

RESOLUTION NO. 2017-_____

A RESOLUTION OF THE CITY COUNCIL OF MARINA FINDING THE CURRENT OPERATION OF THE CEMEX MINE MEETS THE ELEMENTS REQUIRED FOR A PUBLIC NUISANCE DUE TO ITS EROSION EFFECTS ON THE SOUTHERN MONTEREY BAY COAST AND FINDING THE CEMEX MINE TO BE IN VIOLATION OF SECTIONS 17.41.260 AND 17.25.030 OF THE MUNICIPAL CODE

WHEREAS, the CEMEX Sand Mine facility, located between Lapis Road and the Monterey Bay in the City of Marina (hereinafter “Lapis Sand Mine”), extracts large volumes of sand from an artificial dredge pond located on the beach adjacent to the shoreline; and

WHEREAS, the CEMEX dredge operations are maintained by mechanical manipulation of the beach dredge pond, which changes shape and location over time to draw in coarse beach sand from the nearshore and public tidelands during high tide events; and

WHEREAS, the coastal dunes and beach on the CEMEX property contain federally threatened and endangered species and habitat that has been designated as Environmentally Sensitive Habitat Area under the Coastal Act; and

WHEREAS, the Lapis Sand Mine operates and maintains sand-moving equipment, moves wet/dry sand, and extracts sand within an environmentally sensitive beach habitat; and

WHEREAS, the Lapis Sand Mine stockpiles its extracted sand in the sensitive coastal dune habitat; and

WHEREAS, the Lapis Sand Mine operations degrade the environment by interfering with sensitive coastal resources and habitat; and

WHEREAS, the southern Monterey Bay coast suffers from extremely high rates of erosion; and

WHEREAS, the Lapis Sand Mine annually extracts an estimated 153,000 to 205,000 cubic meters of sand; and

WHEREAS, the City resolved on March 15, 2016 to authorize the City Manager “to request the California Coastal Commission to assist the City with and/or assume responsibility for, in coordination with the City, any enforcement proceedings that may be pursued relative to possible violations of the California Coastal Act and the Marina Local Coastal Program by the Cemex Sand Mining operations”; and

WHEREAS, on March 17, 2016, the California Coastal Commission issued a Notice of Intent to Commence Cease and Desist Order and Restoration Proceedings and Administrative Civil Penalties Proceedings against CEMEX for unpermitted development, including sand dredging and extraction and related activities and development; and

WHEREAS, on May 16, 2017, the State Lands Commission issued a letter to CEMEX concluding that the Lapis Sand Mine is engaged in unlawful conversion of state public trust resources and indicating that CEMEX must either immediately submit a lease application to the Commission or cease dredge pond operations because of the financial and resource impacts its operations have on the state; and

WHEREAS, the City commissioned Dr. Robert S. Young, Ph.D., Director of the Program for the Study of Developed Shorelines and a Professor of Coastal Geology at Western Carolina University, to independently review the available information and academic literature on coastal erosion in the southern Monterey Bay and prepare an expert report to evaluate the effects, if any, of the Lapis Sand Mine on coastal erosion; and

WHEREAS, Dr. Young concluded that the Lapis Sand Mine constitutes a significant source of sand loss from the southern Monterey Bay littoral cell and, as a result, is causing erosion and significant adverse effects on coastal property, resources, and uses; and

WHEREAS, there is a scientific consensus that the Lapis Sand Mine extracts sand at a level that significantly contributes to high rates of erosion along the southern Monterey coast; and

WHEREAS, erosion due to the Lapis Sand Mine extraction activities causes significant physical and economic injury to public and private property along the southern Monterey coast; and

WHEREAS, the Lapis Sand Mine interferes with the public's access to and use and enjoyment of the beaches along Marina's coastline in a customary manner; and

WHEREAS, section 3479 of the California Civil Code states: "Anything which is injurious to health, including, but not limited to, the illegal sale of controlled substances, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, or river, bay, stream, canal, or basin, or any public park, square, street, or highway, is a nuisance."; and

WHEREAS, section 3480 of the California Civil Code states: "A public nuisance is one which affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal."; and

WHEREAS, the current operations of the Lapis Sand Mine appear to this Council to meet the required elements for a public nuisance under sections 3479 and 3480 of the California Civil Code; and

WHEREAS, section 731 of the California Code of Civil Procedure authorizes the City Attorney, at the direction of the City Council, to bring a civil action in the name of the people of the State of California to abate a public nuisance; and

WHEREAS, section 17.41.260 of the Municipal Code requires “all operators of existing mining operations” to submit to the planning department (1) a brief statement specifying the approximate annual volume of sand being removed and (2) an accurate cronaflex ortho-topographic map by January 1st of every year “[i]n order to establish reference base data for the purpose of determining whether or not any particular mining activity constitutes new mining activity and to monitor shoreline erosion”; and

WHEREAS, City records indicate that the Lapis Sand Mine has not complied with these requirements since 1992, when the prior facility owner submitted extraction levels for year 1991; and

WHEREAS, section 17.25.030 of the Municipal Code requires a coastal development permit for conditional uses, such as dredge ponds, in the Coastal Conservation and Development District; and

WHEREAS, the CEMEX Sand Mine is located in the Coastal Conservation and Development District and CEMEX has not obtained a coastal development permit; and

WHEREAS, this resolution does not enjoin CEMEX from continuing sand mining activities unless and until the City Attorney seeks judicial enforcement of this nuisance declaration and a judicial order enjoining further sand mining; and

WHEREAS, section 17.60.040 of the Municipal Code empowers the City Council to direct the City Attorney to either commence civil action or abatement proceedings for violations of the City’s zoning title, including sections 17.41.260 and 17.25.030; and

WHEREAS, the action below is taken by this Council following careful consideration of a) all written materials submitted by staff, consultants, and members of the public, and b) comments made at the public hearing by staff, consultants, the public, and members of this Council.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Marina does hereby:

1. Approve this Resolution; and
2. Authorize the City Attorney to pursue the possibility of a civil action against CEMEX to declare and abate the Lapis Sand Mine as a public nuisance under sections 3479 and 3480 of the California Civil Code pursuant to California Code of Civil Procedure section 731; and
3. Authorize the City Attorney to pursue the possibility of commencing action or proceedings for abatement under section 17.60.040 of the Municipal Code due to CEMEX’s continued violations of the reporting requirements under section 17.41.260 of the Municipal Code; and

4. Authorize the City Attorney to pursue the possibility of commencing action or proceedings for abatement under section 17.25.030 of the Municipal Code; and
5. Direct the City Attorney, at such time as he deems appropriate, to report back to the City Council, in closed session, with regard to which of the above-listed litigation actions he recommends and has decided to pursue on behalf of the City.

PASSED AND ADOPTED by the City Council of the City of Marina at a regular meeting duly held on the 6th of June, 2017, by the following vote:

AYES, COUNCIL MEMBERS:

NOES, COUNCIL MEMBERS:

ABSENT, COUNCIL MEMBERS:

ABSTAIN, COUNCIL MEMBERS:

Bruce Delgado, Mayor

ATTEST:

Anita Sharp, Deputy City Clerk

May 26, 2017

Item No. ____

Honorable Mayor and Members
of the Marina City Council

City Council Meeting
of June 6, 2016

**CONSIDER ADOPTING RESOLUTION NO. 2017-____, FINDING THE
CURRENT OPERATION OF THE CEMEX MINE MEETS THE
ELEMENTS REQUIRED FOR A PUBLIC NUISANCE DUE TO ITS
EROSIVE EFFECTS ON THE SOUTHERN MONTEREY BAY COAST
AND FINDING THE CEMEX MINE TO BE IN VIOLATION OF
SECTIONS 17.41.260 AND 17.25.030 OF THE MUNICIPAL CODE**

RECOMMENDATION:

It is recommended that the City Council:

1. Consider adopting Resolution No. 2017-____;
2. Authorize the City Attorney to pursue the possibility of a civil action against CEMEX to declare and abate the Lapis Mine as a public nuisance under sections 3479 and 3480 of the California Civil Code, pursuant to section 731 of the California Code of Civil Procedure;
3. Authorize the City Attorney to pursue the possibility of commencing action or proceedings for abatement under section 17.60.040 of the Municipal Code due to CEMEX's continued violations of the reporting requirements under section 17.41.260 of the Municipal Code; and
4. Authorize the City Attorney to pursue the possibility of commencing action or proceedings for abatement under section 17.25.030 of the Municipal Code.
5. Direct the City Attorney, at such time as he deems appropriate, to report back to the City Council, in closed session, with regard to which of the above-listed litigation actions he recommends and has decided to pursue on behalf of the City.

EXECUTIVE SUMMARY:

For the past several decades, the CEMEX sand mining operation at Lapis Road in Marina ("Lapis Sand Mine") has been extracting significant volumes of coarse beach sand from the public tidelands through the use of a dredge pond adjacent to the shoreline. Studies show that the Lapis Mine is removing approximately 47 to 63 percent of the available local sand supply "budget" in southern Monterey Bay. Removing this volume from the sand supply budget has contributed significantly to erosion in the southern Monterey Bay, where shoreline erosion rates are the highest in California. Exacerbated erosion from sand mining has come at a high public price: jeopardizing public health and safety by putting coastal infrastructure at risk, impeding

public access and use of beaches, and causing habitat loss and significant property damage throughout the region.

Based on evidence available in the public record and on an independent evaluation of that evidence by Dr. Robert Young, City staff has determined that the CEMEX sand mining operation at Lapis Road is causing significant erosion in the southern Monterey Bay littoral cell, the impacts of which constitute a public nuisance under sections 3479 and 3480 of the California Civil Code. In addition, City staff has determined that CEMEX is currently in violation of two municipal code provisions: (1) the requirement under Municipal Code § 17.25.030 (and the LCP) to obtain a CDP; and (2) the requirement under Municipal Code § 17.41.260 to report annual sand extraction numbers and other data about the site.

For these reasons, City staff recommends that City Council adopt the Resolution and authorize the City Attorney to abate these Code violations and to pursue the possibility of a civil action against CEMEX to declare and abate the Lapis Sand Mine as a public nuisance.

BACKGROUND:

Sand mining history in Southern Monterey Bay

Sand mining commenced in southern Monterey Bay in the early 1900s to provide construction materials for the rebuilding of San Francisco after the 1906 earthquake. Alyssum Pohl & Lisa Johnson, *Lapis Sand Mining: An Economic Analysis of Non-Market Impacts of Lapis Sand Mine in Southern Monterey Bay* 3 (2012) (hereinafter “Pohl”)(Attachment A). Early mining operations used shoreline draglines to collect sand directly from the ocean and tidelands. ESA PWA, *Evaluation of Erosion Mitigation Alternatives for Southern Monterey Bay* 107 (2012) (hereinafter “ESA PWA”) (Attachment B). By the 1950s, five commercial shoreline sand mines were operating along the Bay: three in Sand City and two in Marina. *Id.* at 107. In 1965, a sixth operation was established: the artificial dredge pond at the Lapis Mine in Marina that is now operated by CEMEX. Philip Williams & Associates, *Coastal Regional Sediment Management Plan for Southern Monterey Bay* 15 (2008) (hereinafter “PWA”) (Attachment C). The original operator of the dredge pond was Marina Pacific Concrete and Aggregates, which later sold the operation to Lone Star Industries; CEMEX purchased the facility in 2005. *Id.* at 42.

CEMEX’s Lapis Sand Mine

The CEMEX Sand Mine is a 104-acre sand-dredging and -processing operation located between Lapis Road and the Monterey Bay in Marina, California. State Mining & Geology Board, *2012 SMARA Mine Inspection: CEMEX Lapis Sand Plant* 1, 5 (2013) (hereinafter “State Mining & Geology Board”) (Attachment D). The CEMEX operation dredges sand from an artificial pond located between the shoreline and dunes. Pohl at 3. The pond acts as a “sand sink,” drawing in sand from the nearshore and public tidelands during particular high tides and annual storms. *Id.* A suction dredge in the pond extracts sand from the pond floor and feeds it to a processing plant via a pipe. State Mining & Geology Board at 2. Sand mining at this site began in 1965, and by the time of that CEMEX purchased the facility in 2005, several scientific studies had identified the Lapis Sand Mine extraction operations as a significant contributor to coastal erosion in the southern Monterey Bay. The processed coarse sand product sold by CEMEX—known as “Lapis Lustre”—has a low dust content and unique grain size and is used for water filtration systems, golf courses, sand blasters, construction, and other commercial purposes. CEMEX, *About Lapis*

Lustre Sands, available at <http://www.cemexusa.com/ProductsServices/LapisSands.aspx> (last accessed May 25, 2017).

City of Marina's Interest and Involvement

In response to increasing public concern and the emerging scientific consensus concerning adverse impacts from sand mining, the City Council held a discussion and received public comments on this matter at its December 1, 2015 regular meeting. At the conclusion of that discussion, the City Council voted unanimously to send a letter of support for the California Coastal Commission's completion of an investigation into the environmental impacts of the CEMEX Sand Mine on the City of Marina and the Monterey Peninsula. The City sent this letter to the Coastal Commission on December 8, 2015. See Attachment E.

On March 15, 2016, the City Council adopted a resolution authorizing the City Manager to request that the California Coastal Commission assist and coordinate with the City in any enforcement proceedings pursued relative to possible violations of the California Coastal Act and the Marina Local Coastal Program by the CEMEX Sand Mining operations.

On March 17, 2016, the California Coastal Commission issued a Notice of Intent to Commence Cease and Desist Order and Restoration Proceedings and Administrative Civil Penalties Proceedings against CEMEX for unpermitted development, including sand dredging and extraction and related activities and development. See Attachment F. That investigation remains ongoing.

On February 3, 2017, Mayor Bruce Delgado sent a letter to the State Lands Commission urging that agency to assert its jurisdiction over the lands below the Mean High Tide Line and to require that CEMEX obtain any necessary permitting from the State Lands Commission for any continued sand mining activity. See Attachment G.

On May 16, 2017, the State Lands Commission issued a letter to CEMEX indicating that CEMEX must either immediately submit a lease application to the Commission or cease dredge pond operations because of the financial and resource impacts its operations have on the state. Specifically, the State Lands Commission noted that "the intensity of sand extraction at the Lapis operation causes environmental damage, public and private property damage, and loss of economic benefit through beach erosion." See Attachment H.

Community members and coastal geomorphologists have continued to express concern about the high levels of extraction at the CEMEX Mine. Accordingly, the City commissioned an expert report by Robert S. Young, Ph.D., to review the scientific literature and independently evaluate the impacts of the Lapis Sand Mine on coastal erosion. Dr. Young is the Director for the Program for the Study of Developed Shorelines, a joint venture between Western Carolina University and Duke University, as well as a Professor of Coastal Geology at Western Carolina University. Dr. Young's independent report is included herein as Attachment I (hereinafter "Young Report").

CEMEX's Extraction Activity Causing a Public Nuisance

Section 3479 of the California Civil Code provides: "Anything which is injurious to health, including, but not limited to, the illegal sale of controlled substances, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, or river, bay, stream, canal, or basin, or any public park, square, street, or highway, is a nuisance." Section 3480 of the California Civil Code provides: "A public nuisance is one which affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal." California courts interpret section 3479 broadly and have long protected property owners from unwanted encroachments by neighbors. See *Stoiber v. Honeychuck*, 101 Cal. App. 3d 903, 919 (1980) ("The statutory definition of nuisance appears to be broad enough to encompass almost every conceivable type of interference with the enjoyment or use of land or property."); *Aspen Grove Condo. Ass'n v. CNL Income Northstar LLC*, 231 Cal. App. 4th 53, 64 (2014) ("Defendant may not 'force an invasion of the property rights of one private party to serve the convenience or necessity of another party . . . [or else] the sacred right of private property . . . would become but a shadowy unsubstantiality'" (quoting *Felsenthal v. Warring*, 40 Cal. App. 119, 131 (1919))).

Based on the available data, studies, and other information, there is scientific consensus that the CEMEX sand mining operation at Lapis Road is causing significant injury to public and private property along the southern Monterey Bay. That injury rises to the level of, and constitutes, a public nuisance under sections 3479 and 3480 of the California Civil Code. First, the scientific evidence shows that CEMEX's operation of the Lapis Sand Mine is "a substantial factor to the harm suffered" by the public and private coastal property owners. *Ileto v. Glock, Inc.*, 349 F.3d 1191, 1212 (9th Cir. 2003). Second, the CEMEX sand mining operations are causing a significant invasion of and interference with the use and enjoyment of public and private property, and the evidence demonstrates that the gravity of the harm caused by the mining operations outweighs the utility of the conduct. See *People ex rel. Gallo v. Acuna*, 14 Cal. 4th 1090, 1105 (1997). As the State Lands Commission's May 16 letter explained: "Longstanding California Supreme Court mining case law holds that, when the customary and previously legitimate activities of a business develop into a condition that threatens public and private rights, such a customary activity is no longer reasonable and may be found to be a nuisance." *People v. Gold Run Ditch and Mining Company*, 66 Cal. 138, 150-151 (1884); *Pacific Gas & Electric Co. v. Scott*, 10 Cal. 2d 581, 585 (1938).¹

¹ The City is aware that CEMEX has submitted to the Coastal Commission a vested rights claim under the Coastal Act seeking to continue operating without a coastal development permit, but that claim does not affect the City's analysis here. From the publicly-available evidence, there is considerable doubt that the Lapis Sand Mine can satisfy the requirements to establish a vested right to operate the facility without permits. In any event, the existence of a vested right does not affect or defeat the City's analysis and determination as to whether the facility operations constitute a public nuisance. See, e.g., *Davidson v. Cnty. of San Diego*, 49 Cal. App. 4th 639, 649, 56 Cal. Rptr. 2d 617, 622 (1996) ("vested rights . . . may be impaired or revoked if the use authorized or conducted thereunder constitutes a menace to the public health and safety or a public nuisance.")

Given these facts, City staff recommends that the City Council authorize the City Attorney to pursue the possibility of commencing action or proceedings for abatement of a public nuisance pursuant to section 731 of the California Code of Civil Procedure.

CEMEX's Failure to Comply with Reporting Requirements

Section 17.41.260 of the Municipal Code requires "all operators of existing mining operations" to submit to the planning department (1) a brief statement specifying the approximate annual volume of sand being removed and (2) an accurate cronaflex ortho-topographic map by January 1st of every year, "[i]n order to establish reference base data for the purpose of determining whether or not any particular mining activity constitutes new mining activity and to monitor shoreline erosion." City records indicate, however, that the Lapis Mine has not complied with local requirements to report extraction amounts and other information on operations since last reporting on 1991 extraction amounts in 1992. City staff recommends that the City Council authorize the City Attorney to pursue the possibility of commencing action or proceedings for abatement due to CEMEX's continued violations of the reporting requirements under section 17.41.260.

CEMEX's Failure to Obtain a Coastal Development Permit

The Coastal Act and the City's Local Coastal Program (LCP) Implementation Plan provide that any development in the coastal zone may proceed only after obtaining a coastal development permit. Cal. Pub. Res. Code § 30600(a); City of Marina LCP Implementation Plan at 9, n.2. Development is defined broadly in both the Coastal Act and in Marina's LCP to include such activities as grading, removing, dredging, mining or extracting any materials, disposing of any dredged material, changing the intensity of use of land, or reconstructing or altering the size of any structure. Cal. Pub. Res. Code § 30106; LCP Implementation Plan at 15. The Coastal Commission has confirmed that "development has occurred and continues to occur" at the CEMEX Lapis Sand Mine site in Marina without a coastal development permit. Cal. Coastal Commission Notice of Intent at 4. The Lapis Sand Mine is located in the Coastal Conservation and Development District, and CEMEX has not obtained a coastal development permit from the City of Marina. Finally, no coastal development permit exemption in the Coastal Act or LCP applies to the property or operations. In fact, the Municipal Code and the LCP both expressly provide that dredge ponds located in the Coastal Conservation and Development District—the district in which CEMEX sand mine is located—are considered a conditional use and require a coastal development permit. *See* Marina Municipal Code § 17.25.030; *see also* LCP Implementation Plan at 19. Accordingly, City staff recommends that the City Council authorize the City Attorney to pursue the possibility of commencing action or proceedings for abatement under section 17.25.030 of the Municipal Code to require a coastal development permit for any future mining activities.

ANALYSIS OF IMPACTS FROM SAND MINING:

For the past several decades, the CEMEX Lapis Sand mine has been removing approximately 47 to 63 percent of the local beach sand in southern Monterey Bay annually. Young Report at 8. This volume of extraction—on average between 150,000 m³ and 205,000 m³ of sand annually—is the equivalent of removing approximately 20,000 to 30,000 dump trucks loads of sand from the beach each year. Removing this volume of sand from the local sand supply "budget" has contributed significantly to shoreline erosion rates in the southern Monterey Bay, which are

higher than anywhere else in along the California coast. Sand mining has damaged public and private property, jeopardized public health and safety, impeded public access, and shrunk beaches, causing habitat loss, impairing already threatened species, and reducing the amount of beach available for recreational use.

The Southern Monterey Bay Littoral Cell

The CEMEX mine is located within the southern Monterey Bay littoral cell, a relatively self-contained section of coast from Moss Landing in the north to Monterey in the south within which sand circulates. A littoral cell, or a Sand Sharing System, “is based on the uncontroversial science-based concept that sand is constantly being exchanged from one coastal feature to another: from dunes to the beach, from one stretch of shoreline to the next, from the beach to the nearshore sand bars.” Young Report at 3. Littoral cells are separated from each other by topographical features like rocky headlands or submarine canyons that block the exchange of sand. “Removal of sand from the system will impact all portions of the system eventually.” Young Report at 3.

The southern Monterey Bay littoral cell has been divided into a few sections, or sub-cells. Young Report at 3; K. Patsch and Gary Griggs, *Development of Sand Budgets for California's Major Littoral Cells*. California Coastal Sediment Management Workgroup (2007) (Attachment J). The Lapis Sand Mine sits approximately in the middle of the Central sub-cell of the southern Monterey Bay, stretching from the Salinas River to Sand City in the south.

Sediment budget: Sand Inputs and Outputs in the Southern Monterey Bay

A sand budget is useful for understanding beach processes and the impact of sand mining. In a sand budget, the sand inputs and outputs are measured as closely as possible: “If there is a balance between sand entering and leaving the beach, then the beach maintains its shape. If there is an imbalance in sand moving in and out of the beach, then it either grows or shrinks, depending upon which process prevails.” D. Smith, et al., *Are “stable shorelines” and “broad beaches” mutually exclusive management goals along southern Monterey Bay?* The Watershed Institute, California State University Monterey Bay, Report WI-2005-09, 23 (2005) (Attachment K). “The analytical process is the same as managing a checkbook and bank account, where the volume of beach sand at any point in time represents the amount of money in the bank. Creating a sand budget can also allow predictions to be made about the likely result of various coastal management options.” *Id.*

The most recent sand budget for the southern Monterey Bay littoral cell that looks at the inputs and outputs of beach sand² shows that in the Marina area, sand mining is the only significant sink (or loss) of beach sand in the sand budget. E.B. Thornton, *Temporal and spatial variations in sand budgets with application to southern Monterey Bay, California*. Marine Geology 382, 56–67 (2016) (Attachment L); Young Report at 6. The predominant source of sand to the southern Monterey Bay littoral cell is from coastal dune erosion: “sand within this cell moves from dunes to the beach as the shoreline recedes.” PWA at E-7; Young Report at 5. Dunes contribute most

² For purposes of this discussion, “beach sand” means sand that feeds the beaches because it is coarse enough to stay on the beach rather than being blown into the dunes or transported offshore. This coarse beach-sized sand is the kind of sand that CEMEX mines. Young Report at 5.

of the sand to the Central sub-cell—an estimated 155,000 cubic meters/year. Young Report at 5. The Salinas River only contributes a small amount of sand—8,000 to 34,000 cubic meters/year. PWA at E-7, 31; Thornton, 2016 at 61; Young Report at 6. “Sand mining that removes sand from this active system becomes a permanent sink— taking away sand that will never return.” Young Report at 6.

CEMEX Sand Extractions

Although there appear to be year-to-year fluctuations in mining levels at the Lapis facility, studies and estimates based on CEMEX’s self-reported extraction data suggest that CEMEX extracts between 153,000 and 205,000 cubic meters of beach sand each year. Young Report at 8. The total sand volume exchanged annually in southern Monterey Bay is estimated at approximately 326,000 cubic meters per year. Young Report at 7 (citing Thornton, 2016). “Therefore, sand mining at the Lapis site is removing approximately 47% to 63% of the local sand budget.” Young Report at 8.

According to one recent analysis, if the Lapis Mine were closed, beach erosion between Moss Landing and Point Pines in Monterey would “decrease by at least 60 percent.” ESA PWA at 109. Based on these and other figures, various studies conclude that the Lapis Sand Mine is a leading or primary contributor to shoreline erosion in southern Monterey Bay. *See, e.g.*, Pohl at 5 (“[T]he main factor exacerbating shoreline erosion in southern Monterey Bay is hydraulic sand mining from the beach at the Lapis mine in Marina.”); ESA PWA at 108 (explaining that one study “concluded that sand mining had greatly increased coastal erosion in southern Monterey Bay,” and another concluded that the CEMEX Mine is “a primary cause of high erosion rates in” the Bay).

Connection Between Sand Mining and Coastal Erosion

Multiple studies looking at long-term average erosion rates show that erosion rates have increased dramatically over the last century in the southern Monterey Bay and are now higher than anywhere else in California. Young Report at 10; C. Hapke et al., *National assessment of shoreline change part 3; historical shoreline change and associated coastal land loss along sandy shorelines of the California coast*. U.S. Geological Survey Open-File Report. 2006-1219 (2006) (Attachment M). In the first half of the twentieth century, erosion rates were approximately 1.0 foot per year; by the end of the twentieth century, erosion rates had risen to an estimated 4.15 to 4.7 feet per year. Young Report at 10; Hapke, 2006; E.B. Thornton et al., *Sand mining impacts on long-term dune erosion in southern Monterey Bay*. Marine Geology 229 (1–2), 45–58 (2006) (Attachment N).

Table 1 below, taken from a 2008 study prepared for the Association of Monterey Bay Area Governments, helps illustrate the connection between sand mining activity and harmful coastal erosion. On a decade-by-decade basis, it compares beach sand extraction with average erosion rates at Marina State Beach.

Table 1: Beach sand extraction and erosion rates at Marina State Beach

Decade	Sand Mined from Beach (yd ³ /year x 1000)	Average Erosion Rate at Marina State Beach (ft/year)
1940s	20	1.0
1950s	40	
1960s	84	
1970s	129	
1980s	143	
1990s	200	4.7
2000s	200	

Source: PWA, Table 14 at 87(with data from Thornton 2006)

As this table illustrates, removing sand “at these volumes over the long term from a relatively closed littoral cell necessarily causes a negative impact on the coastal systems within that cell.” Young Report at 9. Sand mining induces erosion by reducing the available sand supply to downcoast beaches in the littoral cell. “Less sand moving along the coast can decrease beach widths, which allows waves to more readily attack back-beach dunes and erode the coast.” R. Stamski. *Coastal Erosion And Armoring In Southern Monterey Bay*. A Technical Report in support of the Monterey Bay National Marine Sanctuary Coastal Armoring Action Plan, Vers. 1.1., 13 (2005) (Attachment O). Conversely, cessation of extraction mining positively impacts sand supply and reduces erosion: in Sand City, erosion rates decreased after three mining sites, which extracted a total average of approximately 84,000 cubic meters per year, were closed between 1970 and 1990. PWA at E-7.

Given the lack of data supporting any other major sand sinks or large impediments to sand sources, there is no explanation for the anomalously high erosion rates in southern Monterey Bay other than sand extraction from the littoral zone at the Lapis Mine. Young Report at 11. And, “unless there is some major change in the sand budget,” the shoreline of southern Monterey Bay will continue to erode. G. Jones, G and G. Griggs, *Erosion along an “Equilibrium Coastline,” Southern Monterey Bay, California* in in California’s Battered Coast: proceedings from a Conference on Coastal Erosion, San Diego, 106 (February 6-8, 1985) (Attachment N).

Impacts of Erosion on Public and Private Property³

Erosion results in “high economic” and “high environmental” consequences, negatively impacting public safety and placing facilities in danger. PWA at 51–53. “Erosion compromises the ability of the beaches and dunes to buffer oceanfront development and infrastructure from storms and flooding, to provide vital natural habitat, and to successfully accommodate recreation and tourism.” PWA at 1. The CEMEX Lapis Sand Mine is responsible for about two feet of erosion per year in the southern Monterey Bay. ESA PWA at 88. Thus, an additional 4.36 acres of beach space disappears each year that the CEMEX Mine continues to operate. Pohl at 8. The annual recreational value of Monterey Bay beaches affected by erosion due to the CEMEX Mine is nearly \$1.1 million. Pohl at 8.

The detrimental impacts from erosion to public and private property in the southern Monterey Bay have been well documented. In 2004, Stillwell Hall (part of Fort Ord), just south of the CEMEX operation, was demolished due to years of high erosion rates that threatened the structure and cut off public lateral access along the beach. From 1982 through 1998 alone, the shoreline in front of Fort Ord eroded 70 feet. PWA at 37, 92.

Figure 1: Fort Ord



Source: PWA at 93

Other critical areas of erosion—those areas at the highest risk for potential loss of facility, potential loss of habitat, and human health and safety issues—in southern Monterey Bay include: the Sanctuary Beach resort, the Marina Coast Water District facilities, Sand City, the Seaside Pump station, Monterey Beach resort, Ocean Harbor House Condominiums, and La Playa Street. See PWA at 51–66.

³ While this staff report summarizes some of the available literature and the conclusions of the independent Young Report, there are other publicly-available photographic documentation and technical analyses that support the same conclusion. Some of these other sources are collected in Attachment P.

Table 2: Critical Areas of Erosion in Southern Monterey Bay

Location	Summary of Facility	Erosion Rate (ft/year)	Risk of Erosion	Consequences of Erosion
Sanctuary Beach Resort near Reservation Road	Vacation complex approximately 120 feet from the bluff top	~5.5	High (compromised in approximately 20 years)	High economic
Marina Coast Water District buildings near Reservation Road	Office buildings approximately 70-90 feet from the bluff top	~5.5	High (compromised in approximately 15 years)	High economic (if buildings are converted to other uses)
Sand City and Tioga Avenue west of Highway 1	Bluff top road, storage facility, Highway 1, and proposed hotel developments, and desalination wells	~3.5	High (seaward end of Tioga Avenue eroding)	High environmental safety economic
Seaside Pump Station at Bay Avenue	Raw wastewater pump station approximately 100 feet from the bluff top	~3.0	High (compromised in approximately 30 years)	High economic environmental human health
Monterey Interceptor between Seaside Pump Station and Wharf II	Raw wastewater pipeline approximately 115 to 175 feet from the bluff top or buried mid-beach	~1.0-3.0	High to moderate (some dune portions compromised in approximately 40 years; beach sections exposed in winter)	High economic environmental human health
Monterey Beach Resort, Highway 1 and Resort Access Road	Hotel on Del Monte Beach, Highway 1, and hotel access road	~1.5	High (erosion compromising fronting seawall)	High economic safety
Ocean Harbor House Condominiums/Del Monte Beach Subdivision	Condominium complex and adjacent family homes on the bluff top	~1.0-1.5	High (erosion compromising fronting riprap and homes to the west)	High economic safety
Monterey La Playa Town Homes at La Playa Street	Homes, one of which is 30 feet from the bluff top	~1.0	High to moderate (some homes compromised in approximately 30-50 years)	High economic

Source: PWA Table 11 at 53.

The eight oceanfront facilities in southern Monterey Bay listed in the Table 2 above will require substantial mitigation efforts in the coming decades to prevent (or at least delay) destruction from beach erosion. PWA at 51–66 (detailing each of the properties). A 2012 study estimates that the total costs of revetments necessary to combat the CEMEX Mine’s adverse effects will top \$700 million. ESA PWA at 112–13.

And, as suggested in the photographs below, seawalls and revetments may not be sufficient to protect these and at-risk facilities, in part because such hardening or armoring efforts tend to exacerbate coastal erosion. Young Report at 11. When the Ocean Harbor House condos pictured below were built in 1968, the condos were on top of the dunes and did not need the protection of a seawall. PWA at 62. In 1984, after significant beach erosion had taken place, the owners constructed a 55-foot deep concrete retaining structure and installed reinforced grade beams to buttress the condos. *Id.* at 63. In 2002, the condo association arranged for emergency riprap to be placed on the beach to protect the front row of houses and approved construction of a seawall. *Id.* These “improvements” cost \$4 million, and the condo association was assessed an additional \$5.3 million mitigation fee by the Coastal Commission to compensate the public for the wall’s future contributions to beach erosion. *See Ocean Harbor House Homeowners Ass’n v. Cal. Coastal Comm’n*, 163 Cal. App. 4th 215, 224 (2008) (upholding the record-setting mitigation fee).

Figure 2: Erosion in front of Ocean Harbor House Condominiums



Source: Gary Griggs. Left: Ocean Harbor House in 1975; Right: Ocean Harbor House in 2003

Similarly, when the Monterey Beach Resort, pictured below, was built in 1968, a large beach existed in front of the hotel. PWA at 60. Since then, it has eroded to such a degree that the hotel has become a headland. *Id.* Beach level has dropped by three feet and there is no longer beach access in front of the hotel during high tides. *Id.* at 61. In 2008, the hotel’s 600-foot seawall underwent major renovations at an estimated cost of \$4.5 million, with an annual maintenance cost of \$37,000. *See California Department of Boating and Waterways, Economic Costs of Sea-*

Level Rise to California Beach Communities 45 (undated, but published in 2011 or thereafter) (estimating costs of seawalls in Northern California to be \$7200 per foot in 2010 dollars), available at <http://www.dbw.ca.gov/PDF/Reports/CalifSeaLevelRise.pdf>; see also Pohl at 9.

Figure 3: Erosion in front of Monterey Beach Resort



Source: Gary Griggs

As these two examples graphically illustrate, beach erosion along the southern Monterey Bay has accelerated in recent decades, causing significant ongoing injury to both private and public property. As the existing scientific literature concludes, permanent loss of approximately one-half of the coarse beach sand from the littoral cell as a result extraction operations at the Lapis Sand Mine in Marina is a major contributor to this harm.

Habitat and Wildlife Impacts from Sand Mining and Erosion

Sand mining also significantly and negatively affects habitat and wildlife. The CEMEX Lapis Mine property contains critical habitat for native plants, including the federally threatened Monterey spineflower, the state and federally endangered Yadon's wallflower, and the coast wallflower. Cal. Coastal Commission Notice of Intent at 6. The federally endangered Smith's blue butterfly and the federally threatened Western snowy plover are also present and critical habitat for these species exists on the property. *Id.* Unpermitted sand extraction and the use of mechanized equipment, including the dredge, create noise and physical disturbances that impact these species and degrade their critical habitat. *Id.*

Downcoast erosion from mining also contributes to the loss of critical habitat for these and other species. There are many unique and sensitive areas of southern Monterey Bay that provide

habitat for imperiled species and native plants. California grunion spawn on the beaches in southern Monterey Bay and Western snowy plovers nest and rear their young on the beaches. PWA at 67-75. As erosion from sand mining causes the beaches to narrow, these species become further threatened. Reduced beach area as a result of sand mining also compromises haul-out areas for harbor seals and sea lions, roosting areas for shorebirds, pelicans, and gulls, and habitat for a variety of invertebrate species such as crustaceans.

Public Access Impacts from Sand Mining and Erosion

Increased erosion and narrower beaches caused by sand mining adversely affect access to and use of public tidelands and beaches. Erosion can cause steep scarps, making vertical beach access difficult. Beaches narrowed by erosion reduce lateral access, especially as sea levels rise and where the beach is backed by a hard structure, effectively eliminating the sandy beach area and impeding recreational uses of the public tidelands for recreation and other purposes. Cal. Coastal Commission Notice of Intent at 6. Figures 1 and 3 above of Stillwell Hall and Monterey Beach Resort provide examples of how lateral beach access is eliminated at certain tides and times of year. Reduction in beach width also impairs and injures uses by the public of the dry sand area on nearby publicly-owned beaches.

Figure 4: Rapidly Eroding Shoreline within City of Marina



Source: Young Report at 9

Public Health and Safety Impacts from Sand Mining and Erosion

CEMEX operations at the Lapis Sand Mine have reduced the amount of sand on the Monterey Bay shoreline, causing the beaches within Monterey Bay to become narrower. Narrow beaches, in turn, mean that existing development is closer to wave action, leading to greater susceptibility to erosion and inundation from wave action and storms. This negative impact implicates public health and safety in connection with existing public infrastructure such the storm drain system, the regional wastewater treatment plant, Marina Coast Water District facilities, and Highway 1 and other roads downcoast of the Lapis Sand Mine. Cal. Coastal Commission Notice of Intent at 6. With increased erosion, revetments and rebar can become exposed, posing a safety hazard for beachgoers. In addition, outfall pipes, CalAm slant wells and other infrastructure that are supposed to be buried under the sand have also been exposed as a result of beach sand erosion, which is a visual blight in addition to being potentially hazardous to the public.

Figure 5: Erosion exposing storm drain outfalls on Former Fort Ord



Source: David Norris, Sep. 2002 (from Smith et al 2005)

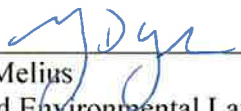
Sea Level Rise Will Exacerbate These Issues

The impacts of erosion in the southern Monterey Bay will be exacerbated by climate changes and sea level rise. Studies indicate that “over the next 50 years, sea level rise will increase erosion by about 40 feet (0.8 ft/year),” an increase of approximately 20-25 percent over recent erosion rates (approximately 3-4 ft/year). PWA at 40. Over the next 100 years, erosion will increase by an additional 80 feet (1.6 ft/year), an increase of 40-50 percent over recent erosion rates. *Id.* These natural background conditions make any loss of beach sand from the littoral cell even more problematic. Sound coastal planning and management require that the City take appropriate action to minimize ongoing damage to both the public interest and private property caused by extraction of beach sand from the nearshore and public tidelands.

CONCLUSION:

This request is submitted for City Council consideration and possible action with regard to the five recommendations set forth on page 1 of this report.

Respectfully submitted by:



Molly Melius
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An Evaluation of the Ongoing Impacts of Sand Mining at the CEMEX Lapis Sand Plant in Marina, California on the Southern Monterey Bay Shoreline

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Purpose and Overview: The City of Marina commissioned this report to assist in its management and decision-making for coastal property and resources within the City's jurisdiction. Consistent with that purpose, this report provides a review and synthesis of available documentary information and scientific literature addressing the impact of current sand mining activities within southern Monterey Bay. To assist in preparation of this report, in March 2017, the author visited the Lapis Sand Mine, the site of current beach sand mining activities in the City of Marina. It is my understanding that the Lapis Sand Mine is the only coastal mining activity in Monterey County at this time, and that other sand mining operations that previously operated along the Monterey Bay shoreline ceased operations in the late 1980s. Accordingly, all references to ongoing beach sand mining in this report are to the Lapis Sand Mining operation in the City of Marina.

This report is intended for an informed lay audience and, in particular, for City of Marina officials seeking to base coastal management decisions on the best available science. It provides a distillation of the most relevant facts and science related to the basic question: "Are sand mining activities at the Lapis Sand Mine (Figure 1) impacting the sediment budget and shoreline change rates in the vicinity of the mine?" Based on my review of the available information, data, and scientific literature, I conclude that beach sand extraction by the Lapis Sand Mine constitutes a significant source of sand loss from the southern Monterey Bay central littoral cell and, as a result, is causing or contributing to significant adverse effects on coastal property, resources, and uses.

The portions of southern Monterey Bay shoreline have the highest erosion rates in the state. None of the documents reviewed for this report can offer any explanation for these anomalously high erosion rates beyond the sand extraction from the littoral zone at the Lapis Mine. The overwhelming evidence leads me to conclude that continued sand mining activities have led to a substantial sand deficit in southern Monterey Bay. This sand deficit is driving these anomalously high rates of coastal erosion. In order to grapple with the serious erosion problems in southern Monterey Bay, I recommend that the

City of Marina pursue options to stop beach sand mining activities at the Lapis facility.



Figure 1. Aerial view of the Lapis Sand Plant, Marina, CA.

Introduction: Sand is to beaches and shorelines, as water is to western urbanization and agriculture. Sand moves between sources and temporary sinks. Preserving this sand and its movement is the key to maintaining the broad coastal economy, providing storm protection to infrastructure and shoreline development, ensuring recreational use of a state's beaches, and protecting coastal ecosystems. This free movement of sand between sources and sinks is commonly referred to as the **Sand Sharing System**. Many legislative and rule-making bodies have codified the importance of the Sand Sharing System.¹

¹ For example, the State of Georgia Code § 12-5-231 (2015) reads:

The General Assembly finds and declares that coastal sand dunes, beaches, sandbars, and shoals comprise a vital natural resource system, known as the sand-sharing system, which acts as a buffer to protect real and personal property and natural resources from the damaging effects of floods, winds, tides, and erosion. . . . The General Assembly further finds that this sand-sharing system is a vital area of the state and is essential to maintain the health, safety, and welfare of all the citizens of the state. . . . It is declared to be a policy of this state and the intent of this part to protect this vital natural resource system by allowing only activities and alterations of the sand dunes and beaches which are considered to be in the best interest of the state and which do not substantially impair the values and functions of the sand-sharing system and by authorizing the local units of government of the State of Georgia to regulate activities and alterations of the ocean sand dunes and beaches

This Sand Sharing System is based on the uncontroversial, science-based concept that sand is constantly being exchanged from one coastal feature to another: from dunes to the beach, from one stretch of shoreline to the next, from the beach to the nearshore sand bars. Removal of sand from the system will impact all portions of the system eventually.

The Sand Sharing System can be described by the development of a sediment budget. Sediment (sand) budgets are important tools in understanding regional sand supply, loss, and movement. Best and Griggs, 1991; Rosati, 2005. A sand budget itemizes and quantifies the sources (inputs), sinks (outputs), and movement of the sand within a littoral cell. A littoral cell is a relatively self-contained section of coast where the sand circulates, i.e. “a defined length of shoreline along which the cycle of sediment erosion, transportation, and deposition is essentially self-contained.” Philip Williams & Associates, 2008 at 21. Littoral cells are separated from each other by features that block the exchange of sand, like a rocky headland. The south Monterey Bay shoreline has been divided into sub-cells, which are essentially delineated by differing sand transport directions (shown in Figure 2). Patsch and Griggs, 2007. The Lapis Mine sits approximately in the middle of the Central sub-cell, stretching from the Salinas River to Sand City in the south. The basic sources and sinks within this sub-cell are listed in Table 1.

Numerous researchers have quantified the sediment movement within the southern Monterey Bay littoral cell. The sediment budgets in these studies vary depending on the area within Monterey Bay they are considering and the type of sediment being quantified (e.g. beach sand vs. all sediment). Patsch and Griggs, 2007; Jones and Griggs, 1985; Smith, 2005; Philip Williams & Associates et al., 2008; Thornton, 2016. However, all of the studies conclude that sand mining removes a significant amount of sand from the sand budget and is contributing to shoreline erosion.

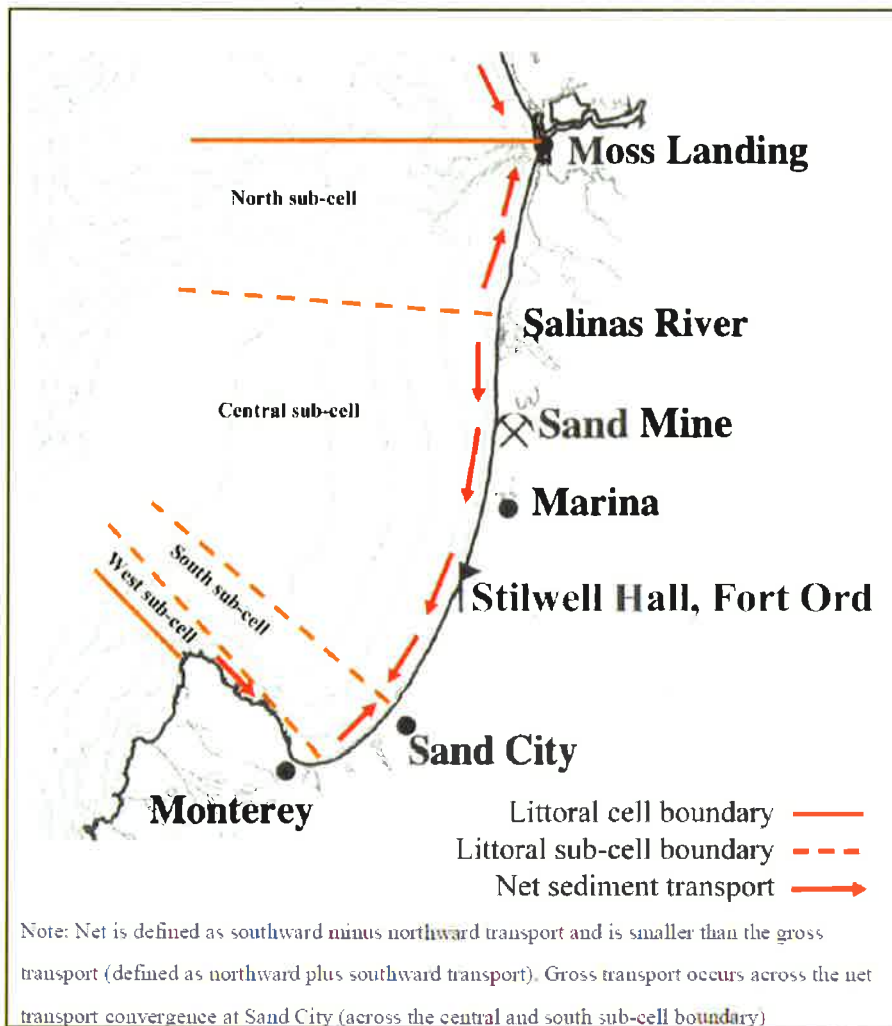


Figure 2. Southern Monterey Bay Littoral Sub-Cells and Net Sediment Transport. Source: Figure 12 from Philip Williams & Associates et al. (2008).

The most recent sediment budget for the Central sub-cell was presented by Thornton (2016) and is summarized in Table 1. It is significant that these data are presented in the peer-reviewed scientific journal, *Marine Geology*. This offers a high level of confidence in the data quality. This sand budget is useful because it is focused on the Central sub-cell and considers only beach compatible sand.

Thornton's recent sediment budget indicates that the biggest source of sand in the southern Monterey Bay is from dune erosion. However, only about 25% of the dune sand is coarse enough to stay on the beach; the remaining 75% of the finer grained sand ends up being transported offshore (or blown back into the dunes). Thornton, 2016. Because CEMEX mines the coarse beach sand tracked in his budget,

Thornton's 2016 budget is the most appropriate sediment budget to use for the purposes of determining the sources and sinks of the sand that feed the beaches in the City of Marina.²

Table 1. Sand budget for SMB central sub-cell.³ Values in m³/year × 10³. Uncertainties are presented with the values. Source: Table 2 from Thornton (2016).

	1940–1989	1989–2011
Mean recession (m)	– 1.0	– 1.3
Dune erosion	190	155
Dune erosion × compatibility factor, 0.25	48 ± 5	39 ± 4
Beach erosion	105 ± 9	127 ± 11
River input	56 ± 6	34 ± 3
Littoral transport in from south	20 ± 4	10 ± 2
Littoral transport in from south × 0.29	6 ± 2	3 ± 1
Sand mining	– 174 ± 43	– 205 ± 50
Residuals	41 ± 69	– 2 ± 71

Dunes contribute an estimated sand volume of 155,000 cubic meters/year to the littoral system. Thornton 2016. There is also a small sediment input to the Central sub-cell system from the Salinas River that has decreased through time.⁴ The sand input to the Central sub-cell from riverine sources is relatively modest – about 34,000 cubic meters/year – because most sand from the Salinas River is transported north.⁵ Thornton, 2016; Patsch and Griggs, 2007.

² Only sand with a grain size greater than .25 mm typically stays on the beach. Thornton, 2016. This coarse beach size sand is the type of sand that CEMEX mines. Thornton, 2016. Therefore, other broader sediment budgets showing large amounts of sand being lost offshore are not relevant to the analysis of impacts from sand mining. See, e.g., Philip Williams & Associates et al., 2008 at 46.

³ Beach sand budgets were calculated for two time periods to examine the impact of sand mining: “The first budget is calculated from 1940 to 1989 during the time of intensive drag-line sand mining of the surf zone focused on the south end of the littoral cell. The second budget is calculated from 1989 to 2011 after all the drag-line mines were closed leaving only a dredge pond mining operation at the north end of the littoral cell.” Thornton, 2016.

⁴ Two dams, built in 1941 and 1961, are estimated to have reduced the total annual sediment input from the Salinas river by 33%. Willis and Griggs, 2003. However, this does not have a major impact on the Central sub-cell sand budget since most of the sand from the Salinas is “is driven northward by the dominant littoral drift” and is eventually carried into the Monterey Submarine Canyon. Patsch and Griggs, 2007.

⁵ Other studies estimate an even lower volume of sediment – less than 8,000 cubic meters – traveling south from the Salinas river. Philip Williams & Associates et al., 2008.

Sand within this cell moves from dunes to the beach as the shoreline recedes. It also moves back and forth along the shore by waves (this is known as longshore sediment transport or littoral drift). But, for the most part, the sand remains in the cell as a part of the Sand Sharing System, maintaining a balance that stabilizes the shoreline and the beaches. If there is a balance between sand entering and leaving the beach, then the shoreline position will remain stable. If there is a deficit of sand entering the beach, the shoreline will move landward, or erode. Sand mining that removes sand from this active system becomes a permanent sink— taking away sand that will never return. Thornton (2016) finds that sand mining is the only significant sink (or loss) of beach size sand in the sand budget for this sub-cell.

Impacts of sand mining: There is no scientific dispute that removing sand from the active Sand Sharing System will decrease the amount of sand available for building and maintaining beaches. The question for setting policy direction is whether such removal is significant enough to have a long-term effect on shoreline position, beach volume, and beach/dune erosion. The first step in understanding the potential impact of the sand removal at the Lapis Mine is to determine if the sand is actually being removed from the active Sand Sharing System (from the littoral zone).

All of the available evidence shows that sand is being removed from the littoral zone. The dredging activity relies on a suction dredge operating in an artificial lagoon immediately adjacent to the beach. The lagoon is filled during coincident high tides and large waves, and the sand is removed by the dredge for processing. The sand filling the lagoon comes directly from the beach and nearshore immediately in front of the mine (Figure 3). The lagoon also traps sand that is moving in either direction along the beach. During a site visit by the author in 2017, recent storm waves had clearly reached well past the seaward portion of the lagoon (Figure 4). The visible wrack line was across the footprint of the lagoon. It is clear that the sand repeatedly filling the lagoon could not be coming from anywhere else other than the adjacent beaches and nearshore. Numerous peer-reviewed papers examining the sediment budget of southern Monterey Bay support the conclusion that the sand being removed at the Lapis Mine is coming from the local Sand Sharing System; and thus, it is a permanent, annual sink (deficit) in the littoral cell sand budget. Patsch and Griggs, 2007; Jones and Griggs, 1985; Smith, 2005; Philip Williams & Associates et al., 2008; Thornton, 2016.



Figure 3. Image of the sand mining operations at the CEMEX Lapis Mine. Note the fact that waves are pouring over the berm and into the lagoon. Effectively, the mining here is occurring in the active surf zone. Photo credit: Gary Griggs



Figure 4. In a March 2017 visit to the site, the author noted that the lagoon had been filled by storm waves and heavy equipment. The high tide wrack lines crossed the tracks of the equipment and the outer edge of the lagoon footprint.

The Lapis Sand Mine has not provided current extraction volumes to the City of Marina, nor publicly shared annual extraction information. Thornton (2016) estimated the sand removal to be approximately 205,000 cubic meters per year based on a CEMEX Annual Report from 2000. The Coastal Regional Sediment Management Plan for Southern Monterey Bay (Philip Williams & Associates et al., 2008) used an estimate of around 153,000 cubic meters per year. Both numbers represent a significant removal of sand from the littoral cell. It is important to keep in mind that these numbers represent average, annual removal. It is likely that the sand volume mined each year has fluctuated from slightly below to above this average rate range. As Table 1 indicates, the total sand volume exchanged annually in the sub-cell is estimated at approximately 326,000 cubic meters per year. Therefore, sand mining at the Lapis site is removing approximately 47% to 63% of the local sand budget.

To put these numbers in perspective, the Lapis mining operation is removing somewhere around 750,000 to just over 1 million cubic meters of sand every five years. This is the equivalent of a large beach nourishment project for many beaches in the United States. For example, a proposed U.S. Army Corps of Engineers beach nourishment project along an eroding stretch of the Southern California coast would (1) initially place 260,000 cubic meters of replacement sand on the Encinitas beach, with 168,000 cubic meters of replacement sand added every five years and (2) initially place 535,000 cubic meters of sand along Solana Beach, with planned renourishment of 221,000 cubic meters every ten years.⁶ The projected cost for this project is \$165 million, with annual costs of over \$3.5 million.⁷ Given the costs of such projects, it is difficult, from a public policy perspective, to justify a similar beach nourishment effort along the similarly erosive southern Monterey Bay coast when the Lapis Sand Mine will quickly offset any replenishment benefits by sand removal for commercial profit.

Evidence of impact: Removal of sand at these volumes, over the long term, from a relatively closed littoral cell necessarily causes a negative impact on the coastal systems within that cell. Because the longshore sediment transport rates in southern Monterey Bay are small (on the order of 10,000 to 20,000 cubic meters per year) relative to the amount of material being removed annually at the Lapis

⁶ See U.S Army Corps of Engineers Project Description (numbers converted from cu yards to cu meters): <http://www.spl.usace.army.mil/Missions/Civil-Works/Projects-Studies/Solana-Encinitas-Shoreline-Study/>.

⁷ Cost estimates are the most recent numbers in the media from December 2016: <http://www.thecoastnews.com/2016/12/15/federal-funding-for-50-year-sand-project-approved/>.

Sand Mine, the greatest sand deficit will be closest to the mine, within the municipality of Marina (Figure 5). Thornton, 2017; Philip Williams & Associates et al., 2008.



Figure 5. Typical section of rapidly eroding shoreline with the City of Marina.

A comprehensive evaluation of coastal erosion rates for the State of California conducted by the United States Geological Survey (Hapke et al., 2006) shows that the Central sub-cell has the highest erosion rates in the state (Figure 6).⁸ Hapke et al. (2006) and other studies looking at long-term average erosion rates show that erosion rates have increased dramatically over the last century in the southern Monterey Bay. This is illustrated by how much higher recent erosion rates are than long-term erosion rates. For Marina State Beach, Hapke et al. (2006) calculated an average erosion rate from 1910-2002 of 1.4 to 2.0 ft/yr and from 1970 to 2002 of 3.1 to 5.2 ft/year.⁹ Other studies support the increasing trend

⁸ Hapke et al. (2006) calculated an average erosion rate from 1970 to 2002 of 4.0 ft/year for southern Monterey Bay between the Salinas River and Monterey. Thornton et al., 2006 estimated approximately 3.0ft/year of erosion from 1985 to 2005. Smith (2005) calculated erosion rates in southern Monterey Bay at 1m/yr (3.28 ft/yr).

⁹ These results are broadly consistent with the erosion rate results in Thornton et al. (2006). Thornton et al., (2006) estimated approximately 1.0 ft/year of erosion in Marina from 1940-1985 and 4.7 ft/year of erosion in Marina from 1985 to 2005.

in erosion rates in southern Monterey Bay over the past century. Thornton, 2006; Jones and Griggs, 1985. The difference between the long-term erosion rates (which include a period of time before sand mining and older mining methods before the suction dredge) and the short-term erosion rates (including only the period of modern mining with current sand extraction amounts) in Hapke et al. 2006 is significant: it demonstrates that the impact of current sand mining practices on local shorelines has been an increase in the rate of erosion.

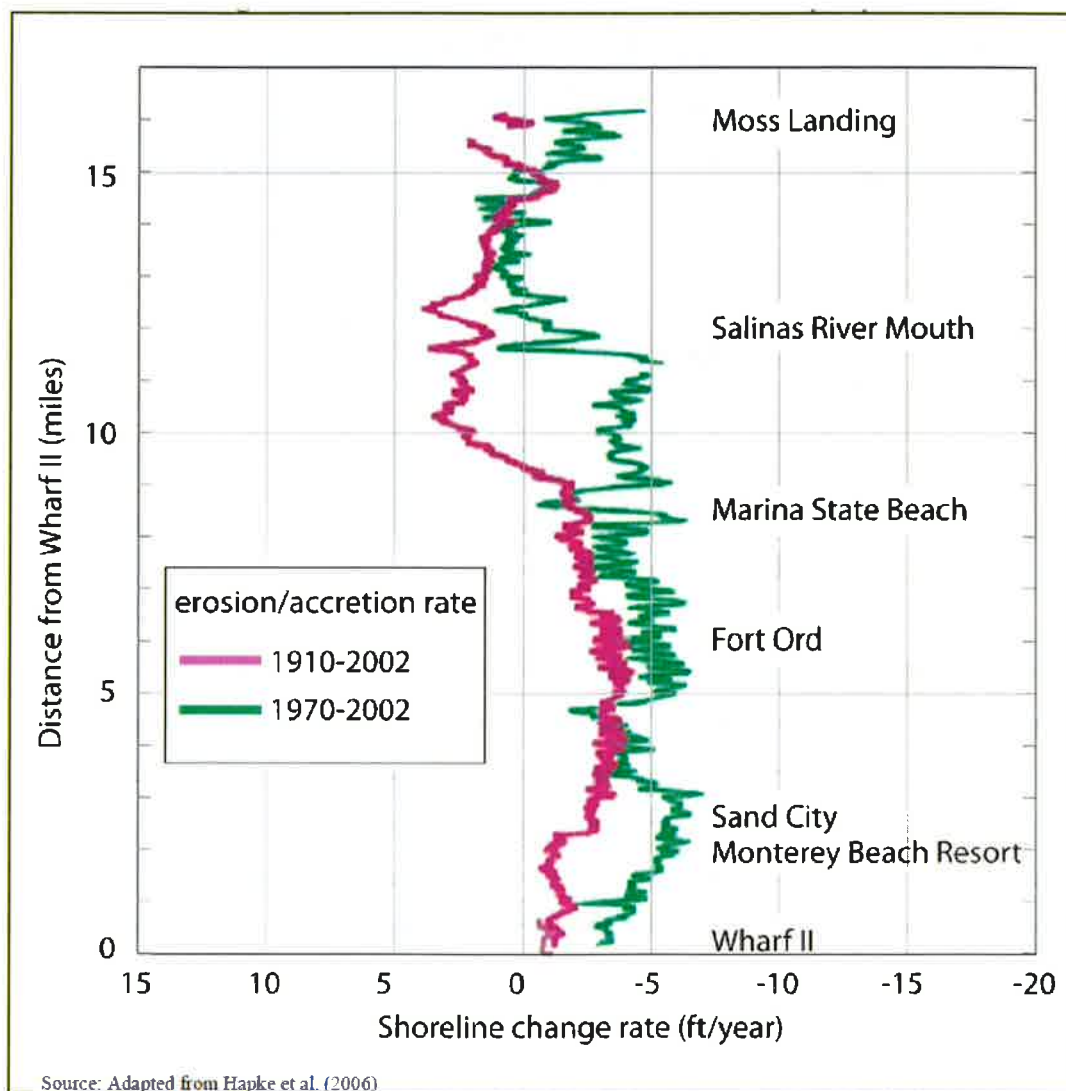


Figure 6. Dune Erosion Rates in Southern Monterey Bay. Source: Figure 18 from Philip Williams & Associates et al. (2008).

None of the documents reviewed for this report can offer any explanation for these anomalously high erosion rates beyond the sand extraction from the littoral zone at the Lapis Mine. The overwhelming evidence leads me to conclude that continued sand mining activities have led to a substantial sand deficit in southern Monterey Bay. This sand deficit is driving high rates of coastal erosion.

Coastal management implications and recommendations: In the vast majority of coastal communities in the continental United States, rising sea level is the primary driver of long-term coastal erosion. In those localities, managers have little choice but to accept the fact that halting global sea-level rise is not a problem they can tackle alone. Coastal management, therefore, becomes an exercise in planned adaptation and perhaps some degree of shoreline stabilization— typically with beach nourishment as a key component.

In southern Monterey Bay, municipalities and coastal managers are confronted with a unique complicating factor for the development of any sediment management plan (e.g. Philip Williams & Associates et al., 2008) or erosion mitigation plan (e.g. ESA PWA, 2012). Coastal erosion is being exacerbated by (at best) or driven by (at worst) the direct and intentional removal of sand from the Sand Sharing System.

Given the costs and other significant disadvantages of long-term beach nourishment programs, coastal managers can best serve the public interest by first attempting to eliminate sand sinks that are contributing to coastal erosion. In southern Monterey County, the Lapis Sand Mine is a substantial sand sink that is removing roughly 50 percent or more from the littoral system sand budget and, therefore, is a significant source of the coastal erosion that is negatively affecting coastal property, resources, and uses. Mitigating this ongoing erosion with hard structures (seawalls, revetments, and other coastal armoring) is not a sound policy response to the problem, as seawalls and groins will also directly interfere with the Sand Sharing System and create additional sand deficits. Before municipalities and regional managers can meaningfully implement any serious, comprehensive, long-term coastal planning, they will have to deal with the harmful sand deficit caused by the Lapis Sand Mine. Based on my review of the available information and literature and my professional expertise, I recommend that the City of Marina pursue options for halting the beach sand mining activities at the Lapis facility.

About the Author

Robert S. Young is the Director of the Program for the Study of Developed Shorelines, a joint Duke University/Western Carolina University venture. He is also a Professor of Geology at Western Carolina University and a licensed professional geologist in three states (FL, NC, SC). The Program for the Study of Developed Shorelines (PSDS) is a research and policy outreach center serving the global coastal community. The primary mission of PSDS is to conduct scientific research into coastal processes and to translate that science into management and policy recommendations through a variety of professional and public outreach mechanisms. The Program specializes in evaluating the design and implementation of coastal engineering projects. In California, Dr. Young is the Principal Investigator of a National Park Service project to map the vulnerability of every building, road, and facility in the state's National Parks.

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