SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION
455 Golden Gate Avenue, Suite 10600 . San Francisco, California 94102 (415) 352-3600 . Fax: (415) 352-3606 . www.bcdc.ca.gov

March 6, 2015

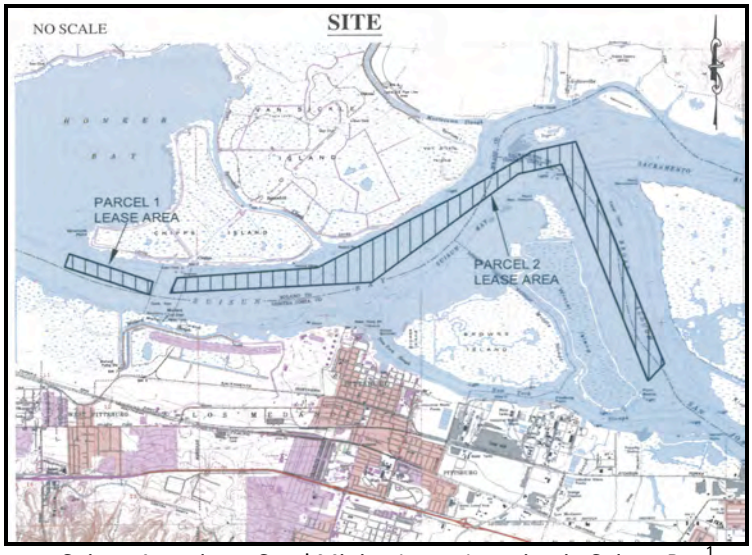
Application Summary
(For Commission consideration on March 19, 2015)

Number:	BCDC Permit Application No. 2013.005.00md
Date Filed:	January 30, 2015
90th Day:	April 30, 2015
Staff Assigned:	Pascale Soumoy (415/352-3669 pascales@bcdc.ca.gov)

Summary

Applicant: Suisun Associates – a joint-venture between Hanson Marine Operations and Lind Marine Incorporated

Location: In Suisun Bay within the Suisun Marsh Primary Management Area, Solano County. Portions of the project are in Broad Slough in Sacramento and Contra Costa Counties, outside BCDC jurisdiction and are not considered in this permit.



Suisun Associates Sand Mining Lease Location in Suisun Bay[1]

[1] California State Lands Commission *Final Environmental Impact Report for the San Francisco Bay and Delta Sand Mining Project (FEIR)*,

Project: The proposed project involves mining up to 245,000 cubic yards (cy) of construction grade sand from the Bay floor annually over a ten year period. The mining would take place in a 936-acre area of sub-tidal, deep water sand shoals in Suisun Bay and Broad Slough using a hydraulic drag-arm dredge (Exhibits A and B). The project includes "peak year" mining volumes up to 300,000 cy in any given year as long as the total volume mined does not exceed 2,450,000 cy over the ten year lease period. The sand would be offloaded and sold at various upland facilities throughout the Bay Area (Exhibit C).

Issues Raised: The staff believes that the application raises seven primary issues: (1) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to be designed to minimize harmful effects to tidal hydrology, sediment movement, and Bay bathymetry; (2) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to minimize impacts to fish, other aquatic organisms and wildlife; (3) whether there are feasible alternatives to dredging sand from the Bay's sandy deep water areas; (4) whether the sand mining project has been designed to minimize impacts to water quality; (5) whether the project's unavoidable adverse impacts have been adequately mitigated; (6) whether the project is consistent with the Commission's policies regarding Dredging, Navigation Safety and Oil Spill Prevention; and (7) and whether the project is consistent with the public trust.

Background

Suisun Associates. Suisun Associates is a joint venture partnership between Lind Marine Incorporated (Lind) and Hanson Marine Operations (Hanson). Suisun Associates was originally formed in 1994 by Olin Jones Sand Company and Morris Tug and Barge, and in 1999 was issued the Suisun Bay mineral lease by California State Lands Commission (CSLC). In late 1999, Hanson purchased Olin Jones Sand Company and joined the venture with Morris Tug and Barge. Morris Tug and Barge was subsequently purchased by Jerico Products (now known as Lind Marine, Inc.), creating the present Suisun Associates partnership. Both Lind and Hanson will be mining as partners in the Suisun Associates lease and sharing the proposed annual volume of 245,000 cy of sand authorized for extraction.

Lind is a privately owned, family-operated company based out of Petaluma, California, whose history dates back over 100 years when Hans Beck, owner of Pioneer Shell, mined oyster shells from the Bay using his schooner, the Alma. In the 1960's Mike Lind, current owner of Lind, began working for Pioneer Shell. In the late 1970's, the company, then called Morris Shell, began sand mining in Suisun Bay. When Mike Lind acquired Morris Shell he not only took over its CSLC lease in Suisun Bay but also changed the company's name to Jerico Products, Inc. In 1999, through the acquisition of Morris Tug and Barge, Lind joined with Hanson as a partner in Suisun Associates. In 2014, Jerico Products, Inc. changed its name to Lind Marine, Inc. Lind uses its fleet of tug boats and barges to mine sand, gravel and oyster shells for the west coast market and provides marine based services such as dredging, barging and lightering.

Hanson is a subsidiary of Lehigh Hanson, Inc. and is a part of the Heidelberg Cement Group, one of the largest building materials manufacturers in the world. With hundreds of production sites across the U.S. and Canada, Lehigh Hanson, Inc. is also one of the largest construction materials companies in North America[2]. Lehigh Hanson, Inc. manages the North American corporate functions and its subsidiaries and affiliates manufacture, supply and market cement, aggregates and other construction materials to North American customers. Hanson has mined sand in the Bay since 1999, when it purchased leaseholds from smaller sand mining companies and assumed their operations. Hanson provides additional marine services, such as lightering imported sand and aggregates from British Columbia. Beginning in 2002, Hanson partnered with Foss Maritime Services to operate Hanson's tug and hopper barge when mining in the San Francisco Bay.

Sand mining occurs to fill discrete construction orders for specific volumes and grain sizes. Depending on the grain size and chloride content, the sand is use to make concrete, asphalt, backfill for utility trenches and general fill. It is used in roads, bridges, buildings and other construction purposes. Sand for these purposes can be supplied by land based quarries, imports from other countries shipped in large, ocean going vessels, and by sand mined from the San Francisco Bay using barges in two general locations – Central Bay and Suisun Bay.

[2] www.lehighhanson.com/aboutus/company-profile.aspx

Demand for aggregate is expected to increase as the state's population continues to grow and infrastructure is maintained, improved, and expanded. The California Geological Survey projects that the 50-year demand for all aggregate (including sand, crushed stone, and gravel) in the South San Francisco Bay and North San Francisco Bay Regions will be approximately 1,902,000,000 tons.[3] There exists a substantial shortfall in total permitted aggregate capacity; local land-based aggregate reserves contain enough permitted resources to last through 2023 in the North Bay and through 2023 to 2032 in the South Bay. Reserves also exist that currently are not permitted for mining.[4] The above projections described above are for supply and demand of all aggregates. Of this total, about 25 percent of total aggregates are estimated to be used for high strength concrete (Portland Concrete).[5] Other projections specific to sand, and for types of sand equivalent to Bay sand, have not been made by the California Geological Survey.

In addition to Bay sand and local land-based reserves, the construction and transportation industries in the Bay Area also purchase aggregate from foreign producers in Mexico and British Columbia. California imported about 3.3 million tons of sand and gravel in 2004 and 2.4 million tons in 2005.[6] With respect to sand in particular, the Bay Area imported 1.7 million tons of British Columbia (BC) sand in 2012.[7] The Bay Area is the largest market for BC sand, which is preferred for major construction projects requiring high-strength concrete due to its high quality.[8] BC sand is not competitive with Bay or other locally-produced sand for private housing construction and neighborhood infrastructure projects, road base or subbase fill, or for general fill purposes.[9]

Bay Sediment Dynamics. Sediment dynamics in the Bay are complex and change over time. The Bay sediment system has been erosional during some periods and accretional in others. In addition to this natural variability, humans have greatly modified sediment dynamics in the Bay and Delta through hydraulic mining and modifications to waterways, including dams and flood control measures. The Gold Rush increased sediment inputs drastically due to hydraulic mining,[10] but by 1999, this pulse of sediments had largely moved into and/or through the Bay system. Since that time, suspended sediment flows into the Bay have since decreased markedly and are not expected to increase or return to previous levels.[11] In the early 2000s, suspended sediment concentrations in the Sacramento River were approximately half of the amount entering over the previous half-century.

---

[3] Clinkenbeard, *Aggregate Sustainability in California*.
[4] Ibid.; John G. Parrish, *Update of Mineral Land Classification: Aggregate Materials in the North San Francisco Bay Production-Consumption Region, Sonoma, Napa, Marin, and Southwester Solano Counties, California* (California Geological Survey, 2013).
[5] Ibid.
[6] Susan Kohler, *California Non-Fuel Minerals, 2005* (California Geological Survey, 2007)
[7] Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[8] Polaris Minerals Corporation, *Management's Discussion and Analysis Year Ending December 31, 2013*, 2013; Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[9] Polaris Minerals Corporation, *Annual Information Form for the Fiscal Year Ended December 31,2012*, March 15, 2013; Economic and Planning Systems, Inc., *Assessment of Economic Impacts Associated with Sand Mining in San Francisco Bay*.
[10] Grove, Karl, *Hydraulic-Mining Debris in the Sierra Nevada*, US Government Printing Office, 1917.
[11] David H. Schoellhamer, "Sudden Clearing of Estuarine Waters upon Crossing the Threshold from Transport Supply Regulation of Sediment Transport as an Erodible Sediment Pool Is Depleted: San Francisco Bay, 1999," *Estuaries and Coasts* 34, no. 5 (2011): 885–99.

Project Description

Commission Jurisdiction: The Commission has jurisdiction over the 534 acres of the lease area located in Suisun Bay within the Suisun Marsh Primary Management Area under the McAteer-Petris Act and Suisun Marsh Preservation Act. The remainder of the project site (402 acres) is located in Broad Slough and is outside the Commission's jurisdiction. The sand offloading sites are within the Commission's shoreline band jurisdiction, but the sand offloading and storage sites are not the subject of this application.

Location: Suisun Associates mines sand from its CSLC Mineral Extraction Lease Parcel No. 7781.1. This lease area is 936 acres and stretches from Suisun Bay to the confluence of the Sacramento and San Joaquin Rivers to a body of water know as Broad Slough (Exhibit B). The portion of the lease within the Commission's jurisdiction (534 acres) is entirely within Solano County and the Suisun Marsh Primary Management Area, running parallel to the southern shoreline of Chipps Island and Van Sickle Island; it is between 15 and 45 feet Mean Lower Low Water (MLLW) deep and a majority of the substrate is sandy shoal. The lease area in Broad Slough, outside the Commission's jurisdiction, has depths ranging from 9 to 20 feet MLLW and is also mostly sand shoal.

Project Details: The applicant, Suisun Associates, describes the project as follows:

In the Bay and Suisun Marsh Primary Management Area. Hydraulically mine 245,000 cy of construction grade sand annually for a period of ten years, this would include "peak year" mining volumes up to 300,000 cy in any given year as long as the total volume mined does not exceed the ten year total of 2.45 million cy. The sand is mined from California State Lands Commission Mineral Extraction Lease Parcel No. 7781.1, a 936-acre area of submerged lands located in Suisun Bay and Broad Slough. Only the 534 acres of the lease located in Suisun Bay within the Commission's jurisdiction is the subject of this application. The sand will be extracted using a hydraulic drag arm and suction pipe and transported by hopper barge to various sand yards around the Bay where it will be sold for construction projects. Sand mining occurs to fill discrete construction orders for specific volumes and grain sizes.

Mining Equipment: **Hanson Marine Operations**. Hanson's current sand mining equipment consists of the tug *San Joaquin River* and hopper barge the *Sand Merchant*. *Sand Merchant* is equipped with suction dredge equipment, is 230 feet long by 55 feet wide and, when loaded has a draft of 14 feet. Fully loaded it can carry about 2,400 cy of sand. The *Sand Merchant's* draft limits its mining activities to areas deeper than 20 feet MLLW and its equipment allows it to mine areas as deep as 80 feet MLLW. A tug is required to maneuver the dredge.

The *Sand Merchant* has a hydraulic mining system made up of a 120-foot long, 24-inch diameter drag arm (trailing suction pipe), with a drag head attached to its end. The drag head is 36 inches long by 36 inches wide, with a 6-inch screen (called a "grizzly") attached to the opening that faces the substrate, preventing material larger than 6 inches from being drawn into the drag head.

Sand is mined through the drag arm using a 22-inch centrifugal pump capable of pumping 15,000 gallons per minutes (gpm) through the drag head. On the top of the drag head is an 8-inch vent pipe (1,720 gpm) (NMFS BO, 12) that allows for the intake of water to ensure correct sand-water slurry (17 percent sand 83 percent water for fill and blend sand and 12 percent sand 88 percent water for coarse sand) in the suction pipe. A fish screen has been installed on the vent pipe to reduce entrainment of fish through this area into the suction pipe.

Lind Marine Incorporated. Lind uses their tugboats *Trig Lind* or *Petaluma* and hopper barge *J5200*, equipped with suction dredge equipment when mining sand. Hopper barge *J5200* is 200 feet long by 45 feet wide, when unloaded has a draft of approximately 3.5 feet, and when fully loaded has a draft of approximately 12 feet. Fully loaded it can carry about 1,850 cy of sand. The *J5200's* draft limits its mining activities to areas deeper than 15 feet MLLW and its equipment allows it to mine areas as deep as 40 feet MLLW. A tug is required to maneuver the dredge.

The *J5200's* hydraulic suction system for mining sand includes a 14-inch diameter, 40-foot long drag arm mounted to the side of the barge and connected to large 5,000 gpm pumps inside the barge. The end of the drag arm is fitted with a shorter 8-10 foot long suction pipe with a 6-inch "grizzly" attached to its end to prevent oversized material from entering the suction pipe. The suction pipe also has additional external vent pipes (725 gpm) that pull in water to create the sand-water slurry (25 percent sand 75 percent water) when the suction head is active in the substrate. A fish screen has been installed on the vent pipe to reduce entrainment of fish through this area into the suction pipe.

Mining Timing and Duration: The timing and duration of a mining event depends on the equipment used, weather, tidal cycles and availability of sand at the selected mining location. Depending on the mining location and the offloading site the entire operation can last 8 to 24 hours, with the actual sand mining activities lasting 3 to 5.5 hours, occurring at any time of day. Hanson's events last an average of 2 to 3 hours, yielding between 1,490-1,768 cy of sand. Lind's actual mining activities last about 4.7 hours during which approximately 1,000-1,850 cy of sand is excavated. [12]

[12] NMFS *Biological Opinion* 2015, pg 13

Mining Process:

Hanson Marine Operations. Hanson uses the *moving potholing* method of sand mining. In preparation for mining, the *Sand Merchant* is positioned above the selected mining area and the drag arm is lowered into the water. When the drag head is approximately three feet or less above the sand shoal, the pump is primed and the drag head is lowered 6 to 18 inches deep into the sand shoal. As the sand is mined, a depression or "pothole" is created around the drag head. As the drag head is pushed further into the substrate, the pothole widens and sand slumps in from the sides of the depression. If there is sufficient volume of sand in one area, the drag head remains relatively stationary, adjusting as needed over the shoal. When the desired grain size of sand is depleted in that area, the barge is moved along with the drag head on Bay bottom (while pumping sand and water) until another pocket of appropriately sized sand is found. The mining continues in this way until the barge is filled.

The sand pumped through the suction pipe, into the barge, flows into a long chute running lengthwise across the barge above the hopper. The chute has hinged gates along its length, each gate fitted with a screen to prevent larger material from being collected as the sand slurry flows through the gates into the hopper. The larger material excluded by the screens is discharged back into the Bay through a pipe extending from the bottom of the barge.

As the slurry is loaded into the barge, the displaced water is displaced into the Bay through screened overflow pipes. Additionally, there is a dewatering system at the bottom of the hopper to collect water that filters through the sand. That water is also discharged into the Bay.

Hanson uses five offload sites around the Bay; Dutra Rock Quarry in San Rafael; Mission Valley and Tidewater in San Francisco; and Tidewater in Oakland. Hanson has an additional yard, Waterfront in Martinez, but this site is not currently in use (Exhibit C). From these locations 85 percent of the mined sand is trucked to concrete and asphalt plants located within 10 miles of the offload sites, with the remaining 15 percent of the sand trucked longer distances within the Bay Area.

Lind Marine Incorporated. Lind mines sand using the *stationary potholing method*, keeping the barge in one position during mining. When the *J5200* is positioned above the selected mining area, the drag arm is lowered into the water. When the suction end of the drag arm is approximately 3 feet or less above the sand shoal the pump is primed and the suction end is lowered into the sand to a depth of up to 5 to 8 feet. The sand slurry is pumped into the barge, creating a pothole in the sand shoal near the suction head. The suction end of the pipe is further lowered into the substrate and adjacent sand rolls into the pothole from its edges as it deepens.

Once pumped into the *J5200* via the suction pipe, the sand enters a loading chute running lengthwise across the barge. The chute has screened gates that the slurry flows through into the barge. Any material that does not pass through the screens is discharged back into the Bay through a pipe extending below the water surface.

Lind takes the loaded *J5200* to one of its offload sites in Petaluma, Collinsville or Napa (Exhibit C). The Collinsville offloading site belongs to Lind and the Petaluma and Napa offload sites are owned by Lind customers. Once there, the sand is removed from *J5200* using an excavator and shore-side conveyor system that piles the sand in the yard for further processing and shipment. From these offload sites the sand may be trucked to Windsor, Vacaville, Vallejo and other locations in Sonoma and Marin counties.

Mitigation: Hanson and Lind have each purchased freshwater habitat at Liberty Island Conservation Bank in Yolo County to compensate for impacts to Delta smelt and longfin smelt while mining in Suisun Bay. Hanson purchased 0.404 acre and Lind purchased 0.107 acre, for a total of 0.511 acre of freshwater habitat (CDFW ITP Amendment).

Additionally Hanson and Lind will contribute $100,000 to CalRecycle's Estuary Clean Up Project within the Central San Francisco Bay or Suisun Bay. The CalRecycle Clean Up Project clears debris such as old pier pilings and abandoned ships from the estuary in order to improve fish habitat. CalRecycle will be responsible for the distribution of the funds. This contribution would mitigate for mining in Central San Francisco Bay, Suisun Bay and Middle Ground shoal.

Schedule and Cost: The estimated total project costs is $4,476,522 over ten years. The project would commence in April 2015, be ongoing and would be completed by April 2025.

Staff Analysis

A. **Issues Raised.** The staff believes that the application raises seven primary issues: (1) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to be designed to minimize harmful effects to tidal hydrology, sediment movement, and Bay bathymetry; (2) whether the proposed level of mining is consistent with Subtidal Area Policy 1 which calls for projects in subtidal areas to minimize impacts to fish, other aquatic organisms and wildlife; (3) whether there are feasible alternatives to dredging sand from the Bay's sandy deep water areas; (4) whether the sand mining project has been designed to minimize impacts to water quality; (5) whether the project's unavoidable adverse impacts have been adequately mitigated; (6) whether the project is consistent with the Commission's policies regarding Dredging, Navigation Safety and Oil Spill Prevention; and (7) and whether the project is consistent with the public trust.

1. **Relevant Commission Policies on Sand Minings Effects on Natural Resources.** The San Francisco Bay Plan has several policies regarding the natural resources of the Bay.

   Subtidal Areas Policy 1 states, "[a]ny proposed filling or dredging project in a subtidal area should be thoroughly evaluated to determine the local and Bay-wide effects of the project on: (a) the possible introduction or spread of invasive species; (b) tidal hydrology and sediment movement; (c) fish, other aquatic organisms and wildlife; (d) aquatic plants; and (e) the Bay's bathymetry. Projects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects."

   Subtidal Area Policy 2 states, "[s]ubtidal areas that are scarce in the Bay or have an abundance and diversity of fish…and wildlife (…sandy deep water or underwater pinnacles) should be conserved. Filling, changes in use; and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits."

   Similarly, the Bay Plan policies on Fish, Other Aquatic Organisms and Wildlife policies state that "[t]o assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's…tidal flats, and subtidal habitat should be conserved, restored and increased." The policies also state that specific habitats that are needed to conserve, increase or prevent the extinction of any native species, including special status species, should be protected.

   Water Quality Policy 2 in the Bay Plan states that "[w]ater quality…should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's *Water Quality Control Plan, San Francisco Bay Basin*…."

   The Bay Plan policies on Tidal Marsh and Tidal Flats also seek to protect both habitat and wildlife. Policy 1 states, in part, that "tidal flats should be conserved to the fullest possible extent," and that "dredging projects that would substantially harm…tidal flats should be allowed only for purposes that provide substantial public benefits and only if there is no feasible alternative." Policy 2 states that "[a]ny proposed…dredging project should be thoroughly evaluated to determine the effect of the project on…tidal flats, and designed to minimize, and if feasible, avoid any harmful effects."

   The Bay Plan policies on Recreation state, in part that "[s]andy beaches should be preserved, enhanced, or restored for recreational use…."

   The Solano County Policies and Regulations Governing the Suisun Marsh cites similar policies supporting the protection of habitat and species. Its Agricultural and Open Space Land Use Policy 2 states '[t]he County shall protect its marsh waterways, managed and natural wetlands, tidal marshes… which are critical habitats for marsh-related wildlife."

2. **Background.** Sand mining has the potential to affect two important Bay resources - the sand itself, which forms landforms and substrates (shoals and beaches), both in the Bay and in the outer California coast, and the Bay's biota, some of which use the Bay's sand as habitat.

   The following analysis regarding local and Bay-wide effects is presented in two parts: (a) physical; and (b) biological.

   a. **Physical Resources**. The Bay plan policies direct the Commission to examine potential impacts to tidal hydrology, sediment transport, tidal flats, beaches and Bay bathymetry. It is important to understand the Bay's sediment system in order to understand the potential impacts of sand mining.

      (1) **Sediment Decline.** Sand is a primary building block of the Bay and its habitats. Most sand in San Francisco Bay originates in the Sierra Nevada mountains and is transported to the bay as bedload (heavy or large sediment particles traveling on or near the bottom or bed) or in suspension with the water column, through the Delta.[13] A smaller amount of sand originates from local sources, such as Bay watersheds, coastal bluffs and cliffs, and from the Pacific Ocean via the Golden Gate. On the Bay floor, sand shoals make up large underwater dunes, some over two meters tall, particularly in Central Bay, while other shoals are made up of smaller sand "ripples" where less energy is present.

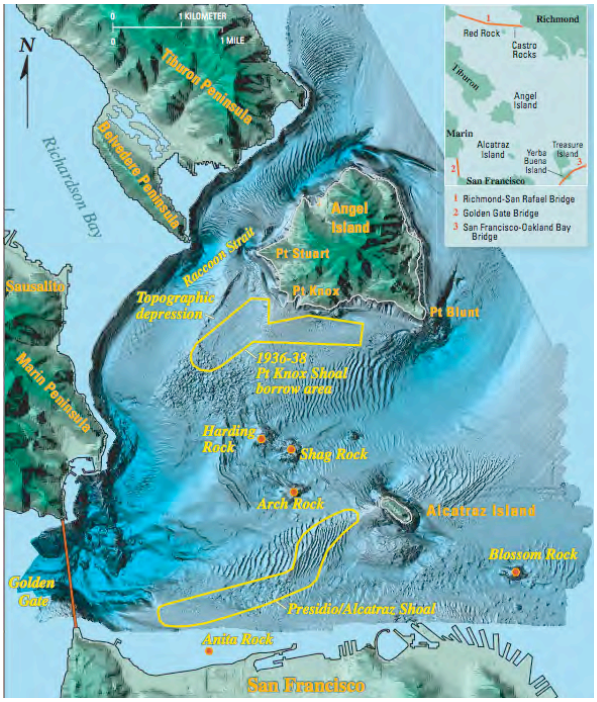


Figure 1. Multibeam survey of Central Bay with shoals delineated.[14]

[13] Patrick L. Barnard et al., "Integration of Bed Characteristics, Geochemical Tracers, Current Measurements, and Numerical Modeling for Assessing the Provenance of Beach Sand in the San Francisco Bay Coastal System," *Marine Geology* 336 (2013)
[14] Chin et al.Shifting Shoals and Shattered Rocks, *Circular 1259* U. S. Geological Survey 2004

System-wide, the sediment supply to the Bay, and sand supply in particular, has decreased in recent years.[15] Furthermore, due to its larger grain size, sand is readily impounded behind dams.[16] Dams and other water control structures also diminish the peak water flows required to move large amounts of sand, further decreasing the amount of sand reaching the Bay.

From 1997 to 2008, the rate of sediment loss in Central Bay was nearly three times higher than during the 1947-1979 period.[17] Most of this erosion occurred in sandy areas. In sediments found at the mouth of the Bay, the percentage of sand decreased while the percentage of mud increased from 1997 to 2008.[18] Finally, a recent analysis of bedforms (underwater sand dune formations) found that they are shorter than would be predicted by local water currents and hydrodynamics, indicating that the system is erosional.[19]

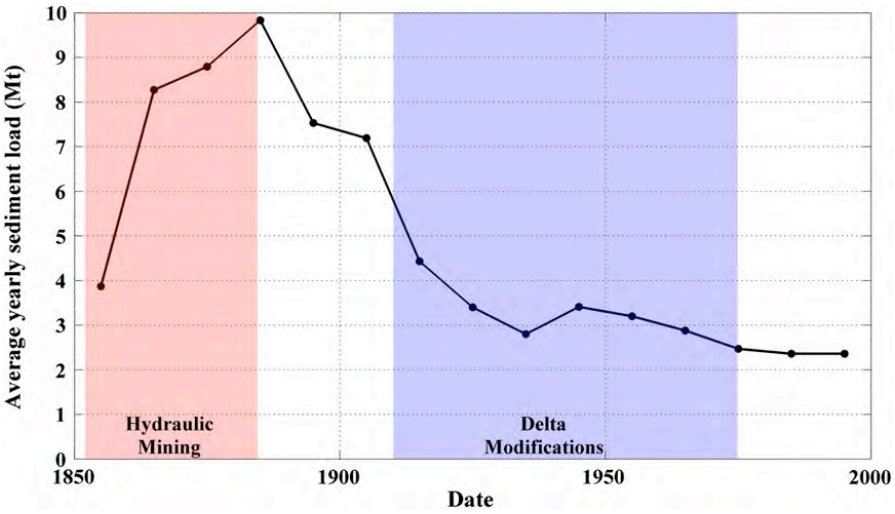


Figure 2. Reconstructed decadal sediment load from the Sacramento and San Joaquin rivers with the major periods of hydraulic mining (1852–1884) and Delta modifications (1910–1975) highlighted.[20]

[15] Patrick Barnard and Rikk Kvitek, "Anthropogenic Influence on Recent Bathymetric Change in West-Central San Francisco Bay," *San Francisco Estuary and Watershed Science* 8, no. 3 (2010).
[16] Matthew J. Slagel and Gary B. Griggs, "Cumulative Losses of Sand to the California Coast by Dam Impoundment," *Journal of Coastal Research*, 2008
[17] Theresa A. Fregoso, Amy C. Foxgrover, and Bruce E. Jaffe, *Sediment Deposition, Erosion, and Bathymetric Change in Central San Francisco Bay: 1855-1979* (U. S. Geological Survey, 2008).
[18] Patrick L. Barnard, Jeff E. Hansen, and Li H. Erikson, "Synthesis Study of an Erosion Hot Spot, Ocean Beach, California," *Journal of Coastal Research* 28, no. 4 (2012): 903–22.
[19] Patrick L. Barnard et al., "Sediment Transport Patterns in the San Francisco Bay Coastal System from Cross-Validation of Bedform Asymmetry and Modeled Residual Flux," *Marine Geology* 345 (2013): 72–95.
[20] Patrick L. Barnard et al., "Sediment Transport Patterns in the San Francisco Bay Coastal System from Cross-Validation of Bedform Asymmetry and Modeled Residual Flux," *Marine Geology* 345 (2013)

With less sand in the Bay system, there is the potential for increased coastal erosion, as less sand will be supplied to beaches and underwater shoals. Smaller sand bars along the shore, and at the mouth of the Bay, are less effective at buffering the coast from wave energy. This has already been observed for the San Francisco Bar with respect to Ocean Beach.[21] However, accretion and erosion patterns for Bay beaches are not well-studied. As is the case for sediment in general, sand is increasingly being viewed as an ecological, societal, and economic resource.

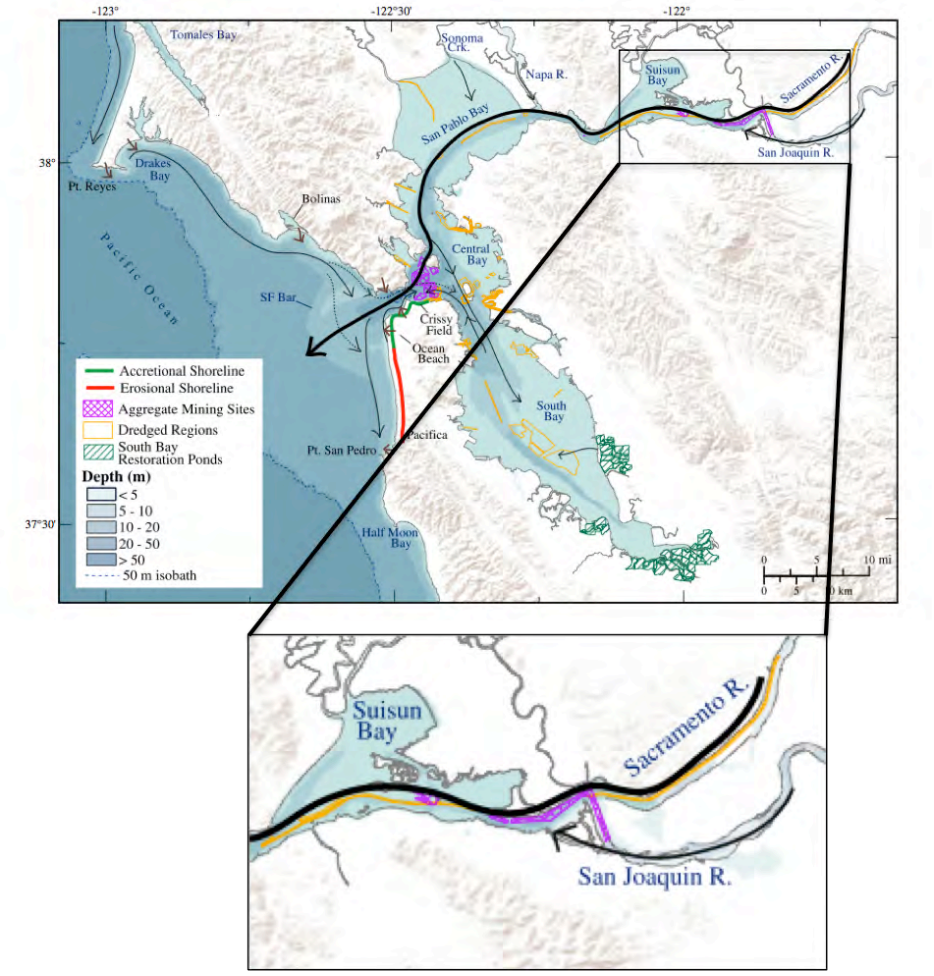


Figure 3. Model of sand transport pathways in the San Francisco Bay Coastal System. Heavier and longer arrows indicate more dominant pathways.[22]

[21] Kate L. Dallas and Patrick L. Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System," *Estuarine, Coastal and Shelf Science* 92, no. 1 (2011): 195–204.

[22] Ibid.

(2) **Sand Transport**. Within the Bay there is both sand that was deposited over geologic time (relic sand) and sand that is in transport today. While the primary sand transport pathway has been well defined for the Bay system through analysis of the mineral and biogenic/anthropogenic component of the sand,[23] the volume of sand currently entering the Bay can only be estimated, though available science is providing better information as a basis for these estimates.

In order to better understand the potential volume of sand transport in the Bay, an examination of peer-reviewed papers detailing studies of sediment inputs to the Bay was completed. A continuous long-term data set (Mallard Island 1997-present) details sediment inputs from the Delta to Bay was examined[24] and shows that on average the total suspended sediment load to the Bay is three percent sand, or approximately 19,000 cubic yards of sand per year. Additional work by the USGS, estimated the bedload contribution of sand using data from 1997-2010 from twenty-seven sites within the Delta found the average volume of sand entering the Bay as bedload to be 58,000 cy (sand makes up 86-90 percent of the total bedload).[25] Combining the volume of suspended sand and bedload, approximate 77,000 cy of sand enters the Bay from the Delta on average annually.

The other primary source for sand in the Bay is the local tributaries. In addition to Delta sediments Suisun Bay receives sediment from local streams[26] with Suisun Slough and Montezuma Slough as its main tributaries. The information available for these sources is extremely limited. Available empirical data from local tributaries suggests that approximately 20 percent of total suspended sediment, or 300,000 cubic yards of sand enters the Bay annually from local tributaries.[27] Bedload transport from the local tributaries is not well described. We do know that sand settles out in flood control structures and most sands are dredged prior to reaching the Bay.[28] Preliminary work has identified removal of an average of 30,000 cy of coarse grain sediment from flood control channels annually.[29] If the flood control channels were regularly maintained, sand from these channels would not enter the Bay. Further, local South Bay tributaries (mainly Calaveras Creek and Alameda Creek) deliver smaller amounts of sand that tend to remain in the South Bay.[30]

There is insufficient information available to estimate the amount of sand entering the Bay from local cliff or bluff erosion, or the outer coast, though these volumes are considered to be minor based on the sand provenance work by USGS and the local geology would suggest that these volumes are minor contributions. While important information is missing, the total annual average

[23] Barnard et al. 2013; McGann et al. 2013.
24 McKee et al. 2013
[25] Marineau and Wright, 2014 and Marineau USGS writ. comm. 2015.
[26] Hein, James R., Mizell, Kira, Barnard, Patrick L., Sand sources and transport pathways for the San Francisco Bay coastal system, based on x-ray diffraction mineralogy, *Marine Geology* (2013), doi: 10.1016/j.margeo.201304.003
[27] McKee et al. 2013
[28] McKee et al. in progress, 2015
[29] McKee writ. comm 2015
[30] Barnard et al., 2013

volume of sand being transported into the Bay from the Delta and the local tributaries may be on the order of approximately 375,000 to 400,000 cy per year. The volume of sand that cannot be estimated is not likely to be greater than the total volume estimated from the Delta suspended sediment from local tributaries (375,000 -400,000 cy), and would likely be within the same order of magnitude on an average annual basis[31].

(3) **Relic Sand.** Relic sand was likely deposited during the last ice age (Holocene Period) when San Francisco Bay was little more than a river. This sand was likely deposited over thousands of years. Relic sand makes up the majority of deep deposits in Central Bay. The amount of relic sand present in Suisun Bay is unknown. A seismic reflection survey through the Delta around the Kirby Hills Fault zone completed by the USGS identified unconsolidated sediment to about 200 meters deep and did not find a clear underlying basement layer down through about 3 miles of sedimentary deposits.[32] The applicant believes that a similar sediment configuration exist around Suisun Associates lease based upon its proximity to the Kirby Hills Fault Zone. However the composition of the unconsolidated material is not known and whether this material contains mostly sand has not been determined around the lease area. There are no comprehensive surveys or data sets that show the actual depth, grain size or quality of the sediment between the sand shoals and the underlying bedrock.[33] The sand resource availability cannot be evaluated fully without field collection of sediment borings in the lease areas.[34]

While this information is helpful in understanding the aggregate available for mining, it is also helpful to better understand the sediment transport and habitat changes as sand is removed from the bottom of the Bay. Hanson Environmental used the USGS acoustic profiling information to make calculations on potential volume of sand resources above minus 90 feet MLLW, but stated "…interpretation of these results is difficult in the absence of additional information on sediment transport and replenishment within the areas where sand mining occurs." Because more specific information is not available the volume of sand resource cannot be clearly defined without a complete grain size profile of the area, but it is likely that millions of cubic yards of sand of varying quality do exist between the bedrock and the current Bay bottom.

(4) **Bay Sand Resources**. The San Francisco Bay Plan policies direct the Commission to thoroughly examine project impacts on the physical processes of the Bay. Potential project impacts include changes to sediment dynamics, including sediment transport and erosion, water currents and velocity, and salinity.

[31] Schoellhamer and McKee, writ. comm 2015
[32] Parsons et al. 2002
[33] USGS 1967-68 Acoustic Profiling and 1997 USGS Bathymetry, Chin et al. 2000
[34] Coastal Harbor Engineering Study, *SLC FEIR*. 2009. Pg G-12

In their BCDC application, Suisun Associates refer to the State Lands Commission Final Environmental Impact Report, 2012 (FEIR) for analysis of potential impacts to tidal hydrology. The project evaluated in the FEIR was 2.02 million cubic yards of mining activity annually for ten years in both Central and Suisun Bays. The reduced project alternative was to mine up to 1.426 million cubic yards per year for ten years for all lease areas.

To assess the potential effects on tidal hydrology, salinity and sediment transport, from the originally proposed project (mining up to 300,000 cy annually), and the reduced project alternative (mining up to 85,476 annually), the FEIR relied on a numerical model. Impacts were evaluated by comparing the existing condition with two project-condition scenarios over 15 day and one-year periods.[35] Scenario 1 explored the potential impacts of 10 years of mining occurring all at once, over the entire lease area, including areas not previously mined, with a constant mining thickness. Scenario 2 limited the mining to only those portions of the lease areas that were actually mined (developed using tracking information from past mining events), using a constant mining thickness. The model results were intended for use in a qualitative sense to evaluate the relative magnitude of change with respect to the existing condition and the proposed Project.[36]

Regarding the impacts to hydrodynamics, the findings of the model indicate that the velocity patterns surrounding the Suisun Bay lease areas were very similar between current conditions and the mining Scenario 1 and 2 with very small changes measured in the lease areas. Changes outside the lease areas were not measurable.[37]

The 15-day simulations indicated that the changes in transport patterns during both ebb and flood currents are limited to areas immediately adjacent to the lease areas. Full-year simulations indicated that the changes in net transport patterns are also limited to the leases and areas immediately adjacent to these lease areas. These model results were the same for Central and Suisun Bay lease areas. Because this modeling was qualitative, it did not describe magnitude of impacts, and therefore it is difficult to analyze the impacts to sediment transport from the project without additional information.

Coast Harbor Engineering's (CHE) analysis for the FEIR found that in the Suisun Bay lease areas the sand-sized material mined for aggregate is primarily bed material delivered, at some point in time, by the Sacramento River (and, to a lesser degree, the San Joaquin River)[38], which is consistent with the most recent research on sediment transport in this region. There are few other tributaries in the Suisun embayment that can contribute sand to this area. Mining in both Suisun Associates lease and Middle Ground Shoal may be capturing much of the

[35] SLC FEIR pg 4.3 - 28
[36] SLC FEIR, 2012, pg. 4.3 - 33
[37] Coast Harbor Engineering 2009 SLC FEIR Appendix G-38
[38] Ibid 4.3 - 7

sand supply, except in very high flow years. CHE's analysis of available bathymetry data and previous mining activities indicates that sand appears to be primarily arriving in the mining areas under transport from the surrounding areas. Suisun Associates lease area specifically showed large fluctuations of both erosional and depositional periods within the lease and surrounding areas that did not appear to be correlated with floods or tidal flow that lead to the conclusion that the sand on this lease is likely derived from adjacent areas. The large surrounding areas of ongoing sand transport and lack of observed change in surrounding morphology during the study period indicate that deposition in the mining areas is likely to continue at similar rates.[39] However, it should be noted that the information analyzed was primarily from the lease areas themselves. The surrounding area includes the Delta, adjacent sand shoals and the sand transporting through this region to Central Bay. The exception to this observation is the deeper portions of the Middle Ground lease area, where the resource also appears to be limited to the material currently in place and is showing an erosional trend.[40]

(5) **Bay Beaches** The Bay Plan Recreation policies state that "[s]andy beaches should be preserved, enhanced, or restored for recreational use…consistent with wildlife protection." Historically, the west side of San Francisco had broad beach and dune systems, and the east side of Central Bay had many beaches as well[41] (Figure 4). Though the Bay shoreline has been altered, some sandy beaches still exist, including Point Pinole, Keller Beach, Crissy Field, Lands End, Candlestick Point and China Camp State Park. These beaches provide shoreline protection, habitat, and recreational opportunities. The BCDC permit application and SLC FEIR lack information regarding the potential impacts to Bay beaches, perhaps because little is known about the transport dynamics of beaches. The applicants provided information describing the East Bay beach sand as being supplied by both local cliff-derived soils and subtidal Central Bay sand.[42] With sea level rise, increasing amounts of sand will likely be needed to prevent erosion and to allow the landward migration of Bay beaches, as well as supplying the outer coast beaches that protect infrastructure and development.[43]

[39] Ibid Appendix G
[40] Ibid pg. 4.2 -10
[41] R. Olmstead and N. Olmstead, *Ocean Beach Study: A Survey Of Historic Maps And Photographs* (City of San Francisco, California, February 23, 1979., n.d.); EcoAtlas, California Wetlands Monitoring Workgroup (CWMW), accessed June 27, 2014, http://www.ecoatlas.org.
[42] Hein, Mizell, and Barnard, "Sand Sources and Transport Pathways for the San Francisco Bay Coastal System, Based on X-Ray Diffraction Mineralogy."
[43] Barnard et al., 2013

Figure 4. Historic sandy beaches inside of the Golden Gate, c. 1850.[44] Points indicate locations of beaches and do not represent the sizes of individual beaches.

(6) **Tidal Flats**. The Bay plan requires that the Commission thoroughly evaluate dredging projects to determine the effect of a project on tidal flats. Unfortunately, even less is known about how sand transport to and from these areas affects tidal flats. A review of the available research did not identify information about tidal flats beyond discussions of mudflats adjacent to marshes. There are some sandy tidal flats in the South Bay where wind surfers use the tidal flat as launching locations, but sediment content and transport is not documented.

(7) **The Outer Coast.** The McAteer Petris Act, Section 66605(d) allows the Commission to examine environmental impacts to the Bay Area. Sand transport continues from the Bay to the Outer Coast to feed beaches to the south. As currently understood, sand from the Bay is first deposited on the San Francisco Bar, a large sand bar formed by the ebb tide. From 1873 to 2005, the San Francisco Bar shrunk both in height and diameter, and migrated approximately 1 kilometer towards the shoreline.[45] This likely resulted from reduced tidal flows due to historic filling, diking, and sedimentation of the Bay, and from decreased amounts of sediment leaving the Bay as a result of hydrologic modifications upstream, mining, and dredging.[46] The erosion and contraction of the San Francisco Bar has effectively resulted in more sand being delivered to northern Ocean Beach, and less to southern Ocean Beach, likely exacerbating erosion to the south.[47] Additionally, modeling has demonstrated that changes to the Bar affect wave energy reaching the shoreline, with northern Ocean Beach being

[44] SFEI EcoAtlas
[45] Kate L. Dallas and Patrick L. Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System," *Estuarine, Coastal and Shelf Science* 92, no. 1 (2011): 195–204.
[46] K. L. Dallas and P. L. Barnard, "Linking Human Impacts within an Estuary to Ebb-Tidal Delta Evolution," *Journal of Coastal Research Special*, no. 56 (2009): 713–16.
[47] Jeff E. Hansen, Edwin Elias, and Patrick L. Barnard, "Changes in Surfzone Morphodynamics Driven by Multi-Decadal Contraction of a Large Ebb-Tidal Delta," *Marine Geology* 345 (2013): 221–34.

protected, and southern Ocean Beach being more exposed.[48] These changes help explain recent accretion at Baker Beach, Crissy Field, and northern Ocean Beach, and partially explain erosion at southern Ocean Beach.

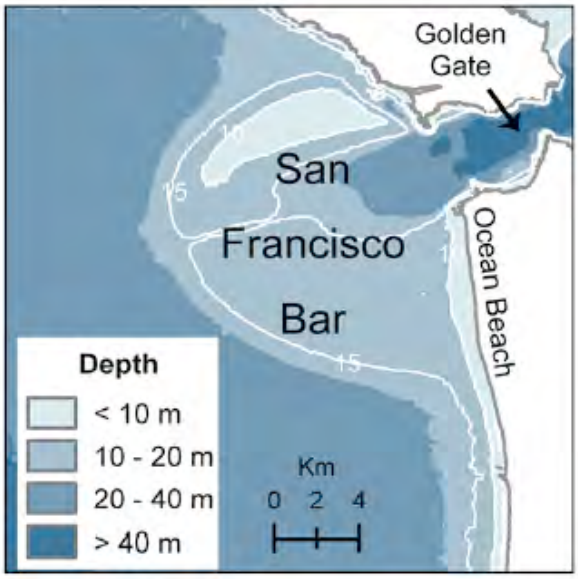


Figure 5. Location of the large underwater sand deposit known as the San Francisco Bar, or ebb-tidal delta.[49]

The California Coastal Commission, the USGS and Bay Keeper have raised concerns over the potential for sand mining to contribute to reduction in the Bar, as well as related impacts to Ocean Beach. Though there are many large and small scale factors affecting sand supply and transport in the Bay system, removing sand from sandy shoals, particularly those along the northwest San Francisco waterfront such as Presidio Shoals that have a net transport to the outer coast, could potentially affect sand supply to the Bar and outer coast beaches.[50] The FEIR found that the proposed mining in Central Bay would likely contribute 0.2 to 0.3 percent of the annual observed erosion of the Bar.[51] However, it further stated, "[i]f the overall reduction in sediment supply in the Bay-Delta system is the cause, or a contributing cause, of the erosion of the San Francisco Bar, it would be reasonable to conclude that the [sand mining] Project could make a considerable contribution to this process."

In letters to BCDC, the San Francisco Bay Keeper and the California Coastal Commission expressed concern over the ability of the model to analyze potential impacts of the project due to the limited nature of its application. The public

[48] Dallas and Barnard, 2011
[49] Kate L. Dallas and Patrick L. Barnard, "Anthropogenic Influences on Shoreline and Nearshore Evolution in the San Francisco Bay Coastal System," *Estuarine, Coastal and Shelf Science* 92, no. 1 (2011): 195–204.
[50] Patrick L. Barnard et al., "Integration of Bed Characteristics, Geochemical Tracers, Current Measurements, and Numerical Modeling for Assessing the Provenance of Beach Sand in the San Francisco Bay Coastal System,"; Patrick L. Barnard et al., "Sediment Transport Patterns in the San Francisco Bay Coastal System from Cross-Validation of Bedform Asymmetry and Modeled Residual Flux."
[51] Scott Fenical et al., *Technical Report: Analysis of Impacts of Sand Mining in the San Francisco Bay on Sediment Transport and Coastal Geomorphology in San Francisco Bay, Suisun Bay, and Outside the Golden Gate*, 2013.

comments call into question the model's prediction that the Central Bay shoals likely contribute only 0.2 to 0.3 percent of the annual observed erosion of the Bar. CHE suggests as a final statement in the FEIR that further research and study is needed in this area to reach more certain conclusions regarding this pathway. The public comments also request that the Commission limit the mining in Central Bay to the existing levels (100,000 cy per year) until potential impacts from the project to the Bar and Ocean Beach can be further analyzed. Tracer studies are suggested as a possible way to determine the pathway from the leases to the Bar and Ocean Beach.

(8) **Bay Bathymetry.** Mining removes sand from the Bay bottom, altering its bathymetry. For their discussion of the project's potential impacts to Bay bathymetry, the applicant relied primarily on the FEIR analysis. The long-term lasting impacts of mining sand from the bottom of the Bay on the Bay's bathymetry are not well known. Unlike Central Bay, the monitoring of the Suisun Bay lease areas consisted of single beam surveys until 2008 when the first multibeam survey of this area was completed. Because the data was less rich for Suisun Bay and Middle Ground Shoal, bathymetric changes were assessed primarily using the single-beam PLS data. The findings for Suisun Associates lease stated in the FEIR include: that sand mined during the last 10 years had been mostly deposited from surrounding areas; changes in lease areas were generally small from survey to survey, likely due to the large size of the surrounding areas that are contributing sediment to the deepened lease areas; and that continuation of sand mining in Suisun Bay during the proposed 10-year period is not likely to cause measurable sediment depletion in areas outside the mining areas.[52] However, the last ten years of mining at this site was very low, on an average of 50,000 cy per year.

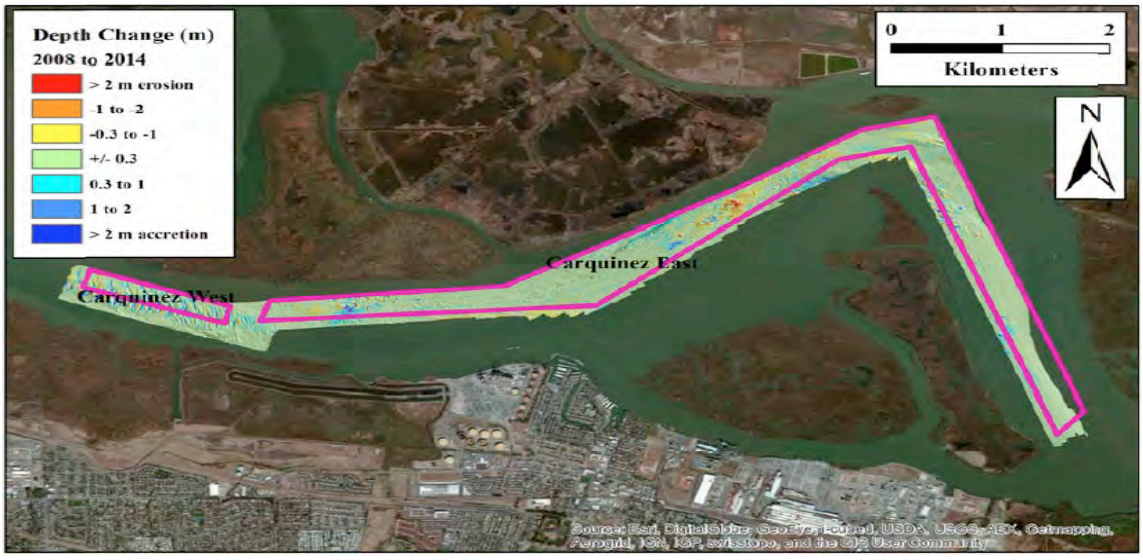


Figure 6. Bathymetric change from 2008-2014 in Suisun Bay, with shaded relief bathymetry from the 2014 multibeam survey.[53]

[52] SLC FEIR 2012 pg 4.3 - 31
[53] Barnard, Patrick, Kvitek, Rikk, Iampietro, Pat. Bathymetric Change Analysis for West-central Bay and Suisun Bay, 2008-2014. USGS 2014.

After the FEIR was completed, an additional multibeam change analysis was completed by the USGS as a result of BCDC permit condition. Between 2008 and 2014 Suisun Bay gained more sand than it lost, exhibiting accretion for both the entire survey area and the lease areas corresponding to 300,000 m3.[54] As stated above, this period also coincided with the least amount of mining in the Suisun Associates lease in 15 years.

The applicant proposes to mine up to 245,000 cy per year, nearly 5 times what was previously mined. As Suisun Associates, both Hanson and Lind nearly tripled their annual volume requests compared to previously authorized 100,000 cy per year. Both companies chose to shift some of their proposed volumes from nearby Middle Ground Island shoal to the Suisun Associates lease area. At this rate, the mining would removal nearly all the sand estimated to enter Suisun Bay on an annual basis. However, mining, as described is an on demand industry and the applicant states that they would only mine the fully authorized volume if the market demanded it.

The applicants have agreed to continue monitoring the potential impacts that mining may have on changing the Bay's bathymetry in the lease areas through multibeam bathymetric surveys of the mining areas and change analysis every 5 years. This information would provide further information in the future regarding the impacts the proposed project would have on the Bay's bathymetry, both short-term and long-term. An individual mining event may have an insignificant impact on the Bay's bathymetry, however the cumulative impacts of multiple mining events over time may have a greater affect, particularly if the sand is not being replenished.

The Commission must consider the full amount requested and balance that against what is known about the sand supply in this area and the larger estuary.

(9) **Bed Forms.** Bay bathymetry is not limited to depth of sediment alone. It also speaks to geomorphology, or shape of the Bay bottom and how it relates both to sediment movement and habitat features. Sand shoals can be flat, rippled or have waves that can be described as underwater sand dunes that have both crests and troughs. The shape is specific both to grain size and the hydrology that creates them. Larger features are found in higher energy areas, where calmer waters produce flatter, less distinct shoals. Sand mining activity changes the wave form and the grain size of the sand that it leaves behind.[55] Recent studies have shown that sand crests are shorter and flatter, and the grain size is smaller than would be predicted in this area given the existing tidal hydrology.[56] What this means to the overall sediment transport and tidal hydrology of the area is unknown at this time.

[54] Ibid.
[55] SLR FEIR 2012
[56] Barnard et al. 2013

Figure 7: 2014 USGS Multibeam Survey of the Suisun Associates Lease Area[57]

As shown in Figure 7, there are several different bedforms within the Suisun Associates lease. Sand waves are apparent in the western end of the channel, an area of high water velocity and steeper slopes are a characterisitic of the north-eastern portion of the channel.

The Bay Plan Subtidal Areas policies state, "projects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects." The applicant is requesting to mine up to 245,000 cy of sand from the Suisun Bay, with peak mining years of 300,000 cy, for a total of not more than 2.45 million cubic yards over a ten year period. This volume is reduced from the original request of 300,000 cy per year for a total of 3 million cubic yards over ten years. This is a reduction of the original mining request of 55,000 cy per year and 550,000 cy over ten years.

The applicant states that the EIR, its appended studies, and additional information documents the lack of harmful effects of sand mining on tidal hydrology. Additionally, the EIR concluded that continued sand mining for ten years will not result in any "measurable" or "detectable" adverse physical harm to these areas or "likely to cause measurable sediment depletion" and would not affect sediment transport outside of the immediately vicinity of the mining leases areas."

[57] Barnard, Patrick, Kvitek, Rikk, Iampietro, Pat. Bathymetric Change Analysis for West-central Bay and Suisun Bay, 2008-2014. USGS 2014

Other evidence and opinions suggest that: (1) Suisun, San Pablo Bay and Central Bay are currently in an erosional state; (2) the sediment supply, including sand sized sediment has shown a step decline in supply that scientists have stated is unlikely to be reversed due to human alteration of the system; (3) Central Bay is erosional and there are significant changes in the bathymetry in some lease areas; (5) Central Bay lease areas are replenishing at a rate of only five to fifteen percent of what is being mined; (6) there are changes to the bedforms themselves, which may have impacts on habitat and species that use them; (7) southern Ocean Beach is erosional, while northern Ocean Beach is accreting, likely due to the change in position of the San Francisco Bar, though these mechanisms are not well defined at this time and (8) the there is not sufficient information to quantify changes to salinity or tidal hydrology resulting from the proposed project.

The Commission should decide if the proposed project has been thoroughly analyzed for impacts to tidal hydrology, sediment transport and Bay bathymetry and if as proposed, the project has minimized harmful effects to the same.

b. **Biological Resources: Fish, Other Aquatic Organisms, and Wildlife, Subtidal Habitats and Tidal Flats.** The San Francisco Bay Plan contains policies requiring the protection of native and threatened and endangered species of the Bay and the protection of habitat areas essential for the survival of these species. These policies include Subtidal Areas Policy 1, which directs the Commission to thoroughly evaluate any proposed project in subtidal areas and minimize potential harm. Commission's Bay Plan Fish, Wildlife and Other Aquatic Organisms, Policy 2 directs the Commission to conserve habitats that are important for endangered and threatened species, but also to protect habitats important for the continued existence of native species within the Bay. Policy 4 requires the Commission to consult with the Resource Agencies when a proposed project has impacts to native and more specifically listed species. It also requires that the applicant obtain biological opinions and "take" permits when impacts to listed species could occur. It further directs the Commission to consider the conservation recommendations of the Resource Agencies to avoid adverse impacts to species and wildlife habitat from a proposed project.

The Bay Plan's Subtidal Policy 2 directs the Commission to conserve sandy deep water habitat, and allow dredging only if there is no feasible alternative and the project provides substantial public benefits. The Bay Plan's policies on Fish and Wildlife and Tidal Marsh and Tidal Flats policies direct the Commission to conserve subtidal habitat and tidal flats to the fullest possible extent (specifically tidal flats). Solano County Policies and Regulations Governing the Suisun Marsh also supports the protection of habitat and species. Its Agricultural and Open Space Land Use Policy 1 states "[t]he County shall preserve and enhance wherever possible the diversity of wildlife and aquatic habitats found in the Suisun Marsh… to maintain

these unique wildlife resources." Lastly, the Region's Subtidal Habitat Goals Report has specific protection goals to "Promote no net increase in disturbance to San Francisco Bay soft bottom habitat", which includes sandy subtidal habitat and to "Promote no net loss to San Francisco Bay subtidal and intertidal sand habitats."[58]

(1) **Suisun Bay Habitat**. This dynamic environment is habitat for a number of state and federally listed species, as well as many native species. The San Francisco Estuary has been designated as critical or essential habitat for many species of fish, such as the Chinook salmon and the Delta smelt, under the federal Magnuson-Stevens Act and the state and federal Endangered Species Acts. Species within the San Francisco Estuary have many different life stages that rely to varying degrees on the estuarine system. Some species of anadromous fish only use the estuary for a relatively short period of time during migration to the ocean as juveniles or back to freshwater streams for spawning, while other species live their whole lives in the estuary and rely heavily on Bay ecosystems.

The NOAA National Marine Fisheries Service (NMFS) determined that the proposed project would adversely affect Essential Fish Habitat (EFH) in the San Francisco Bay. The impacts to EFH would include: (1) direct impacts and removal of the substrate (2) destabilization and slumping of shallow water habitat areas adjacent to the mining area, (3) increased depth and grain size in the lease areas (Barnard and Kvitek 2010), (4) removal of potential food prey items for species normally feeding on the benthic organisms, and (5) increased turbidity in the water column[59]. NMFS defines habitats as "those waters or substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS considers adverse impacts to fish habitat to be those activities that "reduce quality or quantity of EFH [essential fish habitat], and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species, and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH."

Because the proposed project occurs subtidally, "habitat" in this analysis of the project's impacts on Bay species is considered both the sandy-bottom substrate of the Bay floor and the overlying water column. The proposed project would result in the "take" of state and federally listed species as well as native Bay species[60]. Impacts to species living in the estuary as a result of the project may include: (1) impacts to open-water (pelagic) communities resulting from increased turbidity in the discharge plume created during mining activities; and (2) disturbance to bottom-dwelling species through direct entrainment or impingement of species and additional indirect impacts from habitat alteration.

[58] San Francisco Bay Subtidal Habitat Goals Report: Conservation planning for the submerged areas of the Bay. 2010. California Coastal Conservancy, NOAA, BCDC, and SFEP.
[59] NMFS Biological Opinion 2015
[60] SLC EIR 2012

(2) **Potential Impacts to Open Water Habitat.** The proposed project activities would result in the creation of a discharge plume with an increased concentration of fine-grained sediment, which can persist around the project area for about 3-4 hours after completion of the mining activity until fully dissipating to background levels. Direct impacts to the open water communities resulting from increased water column turbidity may include impacts to visual foraging, susceptibility to predation and interference with migratory behavior,[61] delayed hatching, and physiological impacts, including clogged gills or eroded gill and epithelial tissue.[62] [63] Indirect impacts to important open water species within the Bay may occur from a loss of benthic prey items or decreased productivity resulting from turbidity impacts to the planktonic and aquatic plant communities, which form the base of many food webs in the estuary.

Additionally the locally increased turbidity from the discharge plume may cause direct impacts to phytoplankton[64] and zooplankton, which are important food items for many species in the Bay.[65] However, the overflow plume does not last more than about 9.5 hours (depending on environmental conditions) and the impact of this local reduction in plankton productivity is likely to be minor in relation to the productivity of the entire Bay. In addition, the increased local turbidity in the discharge plume can be similar to ambient turbidity levels in Suisun Bay or similar to the turbidity of large runoff events in Central Bay.[66]

NMFS found that the likelihood of fish exposure to the elevated turbidity levels in the overflow plume on any given day would be low since there is one full tidal cycle between mining events. Additionally the size of the overflow plume is relatively small compared to the amount of adjacent open-water areas in Central Bay, Suisun Bay, and the western Delta.[67] The sediment-associated contaminants that may be resuspended are not expected to impact water quality to a level of concern.[68] This issue is further discussed in the Water Quality section.

Entrainment in open water occurs when an organism cannot swim or escape from the mining equipment and is sucked into the drag head or intake pipe. Some planktonic organisms, including larval stages of invertebrate and fish species, may be initially entrained during the ballasting of the hopper barge.[69] However, minimization measures put in place by the resource agencies require that hydraulic pumps only be turned on within three feet of the Bay floor, which limits impacts to planktonic organisms and other species within the water column.

---

[61] NMFS Biological Opinion 2015
[62] SLC EIR
[63] NOAA NMFS. 2015. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation
[64] SLC EIR
[65] USFWS Biological Opinion. 2014
[66] NMFS Biological Opinion 2015
[67] Ibid. 2015
[68] Ibid, 2015
[69] AMS entrainment study.

The USFWS issued a biological opinion for "take" of Delta smelt, an endangered species, and required mitigation at Liberty Island a conservation bank in the Delta being managed for habitat for fish species. The CDFW issued an incidental take permit for longfin and Delta smelt, as well as salmonids, and in it's permit, determined the proposed project would have impacts to state-listed salmonids and smelts. The USFWS also determined that the proposed project would have adverse impacts to Delta smelt and has also required mitigation at Liberty Island. Additionally, NMFS identified that the proposed project would adversely impact salmonids in the San Francisco Bay, but not jeopardize the continued existence of the species, including the threatened Central Valley steelhead (*Oncorhynchus mykiss*), Central California Coast steelhead (*O. mykiss*), Central Valley Spring-run Chinook (*O. tshawytscha*), the endangered Sacramento River Winter-run Chinook (*O. tshawytscha*), and would additionally have impacts to North American Green Sturgeon (*Acipenser medirostris*).

The Resource Agencies required a number of minimization and monitoring measures to decrease the potential take of listed and native species as a result of the proposed project. One important minimization measure is the installation of positive barrier fish screens on the water intake pipes to exclude the juvenile and adult life stages for many fish species located near the project area.[70] The screens are not able to prevent entrainment of eggs, larvae or plankton, only small and larger fish. The applicant has installed these screens. NMFS is requiring the applicant to monitor and assess performance of the intake fish screens. While CDFW and USFWS expect very low entrainment of eggs from federally and state-listed Delta and state listed longfin smelt, they placed seasonal mining and water pumping volume limits and depth restrictions on Hanson and Lind's mining in the Suisun Bay during the smelt spawning season from December through June. The depth limits are required to avoid impacts to shallow water spawning grounds. Eggs would not likely occur at mining depths.[71]

(3) **Potential Impacts to Benthic (Bottom) Habitat.** Sandy deep water habitat areas only account for about eight percent of the Bay floor, and are thus considered relatively "scarce in the Bay". Bottom-dwelling species may be impacted through entrainment, impingement, or habitat alteration. The direct entrainment of bottom-dwelling species may occur through the drag head or suction pipe of the mining equipment. Entrainment of bottom-dwelling fish species is less likely with Lind's mining methods where the suction pipe is placed directly into the substrate prior to beginning the mining. Impingement of species against the water intake screens may also occur during mining activities.

The bottom dwelling community in Suisun Bay, which is dominated by two species of invasive clam (*Corbula amurensis* and *Corbicula fluminea*)[72]also contains other non-mobile invertebrate species (such as worms) living within the substrate. It is characterized as having relatively low species diversity compared

[70] Coast Harbor Engineering, Velocity Testing Study
[71] USFWS Biological Opinion. 2014 pg. 23
[72] BCDC Sand Mining Science Panel

to Central Bay.[73] Organisms living within or on top of the sandy substrate would likely be impacted by the proposed project through direct removal of the top-layer (biologically active layer) of the benthic community, habitat removal and fragmentation, or smothering of organisms by large debris disposed overboard during the mining operations. Disturbance to benthic community organisms and benthic habitat during the proposed project may remove direct prey items important for Bay groundfish species or allow for the introduction of invasive species in disturbed areas.

Sand is often considered a poor habitat for many benthic organisms, but there are some species that are specifically adapted to transitory environments and can survive in these dynamic environments. Some species, such as the commercially important California halibut and the juvenile Dungeness crab, occur on the sandy bottom and utilize subtidal sand wave formations in the Bay. [74] Some bottom-dwelling fish, crabs, shrimps and other organisms may be important prey items for listed species.[7576] Mechanical changes to the bed formations may lead to impacts to these species.[77] Additionally the scientists participating in BCDC's Sand Mining Science Panel (2014) identified that there is little known about how fish and other organisms in the Bay utilize sandy deep water habitats and shoals.[78] Disturbances from mining tracks on the Bay floor persist over time[79] and physically change the habitat available for various species within the Bay by removing habitat, potentially changing the grain size and may lead to localized changes in flow fields over sand sholas.[80]

The project would result in the entrainment of a number of different bottom-dwelling species through the drag head during mining operations. The minimization measure requiring priming the hydraulic pumps within three feet of the Bay floor, which reduces entrainment of listed fish species, would likely not prevent the entrainment of many small, mobile and non-mobile, bottom-dwelling species living on or near the Bay floor. However, for many species, the number of entrained individuals accounts for only a small portion of the total population within the Bay and would not likely cause significant reductions in the populations of these bottom-dwelling species.[81]

The AMS study of entrainment of bottom dwelling species in or near the Suisun Associates lease identified "eleven dominant fish species inhabiting the Suisun Marsh sand mining leases, individual entrainment estimates ranged between 0 and 176 individuals occurring per year from sand mining operations in this region of the Estuary. Calculated entrainment estimates indicate that Shokihaze goby

[73] Ibid
[74] Ibid
[75] NMFS Biological Opinion 2015 pg. 48.
[76] Subtidal Habitat Goals Report. 2010. and NMFS Biological Opinion
[77] BCDC Sand Mining Science Panel 2014
[78] Ibid
[79] NMFS Biological Opinion 2015
[80] BCDC Sand Mining Science Panel 2014
[81] AMS Fish Entrainment Estimates Study. 2009

(176), yellowfin goby (56), white catfish (45), longfin smelt (21), striped bass (12), channel catfish (7), starry flounder (4), and delta smelt (4) were the most entrained fish species. These levels of entrainment were estimated to represent between <0.1% and 0.2% of the total abundance index for each species within Suisun Marsh."[82]

Along with bottom dwelling fish, the sandy habitat is home to macro invertebrates such as crabs and shrimp. The San Francisco estuary is an important nursery ground for the Dungeness crab, which is an important commercial fishery in North Central California waters.[83] Sand mining activities in San Francisco Bay are estimated to lead to the loss of less than 0.1% of the total annual crab harvest. Entrainment of juvenile Dungeness crabs is predicted to be much higher from Central Bay sand mining than from sand mining around the Middle Ground Shoal or Suisun Associates areas. Bay-wide, an estimated 1.2 million shrimp would be entrained during sand mining activities.[84] In the Central Bay mining lease areas, the Blacktail shrimp is estimated to be the most frequently entrained species, whereas in the Middle Ground Shoal and Suisun Marsh areas, the California Bay shrimp are more heavily entrained.[85] The California Bay shrimp is a commercially important shrimp species in the Bay and sand mining activities have been estimated to entrain about 3-6% of the commercial landings. These invertebrates are important prey items for fish and other wildlife.

NMFS determined the proposed project would have impacts on Essential Fish Habitat (EFH). The proposed project's long-term impacts on habitat utilization by certain species, recruitment back into the disturbed areas, direct removal of prey items for fish, impacts to foraging behavior and recovery of the benthic community is not well understood.[86] To date, only one study has been conducted to look at the impacts of sand mining on benthic communities in the Bay and recovery after the mining activity. This study found no significant difference in the biological community composition between recently mined sites and those mined in the past. [87] The study conclusions were based upon a small sample size with data points collected over only a few days. Studies from other areas (other than SF Bay) have looked at recovery times after a benthic disturbance and identified that recovery can take months to years and that the disturbance of the biological community and physical changes to the habitat may result in loss of ecological function for the community[88] Additionally, mining events often reoccur within the same areas of the mining leases and thus the temporary impacts from a single mining event would be a chronic impact.[89]

[82] Ibid.
[83] AMS Fish Entrainment Estimates Study, 2009
[84] Ibid
[85] Ibid.
[86] NMFS Biological Opinion 2015 pg 47
[87] AMS Fish Entrainment Estimates Study, 2009
[88] NMFS Biological Opinion 2015 pg 47
[89] Ibid, pg. 51

NMFS required an additional study of benthic impacts because NMFS considered the study presented in the FEIR inadequate to determine potential mining effects to Essential Fish Habitat. The project proponent has agreed to form a Technical Advisory Committee (TAC), to design a benthic study that would utilize different methods to sample the benthic community in Central Bay and assess the impacts of these mining events on the benthic community recovery and organisms relying on the benthos. Once designed, the applicants would fund that study. As part of the consultation of EFH NMFS recommended that (1) an alternative source of sand be developed to minimize sand mining volumes extracted from the Bay to minimize benthic disturbance; (2) additional support or funding be contributed by the applicant to CalRecycle's efforts to remove anthropogenic debris from the Bay, which restores more natural habitat areas for fish; and (3) that the annual cumulative mining from Hanson and Lind not exceed the FEIR baseline volume (average from 2002-2007) and that no increase in mining above this amount occur to reduce impacts to EFH.

(4) **Potential Impacts to Tidal Flats.** Although most tidal marshes do not contain large amounts of sand, the tidal flats, especially those near the Suisun Associates lease, may consist of large amounts of sand and may be important spawning habitat for the endangered species.[90] The USFWS and CDFW recommends that these areas should be conserved to prevent the extinction of both state and federally listed species. The slope in the north-eastern portion of the channel, near Van Sickle Island appears rather steep and mining in the deep-water channel may cause the slumping of material from the sides of the channel. This may undermine tidal flat areas or other important shallow water habitats near Van Sickle Island.

(5) **Habitat Impacts Minimization Measures.** To minimize impacts to shallow water spawning habitat for the Delta smelt, the resource agencies (NMFS, USFWS, and CDFW) are requiring depth, volume and seasonal limitations to mining in Suisun Bay. The proposed sand mining may not occur within 200 feet of any shoreline and no mining shall occur within 250 feet of areas with depths shallower than nine feet Mean Lower Low Water (MLLW). Mining is also not allowed in depths shallower than -25 feet MLLW from December through June and in depths shallower than -15 feet MLLW from July through November. To further protect Delta smelt larvae in Suisun Bay both Hanson and Lind would limit their mining volumes between December and June of any year. During these months Lind can mine up to 51,000 cy in Middle Ground Shoal and 51,000 cy in the Suisun Channel. During the same time period Hanson can mine up to 5,500 cy of sand from Middle Ground Shoal and 68,500 cy from the Suisun Channel.

[90] USFWS Biological Opinion. 2014.

The Commission should consider whether: (1) the proposed project is consistent with the Bay Plan policies on conservation of habitat, (2) the proposed conservation recommendations are sufficient to protect critical habitat for native, state and federally listed species, (3) impacts from the proposed project have been minimized or mitigated as much as possible, and (4) the required monitoring is sufficient to identify significant impacts to sandy subtidal habitat in and around the lease areas.

(6) **Potential Impacts to Aquatic plants.** The Bay Plan's Subtidal Policy 1 directs the Commission to evaluate the impacts of the proposed project on the Bay's aquatic plants**.** The Bay is home to a number of aquatic plants and algae (seaweeds) native to the area, including eelgrass and seaweeds of different varieties. Both aquatic plants and algae need light to undergo photosynthesis. In addition, algae generally need a hard substrate to attach to in order to withstand tides and currents. Due to the deep-water nature, limited light penetration and shifting sands found at the mining lease area, it is assumed that there are no aquatic plants or algae living there. As described in the previous section, mining activity is limited to areas deeper than minus 15 feet MLLW and a minimum of 250 feet from areas minus 9 feet MLLW or less. Providing these buffer zones in combination with the swift currents should minimize any settlement of fine sediments on adjacent algae beds.

The Commission should consider whether: (1) the proposed project is consistent with the applicable Bay Plan policies on Subtidal Area (Policy One); Fish, Other Aquatic Organisms and Wildlife; and Tidal Marsh and Tidal Flats and (2) the proposed conservation recommendations are sufficient to minimize harm and protect critical habitat for native, state and federally listed species.

(7) **Potential Spread of Invasive Species.** The Bay Plan's Subtidal Policy One directs the Commission to evaluate the whether the proposed project would cause the spread of invasive species. San Francisco Bay is considered one of the most invaded estuaries in the nation.[91] This is largely due to the historic and current shipping industry, commercial fisheries and recreational vessels from all over the world entering the Bay. From the limited information available, Central Bay appears to have retained a community primarily composed of native species,[92] potentially due to its highly stable marine environment, lacking large changes in salinity or temperature.

There appear to be two mechanisms that could facilitate spread of invasive species though mining activity: transport of invasives by the mining equipment and through habitat disturbance from the mining activity. According to Suisun Associates, both both companies use a single barge and tug combination for the proposed mining activity that does not leave the Bay. Hanson's is used to mine sand both in Central Bay and Suisun Bay, which has a highly invaded community, including sand colonized by Asian clams, invasive zooplankton and vegetation. There is potential for invasive species to be transported by the equipment as it

[91] Cohen and Carlton 1998

[92] AMS Fish Entrainment Study, 2009

moves between Central Bay and Suisun or to offloading yards, but the change in salinity may make Central Bay inhospitable to these species. No issue has been identified to date from using the equipment in both locations.

The practice of mining removes both sand and species living within and on top of the sand. In disturbing the habitat in this way, areas devoid of native species within the mined footprint are available for non-natives to colonize without competition from well-established natives.[93] Due to a lack of complete information regarding this habitat and the communities that live in these areas, it is difficult to assess this potential impact, other than to note that the potential exists to provide non-natives a foothold in Central Bay sand shoals due to the mining activity.

The Commission should consider whether additional measures should be taken to either better understand the potential for spread of invasive species or to minimize the potential spread of invasive species are necessary.

(8) **Potential Impacts to Water Quality.** The Commission's Bay Plan Water Quality policy Policy 2 states, "Water quality in all parts of the Bay should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's Water Quality Control Plan, San Francisco Bay Basin and should be protected from all harmful or potentially harmful pollutants. The policies, recommendations, decisions, advice and authority of the State Water Resources Control Board and the Regional Board, should be the basis for carrying out the Commission's water quality responsibilities."

The proposed mining activity would result in an overflow discharge plume of fine-grained material during each mining event, which would temporarily and locally increase concentrations of suspended sediment and water turbidity. Additionally, The proposed project would deepen certain portions of the lease areas during the mining events and the deepening may contribute to intrusion of higher salinity water into the Delta by allowing X2 to move farther up into the Delta.

The waters of the Bay are an important primary element[94] of the habitat for various listed and native species in the San Francisco Estuary. The salinity and turbidity of the water influences the distribution of organisms living in the estuary, as well as those transiting through portions of the Bay along their migratory routes. Different species are adapted to tolerate different salinity ranges and turbidity levels. The water (habitat) quality needs for different Bay species are also dependent upon the turbidity and the presence of contaminants in the water column.

[93] Nature of Invasive Species Colonization
[94] USFWS Biological Opinion. 2014.

Maintenance of the position of the salinity gradient (X2) in the Delta is important to species inhabiting the estuary, especially those in Suisun Bay. The position of X2 is dependent upon the amount of freshwater Delta outflow. The position of X2 is critical for the distribution of species within the Suisun Bay and the Delta. The proposed project would deepen parts of the lease area, but these impacts do not extend much beyond the lease areas and the level of mining would not likely contribute significantly to the movement of X2 farther upstream into the Delta[95].

The overflow discharge from the mining activities would create elevated turbidity levels in plume, which extends outward from the barge in the direction of tidal flow[96]. The extent and duration of the plume depends upon a number of environmental variables during the mining activity. Typically, the highest sediment concentrations are observed at the surface and at the Bay floor, where material settles[97]. The increased turbidity is present for the duration of the mining activity and takes about an additional 3-4 hours to dissipate to background "normal" levels after the activity is completed. An overflow plume study conducted in Central Bay measured sediment concentrations between 5-100 mg/l above the background levels in the plume. The overflow plume discharged by Hanson's Central Bay mining operations was previously measured to extend about 3,000 feet downstream of the vessel and 300 laterally from the vessel. No previous discharge plume studies have been performed in Suisun Bay and Lind has not performed an overflow plume study to assess the extent of the plume created from mining performed with the equipment utilized by Lind.

The short-term increased water column turbidity, may have a variety of impacts to species inhabiting the water column. For instance, the increased turbidity may be beneficial for some species during certain activities such as potentially enhancing Delta smelt feeding success. However, high turbidity levels may also lead to physiological and behavioral impacts to other Bay species. There may additionally be impacts to migration, respiration, feeding, etc. In the CEQA analysis, the State Lands Commission found that the potential impacts to species from increased turbidity of the overflow plume would be less than significant[98]. The material that would be mined mostly consists of sandy material, with a small amount of fine-grained material and that is believed to be free of contaminants due to its low carbon content. The material being mined generally contains less than ten percent fines[99], which would greatly reduce the potential concentrations of contaminants found in the sand. However, borings collected in the Central Bay lease have shown that this area contains layers of clay, which may have a high organic content, intermixed with the sandy material in the substrate.

[95] Ibid.
[96] MEC Analytical Systems Inc. 1993
[97] Ibid
[98] SLC FEIR
[99] SLC FEIR

The California Regional Water Quality Control Board, San Francisco Bay Region (Regional Board) reviewed the proposed project and determined that the proposed project is not likely to result in "water quality less than the prescribed policies"[100]. They further found determined that the currently mined shoals would have at lease a 10:1 dilution for any particular "characteristics" of concern and that the discharge would not cause a nuisance to the Bay.[101]

The Regional Board issued a Final Order for the Waste Discharge requirements on January 21, 2015, which included a Self-Monitoring and Reporting Program (SMP) and is requiring Suisun Associates to perform a study to evaluate the discharge and receiving water quality. The effluent and receiving water study would "characterize the overflow effluent toxicity and composition (suspended sediment, conventional pollutant, and toxic pollutant concentrations), the spatial and temporal extent of the overflow plume in the receiving water based on the magnitude of suspended sediment concentrations within the plume, and would compare overflow plume suspended sediment concentrations to background (ambient) conditions."[102] The study would also be designed to capture the seasonal and tidal variation in the discharge and water quality of the receiving waters. They have provisioned the waste discharge requirements and water quality certification with a reopener clause that would allow the project to be reassessed if the study indicates that there are adverse impacts to water quality or beneficial uses of the receiving waters, or if new regulations or policies, are adopted during the permitted period.

Additionally, it should be noted that in Hanson's operations and landside processing of sand, the sand would be rinsed with freshwater in order to dechlorinate the sand and make the material more suitable for use in construction grade cement. This practice is mainly important for landside processing of Hanson's Central Bay lease sand due to the salinity of the overlying water column in that part of the San Francisco Estuary. However, depending upon the location of the salinity gradient (X2) in the Delta, this may also be necessary for the processing of sand that is mined from the Middle Ground lease area located in Suisun Bay.

The Commission should consider whether the project as proposed and conditioned by the Regional Board is consistent with the Commission's policies on water quality and if the potential impacts from harmful pollutants have been minimized the greatest extent feasible and the beneficial uses of the Bay are protected. Additionally, the Commission should consider whether it would also require the Effluent and Receiving Water Study to gain further understanding of the potential impacts of the discharge plume on Bay species.

[100] SFRWQCB Final Order. 2015.
[101] Ibid.
[102] Ibid.

3. **Feasibility and Public Benefits**. The Commission's Subtidal Policy 2 states, "Subtidal areas that are scarce in the Bay, or have an abundance and diversity of fish, other aquatic organisms and wildlife (e.g. eelgrass beds, sandy deep water or underwater pinnacles) should be conserved. Filling, … and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits."

   This policy requires the Commission to evaluate the feasibility of other alternatives of obtaining sand from locations other than "sandy deep water" areas in the Bay. There are other sources of sand than sand dredged from the Bay's sandy deep water sites. Large volumes of sand are imported into the Bay Area from British Columbia. For example, approximately 1.7 mcy of sand were imported into the Bay Area in 2012. Comparatively, approximately 0.25 mcy were mined from the Central Bay that same year. Sands and aggregate from Bay area land quarries also provide sands to the Bay area market. However, obtaining sands from these sources have downsides. Such sands are typically more expensive to produce, cost more to transport, and as a result of both their production and transport, produce more greenhouse gases in getting them to demand sites than obtaining sand from the Bay's deepwater sandy sites. Hanson also has stated that the ships importing sand need deep draft berthing areas and that their existing barges are not designed to be top loaded, so additional barges would need to be acquired to offload imports. Transporting sand from local land-based quarries would increase wear and tear on roadways, fuel consumption and traffic congestion.

   In assessing the feasibility of these alternative sources, the Commission must apply the definition of feasibility contained in the CEQA (PRC § 21061.1) and in the CEQA Guidelines (14 CCR § 15364). The definition in CEQA also includes not just physical, technological, economic or legal impossibility, but also public policy consistency.[103] An example of the use of public policy concerns as the basis for rejecting a project alternative as infeasible can be found in the FEIR for the project presently before the Commission prepared by the State Lands Commission. In the FEIR the SLC rejected as "infeasible" any reduction in the volume of sand for which the mining companies were seeking leases on the basis of the increased greenhouse gas emissions in which the transportation of sand from alternative sources would result.

   In determining whether the proposed sand mining project is allowable under Subtidal Policy 2, the Commission must determine 1) whether there are alternatives to dredging sand from the Bay's sandy deep water areas, 2) the feasibility of any such alternatives by weighing the adverse impacts associated with these alternatives (largely the production of greenhouse gases and increased cost of sand) against the adverse effects of the proposed activity on a limited Bay resource and its associated biota, as described elsewhere in this application summary, and 3) the public benefits of dredging sand from the Bay.

[103] *Defend the Bay v. City of Irvine* (2004) 119 Cal.App.4th 1261.

4. **Mitigation.** The Commission's policies on Mitigation states that "[p]rojects should be designed to avoid adverse environmental impacts to Bay natural resources such as…fish, other aquatic organisms and wildlife habitat, subtidal areas…or tidal flats. Whenever adverse impacts cannot be avoided, they should be minimized to the greatest extent practicable...and mitigation for unavoidable adverse impacts to the natural resources of the Bay should be required."

   The impacts to Bay resources from the proposed mining activity would include those specific to the lease areas as well as potential impacts beyond the lease boundaries. As previously discussed in other sections of this report, the potential unavoidable impacts from this project within the lease include: (1) entrainment of special status and native species through the drag head; (2) entrainment of the eggs or larval stage of special status and native species through the screened water intake pipe; (3) temporary increases in suspended sediment loads; (4) degradation of sandy habitat by removal of prey and benthic invertebrates; and (5) degradation of habitat through bedform removal and modification of substrate, both in reduction of grain size of sand and sand wave formation.

   In addition, potential impacts beyond the lease boundaries include the entrainment of fish, including special status species, eggs, larvae and plankton that move in and out of the lease boundaries as part of their life cycle; temporary increases in suspended sediment concentrations while mining is occurring; and reduction in sand supply to the system, including Bay shoals, the San Francisco Bar and potentially southern Ocean Beach.

   While the applicant has worked to reduce impacts to threatened and endangered species through the installation of a fish screen, reduction in mining volumes and limits to mining areas, other impacts to EFH cannot be further reduced or minimized due to the nature of the mining activity and therefore mitigation would be required.

   When unavoidable impacts are identified, the Bay Plan policies on mitigation provide guidance regarding how those impacts should be mitigated. The mitigation policies state that "individual compensatory mitigation projects should be sited and designed within a Bay-wide ecological context, as close to the impact site as practicable, to compensate for the adverse impacts," ensure success and support the improved health of the Bay ecology. They further state that the Commission should consider benefits to humans from Bay natural resources; that the rationale for the mitigation should be clear; the siting of the mitigation should be in an area where adjacent land uses and connections to other habitats improve the potential for successful outcomes; and that mitigation should be provided prior to or concurrent with the proposed project.

   The policies also provide that when compensatory mitigation is necessary, a mitigation program should be reviewed and approved by or on behalf of the Commission as part of the project, and describe the "[p]rovisions for the long-term maintenance, management and protection of the mitigation site, such as a conservation easement, cash endowment, and transfer of title." The mitigation programs are also expanded by the

Commission's policies that state that they "…should be coordinated with all affected local, state, and federal agencies having jurisdiction or mitigation expertise to ensure, to the maximum practicable extent, a single mitigation program that satisfies the policies of all the affected agencies."

In response to these policies, the applicants have consulted with NMFS, USFWS, and CDFW in regards to unavoidable impacts to threatened, endangered and native species and their critical habitat, and Essential Fish Habitat due to the mining activity and have incorporated their recommendations into their proposed mitigation plans. In order to compensate for impacts to longfin smelt and Delta smelt while mining in Suisun Bay, Hanson has purchased 0.404 acres and Lind 0.107 acres, for a total of 0.511 acre of freshwater habitat mitigation credits at Liberty Island Conservation Bank in Yolo County. [104] The mitigation credits are located at a distance from the mining activity, however, it is the only mitigation bank available for fish impacts, and has been determined to be suitable compensatory habitat for smelt and salmonids by both CDFW and NOAA Fisheries. CDFW has also determined this bank is suitable for compensation for incidental take of longfin smelt.

These policies also offer opportunities to combine mitigation efforts and describe the framework necessary to allow flexibility in mitigation types in stating: "To encourage cost effective compensatory mitigation programs…the Commission may extend credit for certain fill removal and allow mitigation banking provided that any credit or resource bank is recognized pursuant to written agreement executed by the Commission. …Mitigation banking should only be considered when no mitigation is practicable on or proximate to the project site." The policies further define when fee based mitigation is a potential option. According to the applicants and the Resources Agencies, mitigation bank credit is the only current option for impacts to these species.

To address the impacts of sand mining to essential fish habitat (EFH) in Central Bay and Suisun Bay, Hanson and Lind together proposed as mitigation to contribute to CalRecycle's Estuary Clean Up Project in an amount not to exceed $100,000 for all mining areas. The Clean Up Project clears debris (old pier pilings, abandoned ships) from the estuary in order to improve fish habitat. Hanson will contribute by providing a portion of the funds and Lind will contribute by conducting the actual debris removal. It is not clear at this time how the $100,000.00 worth of removal will be split between the two companies. CalRecycle will be responsible for the distribution of funds and the performance and completion of these projects.

In addition to mitigation policies, the Commission has several policies that encourage the expansion of scientific knowledge, especially where sufficient information is not currently available. Bay Plan policies on Subtidal Areas, Tidal Marshes and Tidal Flats, as well as dredging mirror the need for increased research and knowledge, as well additional studies of both habitat and impacts of proposed projects. Subtidal Areas Policy 5 states, in part that the Commission should continue to support and encourage expansion of scientific information on the Bay's subtidal areas, including: an inventory and description of the Bay's subtidal areas; the relationship between the Bay's physical

[104] CDFW Incidental Take Permit, Amendment One, 2014

regime and biological populations; sediment dynamics, including sand transport; … areas of the Bay used for spawning, birthing, nesting, resting, feeding, migration, among others, by fish, other aquatic organisms and wildlife…"Further, the Tidal Marsh and Tidal Flats policies state that the Commission should support comprehensive Bay sediment research and monitoring to understand sediment processes necessary to sustain and restore wetlands…" Lastly, Dredging Policy 12 states that the Commission should …continue to participate…other initiatives conducting research on Bay sediment movement, the effects of dredging…on Bay natural resources…."

In order to better understand the ecological environment that exists as well as the impacts of mining on the habitat, the applicants have agreed to conduct a benthic study of the Central Bay sandy deep water habitat as described previously in this document. It is anticipated the study would take between three to four years to complete. In addition, the applicants have proposed to continue the multibeam surveys and associated change analysis on a five-year basis to assist in ascertaining the changes to the Bay bathymetry as a result of mining activity. Staff has discussed additional potential studies with the applicant to assist in assessing impacts to the San Francisco Bar and Ocean Beach (potentially tracer studies); an analysis of the volume of sand available to bedrock; and assistance in further refining the sand budget and transport into the lease areas an other sandy subtidal habitat. These discussions are ongoing.

The Commission should determine whether the reduced project volumes, the mitigation provided are sufficient given the identified potential impacts and whether the proposed studies are sufficient to support furthering the knowledge regarding this habitat and the mining activity.

5. **Dredging, Navigation Safety and Oil Spill Prevention.** San Francisco Bay Plan Dredging Policy 2 states that "[d]redging should be authorized when the Commission can find: (a) the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, such as navigational safety; (b) the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board; (c) important fisheries and Bay natural resources would be protected through seasonal restrictions established by the California Department of Fish and Game, the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service, or through other appropriate measures; (d) the siting and design of the project will result in the minimum dredging volume necessary for the project…."

   In their application, Suisun Associates describes sand mining as a water-oriented use in that sand is mined from the Bay and serves the important public purpose of supplying sand to the construction industry from a local source, reducing greenhouse gas emissions, truck traffic, and impacts to Bay Area roadways. The applicants state that using sand from a local source allows for financial savings for public projects, and that obtaining aggregate from farther away increases its cost.

   As described above, the Water Board has issued a Water Quality Certification (WQC) and Waste Discharge Requirements (WDR). The WQC/WDR requires the applicant to comply with specific wastewater dilution ratios, mining of only non-hazardous materials,

and does not allow discharge of pollutants or other materials that would cause nuisance or adversely affect beneficial uses, including increased turbidity and deleterious impacts to wildlife.

Regarding seasonal work windows for this activity, the applicant has requested and received biological opinions and an incidental take permit from the Resource Agencies. In their review of the project, the Resource Agencies did not limit mining activity seasonally in Central Bay.

In response to the question of whether the siting and design of the project would result in the minimum amount of dredging necessary for the project, the applicant has reduced its proposed project as described previously, but requests annual peak volumes, and that the maximum amount of mining be allowed in any given year as long as the total mined over ten years remains under 2.45 million cy. This would allow them to address market fluxuations. In addition, the applicant states the proposed volume would be mined only if the market demanded such a volume, and therefore are minimizing the amount of mining necessary for the project. This would allow them to address market fluctuations. In addition, the applicant states the proposed volume would be mined only if the market demanded such a volume, therefore the applicant has stated that they are minimizing the amount of mining necessary for the project.

The Bay Plan's Navigational Safety and Oil Spill Prevention Policy 2 states that the Commission should ensure that marine facility projects are in compliance with oil spill contingency plan requirements of the Office of Spill Prevention and Response, the U.S. Coast Guard and other appropriate organizations. As owners and/or operators of marine vessels operating in regulated waters of the state and often adjacent to or within federal navigational channels Suisun Associates are required to abide by maritime laws and best safety practices. Specific to their sand mining activities, Provision 10 of the WQC/WDR requires the applicant to maintain and implement a CDFW Office of Oil Spill Prevention and Response-approved plan that demonstrates that adequate measures are in place to prevent and respond to accidental release of hazardous materials. Additionally, the CDFW ITP includes a mitigation measures that requires the sand miners to follow state and federal laws and regulations in regards to hazardous waste spills and clean up. The ITP also prohibits the storage and handling of hazardous wastes in the project area. These requirements are a strong indicator that both companies would comply with the required navigational safety and oil spill contingency plans.

The Commission should determine whether the project is consistent with its policies regarding Dredging and Navigation Safety and Oil Spill Prevention.

6. **Public Trust.** The Bay Plan policy on Public Trust states that "[w]hen the Commission takes any action affecting lands subject to the public trust, it should assure that the action is consistent with the public trust needs for the area…." The public trust is a common law doctrine that guarantees the right of the public to use the state's waterways for navigation, commerce, fisheries, boating, recreation, natural habitat protection, and to preserve lands in their natural state for protection of scenic and wildlife habitat values. Public trust uses of public lands are generally limited to water dependent or water related uses, with some exceptions for ancillary structures

necessary for the water dependent uses. Further, because public trust lands are held in trust for all citizens of the state, they must be used to serve statewide, as opposed to purely local, public purposes.[105]

The State Lands Commission is responsible for determining if a project proposed on submerged or other sovereign land is consistent with the public trust uses as described above and managing those lands for the public.[106] In its decision granting the leases for the sand mining activity that is now before BCDC, the State Lands Commission did not make specific written public trust findings. However, every lease issued by the State Lands Commission has to be determined to be in the best interests of the State pursuant to Public Resources Code section 6005. Additionally, all sovereign lands and resources managed by the State Lands Commission are subject to the common law Public Trust Doctrine, so all decisions made by the Commission include a public trust consideration, even if there are not formal findings.[107]

The FEIR considered public trust resources in detail, though not explicitly referring to the public trust use. In addition, the State Lands Commission staff report regarding the Suisun Associates project stated that "[t]hese mitigation measures [listed in the 2012 FEIR], taken together, will ensure consistency with plans and policies specifying that sand mining operations be conducted in an environmentally sound manner, that agencies protect public trust resources, and that sand mining operations be carried out in a manner that minimizes interference with critical wildlife activities."[108]

In 2014, Bay Keeper challenged the State Lands Commission's finding that the project is consistent with the public trust. Upon review, the Superior Court of the City and County of San Francisco upheld the State Lands Commission's finding. Bay Keeper has appealed this decision to the First District Court of Appeal. The court has not yet heard the appeal.

In completing its independent evaluation of the project, the Commission must determine if the project is consistent with the public trust needs of San Francisco Bay. Public trust needs include the same categories as the uses. Mineral extraction from trust property is an accepted trust use in aid of commerce, much like fishing, which removes natural material from the environment. For Suisun Bay mining areas, the project appears to be consistent with navigational use even though some of the lease areas are are overlaid with a federal channel on the southern side of Chipps Island and Van Sickle Island. Because this area is naturally deeper than the draft needed by the large ships traversing the Bay, the ships can maneuver around the barge and tug without causing a navigation hazard. Similarly, water borne commerce distinct from sand mining and recreational boating would not be inhibited or limited by the mining activity.

It is unclear whether the project is consistent with the public trust as it pertains to natural habitat protection and the preservation of lands in their natural state for protection of scenic and wildlife habitat value needs. As described above, when mining sand, there is likely to be habitat degradation and loss of potential forage species living within and on the sand. In addition, removal of sands in transport may reduce the

[105] State Lands Commission Public Trust Policy: http://www.slc.ca.gov/About_The_CSLC/Public_Trust/Public_Trust_Doctrine.pdf
[106] Ibid.
[107] Pemberton, State Lands Commission, writ. comm 2015
[108] State Lands Commission October 2012 Staff Report Statement of Overriding Considerations

amount of sand available for outer coast beaches, affecting both recreation and habitat needs. Unfortunately, the volume of sand in transport to the outer coast is not well understood at this time.

Regarding statewide purposes, according to the applicant, sand mined from the Bay is used in local construction projects, including residential, commercial and public buildings, as well as roadways. Public buildings, roads, and highways serve a statewide purpose.

The Commission should evaluate the public trust needs and determine whether the project is consistent with its Public Trust policy.

B. **Review Boards**

1. **Science Review Panel.** A science panel of distinguished experts in the fields of geology, engineering, oceanography, marine and benthic ecology convened to discuss the currently available science about the transport of sandy sediment throughout the Bay Area to the outer coast and sandy shoal habitats. This panel discussed a series of management questions proposed by Commission staff regarding the current state of sandy sediment resources in the Bay, replenishment of sand in areas of extraction during mining events, habitat and species impacts, whether disturbance from mining has more of an impact on the biological community recovery than naturally occurring disturbances in the system and potential monitoring that could be used to enhance understanding of sandy sediment resources, the communities that inhabit them and the potential impacts of mining on the system. While the discussion was not conclusive, it informed this process and the management measures that could be incorporated into a final permit authorization. An abridged transcript can be found at http://www.bcdc.ca.gov/dredging/SandMiningSciPanAbridged.pdf

C. **Environmental Review.** The State Lands Commission reviewed the potential project impacts and certified the Final Environmental Impact Report in 2012. The FEIR was challenged in 2013, regarding these issues, and the Superior Court of the City and County of San Francisco upheld the State Lands Commission determination. The Court's decision is currently on appeal, at the First District Court of Appeal. The Commission's regulations require that the permitting process continue during a CEQA challenge. In the event that the courts invalidate the CEQA certification, the permit action would be revisited. A summary of that document is attached as Exhibit E.

D. **Relevant Portions of the McAteer-Petris Act**

1. Section 66605(d)
2. Section 66632
3. Section 66664.4

E. **Relevant Portions of the San Francisco Bay Plan**

1. *San Francisco Bay Plan* Policies on Fish, Other Aquatic Organisms, and Wildlife
2. *San Francisco Bay Plan* Policies on Water Quality
3. *San Francisco Bay Plan* Policies on Tidal Marsh and Tidal Flats
4. *San Francisco Bay Plan* Policies on Subtidal Areas

5. *San Francisco Bay Plan* Policies on Dredging
6. *San Francisco Bay Plan* Policies on Recreation, g. Beaches.
7. *San Francisco Bay Plan* Policies on Mitigation
8. *San Francisco Bay Plan* Policies on Public Trust
9. *San Francisco Bay Plan* Policies on Navigational Safety and Oil Spill Prevention

F. **Relevant Portions of the Suisun Marsh Preservation Act**

1. Section 29401
2. Section 29409.5

G**. Relevant Portions of the Suisun Marsh Protection Plan**

1. Suisun Marsh Protection Plan Policies on the Environment (page 13)
2. Suisun Marsh Protection Plan Policies on Water Supply and Quality (page 17)
3. Suisun Marsh Protection Plan Policies on Land Use and Marsh Management (page 36)

H**. Relevant Portions of the Solano County Policies and Regulations Governing the Suisun Marsh**

1. Section II Suisun Marsh Policies Contained in the Solano County General Plan

Exhibits

A. **Regional and Project Vicinity Map**
B. **Proposed Mining Areas**
C. **Sand Offloading Facility Map**
D. **Sand Samples from Lease Parcels**
E. **Environmental Impact Report Summary**