highly dependant on tides, which are based on roughly 12 hour cycles, with only one tide being high enough to deliver to some offload locations. Limiting sand mining to	

		to minimize impacts. (See Biological Impacts Comments)	daytime hours only would place a huge economic burden on sand mining during this time of year, as it would be virtually impossible to mine during daylight hours and deliver on the high tide on the same day	10-47 cont.
LU-4: Conflicts with regional or local land use plans and policies	MM BIO-6, BIO-8a, BIO-8b, BIO-8c, BIO-9a, BIO-9b, BIO-9c, BIO-9d, BIO-10a, BIO-10b, HAZ-1, AIR-1, AIR-2, CUL-1, CUL-3, and CUL-4.	**No, not all.** For the reasons discussed above, measures MM BIO-6, BIO-8a, BIO-9a, BIO-9d, BIO-10a and BIO-10b are not necessary to reduce a significant environmental impact and, therefore, are not necessary to avoid conflicts with regional or local land use plans and policies.	**No, not all.** For the reasons discussed above, measures MM BIO-6, BIO-8a, BIO-8b, BIO-8c, BIO-9a, BIO-9d, BIO-10a and BIO-10b, are not feasible.	10-48

I-78

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For the reasons outlined in the table, the measures descried as unnecessary, infeasible or both should be eliminated in the EIR.

10-49

Emissions Reductions Due to Project Reduction

2010	Annual Mining Volume (tons)	Annual Emissions (tons/yr)				
		NOx	PM	ROG	CO	CO2
Proposed Project	2754000	123.4	4.5	11.6	36.6	8536.7
Reduced Project	1377000	61.71	2.26	5.78	18.29	4268.36
Reduction Amount	1377000	**61.71**	**2.26**	**5.78**	**18.29**	**4268.36**

Emissions from Increased Trucking

2010	Project Volume (Tons)	Destination	Average distance to destination (miles)	Distance roundtrip to destination (miles)	% of material shipped to terminal	Number of additional trips/year	Number of annual miles driven to and from location (miles)	Emssions due to additional miles driven by heavy duty trucks (tons/yr)				
								NOx	PM	ROG	CO	CO2
Hanson Operations	1175000	Oakland-Tidewater	37	74	49%	23030	1704220	32.57	1.46	2.59	10.19	3588.41
		San Francisco Pier 92	54	108	29%	13630	1472040	28.13	1.26	2.24	8.80	3099.53
		Martinez	46	92	23%	10810	994520	19.01	0.85	1.51	5.94	2094.06
Jerico Operations	202500	Petaluma Yard	108	216	70%	5670	1224720	23.41	1.05	1.86	7.32	2578.77
		Napa Yard	85	170	20%	1620	275400	5.26	0.24	0.42	1.65	579.88
		Collinsville Yard	75	150	10%	810	121500	2.32	0.10	0.18	0.73	255.83
			Total Emissions from Trucking (tons/yr):					**110.70**	**4.97**	**8.81**	**34.62**	**12196.49**

Annual Summary	NOx	PM	ROG	CO	CO2
Annual Emissions from Increased Trucking (tons/yr)	110.70	4.97	8.81	34.62	12196.49
Annual Emissions Reductions due to Project Reductions (tons/yr)	61.71	2.26	5.78	18.29	4268.36
Net Emissions Increase due to increased trucking(tons/yr)	**48.99**	**2.71**	**3.03**	**16.34**	**7928.14**

TRC

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
1-1-06-I-0255

JAN 1 0 2006

Mr. Peter S. Straub
Regulatory Branch (Attn: Philip Shannin)
U.S. Army Corps of Engineers
333 Market Street
San Francisco, California 94105

Subject: Informal Consultation on Sand Mining Activities in the Sacramento-San Joaquin Estuary (Corps file numbers 25041N, 24913N, 25653N, 24996N, 25669N, 27864N, 27865N, 27866N)

Dear Mr. Straub:

This letter is in response to your October 19, 2005, request for the concurrence by the U.S. Fish and Wildlife Service (Service) that all sand mining activities in the Sacramento-San Joaquin Estuary in California (Corps file numbers 25041N, 24913N, 25653N, 24996N, 25669N, 27864N, 27865N, 27866N) are not likely to adversely affect the threatened delta smelt (*Hypomesus transpacificus*) (smelt). Designated critical habitat for this listed species also is found in the action area. This response is in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S. C. 1531 *et seq.*) (Act). Your letter was received in our field office on October 24, 2005.

10-50

Hanson Aggregates (Hanson), Morris Tug and Barge (MTB), Jerico Products, Inc.(Jerico), and RMC/CEMEX Pacific Materials, Inc.(RMC) intend to perform sand mining activities in Central San Francisco Bay (Central Bay), the Carquinez Strait, and Suisun Bay. The specific locations within these water bodies where sand mining can occur and the amount authorized to be harvested is authorized by the California State Lands Commission (SLC), the Bay Conservation and Development Commission (BCDC), and the U.S. Army Corps of Engineers (Corps) under Corps permit number 25669S. Additionally, Hanson and Jerico can mine up to 100,000 cy/yr in Suisun Bay under Corps permit number 25041N.

In October 2004, Hanson Environmental completed a report that synthesized available scientific information regarding the effects of sand mining in San Francisco Bay entitled Assessment & Evaluation of the Effects of Sand Mining on Aquatic Habitat and Fishery Populations of Central

TAKE PRIDE IN AMERICA

San Francisco Bay and the Sacramento-San Joaquin Estuary. This report described sand mining methods and current avoidance measures to avoid effects to fish and other aquatic species.

/In San Francisco Bay near Alcatraz, Hanson can mine up to 600,000 cubic yards per year (cy/yr) under Corps permit number 24305S, 150,000 cy/yr under Corps permit number 23573S, 300,000 cy/yr under Corps permit number 24441N, 400,000 cy/yr under Corps permit number 24997N, and RMC can mine up to 50,000 cy/yr under Corps permit number 25669S. In Carquinez Straits, RMC can mine up to 50,000 cy/yr under Corps permit number 25669S. In Suisun Bay, Hanson can mine up to 550,000 cy/yr under Corps permit numbers 25653N and 24996N, RMC can mine up to 250,000 cy/yr under Corps permit number 25669S and Jerico can mine up to 200,000 cy/yr Areas where sand mining occurs in the bay are typically at depths of 30 to 90 feet in the Central Bay and 15 to 45 feet in Carquinez Strait and Suisun Bay. Sand deposits in these areas have a low percentage of silts and clays and frequently are associated with dynamic bed forms, such as sand waves.

There are three general methods of hydraulic sand mining: trolling, stationary potholing, and moving potholing. Trolling involves mining while moving over a site, generally working back and forth along parallel pathways between markers. Stationary potholing involves an initial search for an appropriate sand source, followed by "stationary" mining of sand at a site. These types of operations may involve mining more than one specific location during a mining event, and may involve some movement within a general site. Moving potholing is similar to stationary potholing, in that it involves mining in a "stationary" position when an appropriate sand source is found, but also involves mining while moving in search of another appropriate stationary source. 10-50 cont.

RMC/CEMEX generally uses the stationary pothole method, MTB/Jerico generally use both stationary potholing and trolling methods, and Hanson uses a moving pothole method. The mechanical fundamentals of sand mining are similar for all three of these methods. Tugboats are used to position and maneuver hopper barges, which are equipped with hydraulic (pumping) suction systems for sand mining. The hydraulic suction system consists of a "drag arm" suction pipe equipped with a suction drag head, generally mounted on the side of the barge and connected to large pumps installed in the barge. The drag head is generally fitted with a "grizzly" screen to prevent oversized material from entering the suction pipe.

During a typical mining event, the drag head is lowered with winches to the substrate surface. Water is drawn into the drag head by the hydraulic suction pump from around the sides of the drag head. Water entrained into the drag head creates the sand-water slurry that allows the sand to be suspended and pumped into the hopper barge. As a result of the need to create the sand-water slurry, the drag head cannot be completely buried in the sand substrate, but is typically buried approximately 12-18 inches into the bottom substrate. This allows the drag head to continually draw water into the drag head while maintaining sufficient suction to mobilize and transport suspended sand. As the sand is withdrawn from an area, the entire drag head assembly is lowered to maintain contact with the substrate.

During sand mining using all three methods, water is forced under pressure through a series of jets (cutter jets) in the drag head, with the jets directed at the substrate. These jets cut into the substrate, helping suspend sediment in a sand-water slurry. The proportion of sand to water in the slurry may vary, depending on equipment and the quality of sand being mined. As sand is mined, the drag head is lowered and/or moved to maintain its position just within the substrate.

Once the sand-water slurry is pumped to the barge, it is discharged into a long loading chute, running lengthwise along the centerline of the barge. This chute has hydraulically controlled screened openings (gates) at intervals along its bottom, and the sand-water slurry flows through these gates into the barge. Some of the slurry, including aggregate and shells larger than the openings in the screens, is discharged overboard. The hopper barges currently used in sand mining in the Bay-Delta estuary have screened overflow outlets. Water displaced by accumulating sand within the hopper barge, in addition to fine grained sediments and other material, returns to the receiving waters through surface discharges or overflow weirs or through subsurface discharges. Cargo hoppers are also fitted with fine mesh screens along the bottom centerline of the barge where water that has filtered through the sand is also collected and pumped overboard. This discharge may contain aggregates, fine sediments, aeration bubbles, and plankton, and a visible plume is sometimes created around the barge.

Hopper barges operated by Hanson and RMC/CEMEX have been modified to include subsurface discharge pipes to release the overflow below the water line. Modifications to these barges to include the subsurface discharge of the overflow plume were intended to help reduce the visibility of the overflow plume and increase the rate of turbulent mixing and dissipation of the overflow plume. The effectiveness of these modifications in reducing overflow plume size or increasing the rate of plume dissipation has not, however, been evaluated. 10-50 cont.

Sand mining events typically last between 3 and 5.5 hour, during which time approximately 1,500 to 2,500 cy of sand is harvested. Once the barge is loaded, it travels to an upland offloading location. Depending on the mining and offloading locations, the entire operation – including loading, unloading and travel time – can take anywhere from 8 to 24 hours. Under these circumstances, from an operational perspective, the greatest frequency that the same mining vessel would disturb any single area is two times in any 24-hour period. Tidal conditions may further reduce the frequency of sand mining operations and disturbance of the sand shoals (for example, the onset of low tide at the time a barge is available to return to the sand shoal could delay the sand mining activity). The relatively short duration of sand mining events serves to reduce the duration of potential exposure of aquatic organisms to the overflow plume and the potential for adverse impacts to aquatic organisms.

Since sand mining activity occurs predominately in high-velocity subtidal areas, sand substrate in the areas where mining occurs is characterized predominantly by low percent fines (less than 10%) which reduce the potential for resuspension of chemical contaminants and the exposure of aquatic organisms within the area to potential impacts resulting from toxicity. As a result of the dynamic nature of water current velocities and sediment movement within subtidal areas of the

Bay-Delta estuary, naturally occurring patterns of sediment accretions and depletions limit the stability of subtidal habitat within high energy areas where much of the sand mining activity occurs.

There are physical limitations imposed by the draft of the tug and barge, in combination with the provisions of applicable permits, which prohibit mining in water depths less than 30 feet mean lower low water (MLLW) and/or restrict mining within 200 feet of any shoreline or within 250 feet of any water four feet or less at MLLW to avoid potential adverse impacts of sand mining activity on shallow-water habitat (SWH). SWH is used as foraging and nursery areas for a variety of juvenile fish, and hence restricting the minimum depth where sand mining can occur avoids potential disturbance and impacts to these habitat areas.

A number of avoidance measures are proposed by the sand mining operators to reduce effects to the environment. The following measures are included as part of the proposed action:

1. Turbidity Reduction During Mining: Several of the hopper barges presently engaged in sand mining activity within the Bay-Delta estuary have been modified to include subsurface discharges of the overflow plume. As part of ongoing activities Sand Miners routinely compile and review information being developed by the marine mining industry and other investigators on modifications to marine mining equipment techniques designed to minimize the potential effects of overflow plume exposure on listed fish and EFH, macroinvertebrates, birds, mammals, and the visual aesthetics of the plume. 10-50 cont.

2. Limited Volume Per Year: Existing State and Federal permits regulate the annual volume of sand that can be harvested from each lease area within the estuary. These limits serve to reduce the potential risk of adverse effects of sand mining on subtidal habitat and aquatic resources.

3. Water Depth Limitation to Avoid Sensitive Habitat: In Central Bay, sand mining typically occurs in relatively deep water (from 30 to 90 feet deep). Within the region of Middle Ground Shoal and Suisun Bay, sand mining typically occurs in waters 15 to 45 feet deep. Due to equipment constraints, such as the barge and tug draft and the suction drag head minimum operation depth (due to pipe length and angle during operation), sand mining cannot occur in shallow-water areas. For instance, Hanson cannot practically mine in areas with less than 20 feet of water or in areas with depths greater than approximately 80 feet of water. Morris Tug & Barge and Jerico do not mine in areas less than 15 feet of water or greater than 40 feet of water. RMC/CEMEX cannot mine in areas less than 20 feet of water or greater than 90 feet of water. In addition to equipment constraints, all recently issued Corps mining permits prohibit sand mining within 200 feet of any shoreline. The permits also prohibit sand mining within 250 feet of any water having a depth of 9 feet or less (MLLW), or 30 feet (MLLW), depending on location within the estuary.

3. Limited Mining Areas: Sand mining is restricted to specific SLC designated lease areas. Mining is not permitted outside of the lease areas. These lease areas, and specific locations within the lease areas where sand deposits occur and mining activity is most frequent, are characterized by relatively high river and tidal current velocities, are areas of sediment (sand) accumulations, have a low percentage of fine sediments, and are dynamic areas with frequent natural disturbance as evidenced by the presence of sand wave formations. Miners are required by current permits to monitor and track specific mining locations. These actions serve to reduce and avoid the risk of mining in sensitive subtidal habitat located outside of the designated lease areas.

4. Monitoring Actual Mining Locations: Current sand mining permits require detailed tracking and accounting of the specific locations of each mining event. Results of the tracking are submitted to BCDC quarterly in compliance with permit requirements. Beginning in 2004, Hanson improved the on-board capability of the tugboat operators to more closely track the mining events. The mining track line is mapped by GPS on to the map of the lease area being mined. A nuclear device signals the tracking device whether or not sand is actually being mined. If the suction head is off the bottom while the dredge is moving to another location, the track line indicates that mining and any disturbance of the benthic environment has ceased. RMC/CEMEX and MTB also track and report mining locations. Tracking mining locations serves to ensure that mining occurs only within designated lease areas and that mining avoids sensitive subtidal habitat located outside of a lease area. Tracking individual mining events also improves the basis for evaluating patterns and trends in the distribution of sand mining activity relative to physical features within the estuary, such as water velocities and dynamic bed features (e.g., sand waves), and to also evaluate the distribution of sand mining with respect to fishery habitat conditions within various portions of the estuary. 10-50 cont.

5. Sand Replenishment Monitoring: Sand replenishment monitoring is an ongoing joint study with the Marine Industry and all the State and Federal resource and regulatory agencies. Sand mining has the potential to deplete sand deposits within areas of the Bay-Delta estuary if the rate of sand accretion (recruitment) is less than the rate of sand harvest. Depletion of sand from an area contributes to increased water depth and could alter localized current patterns and water velocities within an area that result in direct and indirect changes to subtidal benthic habitat for EFH fish species. Bathymetric surveys have been conducted in compliance with sand mining permit requirements within Central Bay and Suisun Bay. These bathymetric surveys are intended to provide comparative information on specific locations within the Bay-Delta estuary where results of surveys conducted approximately twice per year have been used to estimate sediment accretion or depletion (e.g., increases or decreases in water depths) on a regional (lease area) geographic scale.

Results of bathymetric monitoring to date have shown a variable pattern is sediment accretions and depletions within and among lease areas with no evidence of a long-term trend in sediment depletions that would adversely affect habitat for EFH fish species. The bathymetric monitoring is proposed to continue as a routine element of monitoring potential effects of sand mining within the estuary.

As part of the proposed project, the Sand Miners and agencies will continue to review the existing survey program and new information and to develop recommendations regarding further investigations and refinements with respect to quality control/quality assurance, determination of the accuracy of the survey results, and modifications of survey design and protocols. Reference sites have already been identified within various regions of the estuary where sand mining does not occur for use in comparing and evaluating results of the bathymetric surveys.

The Service concurs with your determination that all sand mining activities in Sacramento-San Joaquin Estuary are not likely to adversely affect the threatened delta smelt. We also have determined that the proposed actions are not likely to result in adverse modification or destruction of the designated critical habitat for this listed species. We base our concurrence and determination on designated critical habitat on the information that that the SWH for smelt will not be affected since sand mining will take place in waters that are deeper than 20 feet deep and are not within 200 feet of any shoreline or 250 feet of any water less than 4 feet deep. In addition, sand mining methods such as lowering the drag head into the substrate before it is turned on and keeping the drag head buried likely will not result in entrainment of delta smelt. Since the fine sediment plume is intermittent and is likely to extend over only a portion of the channel it is not likely to create a barrier to fish migration. Therefore, unless new information reveals effects of the project that may affect federally listed species or critical habitat in a manner not identified to date, the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this review, or if a new species is listed or critical habitat is designated that may be affected by the proposed action, no further action pursuant to the Act is necessary.

10-50 cont.

Please contact Ryan Olah of my staff at (916) 414-6625, if you have questions regarding this response on sand mining activities in the Sacramento-San Joaquin Estuary.

Sincerely,

Chris Nagano

Chris Nagano
Deputy Assistant Field Supervisor

cc:
NMFS, Santa Rosa, California

US FWSO Fax:916-414-6712 Feb 8 2006 7:57 P.07

TRC

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September 16, 2010

Mr. Lee Cover
Environmental Manager
Lehigh Hanson West Region
12667 Alcosta Blvd., Suite 400
San Ramon, CA 94583

Subject: TRC's review of the Air Quality Section of the SLC Draft EIR for Lehigh Hanson's San Francisco Bay and Delta Sand Mining Lease Renewal.

Dear Lee,

TRC Solutions Inc. (TRC) was requested by Hanson Aggregates West Region to provide a 3rd party review of the States Land Commission (SLC) Draft EIR for the San Francisco Bay and Delta Sand Mining Lease renewal (July 2010) specific to the Air Quality Section found in this document. Our review findings are summarized and provided in the attached report.

Please let me know if you have any questions regarding our findings.

Sincerely,

Douglas G. Wolf.
Accredited ARB Lead GHG Verifier
Senior Project Engineer/Program Manager
dwolf@trcsolutions.com
direct: 925-688-2491
cell: 925-788-4331

TRC

Executive Summary

The States Land Commission (SLC) prepared a Draft EIR for the San Francisco Bay and Delta Sand Mining lease renewal in July 2010. The Draft EIR addresses mining activities on parcels within the Central Bay, Middle Ground Shoal, and area north of the federal navigation channels of the Western Delta as well as offloading of mined materials at several facilities around the Bay and Delta ("Project"). The new 10 year lease period is valid through 2018. For the purpose of this evaluation the Project's annual mining volume will increase from its base year (1,245,318 yd^3 – 2007) to 2,040,000 yd^3. The Draft EIR assessed emissions associated with this increase in mining volume and recommended implementation of two mitigation measures to reduce potential air quality impacts. TRC reviewed the SLC assessment and has provided comments on the following technical areas:

- Applicability of CEQA Guidelines with respect to CO_2 impacts
- CO_2 Emission Factor Accuracy
- NO_x Tier 2 Emission Factor Accuracy
- Greenhouse Gas Assessment completeness

TRC has identified several areas where emissions have been overestimated resulting in an overly conservative statement of the project impacts. TRC has provided a re-calculation of the emissions used, and has reflected the approximate reduction in the Project's overall emission contribution.

Introduction

The States Land Commission (SLC) has prepared a Draft EIR for the San Francisco Bay and Delta Sand Mining Lease renewal (July 2010). The Draft EIR addresses mining activities on parcels within the Central Bay, Middle Ground Shoal, and area north of the federal navigation channels of the Western Delta as well as offloading of mined materials at several facilities around the Bay and Delta ("Project").

TRC Solutions Inc. was requested by Hanson Aggregates West Region to assist in a third-party review of the draft EIR with emphasis on the Air Quality section (Section 4.5). The draft EIR provides for a new 10 year lease period ending 2018. During this period the Project results in increases of air emissions due to renewal of current lease and increases in mining volume (1,245,318 yd^3 mining volume during base year 2007 increased to 2,040,000 yd^3 annually). Key assumptions and findings of the Air Quality section of the SLC Draft EIR assessment are summarized below. 10-51

- Proposed mining volume will increase to an estimated 2,040,000 yd^3 per year from 2007 baseline of 1,245,318 yd^3 per year.
- A single mining event is approximately 2,000 yd^3 resulting in a net increase of 400 mining events per year from the baseline.

- Each mining event was assumed to occur over a 4 – 12 hour period and result in offloading emissions.
- BAAQMD threshold of significance in effect at the time of the NOP was 15 tons/year per criteria pollutant (i.e., NO_x, PM, ROG, CO) exclusive of CO_2. Any increase in GHG emissions (CO_2) above baseline would be considered significant. 10-51 cont.
- Only NO_x and CO_2 emissions associated with the Project in 2010 resulted in a finding of significance resulting in MM Air-1 and MM Air -2.
- Implementation of mitigation measures (MM) would reduce potential significant impacts to regional air quality and the Project's contribution to global warming to less than significant.

Findings

1. Applicability of CEQA Guidelines

The SLC Draft EIR states (pg 4.5– 15 lines 15 – 17) that their assessment of significance relied on the BAAQMD policy that the specific significant thresholds published in the *CEQA Guidelines* at the time when a project NOP is published. The NOP for this project was published on July 10, 2007; therefore the SLC applied the BAAQMD's *CEQA Guidelines* (1999) for this impact analysis. SLC correctly assessed NO_x emissions and their impacts against the 15 ton/yr threshold that was identified in the 1999 *CEQA Guidelines* (Table 3), but then they deviated from the 1999 *CEQA Guidelines* for CO_2 in stating that any increase in GHG emissions above the baseline would have a significant impact on climate change. CO_2 emissions and climate change were not addressed in the 1999 *CEQA Guidelines*. The 2010 *CEQA Guidelines* established significance thresholds for greenhouse gases. Even though the BAAQMD 1999 CEQA Guidelines do not cover potential greenhouse gas emissions, the inclusion of GHG emissions in the impacts analysis is appropriate under CEQA. 10-52

2. CO2 Emission Factor Accuracy

The SLC Draft EIR cites in Tables D3, D6, and D9 that the emission factors used to calculate CO_2 emission rates were derived from the CEQA distributed software; OFFROAD2007 and represent emission factors for diesel fueled engines. In Tables D3, D6, and D9 the Draft EIR lists **586.3 g/bhp-hr** as the CO_2 emission factor for the diesel powered sources. This value is in disagreement with the emission factor **568.3 g/bhp-hr** derived by TRC using OFFROAD2007 (see Appendix 1). The correction of this emission factor would yield approximately a 3.1% reduction in the Project's CO_2 emission rates. The Load Factors and Emission factors used for the remaining criteria pollutants were verified with the Draft EIR's cited source (Tables D3, D6, and D9): Appendix B – Emissions Estimation Methodology for Commercial Harbor Craft Operating in California. 10-53

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3. NOx Tier 2 Emission Factor Accuracy

A portion of the future NO_x emissions appears to be overestimated. The NO_x emission factor of 7.8 g/kW-hr used in the 2011 and 2018 emission rate calculation for engines upgraded to meet Tier II Emission standards is incorrect. The USEPA's definition of Tier II standards for Category 2 engines lists 7.8 g/kW-hr (5.8 g/bhp-hr) as the emission factor for NO_x + Hydrocarbons (ROGs) (See Appendix 2). The NO_x emission contribution can be estimated by subtracting the ROG portion of the factor. For example in 2011, after the Hanson TS & G Barge – Main Engine has been upgraded to meet Tier II standards the corrected NO_x emission factor would be: 10-54

$$NOx\ emission\ factor - ROG\ emission\ factor = 5.8\frac{g}{bhp \cdot hr} - 0.95\frac{g}{bhp \cdot h} = \mathbf{4.85}\frac{g}{bhp \cdot h}$$

In this case the adjusted emission factor would result in a **16.4% reduction** in NO_x emissions from the Hanson TS & G Barge – Main Engine after the upgrade to Tier II standards. The degree of reduction will vary engine to engine depending upon the ROG emission factor that was obtained from Appendix B. This adjustment will have a more significant impact upon the 2018 estimates when a majority of the engines have been upgraded. Overall the NOx emission inventory would be reduced in future years, 2011 and 2018.

4. Incomplete Greenhouse Gas assessment

Combustion by-product gases other than CO_2 (i.e., CH_4, N_2O) contribute to climate change. These GHG were not included in the SLC Draft EIR. CH_4 and N_2O are emitted in lesser quantities but have greater warming potential. Table 1 shows the CO_2 equivalent values for CH_4 and N_2O emissions. CO_2 equivalency is used to normalize the total GHG contribution. Accounting for CH_4 and N_2O would add approximately 0.6% to the CO_2 total. 10-55

Table 1.

Greenhouse Gas	Warming potential	Relative Emissions (g/g CO_2 emitted)	CO_2 equivalence
CO_2	1	1	1
CH_4	21	0.000138	0.002898
N_20	310	0.00000985	0.0030535

5. Footnote (c) in Tables D6 and D9

Footnote (c) in Tables D6 and D9 states that all Jerico engines would meet the USEPA Tier 2 NO_x standard of 5.8 g/bhp-hr by 2010. This footnote does not agree with the engine upgrade schedule in the Draft EIR and the NO_x emission factors listed for Jerico engines in Tables D6 and D9. Therefore, footnote (c) should be removed from Tables D6 and D9. 10-56

TRC

6. Jerico Dredge Barge Generator NO_x Emission Factor

According to Table 4.5-6. in the SLC Draft EIR, the Jerico Dredge Barge Generator is currently a Tier II engine. The emission factor is currently listed as 6.93 g/bhp-hr, which is not consistent with NO_x Tier II emissions standards. The emission factor should be 4.62 g/bhp-hr which is consistent with the Tier II NO_x emission standard cited in TRC's Comment 3 - *NO_x Tier 2 Emission Factor Accuracy.* 10-57

7. Table 4.5 – 1

The column titled "Standard" in Table 4.5 – 1 - *San Francisco Bay Area Air Basin Ambient Air Quality Summary (2006 – 2008)* is not properly formatted. The values listed in the Standard column do not correlate to the proper pollutant standards listed in the column labeled "Pollutant". 10-58

TRC

Appendix 1 – OFFROAD 2007 Data Set 10-59

TRC

EMFAC.DAT
OFMC, ATV, snowmobiles Exhaust = 0

The file contains engine exhaust, start, and equipment specific emission factors.

The deterioration rates have been revised. The methodology reflects
cumulative hours of use as opposed to percent useful life consumed.
Therefore, the DR units are G/bhp-hr^2

The REC_EXH packet contains equipment specific emission factors which overwrite the default engine specific emission factors.

File History:
ENGINE_EXH
10/03/06: Deleted SO2 data because SO2 emission factor calculation hardcoded based on ppm S and equipment BSFC.
3/28/06: Moved nonhandheld nonpreempt emission factors from /REC-EXH/ to /EXHAUST/.
2/1/05: Updated to reflect diesel teir 4 standards (HC).
6/17/05: Updated to reflect diesel teir 4 standards (NOx&PM) and new 1000 hp bin.
03Jun04: Updated to include Daisy's corrections.
5/23/00 Updated lsi and sore emission rate (WSW)
3/00 PWC rec-exh emission factors in G/bhp-hr
2/00 This file reflects the adopted sore, lsi, ci, boat and the latest recveh data.

EQUIP_EXH
10/24/06 added inactive OFRM, ATV, snowmobiles
04/20/06 reflected USEPA capping standard for snowmobiles
04/17/06 updated OFMC G4 based cert data for controlled engines
04/12/06 removed nonhandheld, nonpreempt and non-lawn mower equipment...these emission factor represented in the
03/27/06 changed negative deterioration rate for golf carts and specialty vehicles to absolute value.
10/24/05 Modified so that all diesel emission factors represent THC emissions. Per Paul Allen TOG/THC is 1.437516.
05/05/04 Added CO2 values for equipment specific. Rec Veh (ATV and motorcylce are in g/mi.)

STARTS
Emissions factors are given for each engine type and fuel type. Units are grams/start.
Extraneous records deleted.

GASCANS

The following list is for exhaust emissions. Emissions factors are given
for each engine type and fuel type.

The format is as follows:

Fuel	HP	Year	CO2zh	CO2dr	CO2units
/ENGINE_EXH/					
D	15	1994	568.3	0.00E+00	G/HP-HR

10-59 cont.

D	15	1999	568.3	0.00E+00	G/HP-HR
D	15	2004	568.3	0.00E+00	G/HP-HR
D	15	2007	568.3	0.00E+00	G/HP-HR
D	15	2040	568.3	0.00E+00	G/HP-HR
D	25	1994	568.3	0.00E+00	G/HP-HR
D	25	1999	568.3	0.00E+00	G/HP-HR
D	25	2004	568.3	0.00E+00	G/HP-HR
D	25	2007	568.3	0.00E+00	G/HP-HR
D	25	2040	568.3	0.00E+00	G/HP-HR
D	50	1987	568.3	0.00E+00	G/HP-HR
D	50	1998	568.3	0.00E+00	G/HP-HR
D	50	2003	568.3	0.00E+00	G/HP-HR
D	50	2004	568.3	0.00E+00	G/HP-HR
D	50	2005	568.3	0.00E+00	G/HP-HR
D	50	2007	568.3	0.00E+00	G/HP-HR
D	50	2012	568.3	0.00E+00	G/HP-HR
D	50	2040	568.3	0.00E+00	G/HP-HR
D	120	1987	568.3	0.00E+00	G/HP-HR
D	120	1997	568.3	0.00E+00	G/HP-HR
D	120	2003	568.3	0.00E+00	G/HP-HR
D	120	2004	568.3	0.00E+00	G/HP-HR
D	120	2005	568.3	0.00E+00	G/HP-HR
D	120	2007	568.3	0.00E+00	G/HP-HR
D	120	2011	568.3	0.00E+00	G/HP-HR
D	120	2012	568.3	0.00E+00	G/HP-HR
D	120	2014	568.3	0.00E+00	G/HP-HR
D	120	2040	568.3	0.00E+00	G/HP-HR
D	175	1969	568.3	0.00E+00	G/HP-HR
D	175	1971	568.3	0.00E+00	G/HP-HR
D	175	1979	568.3	0.00E+00	G/HP-HR
D	175	1984	568.3	0.00E+00	G/HP-HR
D	175	1987	568.3	0.00E+00	G/HP-HR
D	175	1996	568.3	0.00E+00	G/HP-HR
D	175	2002	568.3	0.00E+00	G/HP-HR
D	175	2003	568.3	0.00E+00	G/HP-HR
D	175	2004	568.3	0.00E+00	G/HP-HR
D	175	2006	568.3	0.00E+00	G/HP-HR
D	175	2011	568.3	0.00E+00	G/HP-HR
D	175	2014	568.3	0.00E+00	G/HP-HR
D	175	2040	568.3	0.00E+00	G/HP-HR
D	250	1969	568.3	0.00E+00	G/HP-HR
D	250	1971	568.3	0.00E+00	G/HP-HR
D	250	1979	568.3	0.00E+00	G/HP-HR
D	250	1984	568.3	0.00E+00	G/HP-HR
D	250	1987	568.3	0.00E+00	G/HP-HR
D	250	1995	568.3	0.00E+00	G/HP-HR
D	250	2002	568.3	0.00E+00	G/HP-HR

10-59 cont.

D	250	2003	568.3	0.00E+00	G/HP-HR
D	250	2004	568.3	0.00E+00	G/HP-HR
D	250	2006	568.3	0.00E+00	G/HP-HR
D	250	2010	568.3	0.00E+00	G/HP-HR
D	250	2013	568.3	0.00E+00	G/HP-HR
D	250	2040	568.3	0.00E+00	G/HP-HR
D	500	1969	568.3	0.00E+00	G/HP-HR
D	500	1971	568.3	0.00E+00	G/HP-HR
D	500	1979	568.3	0.00E+00	G/HP-HR
D	500	1984	568.3	0.00E+00	G/HP-HR
D	500	1987	568.3	0.00E+00	G/HP-HR
D	500	1995	568.3	0.00E+00	G/HP-HR
D	500	2000	568.3	0.00E+00	G/HP-HR
D	500	2001	568.3	0.00E+00	G/HP-HR
D	500	2002	568.3	0.00E+00	G/HP-HR
D	500	2004	568.3	0.00E+00	G/HP-HR
D	500	2005	568.3	0.00E+00	G/HP-HR
D	500	2010	568.3	0.00E+00	G/HP-HR
D	500	2013	568.3	0.00E+00	G/HP-HR
D	500	2040	568.3	0.00E+00	G/HP-HR
D	750	1969	568.3	0.00E+00	G/HP-HR
D	750	1971	568.3	0.00E+00	G/HP-HR
D	750	1979	568.3	0.00E+00	G/HP-HR
D	750	1984	568.3	0.00E+00	G/HP-HR
D	750	1987	568.3	0.00E+00	G/HP-HR
D	750	1995	568.3	0.00E+00	G/HP-HR
D	750	2001	568.3	0.00E+00	G/HP-HR
D	750	2002	568.3	0.00E+00	G/HP-HR
D	750	2003	568.3	0.00E+00	G/HP-HR
D	750	2005	568.3	0.00E+00	G/HP-HR
D	750	2010	568.3	0.00E+00	G/HP-HR
D	750	2013	568.3	0.00E+00	G/HP-HR
D	750	2040	568.3	0.00E+00	G/HP-HR
D	1000	1969	568.3	0.00E+00	G/HP-HR
D	1000	1971	568.3	0.00E+00	G/HP-HR
D	1000	1979	568.3	0.00E+00	G/HP-HR
D	1000	1984	568.3	0.00E+00	G/HP-HR
D	1000	1987	568.3	0.00E+00	G/HP-HR
D	1000	1999	568.3	0.00E+00	G/HP-HR
D	1000	2005	568.3	0.00E+00	G/HP-HR
D	1000	2006	568.3	0.00E+00	G/HP-HR
D	1000	2007	568.3	0.00E+00	G/HP-HR
D	1000	2009	568.3	0.00E+00	G/HP-HR
D	1000	2010	568.3	0.00E+00	G/HP-HR
D	1000	2014	568.3	0.00E+00	G/HP-HR
D	1000	2040	568.3	0.00E+00	G/HP-HR
D	9999	1969	568.3	0.00E+00	G/HP-HR

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cont.

D	9999	1971	568.3	0.00E+00 G/HP-HR				
D	9999	1979	568.3	0.00E+00 G/HP-HR				
D	9999	1984	568.3	0.00E+00 G/HP-HR				
D	9999	1987	568.3	0.00E+00 G/HP-HR				
D	9999	1999	568.3	0.00E+00 G/HP-HR				
D	9999	2005	568.3	0.00E+00 G/HP-HR				
D	9999	2006	568.3	0.00E+00 G/HP-HR				
D	9999	2007	568.3	0.00E+00 G/HP-HR				
D	9999	2009	568.3	0.00E+00 G/HP-HR				
D	9999	2010	568.3	0.00E+00 G/HP-HR				
D	9999	2014	568.3	0.00E+00 G/HP-HR				
D	9999	2040	568.3	0.00E+00 G/HP-HR				
C4	15	1994	3.96	4.20E-03 G/HP-HR	240	1.44E-02 G/HP-HR	1.77	4.48E-04
C4	15	1998	1.56	4.20E-03 G/HP-HR	300	1.44E-02 G/HP-HR	8.44	4.48E-04
C4	15	2040	0.5	4.20E-03 G/HP-HR	100	1.44E-02 G/HP-HR	2.7	4.48E-04
C4	25	1994	3.96	4.12E-03 G/HP-HR	240	1.42E-02 G/HP-HR	1.77	4.41E-04
C4	25	1998	1.56	4.12E-03 G/HP-HR	300	1.42E-02 G/HP-HR	8.44	4.41E-04
C4	25	2040	0.5	4.12E-03 G/HP-HR	100	1.42E-02 G/HP-HR	2.7	4.41E-04
C4	50	1983	1.38	1.51E-04 G/HP-HR	7.02	4.75E-04 G/HP-HR	13	6.62E-05
C4	50	2000	1.38	1.51E-04 G/HP-HR	7.02	4.75E-04 G/HP-HR	13	6.62E-05
C4	50	2001	1.16	1.59E-04 G/HP-HR	7.02	4.75E-04 G/HP-HR	10.4	1.56E-04
C4	50	2002	0.93	1.66E-04 G/HP-HR	7.02	4.75E-04 G/HP-HR	7.79	2.45E-04
C4	50	2003	0.71	1.74E-04 G/HP-HR	7.02	4.75E-04 G/HP-HR	5.19	3.35E-04
C4	50	2006	0.14	1.06E-04 G/HP-HR	7.02	4.75E-04 G/HP-HR	1.95	2.76E-04
C4	50	2040	0.14	7.24E-05 G/HP-HR	7.02	4.75E-04 G/HP-HR	1.95	1.10E-04
C4	120	1983	1.55	1.69E-04 G/HP-HR	19.72	1.34E-03 G/HP-HR	10.53	5.33E-05
C4	120	2000	1.55	1.69E-04 G/HP-HR	19.72	1.34E-03 G/HP-HR	10.53	5.33E-05
C4	120	2001	1.28	1.72E-04 G/HP-HR	19.72	1.34E-03 G/HP-HR	8.54	1.46E-04
C4	120	2002	1.02	1.75E-04 G/HP-HR	19.72	1.34E-03 G/HP-HR	6.56	2.39E-04
C4	120	2003	0.75	1.78E-04 G/HP-HR	19.72	1.34E-03 G/HP-HR	4.57	3.31E-04
C4	120	2006	0.16	1.03E-04 G/HP-HR	19.72	1.34E-03 G/HP-HR	1.58	3.50E-04
C4	120	2040	0.16	6.90E-05 G/HP-HR	19.72	1.34E-03 G/HP-HR	1.58	1.84E-04
C4	175	1983	1.38	3.53E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	10.51	1.04E-04
C4	175	2000	1.38	3.53E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	10.51	1.04E-04
C4	175	2001	1.16	3.55E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	8.53	9.08E-05
C4	175	2002	0.94	3.57E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	6.54	7.77E-05
C4	175	2003	0.71	3.58E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	4.56	6.45E-05
C4	175	2006	0.14	1.06E-04 G/HP-HR	16.47	8.62E-04 G/HP-HR	1.58	2.64E-04
C4	175	2040	0.14	3.60E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	1.58	5.13E-05
C4	250	1983	1.38	3.53E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	10.51	1.04E-04
C4	250	2000	1.38	3.53E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	10.51	1.04E-04
C4	250	2001	1.16	3.55E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	8.53	9.08E-05
C4	250	2002	0.94	3.57E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	6.54	7.77E-05
C4	250	2003	0.71	3.58E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	4.56	6.45E-05
C4	250	2006	0.14	1.06E-04 G/HP-HR	16.47	8.62E-04 G/HP-HR	1.58	2.64E-04
C4	250	2040	0.14	3.60E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	1.58	5.13E-05
C4	500	1983	1.38	3.53E-05 G/HP-HR	16.47	8.62E-04 G/HP-HR	10.51	1.04E-04

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C4	500	2000	1.38	3.53E-05	G/HP-HR	16.47	8.62E-04	G/HP-HR	10.51	1.04E-04	
C4	500	2001	1.16	3.55E-05	G/HP-HR	16.47	8.62E-04	G/HP-HR	8.53	9.08E-05	
C4	500	2002	0.94	3.57E-05	G/HP-HR	16.47	8.62E-04	G/HP-HR	6.54	7.77E-05	
C4	500	2003	0.71	3.58E-05	G/HP-HR	16.47	8.62E-04	G/HP-HR	4.56	6.45E-05	
C4	500	2007	0.14	1.06E-04	G/HP-HR	16.47	8.62E-04	G/HP-HR	1.58	2.64E-04	
C4	500	2040	0.14	3.60E-05	G/HP-HR	16.47	8.62E-04	G/HP-HR	1.58	5.13E-05	
G2	2	1994	284.27	0.00E+00	G/HP-HR	842.73	0.00E+00	G/HP-HR	0.96	0.00E+00	
G2	2	1996	7.28	5.65E-02	G/HP-HR	272.56	-6.70E-02	G/HP-HR	2.32	3.10E-03	
G2	2	2001	7.28	5.65E-02	G/HP-HR	317.99	-6.70E-02	G/HP-HR	2.32	3.10E-03	
G2	2	2006	6	1.44E-02	G/HP-HR	235.77	-3.85E-01	G/HP-HR	2.7	6.49E-03	
G2	2	2040	3.66	1.82E-02	G/HP-HR	235.77	-3.85E-01	G/HP-HR	0.86	4.96E-03	
G2	15	1994	208	0.00E+00	G/HP-HR	486	0.00E+00	G/HP-HR	0.29	0.00E+00	
G2	15	1995	4.56	2.07E-02	G/HP-HR	234.54	8.95E-02	G/HP-HR	2.84	0.00E+00	
G2	15	2001	4.56	2.07E-02	G/HP-HR	273.63	8.95E-02	G/HP-HR	2.84	0.00E+00	
G2	15	2007	3.9	4.69E-03	G/HP-HR	224.66	0.00E+00	G/HP-HR	2.9	3.47E-03	
G2	15	2040	2.51	3.88E-03	G/HP-HR	224.66	0.00E+00	G/HP-HR	1.86	2.64E-03	
G2	25	1994	208	0.00E+00	G/HP-HR	486	0.00E+00	G/HP-HR	0.29	0.00E+00	
G2	25	1995	4.42	1.66E-02	G/HP-HR	243.17	3.45E-02	G/HP-HR	2.32	0.00E+00	
G2	25	2001	4.42	1.66E-02	G/HP-HR	283.69	3.45E-02	G/HP-HR	2.32	0.00E+00	
G2	25	2007	4.12	4.95E-03	G/HP-HR	238.46	0.00E+00	G/HP-HR	2.68	3.21E-03	
G2	25	2040	2.64	3.36E-03	G/HP-HR	238.46	0.00E+00	G/HP-HR	1.71	3.24E-03	
G4	5	1994	26.44	9.48E-02	G/HP-HR	504.25	5.20E-01	G/HP-HR	2.12	2.39E-04	
G4	5	1995	7.28	5.65E-02	G/HP-HR	272.56	-6.70E-02	G/HP-HR	2.32	3.10E-03	10-59
G4	5	2001	7.28	5.65E-02	G/HP-HR	317.99	-6.70E-02	G/HP-HR	2.32	3.10E-03	cont.
G4	5	2006	6	1.44E-02	G/HP-HR	235.77	-3.85E-01	G/HP-HR	2.7	6.49E-03	
G4	5	2040	3.66	1.82E-02	G/HP-HR	235.77	-3.85E-01	G/HP-HR	0.86	4.96E-03	
G4	15	1994	7.46	1.78E-02	G/HP-HR	393.1	3.37E-02	G/HP-HR	3.48	1.33E-03	
G4	15	1995	4.56	2.07E-02	G/HP-HR	234.54	8.95E-02	G/HP-HR	2.84	0.00E+00	
G4	15	2001	4.56	2.07E-02	G/HP-HR	273.63	8.95E-02	G/HP-HR	2.84	0.00E+00	
G4	15	2007	3.9	4.69E-03	G/HP-HR	224.66	0.00E+00	G/HP-HR	2.9	3.47E-03	
G4	15	2040	2.51	3.88E-03	G/HP-HR	224.66	0.00E+00	G/HP-HR	1.86	2.64E-03	
G4	25	1994	7.46	1.41E-02	G/HP-HR	393.1	2.76E-02	G/HP-HR	3.48	1.09E-03	
G4	25	1995	4.42	1.66E-02	G/HP-HR	243.17	3.45E-02	G/HP-HR	2.32	0.00E+00	
G4	25	2001	4.42	1.66E-02	G/HP-HR	283.69	3.45E-02	G/HP-HR	2.32	0.00E+00	
G4	25	2007	4.12	4.95E-03	G/HP-HR	238.46	0.00E+00	G/HP-HR	2.68	3.21E-03	
G4	25	2040	2.64	3.36E-03	G/HP-HR	238.46	0.00E+00	G/HP-HR	1.71	3.24E-03	
G4	50	1983	3.76	4.12E-04	G/HP-HR	89.9	5.55E-03	G/HP-HR	8.01	4.06E-05	
G4	50	2000	3.76	4.12E-04	G/HP-HR	89.9	5.55E-03	G/HP-HR	8.01	4.06E-05	
G4	50	2001	2.96	3.48E-04	G/HP-HR	78.09	2.01E-02	G/HP-HR	6.91	1.44E-04	
G4	50	2002	2.34	3.74E-04	G/HP-HR	81.78	1.97E-02	G/HP-HR	5.52	3.08E-04	
G4	50	2003	1.62	3.16E-04	G/HP-HR	71.03	1.93E-02	G/HP-HR	4.52	4.02E-04	
G4	50	2006	0.71	1.69E-04	G/HP-HR	38.19	1.90E-02	G/HP-HR	1.33	4.71E-04	
G4	50	2040	0.71	1.38E-04	G/HP-HR	38.19	1.90E-02	G/HP-HR	1.33	3.20E-04	
G4	120	1983	2.63	2.87E-04	G/HP-HR	43.8	2.90E-03	G/HP-HR	11.84	6.01E-05	
G4	120	2000	2.63	2.87E-04	G/HP-HR	43.8	2.90E-03	G/HP-HR	11.84	6.01E-05	
G4	120	2001	2.08	2.56E-04	G/HP-HR	41.08	4.00E-03	G/HP-HR	9.58	1.63E-04	
G4	120	2002	1.54	2.25E-04	G/HP-HR	39.72	4.55E-03	G/HP-HR	7.32	2.66E-04	

Appendix 2 – USEPA Tier 2 Emission Standards 10-60

EPA
United States
Environmental Protection
Agency

Office of Transportation
and Air Quality

EPA420-F-04-031
August 2004

Regulatory Update

Overview of EPA's Emission Standards for Marine Engines

The U.S. Environmental Protection Agency's (EPA) emission control program for marine engines consists of several sets of standards which vary based on the type of engine (gasoline or diesel powered) and engine size. These standards apply to newly manufactured products produced after the effective date of the standards.

This fact sheet gives an overview of the final and proposed rules for marine engines and vessels as of July 2004. Refer to our Web site for additional information about the standards and the certification and compliance programs, as well as for regulatory updates.

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What are the compression-ignition (diesel) marine engine standards?

Marine diesel engines are grouped into the five categories shown in Table 1. Each of these are subject to different standards.

Acronyms Used in This Fact Sheet

kW = kilowatts
g/kW-hr = grams per kilowatt-hour
rpm = revolutions per minute
HC + NOx = hydrocarbons plus nitrogen oxides
PM = particulate matter
CO = carbon monoxide

Table 1: Marine Diesel Engine Categories

Category	Rated Power	Displacement per Cylinder	Final Rule Publication
Small	<37 kW	any	1998
Commercial C1	≥37 kW	<5 liters	1999
C2		≥5 liters and < 30 liters	
C3		≥30 liters	2003
Recreational C1	≥37 kW	<5 liters	2002

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Small Marine Diesel Engines (<37 kW)

Small marine diesel engines were included in our Tier 1 and Tier 2 nonroad diesel engine rules and are subject to the same emission limits as their land-based counterparts, as shown in Table 2.

Table 2: Small Marine Diesel Engines[a]
See: www.epa.gov/nonroad-diesel

Tier	Rulemaking	CFR	Effective Dates
Tier 1	Control of Emissions of Air Pollution from Nonroad Diesel Engines (published October 23, 1998, 63 FR 56968)	40 CFR 89	1999 or 2000, depending on engine size
Tier 2			2004 or 2005, depending on engine size

[a] The emission limits are set out in Tables 6 and 7.

Category 1 Commercial and Category 2 Marine Diesel Engines

Category 1 marine diesel engines are similar to land-based nonroad diesel engines. Most Category 2 marine diesel engines are similar to locomotive engines.

The Tier 1 standards for these engines are equivalent to the nitrogen oxides (NOx) limits adopted by the Annex VI to the International Convention on the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978 Relating Thereto (this convention is also known as MARPOL 73/78).[1] The Annex VI standards apply to engines over 130 kW installed on vessels constructed on or after January 1, 2000, or engines that undergo a major conversion on or after January 1, 2000. However, those standards are not enforceable until the Annex goes into effect in May 2005.[2] In the meantime, we adopted these standards into our federal emission control program as Tier 1 standards. The Tier 1 standards are voluntary for all Category 1 and Category 2 engines through 2003. Beginning in 2004, they will be mandatory for engines ≥2.5 l/cyl installed on U.S. vessels. For all engines subject to the Tier 1 standards, EPA's Tier 2 standards supersede the Annex VI limits by 2007 (or 2009 for recreational engines above 2.5 l/cyl).

Table 3: Category 1 (Commercial only) and Category 2 Marine Diesel Engines[a]
See: www.epa.gov/otaq/marine.htm

Tier	Rulemaking	CFR	Effective Dates
Tier 1	Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder (published February 28, 2003, 68 FR 9746)	40 CFR 94	Voluntary through 2003; mandatory for engines ≥2.5 l/cyl beginning in 2004[b]
Tier 2	Control of Emissions of Air Pollution from New Marine Compression-Ignition Engines at or Above 37 kW (published December 29, 1999, 64 FR 73300)		2004 to 2007, depending on engine size

[a] The emission limits are set out in Tables 6 and 7.
[b] MARPOL Annex VI applies these standards to any engine >130 kW installed on a vessel constructed on or after 1/1/2000 and any engine that undergoes a major conversion on or after 1/1/2000. However, those requirements are not enforceable until the Annex goes into effect in May 2005. Annex VI limits are superseded by the Tier 2 standards for these engines.

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Category 3 Marine Diesel Engines

Category 3 marine diesel engines are very large engines used for propulsion power on ocean-going vessels. The EPA standards for these engines are equivalent to the Annex VI standards.

[1] Copies of the conference versions of the Annex and the NOx Technical Code can be found in Docket A-97-50, Document II.B.01 or at www.epa.gov/otaq/marine.htm. Copies of the updated versions can be obtained from the International Maritime Organization (www.imo.org).

[2] The IMO Web site, www.imo.org, contains the latest information on the status of this convention.

Table 4: Category 3 Marine Diesel Engines[a]
See www.epa.gov/otaq/marine.htm

Tier	Rulemaking	CFR	Effective Dates
Tier 1	Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder (published February 28, 2003, 68 FR 9746)	40 CFR 94	Voluntary through 2003; mandatory 2004[b]

[a] The emission limits are set out in Tables 6 and 7.
[b] MARPOL Annex VI applies these standards to any engine >130 kW installed on a vessel constructed on or after 1/1/2000 and any engine that undergoes a major conversion on or after 1/1/2000. However, those requirements are not enforceable until the Annex goes into effect in May 2005.

Recreational Marine Diesel Engines

Recreational marine diesel engines are those that will be installed on vessels used for recreational purposes. They must be at or above 37 kW and less than 5 liters per cylinder displacement to be considered recreational for the purposes of our standards. The Tier 1 standards for engines ≥2.5 liters/cylinder displacement are equivalent to the MARPOL standards (described above). Once the MARPOL standards take effect, they will apply to recreational engines >130 kW. The more stringent Tier 2 standards will supersede the Tier 1 and MARPOL NOx limits.

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Table 5: Recreational Marine Diesel Engines[a]
See www.epa.gov/otaq/marine.htm

Tier	Rulemaking	CFR	Effective Dates
Tier 1	Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder (published February 28, 2003, 68 FR 9746)	40 CFR 94	Voluntary through 2003; mandatory for engines ≥2.5 l/cyl beginning in 2004[b]
Tier 2	Control of Emissions from Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based) (published November 8, 2002, 67 FR 68242)		2006 to 2009, depending on engine size

[a] The emission limits are set out in Tables 6 and 7.
[b] MARPOL Annex VI applies these standards to any engine >130 kW installed on a vessel constructed on or after 1/1/2000 and any engine that undergoes a major conversion on or after 1/1/2000. However, those requirements are not enforceable until the Annex goes into effect in May 2005. Annex VI limits are superseded by the Tier 2 standards for these engines.

Tables 6 and 7 present the emission standards for marine diesel engines. These standards are for hydrocarbons (HC), oxides of nitrogen (NOx), and particulate matter (PM) and are expressed in units of grams per kilowatt-hour (g/kW-hr).

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Table 6: Tier 1 Standards for Marine Diesel Engines

Category	Power (kW) & Displacement (liter/cylinder)	Speed (rpm)	Tier 1 Model Year	NOx (g/kW-hr)	HC+NOx (g/kW-hr)	PM (g/kW-hr)	CO (g/kW-hr)
Small	<8 kW	-	2000	-	10.5	1.0	8.0
	8≤ kW <19	-	2000	-	9.5	0.8	6.6
	19≤ kW <37	-	1999	-	9.5	0.8	5.5
1, 2, 3, including Recreational	≥37 kW & ≥2.5 l/cyl[a]	rpm ≥2000	2004	9.8	-	-	-
		130≤ rpm <2000	2004	$45 \times rpm^{-0.2}$	-	-	-
		rpm<130	2004	17			

[a] These standards are voluntary for all engines through 2003; they are mandatory for engines ≥2.5 l/cyl beginning in 2004. For Category 1 and Category 2 engines, they will remain mandatory through 2006; beginning in 2007 for commercial and 2009 for recreational, EPA standards supersede the Annex VI limits for these engines.

Table 7: Tier 2 Standards for Marine Diesel Engines

Category[a]	Displacement (liter/cylinder)	Power (kW)	Tier 2 Model Year	HC+NOx (g/kW-hr)	PM (g/kW-hr)	CO (g/kW-hr)
Small	-	<8 kW	2005	7.5	0.80	8.0
	-	8≤ kW <19	2005	7.5	0.80	6.6
	-	19≤ kW <37	2004	7.5	0.60	5.5
Commercial C1	disp. <0.9	≥37kW	2005	7.5	0.40	5.0
	0.9≤ disp. <1.2	-	2004	7.2	0.30	5.0
	1.2≤ disp. <2.5	-	2004	7.2	0.20	5.0
	2.5≤ disp. <5.0	-	2007	7.2	0.20	5.0
C2	5.0≤ disp. <15	-	2007	7.8	0.27	5.0
	15≤ disp. <20	<3300kW	2007	8.7	0.50	5.0
	15≤ disp. <20	≥3300kW	2007	9.8	0.50	5.0
	20≤ disp. <25	-	2007	9.8	0.50	5.0
	25≤ disp. <30	-	2007	11.0	0.50	5.0
Recreational C1	disp. <0.9	≥37kW	2007	7.5	0.40	5.0
	0.9≤ disp. <1.2	≥37kW	2006	7.2	0.30	5.0
	1.2≤ disp. <2.5	≥37kW	2006	7.2	0.20	5.0
	2.5≤ disp. <5.0	≥37kW	2009	7.2	0.20	5.0

[a] There are no Tier 2 standards for Category 3 marine engines.

What emissions standards apply to spark-ignition (gasoline) marine engines?

We also have several sets of standards for gasoline marine engines. For these engines we distinguish between:

- Outboards and personal watercraft
- Sterndrive and inboard engines
- Gasoline auxiliary engines

Outboards and Personal Watercraft Exhaust Standards

The outboard and personal watercraft exhaust standards phase in over nine years from 1998 to 2006. Because it is an averaging standard,[3] manufacturers are typically offering a mix of new and old technology throughout the phase-in period. The standard is based on a curve function that is intended to represent the relationship between rated power and brake-specific emissions. In addition, California has two additional tiers of standards that are more stringent than the EPA standards (see www.arb.ca.gov).

Table 8: Outboard and Personal Watercraft Standards[a]
See www.epa.gov/otaq/marinesi.htm

Tier	Rulemaking	CFR	Effective Date
1	Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or below 19 Kilowatts (published October 4, 1996, 61 FR 52088)	40 CFR 91	1998 to 2006; standard becomes more stringent over time

[a] The emission limits are set out in Table 11 below.

Gasoline Sterndrive and Inboard Engines

There are currently no federal standards for gasoline sterndrive and inboard engines. However, we gave notice of our intent to develop emission standards for these engines (published August 14, 2002, 67 FR 53050, see www.epa.gov/otaq/marinesi.htm). Although there are no federal requirements for these engines, California has adopted exhaust emission standards (see: www.arb.ca.gov).

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[3] This means that emission credits may be earned for engines certified below the emission standard. These credits may be used to sell engines certified above the standard provided that, on average, the engines meet the emission standard.

Marine Generators

Gasoline auxiliary engines used onboard marine vessels are covered in our gasoline nonroad engine programs. There are two sets of EPA standards for these engines which are covered in our programs for land-based spark-ignition engines, as shown in Tables 9 and 10.

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Table 9: Spark-Ignition Marine Generators <19 kW[a]
See www.epa.gov/otaq/equip-ld.htm

Tier	Rulemaking	CFR	Effective Dates
Tier 1	Emission Standards for New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts (published July 3, 1995, 60 FR 34581) Revised Carbon Monoxide (CO) Standard for Class I and II Nonhandheld New Nonroad Phase 1 Small Spark-Ignition Engines (published November 13, 1996, 61 FR 58296)	40 CFR 90	1997
Tier 2	Phase 2 Emission Standards for New Nonroad Spark-Ignition Nonhandheld Engines at or below 19 Kilowatts (published March 30, 1999, 64 FR 15208)		2001 to 2007, depending on engine size

[a] The emission limits are set out in Table 12 below.

Table 10: Spark-Ignition Marine Generators >19 kW[a]
See www.epa.gov/otaq/largesi.htm

Tier	Rulemaking	CFR	Effective Dates
Tier 1	Control of Emissions from Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based) (published November 8, 2002, 67 FR 68242)	40 CFR 1048	2004
Tier 2			2007

[a] The emission limits are set out in Table 13 below.

Table 11: Standards for Outboard and Personal Watercraft Spark-Ignition Marine Engines

Model Year	HC+NOx (g/kW-hr)	
	<4.3 kW	>4.3 kW[a]
1998	278	$0.917x(151 + 557/P^{0.9})+2.44$
1999	253	$0.833x(151 + 557/P^{0.9})+2.89$
2000	228	$0.750x(151 + 557/P^{0.9})+3.33$
2001	204	$0.667x(151 + 557/P^{0.9})+3.78$
2002	179	$0.583x(151 + 557/P^{0.9})+4.22$
2003	155	$0.500x(151 + 557/P^{0.9})+4.67$
2004	130	$0.417x(151 + 557/P^{0.9})+5.11$
2005	105	$0.333x(151 + 557/P^{0.9})+5.56$
2006	81	$0.250x(151 + 557/P^{0.9})+6.00$

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[a] For engines over 4.3 kW, the emission standard is a function of rated engine power (P), in Kilowatts.

Table 12: Standards for Spark-Ignition Marine Generators ≤19kW

Phase	Class	Total Displacement (cubic centimeters)	Model Year	HC+NOx (g/kW-hr)	CO (g/kW-hr)
Phase 1 [a]	I	cc <225	1997	16.1	519
	II	cc ≥225	1997	13.4	519
Phase 2	I-A	cc <66	2001	50	610
	I-B	66≤ cc <100	2001	40	610
	I	100≤ cc <225	August 2007 [b]	16.1	610
	II	cc ≥0.225	2001 2002 2003 2004 2005	18.0 16.6 15.0 13.6 12.1	610

[a] Zero hour standards (no deterioration considered in standards).
[b] Effective date. (If a new engine family is introduced after August 1, 2003, it must meet the Phase 2 standards.)

Tier	Model Year	HC+NOx (g/kW-hr)	CO (g/kW-hr)
1	2004	4.0	50
2[a]	2007	2.7	4.4

Table 13: Standards for Spark-Ignition Marine Generators >19kW

[a] Alternatively, can meet standard of $(HC+NOx) \times CO^{0.784} \leq 8.57$ g/kW-hr.

How can I get more information?

You can access documents on marine engine emission standards from EPA's main non-road engines, equipment, and vehicles Web page at: 10-60 cont.

www.epa.gov/nonroad

You can also contact the OTAQ library for document information at:

U.S. Environmental Protection Agency
Office of Transportation and Air Quality Library
2000 Traverwood Drive
Ann Arbor, MI 48105
(734) 214-4311 & 214-4434
E-mail: Group_AALibrary@epa.gov

Appendix 3 – Corrected Calculation Worksheets 10-61

Table D1. Emissions Summary

Scenario	Annual Emissions (tons per year)					Metric Tons
	NOx	PM	ROG	CO	CO2	CO2
Existing						
Hanson (TS&G)	43.9	1.5	3.8	12.1	2,823.1	
Hanson (DS-10)	33.6	1.3	3.4	10.7	2,684.4	
Suisin Assoc. (TS&G)	1.8	0.1	0.2	0.5	113.7	
Suisun Assoc. (DS-10)	0.7	0.0	0.1	0.2	52.8	
Suisun Assoc. (Jerico)	0.4	0.0	0.1	0.2	39.8	
Jerico	0.6	0.0	0.1	0.3	60.6	
TOTAL	*81.0*	*3.0*	*7.6*	*24.0*	*5,774.4*	*5,238*
Future (2010)						
Hanson (TS&G)	64.1	2.2	5.6	17.6	4,115.7	
Hanson (DS-10)	48.9	1.9	4.9	15.6	3,913.5	
Suisin Assoc. (TS&G)	6.1	0.2	0.5	1.7	393.0	
Suisun Assoc. (DS-10)	2.2	0.1	0.2	0.7	177.7	
Suisun Assoc. (Jerico)	1.5	0.1	0.2	0.7	142.0	
Jerico	0.6	0.0	0.1	0.3	60.6	
TOTAL	123.5	4.5	11.6	36.6	8,802.4	*7,985*
Change from Existing	***42.5***	*1.6*	*4.0*	*12.6*	*3,028.1*	*2,747*
Future (2011) NOx Emissions						
Hanson (TS&G)	45.5	--	--	--	--	
Hanson (DS-10)	45.3	--	--	--	--	
Suisin Assoc. (TS&G)	4.3	--	--	--	--	
Suisun Assoc. (DS-10)	2.1	--	--	--	--	
Suisun Assoc. (Jerico)	1.5	--	--	--	--	
Jerico	0.6	--	--	--	--	
TOTAL	*99.4*	--	--	--	--	
Change from existing	***18.4***	--	--	--	--	-
Future (2018) NOx Emissions						
Hanson (TS&G)	40.7	--	--	--	--	
Hanson (DS-10)	42.2	--	--	--	--	
Suisin Assoc. (TS&G)	3.9	--	--	--	--	
Suisun Assoc. (DS-10)	1.9	--	--	--	--	
Suisun Assoc. (Jerico)	1.3	--	--	--	--	
Jerico	0.6	--	--	--	--	
TOTAL	*90.5*	--	--	--	--	
Change from Existing	*9.5*	--	--	--	--	-

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Table D1A. Emissions Summary - Corrected

Scenario	Annual Emissions (tons per year)					Metric Tons
	NOx	PM	ROG	CO	CO2	CO2
Existing						
Hanson (TS&G)	43.9	1.5	3.8	12.1	2736.4	
Hanson (DS-10)	33.6	1.3	3.4	10.7	2602.0	
Suisin Assoc. (TS&G)	1.8	0.1	0.2	0.5	110.3	
Suisun Assoc. (DS-10)	0.7	0.0	0.1	0.2	51.2	
Suisun Assoc. (Jerico)	0.4	0.0	0.1	0.2	39.3	
Jerico	0.6	0.0	0.1	0.3	60.6	
TOTAL	*81.0*	*3.0*	*7.6*	*24.0*	*5,599.7*	*5,080*
Future (2010)						
Hanson (TS&G)	64.1	2.2	5.6	17.6	3989.3	
Hanson (DS-10)	48.9	1.9	4.9	15.6	3793.4	
Suisin Assoc. (TS&G)	6.1	0.2	0.5	1.7	380.9	
Suisun Assoc. (DS-10)	2.2	0.1	0.2	0.7	172.3	
Suisun Assoc. (Jerico)	1.4	0.1	0.2	0.7	140.3	
Jerico	0.6	0.0	0.1	0.3	60.6	
TOTAL	123.4	4.5	11.6	36.6	*8,536.7*	*7,744*
Change from Existing	*42.5*	*1.6*	*4.0*	*12.6*	*2,937.0*	*2,664*
Future (2011) NOx Emissions						
Hanson (TS&G)	42.9					
Hanson (DS-10)	44.5					
Suisin Assoc. (TS&G)	4.1					
Suisun Assoc. (DS-10)	2.0					
Suisun Assoc. (Jerico)	1.4					
Jerico	0.6					
TOTAL	*95.5*					
Change from existing	*14.5*					-
Future (2018) NOx Emissions						
Hanson (TS&G)	35.1	--	--	--	--	
Hanson (DS-10)	33.8	--	--	--	--	
Suisin Assoc. (TS&G)	3.4	--	--	--	--	
Suisun Assoc. (DS-10)	1.5	--	--	--	--	
Suisun Assoc. (Jerico)	1.2	--	--	--	--	
Jerico	0.5	--	--	--	--	
TOTAL	*75.5*	--	--	--	--	
Change from Existing	*-5.5*	--	--	--	--	-

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Table D2. Mining Events (Current and Requested)

Parcel	Current Conditions - Permitted		Requested Conditions	
	Annual Volume	Mining Events [a]	Annual Volume	Mining Events [a]
State Lands Commission Parcels				
PRC 709.1 Presidio Shoals (Hanson)	205,366	103	340,000	170
PRC 2036.1 Point Knox South (Hanson)	254,626	127	450,000	225
PRC 7779.1 Point Knox Shoal (Hanson)	396,656	198	550,000	275
PRC 7780.1 Alcatraz South Shoal (Hanson)	108,318	54	200,000	100
PRC 7781.1: Suisun Associates	85,407	43	300,000	150
State Lands Lease Totals	*1,050,373*	*525*	*1,840,000*	*920*
Private Parcels				
Grossi Middle Ground: ACOE Permit No. 25653N (Hanson)	64,981	32	25,000	13
Grossi Middle Ground: ACOE Permit No. 24996N (Hanson)	64,982	32	25,000	13
Grossi Middle Ground: ACOE Permit No. 24913N (Jerico)	64,982	32	150,000	75
Private Parcel Lease Totals	*194,945*	*96*	*200,000*	*101*
Total All Leases	**1,245,318**	**621**	**2,040,000**	**1,021**
Net Change in Mining Events	**400**			

[a] Assumes that 2,000 cubic yards of sand are collected during each mining event

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Table D3. Emission Factors for Mining Equipment (Baseline)

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d]					Emission Rate (lb/hr)				
					NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	586.3	13.1	0.5	1.3	3.7	1,105.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	586.3	19.9	0.8	1.9	5.6	1,680.4
	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	586.3	15.1	0.4	1.1	3.5	672.1
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	586.3	2.6	0.1	0.3	1.1	147.3
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	10.23	0.32	1.07	4.33	586.3	2.9	0.1	0.3	1.2	169.0
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	586.3	8.7	0.4	0.9	2.5	739.4
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	10.23	0.32	1.07	4.33	586.3	3.6	0.1	0.4	1.5	208.4
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	586.3	8.1	0.3	0.8	2.3	685.1
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	586.3	0.3	0.0	0.1	0.2	25.6
	Barge Generator (Aux)	2004	99	0.43	6.93	0.46	1.18	3.59	586.3	0.7	0.0	0.1	0.3	55.0
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	586.3	1.5	0.1	0.2	0.6	127.8
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	586.3	0.9	0.0	0.1	0.7	108.4

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft*, September 2007.

[c] Criteria pollutant emission factors obtained from Appendix B (cited above). All Equipment except for the TS&G assumes a fuel correction factor of 0.948 and 0.8 for NOx and PM respectively while the TS&G assumes a fuel correction factor of 0.930 and 0.720 for NOx and PM10 respectively.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

Table D3A. Emission Factors for Mining Equipment (Baseline) - Corrected

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d]					Emission Rate (lb/hr)				
					NOx[2]	PM	ROG	CO	CO2[1]	NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	568.3	15.1	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	568.3	2.6	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	10.23	0.32	1.07	4.33	568.3	2.9	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	10.23	0.32	1.07	4.33	568.3	3.6	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
	Barge Generator (Aux)[3]	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial*

[c] Criteria pollutant emission factors obtained from Appendix B (cited above). All Equipment except for the TS&G assumes a fuel correction factor of 0.948 and 0.8 for NOx and PM respectively while the TS&G assumes a fuel correction factor of 0.930 and 0.720 for NOx and PM10

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

TRC

[1] Correction noted in TRC Comment: 2. *CO2 Emission Factor Accuracy*

[2] Correction noted in TRC Comment: 3. *NOx Tier II Emission Factor Accuracy*

[3] Correction noted in TRC Comment: 6. *Jerico Dredge Barge Generator NOx Emission Factor*

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Table D4. Emission Rates by Activity (Baseline)

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Main	15.1	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	147.3
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,499.8***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	147.3
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,827.6***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	147.3
Total	***17.7***	***0.5***	***1.4***	***4.6***	***819.4***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	739.4
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	208.4
Total	***25.4***	***1.0***	***2.5***	***7.7***	***2,052.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	208.4
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,313.6***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	739.4
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	244.6
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	244.6
Barge - Gen - Aux	3.6	0.1	0.4	1.5	208.4
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,436.9***
Jerico Barge - Mining					
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	127.8
Total	***2.2***	***0.1***	***0.3***	***0.9***	***182.9***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	685.1
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Total	***8.7***	***0.4***	***0.9***	***2.6***	***740.1***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	108.4
Total	***0.9***	***0.0***	***0.1***	***0.7***	***108.4***

10-61 cont.

TRC

Table D4A. Emission Rates by Activity (Baseline) - Corrected

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***17.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***25.4***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	3.6	0.1	0.4	1.5	202.0
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

10-61
cont.

Table D5. Annual Emissions (Baseline)

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr) NOx	PM	ROG	CO	CO2	Annual Emissions (tons per year) NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	273	Cruising	2	22.4	0.9	2.2	6.7	1,827.6	6.1	0.2	0.6	1.8	498.9
		Mining	5.5	37.5	1.3	3.3	10.3	2,499.8	28.2	1.0	2.5	7.7	1,876.7
		Unloading	4	17.7	0.5	1.4	4.6	819.4	9.6	0.3	0.7	2.5	447.4
Hanson (DS-10)	273	Cruising	2	16.7	0.7	1.7	5.3	1,313.6	4.6	0.2	0.5	1.4	358.6
		Mining	5.5	25.4	1.0	2.5	7.7	2,052.9	19.1	0.8	1.9	5.8	1,541.2
		Unloading	4	18.2	0.7	1.9	6.3	1,436.9	9.9	0.4	1.0	3.5	784.5
Suisun Associates (TS&G 230)	11	Cruising	2	22.4	0.9	2.2	6.7	1,827.6	0.2	0.0	0.0	0.1	20.1
		Mining	5.5	37.5	1.3	3.3	10.3	2,499.8	1.1	0.0	0.1	0.3	75.6
		Unloading	4	17.7	0.5	1.4	4.6	819.4	0.4	0.0	0.0	0.1	18.0
Suisun Associates (DS-10)	11	Cruising	2	16.7	0.7	1.7	5.3	1,313.6	0.2	0.0	0.0	0.1	14.4
		Cruising	2	25.4	1.0	2.5	7.7	2,052.9	0.3	0.0	0.0	0.1	22.6
		Cruising	2	18.2	0.7	1.9	6.3	1,436.9	0.2	0.0	0.0	0.1	15.8
Suisun Associates (Jerico Barge)	21	Cruising	2	8.7	0.4	0.9	2.6	740.1	0.2	0.0	0.0	0.1	15.5
		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.1	0.0	0.0	0.1	10.6
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.1	0.0	0.0	0.1	13.7
Jerico	32	Cruising	2	8.7	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**81.0**	**3.0**	**7.6**	**24.0**	**5,774.4**

10-61 cont.

Table D5A. Annual Emissions (Baseline) - Corrected

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr) NOx	PM	ROG	CO	CO2	Annual Emissions (tons per year) NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	273	Cruising	2	22.4	0.9	2.2	6.7	1771.5	6.1	0.2	0.6	1.8	483.6
		Mining	5.5	37.5	1.3	3.3	10.3	2423.0	28.2	1.0	2.5	7.7	1,819.1
		Unloading	4	17.7	0.5	1.4	4.6	794.3	9.6	0.3	0.7	2.5	433.7
Hanson (DS-10)	273	Cruising	2	16.7	0.7	1.7	5.3	1273.3	4.6	0.2	0.5	1.4	347.6
		Mining	5.5	25.4	1.0	2.5	7.7	1989.9	19.1	0.8	1.9	5.8	1,493.9
		Unloading	4	18.2	0.7	1.9	6.3	1392.8	9.9	0.4	1.0	3.5	760.5
Suisun Associates (TS&G 230)	11	Cruising	2	22.4	0.9	2.2	6.7	1771.5	0.2	0.0	0.0	0.1	19.5
		Mining	5.5	37.5	1.3	3.3	10.3	2423.0	1.1	0.0	0.1	0.3	73.3
		Unloading	4	17.7	0.5	1.4	4.6	794.3	0.4	0.0	0.0	0.1	17.5
Suisun Associates (DS-10)	11	Cruising	2	16.7	0.7	1.7	5.3	1273.3	0.2	0.0	0.0	0.1	14.0
		Cruising	2	25.4	1.0	2.5	7.7	1989.9	0.3	0.0	0.0	0.1	21.9
		Cruising	2	18.2	0.7	1.9	6.3	1392.8	0.2	0.0	0.0	0.1	15.3
Suisun Associates (Jerico Barge)	21	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.2	0.0	0.0	0.1	15.1
		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.1	0.0	0.0	0.1	10.6
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.1	0.0	0.0	0.1	13.7
Jerico	32	Cruising	2	8.5	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**81.0**	**3.0**	**7.6**	**24.0**	**5,599.7**
% Reduction due to TRC corrections:									0.05%	0.00%	0.00%	0.00%	3.03%

Table D6. Emission Factors for Mining Equipment (2010)

Equipment Name	Type	Manufacture Year[a]	Horsepower[a]	Load Factor[b]	Emission Factor (g/bhp-hr)[c,d] NOx	PM	ROG	CO	CO2	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	586.3	13.1	0.5	1.3	3.7	1,105.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	586.3	19.9	0.8	1.9	5.6	1,680.4
	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	586.3	15.1	0.4	1.1	3.5	672.1
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	586.3	2.6	0.1	0.3	1.1	147.3
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	10.23	0.32	1.07	4.33	586.3	2.9	0.1	0.3	1.2	169.0
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	586.3	8.7	0.4	0.9	2.5	739.4
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	10.23	0.32	1.07	4.33	586.3	3.6	0.1	0.4	1.5	208.4
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	586.3	8.1	0.3	0.8	2.3	685.1
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	586.3	0.3	0.0	0.1	0.2	25.6
	Barge Generator (Aux)	2004	99	0.43	6.93	0.46	1.18	3.59	586.3	0.7	0.0	0.1	0.3	55.0
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	586.3	1.5	0.1	0.2	0.6	127.8
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	586.3	0.9	0.0	0.1	0.7	108.4

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft*, September 2007

[c] Assumes all Jerico engines would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines

Table D6A. Emission Factors for Mining Equipment (2010) - Corrected

Equipment Name	Type	Manufacture Year[a]	Horsepower[a]	Load Factor[b]	Emission Factor (g/bhp-hr)[c,d] NOx[2]	PM	ROG	CO	CO2[1]	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	568.3	15.1	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	568.3	2.6	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	10.23	0.32	1.07	4.33	568.3	2.9	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	10.23	0.32	1.07	4.33	568.3	3.6	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
	Barge Generator (Aux)[4]	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft*, September 2007

[c] ~~Assumes all Jerico engines would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.~~[3]

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines

[1] Correction noted in TRC Comment: 2 *CO2 Emission Factor Accuracy*

[2] Correction noted in TRC Comment: 3 *NOx Tier II Emission Factor Accuracy*

[3] Correction noted in TRC Comment: 5 *Footnote (c) in Tables D.6 and D.9*

[4] Correction noted in TRC Comment: 6 *Jerico Dredge Barge Generator NOx Emission Factor*

TRC

10-61 cont.

Table D7. Emission Rates by Activity (2010)

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Main	15.1	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	147.3
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,499.8***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	147.3
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,827.6***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	147.3
Total	***17.7***	***0.5***	***1.4***	***4.6***	***819.4***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	739.4
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	208.4
Total	***25.4***	***1.0***	***2.5***	***7.7***	***2,052.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	208.4
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,313.6***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	739.4
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	244.6
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	244.6
Barge - Gen - Aux	3.6	0.1	0.4	1.5	208.4
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,436.9***
Jerico Barge - Mining					
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	127.8
Total	***2.2***	***0.1***	***0.3***	***0.9***	***182.9***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	685.1
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Total	***8.7***	***0.4***	***0.9***	***2.6***	***740.1***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	108.4
Total	***0.9***	***0.0***	***0.1***	***0.7***	***108.4***

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TRC

Table D7A. Emission Rates by Activity (2010) - Corrected

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***17.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***25.4***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	3.6	0.1	0.4	1.5	202.0
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

10-61 cont.

TRC

Table D8. Annual Emissions (2010)

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	22.4	0.9	2.2	6.7	1,827.6	8.9	0.4	0.9	2.7	727.4
		Mining	5.5	37.5	1.3	3.3	10.3	2,499.8	41.1	1.4	3.6	11.2	2,736.0
		Unloading	4	17.7	0.5	1.4	4.6	819.4	14.1	0.4	1.1	3.7	652.3
Hanson (DS-10)	398	Cruising	2	16.7	0.7	1.7	5.3	1,313.6	6.6	0.3	0.7	2.1	522.8
		Mining	5.5	25.4	1.0	2.5	7.7	2,052.9	27.8	1.1	2.8	8.5	2,246.9
		Unloading	4	18.2	0.7	1.9	6.3	1,436.9	14.5	0.6	1.5	5.0	1,143.8
Suisun Associates (TS&G 230)	38	Cruising	2	22.4	0.9	2.2	6.7	1,827.6	0.9	0.0	0.1	0.3	69.5
		Mining	5.5	37.5	1.3	3.3	10.3	2,499.8	3.9	0.1	0.3	1.1	261.2
		Unloading	4	17.7	0.5	1.4	4.6	819.4	1.3	0.0	0.1	0.4	62.3
Suisun Associates (DS-10)	37	Cruising	2	16.7	0.7	1.7	5.3	1,313.6	0.6	0.0	0.1	0.2	48.6
		Cruising	2	25.4	1.0	2.5	7.7	2,052.9	0.9	0.0	0.1	0.3	76.0
		Cruising	2	18.2	0.7	1.9	6.3	1,436.9	0.7	0.0	0.1	0.2	53.2
Suisun Associates (Jerico Barge)	75	Cruising	2	8.7	0.4	0.9	2.6	740.1	0.7	0.0	0.1	0.2	55.5
		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.4	0.0	0.1	0.2	37.7
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
Jerico	32	Cruising	2	8.7	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**123.5**	**4.5**	**11.6**	**36.6**	**8,802.4**

Table D8A. Annual Emissions (2010) - Corrected

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	22.4	0.9	2.2	6.7	1771.5	8.9	0.4	0.9	2.7	705.1
		Mining	5.5	37.5	1.3	3.3	10.3	2423.0	41.1	1.4	3.6	11.2	2,652.0
		Unloading	4	17.7	0.5	1.4	4.6	794.3	14.1	0.4	1.1	3.7	632.2
Hanson (DS-10)	398	Cruising	2	16.7	0.7	1.7	5.3	1273.3	6.6	0.3	0.7	2.1	506.8
		Mining	5.5	25.4	1.0	2.5	7.7	1989.9	27.8	1.1	2.8	8.5	2,178.0
		Unloading	4	18.2	0.7	1.9	6.3	1392.8	14.5	0.6	1.5	5.0	1,108.7
Suisun Associates (TS&G 230)	38	Cruising	2	22.4	0.9	2.2	6.7	1771.5	0.9	0.0	0.1	0.3	67.3
		Mining	5.5	37.5	1.3	3.3	10.3	2423.0	3.9	0.1	0.3	1.1	253.2
		Unloading	4	17.7	0.5	1.4	4.6	794.3	1.3	0.0	0.1	0.4	60.4
Suisun Associates (DS-10)	37	Cruising	2	16.7	0.7	1.7	5.3	1273.3	0.6	0.0	0.1	0.2	47.1
		Cruising	2	25.4	1.0	2.5	7.7	1989.9	0.9	0.0	0.1	0.3	73.6
		Cruising	2	18.2	0.7	1.9	6.3	1392.8	0.7	0.0	0.1	0.2	51.5
Suisun Associates (Jerico Barge)	75	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.6	0.0	0.1	0.2	53.8
		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.4	0.0	0.1	0.2	37.7
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
Jerico	32	Cruising	2	8.5	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**123.4**	**4.5**	**11.6**	**36.6**	**8,536.7**
% Reduction due to TRC corrections:									0.07%	0.00%	0.00%	0.00%	3.02%

TRC

10-61 cont.

Table D9. Emission Factors for Mining Equipment (2011)

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d] NOx	PM	ROG	CO	CO2	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	586.3	13.1	0.5	1.3	3.7	1,105.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	586.3	19.9	0.8	1.9	5.6	1,680.4
	Barge - Main Engine	1983	1,000	0.52	5.8	0.36	0.95	3.07	586.3	6.6	0.4	1.1	3.5	672.1
	Barge - Generator (Aux)	1984	265	0.43	5.8	0.32	1.07	4.33	586.3	1.5	0.1	0.3	1.1	147.3
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	5.8	0.32	1.07	4.33	586.3	1.7	0.1	0.3	1.2	169.0
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	586.3	8.7	0.4	0.9	2.5	739.4
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	5.8	0.32	1.07	4.33	586.3	2.1	0.1	0.4	1.5	208.4
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	586.3	8.1	0.3	0.8	2.3	685.1
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	586.3	0.3	0.0	0.1	0.2	25.6
	Barge Generator (Aux)	2004	99	0.43	6.93	0.46	1.18	3.59	586.3	0.7	0.0	0.1	0.3	55.0
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	586.3	1.5	0.1	0.2	0.6	127.8
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	586.3	0.9	0.0	0.1	0.7	108.4

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft*, September 2007

[c] Assumes all Hanson engines manufactured in or prior to 1985 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2011 adn that all Jerico engines met the USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

Table D9A. Emission Factors for Mining Equipment (2011) - Corrected

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d] NOx[2]	PM	ROG	CO	CO2[1]	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	4.85	0.36	0.95	3.07	568.3	5.6	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	4.73	0.32	1.07	4.33	568.3	1.2	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	4.73	0.32	1.07	4.33	568.3	1.4	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	4.73	0.32	1.07	4.33	568.3	1.7	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
	Barge Generator (Aux)[4]	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial*

[c] Assumes all Hanson engines manufactured in or prior to 1985 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2011 ~~and that all Jerico engines met the USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.~~[3]

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

[1] Correction noted in TRC Comment: 2, *CO2 Emission Factor Accuracy*

[2] Correction noted in TRC Comment: 3 *NOx Tier II Emission Factor Accuracy*

[3] Correction noted in TRC Comment: 5 *Footnote (c) in Tables D 6 and D 9*

[4] Correction noted in TRC Comment: 6 *Jerico Dredge Barge Generator NOx Emission Factor*

10-61 cont.

Table D10. Emission Rates by Activity (2011)

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***28.0***	***1.3***	***3.3***	***10.3***	***2,499.8***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,680.4
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***21.3***	***0.9***	***2.2***	***6.7***	***1,827.6***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***8.1***	***0.5***	***1.4***	***4.6***	***819.4***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	739.4
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***23.9***	***1.0***	***2.5***	***7.7***	***2,052.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***15.1***	***0.7***	***1.7***	***5.3***	***1,313.6***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	739.4
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	244.6
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	244.6
Barge - Gen - Aux	2.1	0.1	0.4	1.5	208.4
Total	***16.6***	***0.7***	***1.9***	***6.3***	***1,436.9***
Jerico Barge - Mining					
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	127.8
Total	***2.2***	***0.1***	***0.3***	***0.9***	***182.9***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	685.1
Jerico Barge - Generator	0.7	0.0	0.1	0.3	55.0
Total	***8.7***	***0.4***	***0.9***	***2.6***	***740.1***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	108.4
Total	***0.9***	***0.0***	***0.1***	***0.7***	***108.4***

10-61 cont.

Table D10A. Emission Rates by Activity (2011) - Corrected

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***26.6***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***21.0***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***6.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***23.5***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***14.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	1.7	0.1	0.4	1.5	202.0
Total	***16.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

10-61 cont.

TRC

Table D11. Annual Emissions (2011)

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	21.3	0.9	2.2	6.7	1,827.6	8.5	0.4	0.9	2.7	727.4
		Mining	5.5	28.0	1.3	3.3	10.3	2,499.8	30.6	1.4	3.6	11.2	2,736.0
		Unloading	4	8.1	0.5	1.4	4.6	819.4	6.5	0.4	1.1	3.7	652.3
Hanson (DS-10)	398	Cruising	2	15.1	0.7	1.7	5.3	1,313.6	6.0	0.3	0.7	2.1	522.8
		Mining	5.5	23.9	1.0	2.5	7.7	2,052.9	26.1	1.1	2.8	8.5	2,246.9
		Unloading	4	16.6	0.7	1.9	6.3	1,436.9	13.2	0.6	1.5	5.0	1,143.8
Suisun Associates (TS&G 230)	38	Cruising	2	21.3	0.9	2.2	6.7	1,827.6	0.8	0.0	0.1	0.3	69.5
		Mining	5.5	28.0	1.3	3.3	10.3	2,499.8	2.9	0.1	0.3	1.1	261.2
		Unloading	4	8.1	0.5	1.4	4.6	819.4	0.6	0.0	0.1	0.4	62.3
Suisun Associates (DS-10)	37	Cruising	2	15.1	0.7	1.7	5.3	1,313.6	0.6	0.0	0.1	0.2	48.6
		Cruising	2	23.9	1.0	2.5	7.7	2,052.9	0.9	0.0	0.1	0.3	76.0
		Cruising	2	16.6	0.7	1.9	6.3	1,436.9	0.6	0.0	0.1	0.2	53.2
Suisun Associates (Jerico Barge)	75	Cruising	2	8.7	0.4	0.9	2.6	740.1	0.7	0.0	0.1	0.2	55.5
		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.4	0.0	0.1	0.2	37.7
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
Jerico	32	Cruising	2	8.7	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	2.2	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									99.4	4.5	11.6	36.6	8,802.4

Table D11A. Annual Emissions (2011) - Corrected

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	21.0	0.9	2.2	6.7	1771.5	8.4	0.4	0.9	2.7	705.1
		Mining	5.5	26.6	1.3	3.3	10.3	2423.0	29.1	1.4	3.6	11.2	2,652.0
		Unloading	4	6.7	0.5	1.4	4.6	794.3	5.4	0.4	1.1	3.7	632.2
Hanson (DS-10)	398	Cruising	2	14.7	0.7	1.7	5.3	1273.3	5.9	0.3	0.7	2.1	506.8
		Mining	5.5	23.5	1.0	2.5	7.7	1989.9	25.7	1.1	2.8	8.5	2,178.0
		Unloading	4	16.2	0.7	1.9	6.3	1392.8	12.9	0.6	1.5	5.0	1,108.7
Suisun Associates (TS&G 230)	38	Cruising	2	21.0	0.9	2.2	6.7	1771.5	0.8	0.0	0.1	0.3	67.3
		Mining	5.5	26.6	1.3	3.3	10.3	2423.0	2.8	0.1	0.3	1.1	253.2
		Unloading	4	6.7	0.5	1.4	4.6	794.3	0.5	0.0	0.1	0.4	60.4
Suisun Associates (DS-10)	37	Cruising	2	14.7	0.7	1.7	5.3	1273.3	0.5	0.0	0.1	0.2	47.1
		Cruising	2	23.5	1.0	2.5	7.7	1989.9	0.9	0.0	0.1	0.3	73.6
		Cruising	2	16.2	0.7	1.9	6.3	1392.8	0.6	0.0	0.1	0.2	51.5
Suisun Associates (Jerico Barge)	75	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.6	0.0	0.1	0.2	53.8
		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.4	0.0	0.1	0.2	37.7
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
Jerico	32	Cruising	2	8.5	0.4	0.9	2.6	740.1	0.3	0.0	0.0	0.1	23.7
		Mining	5.5	1.9	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									95.5	4.5	11.6	36.6	8,536.7
% Reduction due to TRC corrections:									3.95%	0.00%	0.00%	0.00%	3.02%

TRC

10-61 cont.

Table D12. Emission Factors for Mining Equipment (2018)

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d] NOx	PM	ROG	CO	CO2	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	5.8	0.29	0.68	1.97	586.3	10.9	0.5	1.3	3.7	1,105.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	5.8	0.29	0.68	1.97	586.3	16.6	0.8	1.9	5.6	1,680.4
	Barge - Main Engine	1983	1,000	0.52	5.8	0.36	0.95	3.07	586.3	6.6	0.4	1.1	3.5	672.1
	Barge - Generator (Aux)	1984	265	0.43	5.8	0.32	1.07	4.33	586.3	1.5	0.1	0.3	1.1	147.3
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	5.8	0.32	1.07	4.33	586.3	1.7	0.1	0.3	1.2	169.0
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	586.3	8.7	0.4	0.9	2.5	739.4
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	586.3	2.9	0.1	0.3	1.2	244.6
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	5.8	0.32	1.07	4.33	586.3	2.1	0.1	0.4	1.5	208.4
	Tug (2 engines)	2001	1,060	0.5	5.8	0.29	0.68	1.97	586.3	6.8	0.3	0.8	2.3	685.1
Jerico Tug	Tug (generator)	2000	64	0.31	5.8	0.46	1.18	3.59	586.3	0.3	0.0	0.1	0.2	25.6
	Barge Generator (Aux)	2004	99	0.43	5.8	0.46	1.18	3.59	586.3	0.5	0.0	0.1	0.3	55.0
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	5.8	0.26	0.81	2.78	586.3	1.3	0.1	0.2	0.6	127.8
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	586.3	0.9	0.0	0.1	0.7	108.4

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making. Proposed Regulation for Commercial Harbor Craft*. September 2007

[c] Assumes all Hanson engines manufactured in or prior to 2003 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5 8 grams per brake-horsepower hour) by 2018.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

Table D12A. Emission Factors for Mining Equipment (2018) - Corrected

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d] NOx[2]	PM	ROG	CO	CO2[1]	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	5.12	0.29	0.68	1.97	568.3	9.7	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	5.12	0.29	0.68	1.97	568.3	14.7	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	4.85	0.36	0.95	3.07	568.3	5.6	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	4.73	0.32	1.07	4.33	568.3	1.2	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	4.73	0.32	1.07	4.33	568.3	1.4	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	5.12	0.29	0.68	1.97	568.3	6.5	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	4.99	0.26	0.81	2.78	568.3	2.1	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	4.99	0.26	0.81	2.78	568.3	2.1	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	4.73	0.32	1.07	4.33	568.3	1.7	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	5.12	0.29	0.68	1.97	568.3	6.0	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	4.62	0.46	1.18	3.59	568.3	0.2	0.0	0.1	0.2	24.9
	Barge Generator (Aux)[4]	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	4.99	0.26	0.81	2.78	568.3	1.1	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making. Proposed Regulation for Commercial Harbor Craft*. September 2007

[c] Assumes all Hanson engines manufactured in or prior to 2003 would meet USEPA Tier 2 NOx standard of 7 8 grams per kilowatt-hour (5 8 grams per brake-horsepower hour) by 2018

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

[1] Correction noted in TRC Comment *2. CO2 Emission Factor Accuracy*

[2] Correction noted in TRC Comment *3. NOx Tier II Emission Factor Accuracy*

[4] Correction noted in TRC Comment *6. Jerico Dredge Barge Generator NOx Emission Factor*

TRC

10-61 cont.

Table D13. Emission Rates by Activity (2018)

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	16.6	0.8	1.9	5.6	1,680.4
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***24.7***	***1.3***	***3.3***	***10.3***	***2,499.8***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	16.6	0.8	1.9	5.6	1,680.4
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***18.1***	***0.9***	***2.2***	***6.7***	***1,827.6***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	6.6	0.4	1.1	3.5	672.1
TS&G - Barge - Gen - Aux	1.5	0.1	0.3	1.1	147.3
Total	***8.1***	***0.5***	***1.4***	***4.6***	***819.4***
Hanson DS-10 - Mining					
American River Tug	10.9	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	739.4
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***21.7***	***1.0***	***2.5***	***7.7***	***2,052.9***
Hanson DS-10 - Cruising					
American River Tug	10.9	0.5	1.3	3.7	1,105.2
DS-10 - Barge (Generator)	2.1	0.1	0.4	1.5	208.4
Total	***13.0***	***0.7***	***1.7***	***5.3***	***1,313.6***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	739.4
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	244.6
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	244.6
Barge - Gen - Aux	2.1	0.1	0.4	1.5	208.4
Total	***16.6***	***0.7***	***1.9***	***6.3***	***1,436.9***
Jerico Barge - Mining					
Jerico Barge - Generator	0.5	0.0	0.1	0.3	55.0
Jerico Barge - Monitor	1.3	0.1	0.2	0.6	127.8
Total	***1.8***	***0.1***	***0.3***	***0.9***	***182.9***
Jerico Barge - Cruising					
Jerico Tug - Main	6.8	0.3	0.8	2.3	685.1
Jerico Barge - Generator	0.5	0.0	0.1	0.3	55.0
Total	***7.3***	***0.4***	***0.9***	***2.6***	***740.1***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	108.4
Total	***0.9***	***0.0***	***0.1***	***0.7***	***108.4***

10-61
cont.

TRC

Table D13A. Emission Rates by Activity (2018) - Corrected

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	14.7	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***21.4***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	14.7	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***15.9***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***6.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	9.7	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	6.5	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***17.8***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	9.7	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***11.3***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	6.5	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.1	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.1	0.1	0.3	1.2	237.0
Barge - Gen - Aux	1.7	0.1	0.4	1.5	202.0
Total	***12.3***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.1	0.1	0.2	0.6	123.9
Total	***1.5***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	6.0	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***6.4***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

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TRC

Table D14. Annual Emissions (2018)

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr) NOx	PM	ROG	CO	CO2	Annual Emissions (tons per year) NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	18.1	0.9	2.2	6.7	1,827.6	7.2	0.4	0.9	2.7	727.4
		Mining	5.5	24.7	1.3	3.3	10.3	2,499.8	27.1	1.4	3.6	11.2	2,736.0
		Unloading	4	8.1	0.5	1.4	4.6	819.4	6.5	0.4	1.1	3.7	652.3
Hanson (DS-10)	398	Cruising	2	13.0	0.7	1.7	5.3	1,313.6	5.2	0.3	0.7	2.1	522.8
		Mining	5.5	21.7	1.0	2.5	7.7	2,052.9	23.8	1.1	2.8	8.5	2,246.9
		Unloading	4	16.6	0.7	1.9	6.3	1,436.9	13.2	0.6	1.5	5.0	1,143.8
Suisun Associates (TS&G 230)	38	Cruising	2	18.1	0.9	2.2	6.7	1,827.6	0.7	0.0	0.1	0.3	69.5
		Mining	5.5	24.7	1.3	3.3	10.3	2,499.8	2.6	0.1	0.3	1.1	261.2
		Unloading	4	8.1	0.5	1.4	4.6	819.4	0.6	0.0	0.1	0.4	62.3
Suisun Associates (DS-10)	37	Cruising	2	13.0	0.7	1.7	5.3	1,313.6	0.5	0.0	0.1	0.2	48.6
		Cruising	2	21.7	1.0	2.5	7.7	2,052.9	0.8	0.0	0.1	0.3	76.0
		Cruising	2	16.6	0.7	1.9	6.3	1,436.9	0.6	0.0	0.1	0.2	53.2
Suisun Associates (Jerico Barge)	75	Cruising	2	7.3	0.4	0.9	2.6	740.1	0.5	0.0	0.1	0.2	55.5
		Mining	5.5	1.8	0.1	0.3	0.9	182.9	0.4	0.0	0.1	0.2	37.7
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
Jerico	32	Cruising	2	7.3	0.4	0.9	2.6	740.1	0.2	0.0	0.0	0.1	23.7
		Mining	5.5	1.8	0.1	0.3	0.9	182.9	0.2	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**90.5**	**4.5**	**11.6**	**36.6**	**8,802.4**

Table D14A. Annual Emissions (2018) - Corrected

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr) NOx	PM	ROG	CO	CO2	Annual Emissions (tons per year) NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	15.9	0.9	2.2	6.7	1771.5	6.3	0.4	0.9	2.7	705.1
		Mining	5.5	21.4	1.3	3.3	10.3	2423.0	23.4	1.4	3.6	11.2	2,652.0
		Unloading	4	6.7	0.5	1.4	4.6	794.3	5.4	0.4	1.1	3.7	632.2
Hanson (DS-10)	398	Cruising	2	11.3	0.7	1.7	5.3	1273.3	4.5	0.3	0.7	2.1	506.8
		Mining	5.5	17.8	1.0	2.5	7.7	1989.9	19.5	1.1	2.8	8.5	2,178.0
		Unloading	4	12.3	0.7	1.9	6.3	1392.8	9.8	0.6	1.5	5.0	1,108.7
Suisun Associates (TS&G 230)	38	Cruising	2	15.9	0.9	2.2	6.7	1771.5	0.6	0.0	0.1	0.3	67.3
		Mining	5.5	21.4	1.3	3.3	10.3	2423.0	2.2	0.1	0.3	1.1	253.2
		Unloading	4	6.7	0.5	1.4	4.6	794.3	0.5	0.0	0.1	0.4	60.4
Suisun Associates (DS-10)	37	Cruising	2	11.3	0.7	1.7	5.3	1273.3	0.4	0.0	0.1	0.2	47.1
		Cruising	2	17.8	1.0	2.5	7.7	1989.9	0.7	0.0	0.1	0.3	73.6
		Cruising	2	12.3	0.7	1.9	6.3	1392.8	0.5	0.0	0.1	0.2	51.5
Suisun Associates (Jerico Barge)	75	Cruising	2	6.4	0.4	0.9	2.6	717.4	0.5	0.0	0.1	0.2	53.8
		Mining	5.5	1.5	0.1	0.3	0.9	182.9	0.3	0.0	0.1	0.2	37.7
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.4	0.0	0.1	0.3	48.8
Jerico	32	Cruising	2	6.4	0.4	0.9	2.6	740.1	0.2	0.0	0.0	0.1	23.7
		Mining	5.5	1.5	0.1	0.3	0.9	182.9	0.1	0.0	0.0	0.1	16.1
		Unloading	12	0.9	0.0	0.1	0.7	108.4	0.2	0.0	0.0	0.1	20.8
Total Emisisons (tons per year)									**75.5**	**4.5**	**11.6**	**36.6**	**8,536.7**

% Reduction due to TRC corrections: 16.62% 0.00% 0.00% 0.00% 3.02%

TRC

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Appendix 4 – Emissions Modified Baseline 10-62

Table D1. Emissions Summary - Averaged Mined Per Year 1998-2008

Scenario	Annual Emissions (tons per year)					Metric Tons
	NOx	PM	ROG	CO	CO2	CO2
Existing						
Hanson (TS&G)	52.3	1.8	4.6	14.3	3,257.6	
Hanson (DS-10)	39.8	1.6	4.0	12.7	3,088.1	
Suisin Assoc. (TS&G)	1.8	0.1	0.2	0.5	110.3	
Suisun Assoc. (DS-10)	0.7	0.0	0.1	0.2	51.2	
Suisun Assoc. (Jerico)	0.6	0.0	0.1	0.3	55.1	
Jerico	0.7	0.0	0.1	0.4	69.7	
CEMEX	6.1	0.2	0.5	1.7	380.9	
TOTAL	*102.0*	*3.7*	*9.5*	*30.1*	*7012.8*	*6,362*
Future (2010)						
Hanson (TS&G)	64.1	2.2	5.6	17.6	3,989.3	
Hanson (DS-10)	48.9	1.9	4.9	15.6	3,793.4	
Suisin Assoc. (TS&G)	6.1	0.2	0.5	1.7	380.9	
Suisun Assoc. (DS-10)	2.2	0.1	0.2	0.7	172.3	
Suisun Assoc. (Jerico)	1.4	0.1	0.2	0.7	137.6	
Jerico	0.6	0.0	0.1	0.3	58.7	
TOTAL	*123.4*	*4.5*	*11.6*	*36.6*	*8,532.2*	*7,740*
Change from Existing	***21.4***	*0.8*	*2.0*	*6.5*	*1,519.4*	*1,378*
Future (2011) NOx Emissions						
Hanson (TS&G)	42.9	--	--	--	--	
Hanson (DS-10)	44.5	--	--	--	--	
Suisin Assoc. (TS&G)	4.1	--	--	--	--	
Suisun Assoc. (DS-10)	2.0	--	--	--	--	
Suisun Assoc. (Jerico)	1.4	--	--	--	--	
Jerico	0.6	--	--	--	--	
TOTAL	*95.5*	--	--	--	--	
Change from existing	***(6.5)***	--	--	--	--	-
Future (2018) NOx Emissions						
Hanson (TS&G)	35.1	--	--	--	--	
Hanson (DS-10)	33.8	--	--	--	--	
Suisin Assoc. (TS&G)	3.4	--	--	--	--	
Suisun Assoc. (DS-10)	1.5	--	--	--	--	
Suisun Assoc. (Jerico)	1.2	--	--	--	--	
Jerico	0.5	--	--	--	--	
TOTAL	*75.5*	--	--	--	--	
Change from Existing	*(26.5)*	--	--	--	--	-

10-62 cont.

TRC

Table D2. Mining Events (Current and Requested) Averaged Mined Per Year 1998-2008

Parcel	Average Mined per Year 1998-2008		Requested Conditions	
	Annual Volume	Mining Events [a]	Annual Volume	Mining Events [a]
State Lands Commission Parcels				
PRC 709.1 Presidio Shoals (Hanson)	389,344	195	340,000	170
PRC 2036.1 Point Knox South (Hanson)	274,099	137	450,000	225
PRC 7779.1 Point Knox Shoal (Hanson)	378,201	189	550,000	275
PRC 7780.1 Alcatraz South Shoal (Hanson)	104,925	52	200,000	100
PRC 7781.1: Suisun Associates	103,987	52	300,000	150
PRC 5871.1 CEMEX	51,989	26		
State Lands Lease Totals	*1,302,545*	*651*	*1,840,000*	*920*
Private Parcels				
Grossi Middle Ground: ACOE Permit No. 25653N (Hanson)	75,858	38	25,000	13
Grossi Middle Ground: ACOE Permit No. 24996N (Hanson)	75,858	38	25,000	13
Grossi Middle Ground: ACOE Permit No. 24913N (Jerico)	75,858	38	150,000	75
CEMEX	19,539	10		
Private Parcel Lease Totals	*247,113*	*124*	*200,000*	*101*
Total All Leases	**1,549,658**	**775**	**2,040,000**	**1,021**
Net Change in Mining Events	**246**			

[a] Assumes that 2,000 cubic yards of sand are collected during each mining event

TRC

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Table D3. Emission Factors for Mining Equipment (Baseline) - Averaged Mined per Year 1998-2008

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d] NOx	PM	ROG	CO	CO2	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	568.3	15.1	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	568.3	2.6	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	10.23	0.32	1.07	4.33	568.3	2.9	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	10.23	0.32	1.07	4.33	568.3	3.6	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
	Barge Generator (Aux)	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1
CEMEX Tug[e]	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
CEMEX Barge[e]	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	568.3	15.1	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	568.3	2.6	0.1	0.3	1.1	142.8

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft,* September 2007.

[c] Criteria pollutant emission factors obtained from Appendix B (cited above). All Equipment except for the TS&G assumes a fuel correction factor of 0.948 and 0.8 for NOx and PM respectively while the TS&G assumes a fuel correction factor of 0.930 and 0.720 for NOx and PM10 respectively.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

[e] CEMEX Tug and barge specs are estimated based on comparable equipment operated by Hanson.

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Table D4. Emission Rates by Activity (Baseline)
Average Mined per Year 1998-2008

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***17.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***25.4***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	3.6	0.1	0.4	1.5	202.0
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***
CEMEX - Mining					
Tug	19.9	0.8	1.9	5.6	1628.8
Barge - Main	15.1	0.4	1.1	3.5	651.5
Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	**37.5**	**1.3**	**3.3**	**10.3**	**2423.0**
CEMEX - Cruising					
Tug	19.9	0.8	1.9	5.6	1628.8
Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	**22.4**	**0.9**	**2.2**	**6.7**	**1771.5**
CEMEX - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	**17.7**	**0.5**	**1.4**	**4.6**	**794.3**

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TRC

Table D5. Annual Emissions (Baseline) - Average Mined per Year 1998-2008

				Emission Rates (lb/hr)					Annual Emissions (tons per year)				
Barge	Mining Events	Activity	Hours	NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	325	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	7.3	0.3	0.7	2.2	575.7
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	33.5	1.2	3.0	9.2	2,165.6
		Unloading	4	17.7	0.5	1.4	4.6	794.3	11.5	0.3	0.9	3.0	516.3
Hanson (DS-10)	324	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	5.4	0.2	0.5	1.7	412.5
		Mining	5.5	25.4	1.0	2.5	7.7	1,989.9	22.7	0.9	2.2	6.9	1,773.0
		Unloading	4	18.2	0.7	1.9	6.3	1,392.8	11.8	0.5	1.2	4.1	902.5
Suisun Associates (TS&G 230)	11	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	0.2	0.0	0.0	0.1	19.5
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	1.1	0.0	0.1	0.3	73.3
		Unloading	4	17.7	0.5	1.4	4.6	794.3	0.4	0.0	0.0	0.1	17.5
Suisun Associates (DS-10)	11	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	0.2	0.0	0.0	0.1	14.0
		Cruising	2	25.4	1.0	2.5	7.7	1,989.9	0.3	0.0	0.0	0.1	21.9
		Cruising	2	18.2	0.7	1.9	6.3	1,392.8	0.2	0.0	0.0	0.1	15.3
Suisun Associates (Jerico Barge)	30	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.3	0.0	0.0	0.1	21.5
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.2	0.0	0.0	0.1	14.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.1	18.9
Jerico	38	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.3	0.0	0.0	0.1	27.3
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.2	0.0	0.0	0.1	18.5
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.2	24.0
CEMEX	36	Cruising	2	22.4	0.9	2.2	6.7	1771.5	0.9	0.0	0.1	0.3	67.3
		Mining	5.5	37.5	1.3	3.3	10.3	2423.0	3.9	0.1	0.3	1.1	253.2
		Unloading	4	17.7	0.5	1.4	4.6	794.3	1.3	0.0	0.1	0.4	60.4
Total Emisisons (tons per year)									**102.0**	**3.7**	**9.5**	**30.1**	**7,012.8**

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TRC

Table D6. Emission Factors for Mining Equipment (2010) - Average Mined per Year 1998-2008

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d] NOx	PM	ROG	CO	CO2	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	568.3	15.1	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	568.3	2.6	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	10.23	0.32	1.07	4.33	568.3	2.9	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	10.23	0.32	1.07	4.33	568.3	3.6	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
	Barge Generator (Aux)	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft,* September 2007.

[c] Assumes all Jerico engines would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

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Table D7. Emission Rates by Activity (2010)
Average Mined per Year 1998-2008

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***17.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***25.4***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	3.6	0.1	0.4	1.5	202.0
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

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Table D8. Annual Emissions (2010) - Average Mined per Year 1998-2008

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr) NOx	PM	ROG	CO	CO2	Annual Emissions (tons per year) NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	8.9	0.4	0.9	2.7	705.1
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	41.1	1.4	3.6	11.2	2,652.0
		Unloading	4	17.7	0.5	1.4	4.6	794.3	14.1	0.4	1.1	3.7	632.2
Hanson (DS-10)	398	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	6.6	0.3	0.7	2.1	506.8
		Mining	5.5	25.4	1.0	2.5	7.7	1,989.9	27.8	1.1	2.8	8.5	2,178.0
		Unloading	4	18.2	0.7	1.9	6.3	1,392.8	14.5	0.6	1.5	5.0	1,108.7
Suisun Associates (TS&G 230)	38	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	0.9	0.0	0.1	0.3	67.3
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	3.9	0.1	0.3	1.1	253.2
		Unloading	4	17.7	0.5	1.4	4.6	794.3	1.3	0.0	0.1	0.4	60.4
Suisun Associates (DS-10)	37	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	0.6	0.0	0.1	0.2	47.1
		Cruising	2	25.4	1.0	2.5	7.7	1,989.9	0.9	0.0	0.1	0.3	73.6
		Cruising	2	18.2	0.7	1.9	6.3	1,392.8	0.7	0.0	0.1	0.2	51.5
Suisun Associates (Jerico Barge)	75	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.6	0.0	0.1	0.2	53.8
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.4	0.0	0.1	0.2	36.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.4	0.0	0.1	0.3	47.3
Jerico	32	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.3	0.0	0.0	0.1	23.0
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.2	0.0	0.0	0.1	15.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.1	20.2
Total Emisisons (tons per year)									**123.4**	**4.5**	**11.6**	**36.6**	**8,532.2**

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Table D9. Emission Factors for Mining Equipment (2011) - Average Mined per Year 1998-2008

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d] NOx	PM	ROG	CO	CO2	Emission Rate (lb/hr) NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	4.85	0.36	0.95	3.07	568.3	5.6	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	4.73	0.32	1.07	4.33	568.3	1.2	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	4.73	0.32	1.07	4.33	568.3	1.4	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	4.73	0.32	1.07	4.33	568.3	1.7	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
	Barge Generator (Aux)	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft,* September 2007.

[c] Assumes all Hanson engines manufactured in or prior to 1985 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2011 adn that all Jerico engines met the USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

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Table D10. Emission Rates by Activity (2011)

Average Mined per Year 1998-2008

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***26.6***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***21.0***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***6.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***23.5***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***14.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	1.7	0.1	0.4	1.5	202.0
Total	***16.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

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Table D11. Annual Emissions (2011) - Average Mined per Year 1998-2008

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	21.0	0.9	2.2	6.7	1,771.5	8.4	0.4	0.9	2.7	705.1
		Mining	5.5	26.6	1.3	3.3	10.3	2,423.0	29.1	1.4	3.6	11.2	2,652.0
		Unloading	4	6.7	0.5	1.4	4.6	794.3	5.4	0.4	1.1	3.7	632.2
Hanson (DS-10)	398	Cruising	2	14.7	0.7	1.7	5.3	1,273.3	5.9	0.3	0.7	2.1	506.8
		Mining	5.5	23.5	1.0	2.5	7.7	1,989.9	25.7	1.1	2.8	8.5	2,178.0
		Unloading	4	16.2	0.7	1.9	6.3	1,392.8	12.9	0.6	1.5	5.0	1,108.7
Suisun Associates (TS&G 230)	38	Cruising	2	21.0	0.9	2.2	6.7	1,771.5	0.8	0.0	0.1	0.3	67.3
		Mining	5.5	26.6	1.3	3.3	10.3	2,423.0	2.8	0.1	0.3	1.1	253.2
		Unloading	4	6.7	0.5	1.4	4.6	794.3	0.5	0.0	0.1	0.4	60.4
Suisun Associates (DS-10)	37	Cruising	2	14.7	0.7	1.7	5.3	1,273.3	0.5	0.0	0.1	0.2	47.1
		Cruising	2	23.5	1.0	2.5	7.7	1,989.9	0.9	0.0	0.1	0.3	73.6
		Cruising	2	16.2	0.7	1.9	6.3	1,392.8	0.6	0.0	0.1	0.2	51.5
Suisun Associates (Jerico Barge)	75	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.6	0.0	0.1	0.2	53.8
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.4	0.0	0.1	0.2	36.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.4	0.0	0.1	0.3	47.3
Jerico	32	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.3	0.0	0.0	0.1	23.0
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.2	0.0	0.0	0.1	15.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.1	20.2
Total Emisisons (tons per year)									**95.5**	**4.5**	**11.6**	**36.6**	**8,532.2**

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Table D12. Emission Factors for Mining Equipment (2018) - Average Mined per Year 1998-2008

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d]					Emission Rate (lb/hr)				
					NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	5.12	0.29	0.68	1.97	568.3	9.7	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	5.12	0.29	0.68	1.97	568.3	14.7	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	4.85	0.36	0.95	3.07	568.3	5.6	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	4.73	0.32	1.07	4.33	568.3	1.2	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	4.73	0.32	1.07	4.33	568.3	1.4	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	5.12	0.29	0.68	1.97	568.3	6.5	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	4.99	0.26	0.81	2.78	568.3	2.1	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	4.99	0.26	0.81	2.78	568.3	2.1	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	4.73	0.32	1.07	4.33	568.3	1.7	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	5.12	0.29	0.68	1.97	568.3	6.0	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	4.62	0.46	1.18	3.59	568.3	0.2	0.0	0.1	0.2	24.9
	Barge Generator (Aux)	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	4.99	0.26	0.81	2.78	568.3	1.1	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft*, September 2007.

[c] Assumes all Hanson engines manufactured in or prior to 2003 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2018.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

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Table D13. Emission Rates by Activity (2018)
Average Mined per Year 1998-2008

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	14.7	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***21.4***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	14.7	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***15.9***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***6.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	9.7	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	6.5	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***17.8***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	9.7	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***11.3***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	6.5	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.1	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.1	0.1	0.3	1.2	237.0
Barge - Gen - Aux	1.7	0.1	0.4	1.5	202.0
Total	***12.3***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.1	0.1	0.2	0.6	123.9
Total	***1.5***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	6.0	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***6.4***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

10-62 cont.

TRC

Table D14. Annual Emissions (2018) - Average Mined per Year 1998-2008

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	15.9	0.9	2.2	6.7	1,771.5	6.3	0.4	0.9	2.7	705.1
		Mining	5.5	21.4	1.3	3.3	10.3	2,423.0	23.4	1.4	3.6	11.2	2,652.0
		Unloading	4	6.7	0.5	1.4	4.6	794.3	5.4	0.4	1.1	3.7	632.2
Hanson (DS-10)	398	Cruising	2	11.3	0.7	1.7	5.3	1,273.3	4.5	0.3	0.7	2.1	506.8
		Mining	5.5	17.8	1.0	2.5	7.7	1,989.9	19.5	1.1	2.8	8.5	2,178.0
		Unloading	4	12.3	0.7	1.9	6.3	1,392.8	9.8	0.6	1.5	5.0	1,108.7
Suisun Associates (TS&G 230)	38	Cruising	2	15.9	0.9	2.2	6.7	1,771.5	0.6	0.0	0.1	0.3	67.3
		Mining	5.5	21.4	1.3	3.3	10.3	2,423.0	2.2	0.1	0.3	1.1	253.2
		Unloading	4	6.7	0.5	1.4	4.6	794.3	0.5	0.0	0.1	0.4	60.4
Suisun Associates (DS-10)	37	Cruising	2	11.3	0.7	1.7	5.3	1,273.3	0.4	0.0	0.1	0.2	47.1
		Cruising	2	17.8	1.0	2.5	7.7	1,989.9	0.7	0.0	0.1	0.3	73.6
		Cruising	2	12.3	0.7	1.9	6.3	1,392.8	0.5	0.0	0.1	0.2	51.5
Suisun Associates (Jerico Barge)	75	Cruising	2	6.4	0.4	0.9	2.6	717.4	0.5	0.0	0.1	0.2	53.8
		Mining	5.5	1.5	0.1	0.3	0.9	177.2	0.3	0.0	0.1	0.2	36.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.4	0.0	0.1	0.3	47.3
Jerico	32	Cruising	2	6.4	0.4	0.9	2.6	717.4	0.2	0.0	0.0	0.1	23.0
		Mining	5.5	1.5	0.1	0.3	0.9	177.2	0.1	0.0	0.0	0.1	15.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.1	20.2
Total Emisisons (tons per year)									**75.5**	**4.5**	**11.6**	**36.6**	**8,532.2**

10-62 cont.

TRC

Additional Materials Received

SAN FRANCISCO ESTUARY & WATERSHED SCIENCE
Sponsored by the Delta Science Program and the UC Davis John Muir Institute of the Environment

Anthropogenic Influence on Recent Bathymetric Change in West–Central San Francisco Bay

Patrick L. Barnard[1] and Rikk G. Kvitek[2]

ABSTRACT

Two multi-beam sonar surveys of west–central San Francisco Bay, California, were conducted in 1997 and 2008. Bathymetric change analysis between the two surveys indicates a loss of 14.1 million m^3 (–3.1 cm yr^{-1}) of sediment during this time period, representing an approximately three-fold acceleration of the rate that was observed from prior depth change analysis from 1947 to 1979 for all of Central Bay, using more spatially coarse National Ocean Service (NOS) soundings. The portions of the overlapping survey areas between 1997 and 2008 designated as aggregate mining lease sites lost sediment at five times the rate of the remainder of west–central San Francisco Bay. Despite covering only 28% of the analysis area, volume change within leasing areas accounted for 9.2 million m^3 of sediment loss, while the rest of the area lost 4.9 million m^3 of sediment. The uncertainty of this recent analysis is more tightly constrained due to more stringent controls on vertical and horizontal position via tightly coupled, inertially aided differential Global Positioning Systems (GPS) solutions for survey vessel trajectory that virtually eliminate inaccuracies from traditional tide modeling and vessel motion artifacts. Further, quantification of systematic depth measurement error can now be calculated through comparison of static surfaces (e.g., bedrock) between surveys using sea-floor habitat maps based on acoustic back-scatter measurements and ground-truthing with grab samples and underwater video. Sediment loss in the entire San Francisco Bay Coastal System during the last half-century, as estimated from a series of bathymetric change studies, is 240 million m^3, and most of this is believed to be coarse sediment (i.e., sand and gravel) from Central Bay and the San Francisco Bar, which is likely to limit the sand supply to adjacent, open-coast beaches. This hypothesis is supported by a calibrated numerical model in a related study that indicates that there is a potential net export of sand-sized sediment across the Golden Gate, suggesting that a reduction in the supply of sand-sized sediment within west–central San Francisco Bay will limit transport to the outer coast.

KEYWORDS

bathymetry, multi-beam sonar, estuary, anthropogenic, dredging, aggregate mining, sediment transport

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INTRODUCTION

Multi-beam sonars use swaths of sound pulses focused perpendicular to the direction of a ship to measure depths of the seafloor. Within the last decade, multi-beam sonar system technology has advanced to enable imaging of the seafloor with increased spatial coverage (sub^{-1} m grid resolution) and angular resolution, allowing a greater number of beams per swath, increased ping frequency (5 Hz in 30 m of water) and speed (3,000 soundings/sec), and the potential of measuring depths with resolution of a few centimeters. Modern systems can collect data at boat speeds of up to 16 km hr^{-1} while still maintaining density of up to 10 soundings per m^2 in 50 m water depth, a four-fold increase in the last decade. By combining sub-meter resolution multi-beam data with the sub-decimeter positioning accuracy of differential GPS surveying, the seafloor position can now be mapped with unprecedented detail and precision. The goal of this paper is to report the results of bathymetric change analysis in west–central San Francisco Bay, California, using the first multi-beam surveys performed with differential GPS covering this region. This information is critical for the sediment-management community who must assess the impact of anthropogenic influences such as aggregate mining and dredging on the regional sediment supply.

STUDY AREA

San Francisco Bay is a large estuary with a number of economically significant harbors in one of the most developed regions of the United States (Figure 1). The San Joaquin and Sacramento rivers had, from the period 1938 to 2005, an annual mean fresh-water discharge rate into the San Francisco Bay of 800 m^3 s^{-1} (DWR 2007). Despite this accounting for 40% of California's drainage area, fresh-water input represents less than 1% of the tidal prism of 2 x 10^9 m^3 served by the Golden Gate tidal inlet, the only point of exchange with the Pacific Ocean. Tidal currents in the inlet throat peak at over 2.5 m s^{-1}, and can exceed 1 m s^{-1} even on the edge of the San Francisco Bar (i.e., ebb tidal delta), which is more than 10 km seaward of the inlet throat (Barnard and others 2007) (Figure 1). Landward of the Golden Gate, west–central San Francisco Bay is the deepest part of the entire estuary, containing the coarsest sediment, and the strongest currents. Bedrock pinnacles and sandy shoals focus currents and produce a wide range of bedform morphologies (Rubin and McCulloch 1980; Barnard and others, in press). Wave energy in the Bay is primarily generated by local winds, and plays only a minor role in sediment transport throughout the deeper portions of the bay. However, the impact of local, wind-generated waves and deep ocean swell can induce significant turbulence and sediment transport in the shallow, inter-tidal areas, where fine sediment dominates the substrate (Talke and Stacey 2003).

PRIOR WORK

Major anthropogenic changes to the San Francisco Bay Coastal System (which incorporates the San Francisco Bay, the mouth of the Sacramento–San Joaquin Delta, and the mouth of the San Francisco Bay, including the adjacent open coast) began during the Gold Rush in the 19th century and have continued to the present. The influx of an estimated 1.15 x 10^9 m^3 of sediment from hydraulic mining during the Gold Rush (Gilbert 1917) in concert with major building development in the coastal wetlands in San Francisco Bay has exerted a strong influence on San Francisco Bay evolution during the last 150 years. Anthropogenic activities in the San Francisco Bay Coastal System have permanently removed at least 200 million m^3 of sediment in the last century from borrow pit mining (54 million m^3), aggregate mining (26 million m^3), and dredging (120 million m^3) (USACE 1996; Friends of the Estuary 1997; Chin and others 1997, 2004; Dallas 2009; Dallas and Barnard 2009). However, this is a minimum estimate because not all records have been compiled. For instance, records are missing from 1976 to 1996 for dredging and borrow pit mining for the San Francisco waterfront, Alameda Air Base, BART tunnel, and Oakland Airport, and other records are incomplete. A majority of the sediment was removed from Central Bay (52%), with lesser amounts removed from the North Bay (28%), San Francisco Bar (18%), and South Bay (2%). Grain sizes were not recorded for most of the documented events,

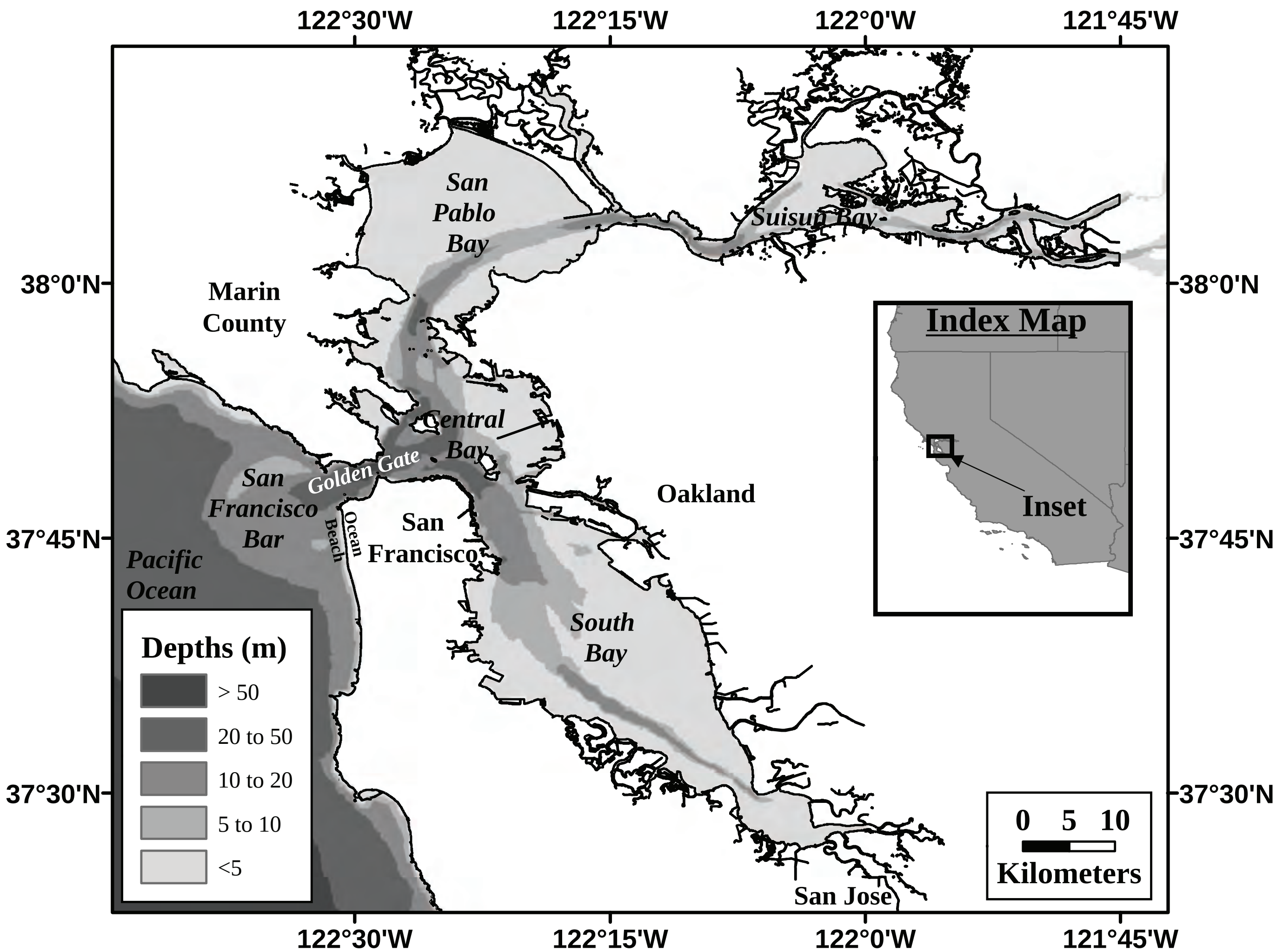

Figure 1 Study area: San Francisco Bay, California, USA

but 75 million m^3 of sediment was reported to be coarser than fine sand (Dallas 2009). The largest single removal event on record was the extraction of 22 million m^3 of sand from Central San Francisco Bay for the building of Treasure Island from 1936 to 1938 (Scheffauer 1954). The impact of these disturbances on the San Francisco Bay Coastal System has not been quantified, although it was recently determined that the mouth of San Francisco Bay lost over 90 million m^3 of sediment between 1956 and 2005 (Barnard and others 2006; Hanes and Barnard 2007), and Central San Francisco Bay lost 52 million m^3 of sediment between 1947 and 1979 (Fregoso and others 2008). Additionally, Wright and Schoellhamer (2004) demonstrated that modifications in the Delta have resulted in a ~50% reduction in suspended sediment flux to the San Francisco Bay from 1957 to 2001. Since the mid-1950s, sediment-loss trends have been documented in North Bay (i.e., San Pablo Bay and Suisun Bay by Jaffe and others (1998) and Capiella and others (1999); Central Bay by Fregoso and others [2008]; and San Francisco Bar (i.e., mouth of San Francisco Bay) by Hanes and Barnard (2007) (Table 1). Applying these rates over the last 50 years would result in an estimated sediment loss of 240 million m^3 from the entire San Francisco Bay Coastal System. It is highly probable that the majority of sediment lost from the Central Bay and on the San Francisco Bar is coarse sediment (i.e., sand and gravel) because mud only accounts for

Table 1 Summary of historical bathymetry changes in the San Francisco Bay Coastal System

Location	Reference	Dates of Analyzed Data	Rate of Change ($m^3\ yr^{-1} \times 10^6$)	Total Volume Change Projected from 1959 to 2009 ($m^3\ yr^{-1} \times 10^6$)
San Francisco Bar	Hanes and Barnard (2007)	1956 – 2005	–1.9	–95
Central Bay	Fregoso and others (2008)	1947 – 1979	–1.6	–80
San Pablo Bay	Jaffe and others (1998)	1951 – 1983	–0.7	–35
Suisun Bay	Cappiella and others (1999)	1942 – 1990	–1.1	–55
South Bay	Jaffe and Foxgrover (2006)	1983 – 2005	0.5	25
			Total	–240

~10% and 0.1% of the substrate, respectively (Greene and others 2009). Barnard and others (in press) used a calibrated hydrodynamic model to demonstrate that there is a net potential export of sand-sized sediment from the Bay to the ocean. Therefore, limits on the sand supply to the San Francisco Bay Coastal System, especially west–central San Francisco Bay, can limit the sand supply to open-coast beaches such as Ocean Beach, portions of which have been experiencing severe erosion over the last several decades (Barnard and others 2009).

METHODS

In 1997, the U.S. Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA) mapped west–central San Francisco Bay at a 4-m horizontal resolution using a Simrad EM-1000 multi-beam sonar system (Dartnell and Gardner 1999). The vertical uncertainty of each sounding in this survey is reported as 10 to 20 cm (Chin and others 1997).

In April 2008, the footprint of the 1997 multi-beam survey was re-surveyed by the Seafloor Mapping Lab at California State University, Monterey Bay, aboard the R/V VenTresca (Kvitek 2008; Figure 2). The study area was mapped using a Reson 8101 multi-beam sonar system, which operates at 240 kHz and measures relative water depths within a 150° swath consisting of 101 1.5° x 1.5° beams. The Reson 8101 can provide up to 3,000 soundings per second with a swath coverage of up to 7.4 times the water depth. A C-Nav 2050 RTG GPS system supplied real-time position data to an Applanix Position and Orientation System, Marine Vessel (POS/MV 320v4). Horizontal positional accuracy of this system is typically ±15 cm. Attitude (pitch, roll, yaw, and heave) data were generated at 200 Hz by the POS/MV with an average pitch, roll and yaw accuracy of ±0.03°, while heave accuracy was maintained at ±5% or 5 cm. Water surface-to-seafloor profiles of the speed of sound through the water were collected periodically during the surveys to correct for variations in sound velocity resulting from salinity and temperature changes throughout the water column.

Sonar data were post-processed using CARIS Hydrographic Information Processing System (HIPS) 6.1 software, after being combined with the vessel trajectory and sound velocity data. Vessel trajectory data from the Applanix POS/MV were processed with local L1/L2 GPS reference-station data using Applanix POSPac 5 software and a tightly coupled Inertially Aided Post-Processed Kinematic (IAPPK) technique to generate a smoothed best estimate of trajectory (SBET) file at 200 Hz. The SBET solution includes rotational motion about all three axes as well as heave from surface waves and tidal variation over the survey period, all tied directly to the ellipsoid, virtually eliminating positional and motion-related artifacts traditionally found in multi-beam data that tended to obscure fine, sub-meter geomorphic detail, particularly when data from adjacent track lines are superimposed. Applying the new IAPPK SBET approach to existing multi-beam sonar data yields more co-registered data points per unit area with less noise, bringing fine features into much sharper focus than previously was possible (see Figure 2). The maximum vertical uncertainty of the individual soundings in this survey was reported at 12 cm.

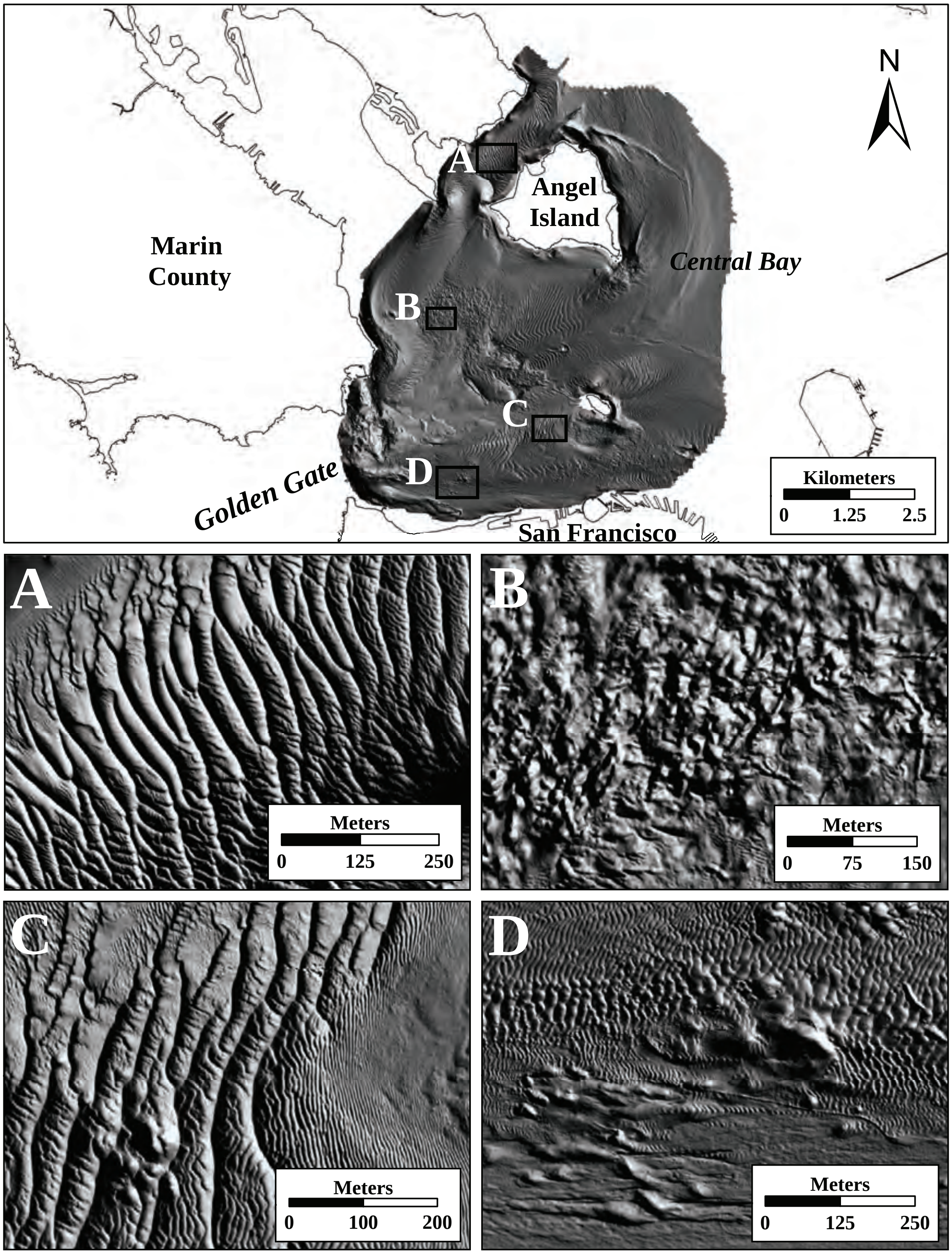

Figure 2 Shaded relief bathymetry of west-central San Francisco Bay from the 2008 multibeam sonar survey with selected close-ups of seafloor details. All bathymetry presented at 1-m resolution with a sun azimuth of 240° and vertical angle of 25°. (A) Bi-directional flow patterns in Raccoon Strait. (B) Apparent significant bottom disturbance due to aggregate mining activities on Pt. Knox Shoal. (C) Transitions to different flow regimes west of Alcatraz. (D) Large-scale flute marks due to dredge mound evolution under largely uni-directional (i.e., seaward, right to left on map) transport.

Prior to change-detection analysis, the cleaned soundings for the 2008 survey were gridded to 4-m cells using a standard inverse distance-weighting procedure. The 1997 survey data was only available as 4-m grids. The gridding accuracy for the 2008 survey was verified by spatially joining each of the cleaned soundings with the nearest gridded sounding and calculating the difference. The mean difference for over 2.8 million sounding pairs (gridded and point data) showed no significant gridding error (mean value = –0.001 m). The grids were then converted to the same horizontal coordinate system (Universal Transverse Mercator Zone 10 North) using ArcGIS transformation tools, and a common vertical datum (North American Vertical Datum of 1988 [NAVD 88]). The 1997 survey soundings were measured relative to the mean lower low water (MLLW) tidal datum (1960 to 1978 epoch) and then converted to NAVD 88 based on the datum offsets published on the Bench Mark Sheet page for the NOAA San Francisco Tide Gauge Station ID: 9414290 (NOAA 2009). The height of the geoid varies by ~±0.02 m in the study area (NOAA 2010), but it was unclear whether the soundings from the 1997 survey were mapped relative to MLLW based only on the San Francisco Tide Gauge Station or if corrections were applied using a regional tide model. Therefore, given the relatively insignificant amount of geoid height variation and to avoid potentially introducing additional vertical uncertainty, no geoid adjustments were made to the 1997 survey. The soundings from the 2008 survey were mapped directly to the North American Datum (NAD) 83 ellipsoid (Continuously Operating Reference Station [CORS] 96) and then converted to NAVD 88 on a sounding by sounding basis using the Geoid03 model (i.e., the sonar head trajectory was computed in NAD 83 height above the reference ellipsoid (HAE) and the elevations were then converted to NAVD 88 via Geoid03. Bathymetric change was then calculated by subtracting the 1997 survey grid from the 2008 grid.

RESULTS

For the total overlapping survey areas of 40.56 km^2 between the 1997 and 2008 surveys, the mean vertical change was –0.13 m (–1.2 cm yr^{-1}), which equates to a total sediment loss of 5.4 x 10^6 m^3. To assess systematic depth-measurement error, we performed a grid subtraction between the two surveys for the static surfaces (i.e., primarily bedrock surfaces that could be expected to show negligible change between surveys) as defined by the habitat mapping of Greene and others (2009) that utilized acoustic backscatter from the 2008 multi-beam sonar survey, grab samples, and underwater video (Figure 3). This analysis resulted in a systematic vertical offset of +0.21 m; the 1997 survey was too low relative to the 2008 survey that showed no statistical correlation ($r^2 \leq 0.01$) with depth, slope, easting position or northing position (Figure 4). Because there was no spatial or slope bias to the offset, we applied this value to the entire data set, although it should be noted that these static surfaces only accounted for ~4% of the total survey areas. After applying the offset, the corrected mean vertical change was –0.35 m (–3.2 cm yr^{-1})[1], equating to a total sediment loss of 14.1 x 10^6 m^3 for the 11-year span between surveys. Using the seafloor characterization of Greene and others (2009), 5% (~750,000 m^3) of the total volume loss detected from 1997 to 2008 was from substrates that are mud-dominated.

DISCUSSION

The area for the change detection from 1947 to 1979 performed by Fregoso and others (2008) only overlapped with the recent analysis by ~50%. However, they reported a rate of –1.1 cm yr^{-1} (–31 x 10^6 m^3) for the area that most closely approximates the 1997 to 2008 change-detection analysis region. Additionally, the rate of change calculated for the mouth of San Francisco Bay from 1956 to 2005 was –1.3 cm yr^{-1} (Hanes and Barnard 2007). A comparison of these values and the 1997 to 2008 average of –3.2 cm yr^{-1} indicates that Central Bay is losing sediment at approximately two to three times the rates of both the historical Central Bay rate (1947 to 1979) and the recent rate (1956 to 2005) calculated for the San Francisco Bar.

Figure 5 shows the bathymetric change map overlain with aggregate mining lease sites as designated

1 Due to carrying over of the third decimal place, not reported in the text, the rounded value after adding 0.21 and 0.13 is in fact 0.35.

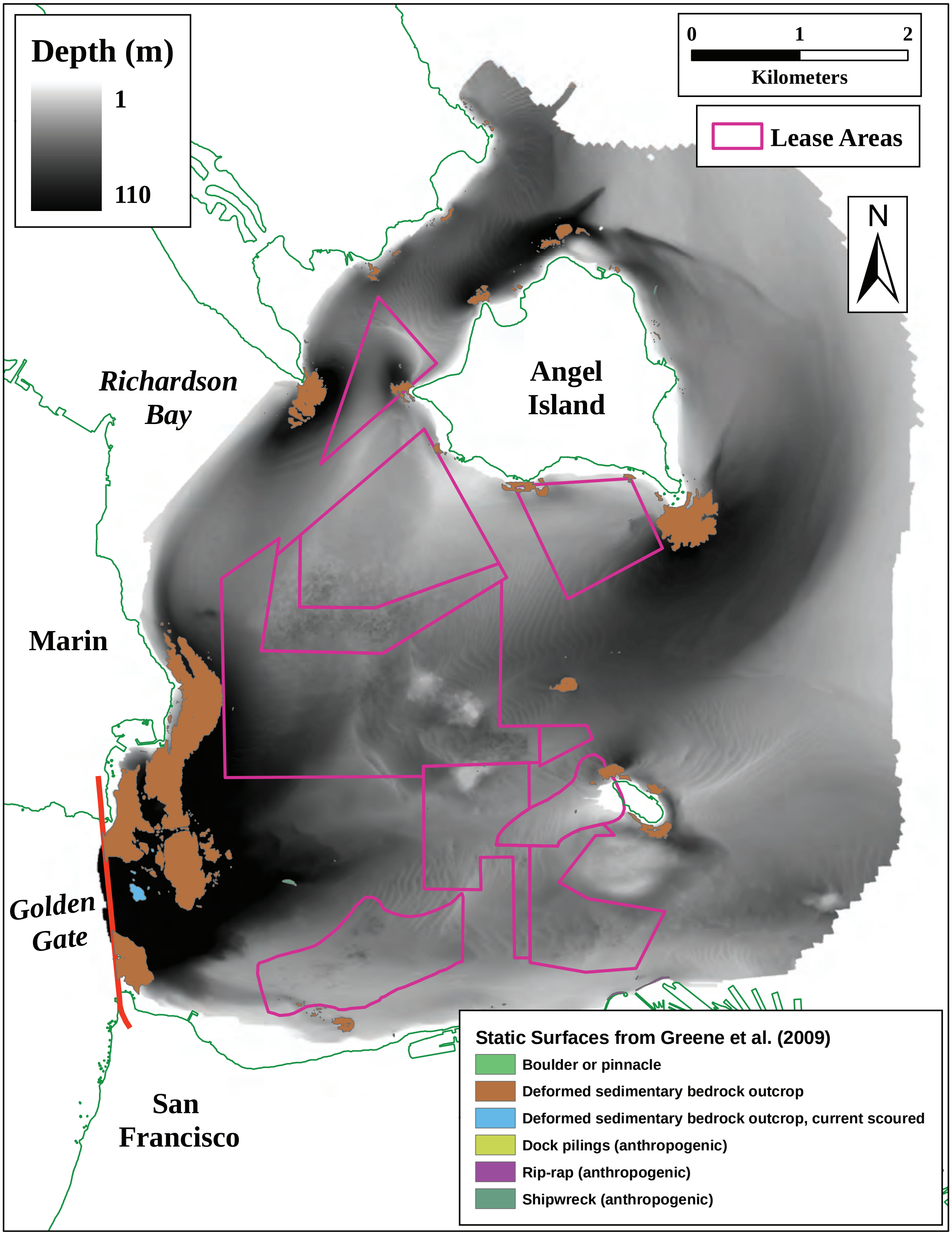

Figure 3 Location of static surfaces in west-central San Francisco Bay as defined by Greene and others (2009), with depth from the 2008 multibeam sonar survey. Note that ~95% of the static surfaces are identified as "deformed sedimentary bedrock outcrop" and that most features in the legend are barely visible due to their limited extent.

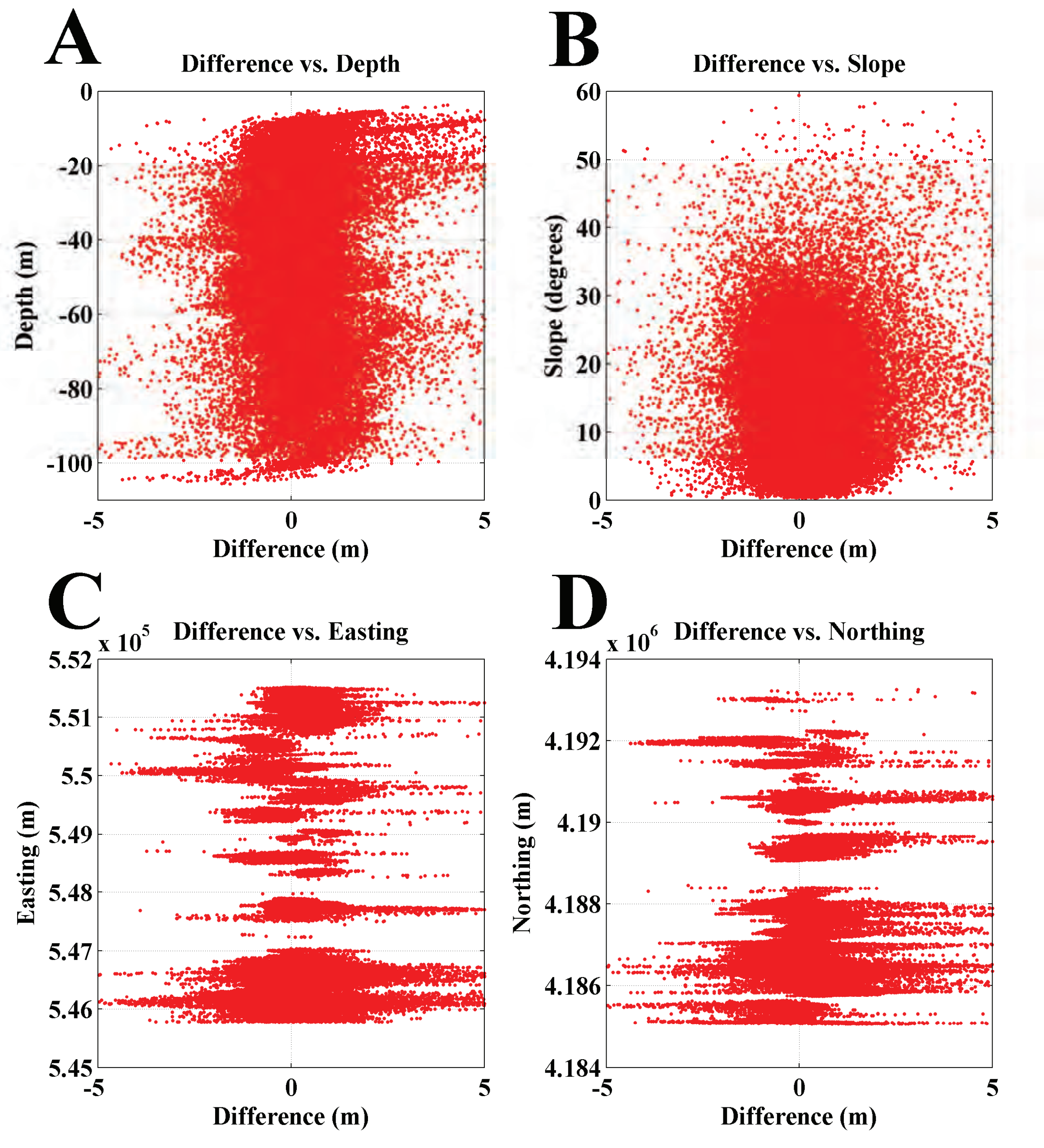

Figure 4 Plots of depth difference between the 1997 and 2008 multibeam surveys for the static surfaces identified by Greene and others (2009) vs. other spatial and slope parameters, indicating no significant correlations

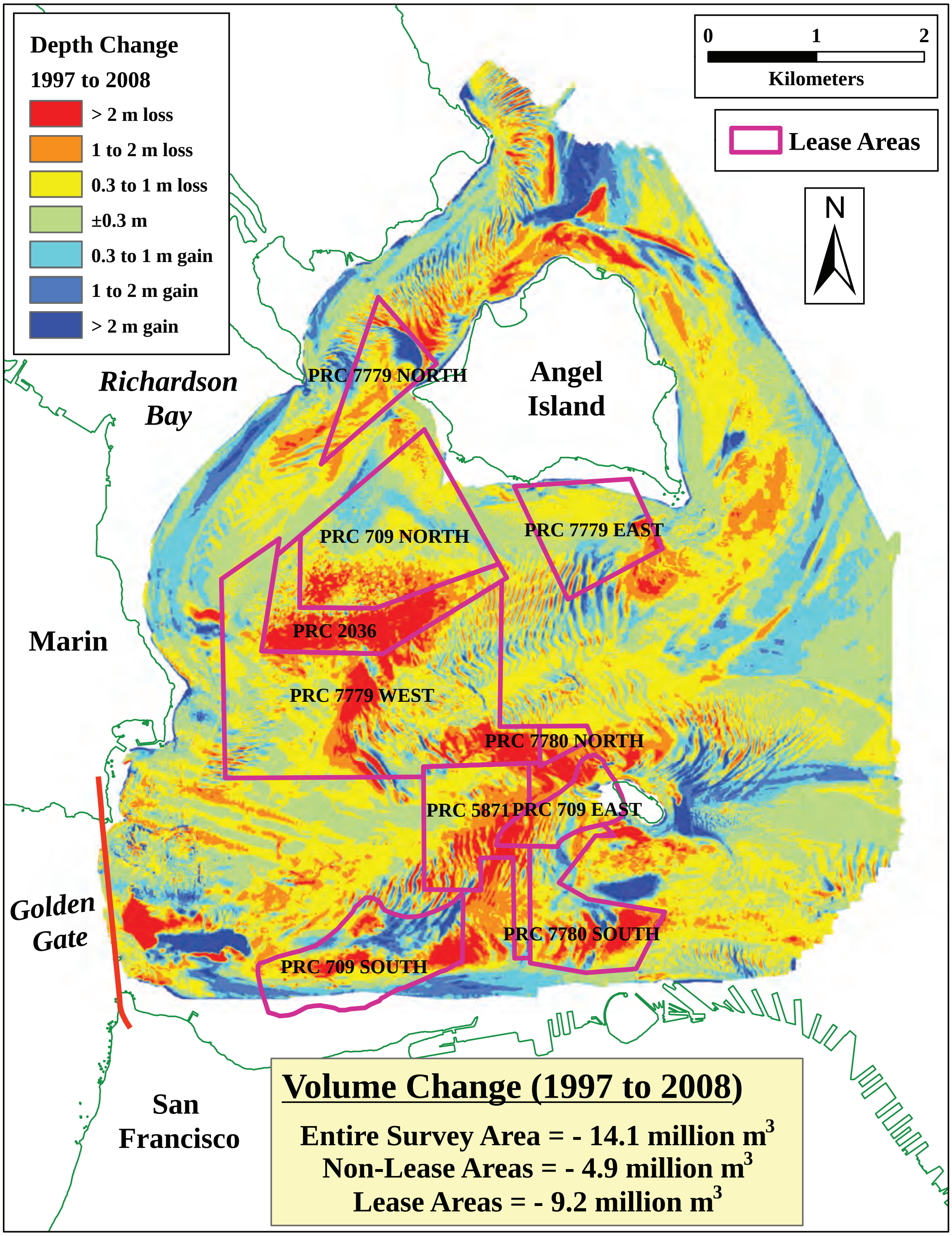

Figure 5 Bathymetric change in west-central San Francisco Bay from 1997 to 2008 with location of aggregate mining lease sites

by the California State Lands Commission and the San Francisco Bay Conservation and Development Commission (BCDC). Net sediment loss was detected within each of the ten aggregate mining lease sites in west–central San Francisco Bay (Table 2), peaking with a mean vertical change of >2 m at PRC 2036, near Pt. Knox Shoal. Bathymetric change, in terms of volume loss, was nearly double within the aggregate mining lease sites compared to non-lease sites (–9.2 x 10^6 m^3 vs. –4.9 x 10^6 m^3), although lease areas account for only 28% of the study area. Additionally, there is an almost five-fold difference in the rate of sediment loss between the lease and non-lease areas (–7.2 cm yr^{-1} vs. –1.5 cm yr^{-1}).

The rate of sediment loss for the non-lease areas in west–central San Francisco Bay from 1997 to 2008 (–1.5 cm yr^{-1}) appears to approximate the background rate of sediment loss over the last half-century, because it is broadly consistent with rates for the adjacent San Francisco Bar (–1.3 cm yr^{-1}, 1956 to 2005) and central San Francisco Bay (–1.1 cm yr^{-1}, 1947 to 1979). Therefore, the 1997 to 2008 rate of change in the lease areas (–7.2 cm yr^{-1}) must be largely attributable to anthropogenic sediment removal by aggregate mining and/or dredging, given that the rate of loss is at least 5.7 cm yr^{-1} higher than the background rate. The slightly higher background rate from 1997 to 2008 in west–central San Francisco Bay may result from the cumulative impacts of sediment removal in this region, especially in leasing areas, which can effectively limit sediment supply/replenishment to adjacent, non-lease areas. The background rate of sediment loss and local patterns of sediment gain/loss from the San Francisco Bar and Central San Francisco Bay are likely attributable to a combination of natural (e.g., flood and ebb tidal delta deposition, tidal-channel incision, submarine landslides, bedform migration, etc.) and anthropogenic influences (e.g., hydraulic mining signal reduction, drainage damming, bay sediment removal, bay development, etc., see "Prior Work"). Given that an estimated one-quarter of a billion cubic meters of sediment has been lost from the San Francisco Bay Coastal System in thelast 50 years (Table 1), most of which is sand and due to anthropogenic activities (Dallas 2009), and that a direct potential sediment transport link from the San Francisco Bay to the outer coast (Barnard and others, in press) has been established, it is not surprising that over 90% of the 13-km-long shoreline south of the San Francisco Bar has been eroding during this same period (Dallas 2009).

Table 2 Summary of bathymetric change analysis in west-central San Francisco Bay from 1997 to 2008, differentiated by aggregate mining lease sites. The geographical extent of each lease site is shown in Figure 5.

Sample Area	Area (m^2)	Mean Vertical Change (m)	Volume Change (m^3)
Total Survey Area	40,564,490	–0.35	–14,087,792
Non-lease Areas	29,032,349	–0.17	–4,861,591
All Lease Areas	11,532,142	–0.80	–9,226,201
Individual Lease Sites:			
PRC 7779 NORTH	569,432	–0.27	–152,999
PRC 7779 EAST	888,764	–0.22	–199,647
PRC 2036	918,573	–2.17	–1,991,812
PRC 709 NORTH	1,791,064	–0.52	–926,317
PRC 7779 WEST	3,699,923	–0.81	–3,015,028
PRC 7780 NORTH	114,594	–1.08	–123,648
PRC 709 EAST	424,550	–1.09	–464,579
PRC 7780 SOUTH	930,381	–0.81	–757,307
PRC 709 SOUTH	1,099,743	–0.40	–437,086
PRC 5871	1,053,022	–1.07	–1,124,425

Dallas (2009) reports that 50 million m^3 of sand-sized or coarser sediment has been removed through dredging, aggregate mining, and borrow pit mining from Central Bay since 1900. However, neither borrow pit mining nor dredging was performed in the bathymetric change analysis area (Figure 5) from 1997 to 2008, although there were minor amounts of dredging of predominantly fine-grained material (i.e., mud) in small marinas adjacent to the study area (B. Goeden, BCDC, pers. comm.). During this same period, 10.8 million m^3 of sediment was reported to be permanently removed by aggregate mining from the lease sites in west–central San Francisco Bay, while 9.2 million m^3 of sediment loss was recorded by the bathymetric change analysis within these same lease sites (Table 3). Therefore, within the lease sites, 85% of the sediment that was extracted by aggregate mining from 1997 to 2008 was not "replenished," based on the bathymetric change analysis. However, a closer inspection of Table 3 and Figure 5 indicates areas where sediment loss values were heavily influenced by natural processes and/or other anthropogenic factors. For example, the amount of sediment loss in PRC 5871 is approximately double the amount extracted by aggregate mining, suggesting that other processes play a significant role in sediment loss. Further, although Table 3 indicates that ~50% of the sediment extracted from PRC 709 by aggregate mining was naturally replenished, the spatial distribution of bed-level change in Figure 5 shows extensive mining impact in the southwest section of PRC 709 North, while the northeast section is naturally accreting, suggesting that the local impact of mining on the 11-year sediment loss values may still be substantial. Regardless of the aforementioned nuances and relatively minor uncertainties of the bathymetric change analysis, the data presented here demonstrates a clear anthropogenic influence on sediment loss in west–central San Francisco Bay from 1997 to 2008.

Table 3 Sediment volume loss by leasing block based on the depth change analysis and volume of sediment reported to be extracted by aggregate mining (Dallas, 2009; B. Goeden, pers. comm.) during the 1997 to 2008 analysis period. Volumes of sediment extracted were only reported by leasing block (i.e., not by individual lease site; see Table 2 and Figure 5).

Leasing Block	Sediment Loss (10^6 m^3)	Sediment Extracted (10^6 m^3)	Loss/ Extracted
PRC 7779	3.4	3.3	101%
PRC 2036	2.0	2.3	85%
PRC 709	1.8	3.8	49%
PRC 7780	0.9	0.8	106%
PRC 5871	1.1	0.5	211%
Total	9.2	10.8	85%

CONCLUSIONS

From 1997 to 2008, west–central San Francisco Bay lost over 14 million m^3 of sediment, the majority of which was located within aggregate mining lease sites. The rate of sediment loss is nearly three times the rate determined between surveys from 1947 to 1979, indicating a rapid acceleration of sediment loss from the region during the last decade. As only 10% of the mapped substrate is dominated by mud, and only 5% of the measured sediment loss is from mud-dominated substrates, the majority of the sediment lost from west–central San Francisco Bay was coarse sediment, material that would otherwise have been available for transport to eroding, open-coast beaches. While it is difficult to establish the precise contribution of the various potential anthropogenic influences to the observed sediment loss from 1997 to 2008 in west–central San Francisco Bay, the timing, spatial distribution, and magnitude of sediment loss suggests a strong correlation with sediment removal by aggregate mining activities.

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