

# **SAN FRANCISCO BAY SAND BUDGET, TRANSPORT, PROVENANCE, AND BATHYMETRIC CHANGE STUDIES AND POTENTIAL PHYSICAL EFFECTS OF SAND MINING ACTIVITIES**

Appendices

## **Appendix A – Independent Science Panel Members**

This Appendix includes curriculum vitae for the Independent Science Panel Members:

- John Largier, PhD
- Paul Work, PhD, PE
- Bob Battalio, PE
- Craig Jones, PhD
- David Schoellhamer, PhD

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**JOHN L. LARGIER**  
University of California Davis  
jlargier@ucdavis.edu

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## Professional Preparation

B.Sc., Physics & Applied Mathematics, University of Cape Town, South Africa, 1981

B.Sc., Hons., Applied Mathematics, University of Cape Town, South Africa, 1983

Ph.D., Oceanography, University of Cape Town, South Africa, 1987

## Appointments

UC Davis, *Bodega Marine Laboratory*

Distinguished Professor of Oceanography, Department of Environmental Science & Policy, 2004-

Director, Bodega Marine Laboratory, 2022-

Associate Director, Coastal & Marine Sciences Institute, 2014-

UC San Diego, *Scripps Institution of Oceanography*

Research Oceanographer, 1988-2004

Lecturer, 1992-2004

Research Associate, 2004-2007

*University of Cape Town* (South Africa), Department of Oceanography

Senior Lecturer, 1995-1999

International Research Associate, 2000-2012

*National Research Institute for Oceanology* (CSIR, South Africa),

Researcher, 1984-1988

## Area of Expertise

Coastal oceanography/ecology/hydrology/geomorphology with focus on forcing and impacts of water motion in bays/estuaries/ocean – and emphasis on addressing environment challenges.

## Publications – 5 primary publications

Largier, J.L. 2020. Upwelling bays: How coastal upwelling controls circulation, habitat and productivity in bays. *Annual Review of Marine Science*, 12, doi.org/10.1146/annurev-marine-010419-011020

Largier JL, Lawrence CA, Roughan M, Kaplan DM, Dever EP, Dorman CE, Kudela RM, Bollens SM, Wilkerson FP, Dugdale RC, Botsford LW, Garfield N, Kuebel Cervantes B, Koračin D, 2006. WEST: A northern California study of the role of wind-driven transport in the productivity of coastal plankton communities. *Deep Sea Res II*, 53(25-26): 2833-2849. doi:10.1016/j.dsr2.2006.08.018

Largier JL, 2003. Considerations in estimating larval dispersal distances from oceanographic data. *Ecological Applications*, 13(1) Supplement: S71-S89. <http://www.jstor.org/stable/3099999>

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Largier JL, SV Smith, Hollibaugh JT 1997. Seasonally hypersaline estuaries in mediterranean-climate regions. *Estuarine Coastal and Shelf Science*, 45: 789-797.  
doi:10.1006/ecss.1997.0279

Largier JL, BA Magnell, CD Winant, 1993. Subtidal circulation over the northern California shelf. *J Geophys Res*, 98(C10): 18147-18179. doi: 10.1029/93JC01074

## Publications – 10 additional publications

*Total: >200 papers published; H-index 69; i10-index 177; total citations ~14,769 (Google Scholar)*

Fellowes, T., A. Vila-Concejo, S. Gallop, R. Schosberg; V. de Staercke, J. Largier 2021. Decadal shoreline erosion and recovery of beaches in modified and natural estuaries. *Geomorphology* 390.

Sanford, E., J.L. Sones, M. Garcia-Reyes, J.H.R. Goddard, J.L. Largier, 2019. Widespread shifts in the coastal biota of northern California during the 2014-2016 marine heatwaves. *Scientific Reports*, 9:4216, <https://doi.org/10.1038/s41598-019-40784-3>

George, D.A., J L. Largier, G.B. Pasternack, P.L. Barnard, C.D. Storlazzi, L.H. Erikson 2019. Modeling sediment bypassing around idealized rocky headlands. *Journal of Marine Science & Engineering*, 7(40); doi:10.3390/jmse7020040.

Nickols KJ, B Gaylord, JL Largier, 2012. The coastal boundary layer: Predictable current structure decreases alongshore transport and alters scales of dispersal. *Marine Ecology Progress Series*, 464:17-35, doi: 10.3354/meps09875.

Garcia-Reyes M, J Largier, 2010. Observations of increased wind-driven coastal upwelling off central California. *Journal of Geophysical Research*, 115, C04011, doi:10.1029/2009JC005576.

Shapiro K, PA Conrad, JAK Mazet, WW Wallender, WA Miller, JL Largier 2010. Effect of estuarine wetland degradation on transport of *Toxoplasma gondii* surrogates from land to sea. *Applied Environmental Microbiology* 76 (20), 6821-6828

Cloern JE, KA Hieb, T Jacobson, B Sansó, E Di Lorenzo, MT Stacey, JL Largier, W Meiring, WT Peterson, TM Powell, M Winder, AD Jassby, 2010. Biological communities in San Francisco Bay track large-scale climate forcing over the North Pacific. *Geophysical Research Letters*, 37, L21602, doi:10.1029/2010GL044774.

Morgan SG, JL Fisher, SH Miller, ST McAfee, JL Largier, 2009. Nearshore larval retention in a region of strong upwelling and recruitment limitation. *Ecology*, 90(12): 3489-3502.

Kim JH, SB Grant, CD McGee, BF Sanders, JL Largier 2004. Locating sources of surf zone pollution: a mass budget analysis of fecal indicator bacteria at Huntington Beach, California. *Environmental Science & Technology* 38 (9), 2626-2636

Graham WM, JL Largier, 1997. Upwelling shadows as nearshore retention sites: the example of northern Monterey Bay. *Continental Shelf Research*, vol. 17(5), 509-532.

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## **Synergistic Activities**

Education Activities: Undergraduate classes (Principles of Environmental Science, Coastal Oceanography, Physical Oceanography, Data Analysis, Marine Environmental Issues); graduate groups (Hydrologic Science, Ecology, Atmospheric Science, Applied Math); international short courses and invited lectures/seminars; research internships.

Engaged Scholarship: Public lectures, academic seminars, and presentations at stakeholder/agency workshops on coastal ocean environmental issues; participate in workshops and ongoing dialog with non-academic community.

International Collaboration: Beyond research collaboration, enhance graduate education and engaged scholarship through environmental oceanography in comparable marine environments off Chile, Spain, Portugal, Mexico, South Africa, Australia, and New Zealand.

Coastal Ocean Observing Systems: Developed Bodega Ocean Observing Node [www.bml.ucdavis.edu/boon/](http://www.bml.ucdavis.edu/boon/) as founding node of the Central and Northern California Ocean Observing System (CeNCOOS) to provide information to regional community and ocean users; BOON operations include HF radar mapping of surface currents, permanent coastal moorings, shore stations, and routine boat-based surveys (also seasonal monitoring in estuaries); lead CeNCOOS HFR surface current mapping.

Honors & Awards: Distinguished Scholarly Public Service Award, UC Davis (2012), Annual Riley Memorial Lecture, Dalhousie University, Canada (2008), Fellow, Leopold Leadership Program (Earth Leadership Program, 2001).

Service to Profession: Advising State/Federal/Local governments: Sonoma County Water Agency, California State Parks, Ocean Protection Council, Greater Farallones National Marine Sanctuary (NOAA), Central & Northern California Ocean Observing System (CeNCOOS/NOAA), San Francisco Bay Conservation and Development Commission (BCDC), Southern California Wetlands Recovery Project, West Coast Panel on Ocean Acidification and Hypoxia (CA/OR/WA/BC), Marine Life Protection Act (Dept Fish & Wildlife, CA), Clean Beach Task Force (Dept Water Resources, CA), Coastal Zone Management Policy (Environment Affairs & Tourism, S Africa), Academic societies.

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**Paul A. Work, Ph.D., P.E.**  
Consulting Engineer/Educator

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## Contact and Personal Information

(916) 634-8963, paulworkusa@gmail.com  
Citizenship: USA

## Education

Ph.D.	1992	University of Florida	Coastal and Oceanographic Engineering
M.S.	1987	University of California – Berkeley	Civil Engineering
B.S.	1986	University of California – Berkeley	Civil Engineering

## Employment and Academic Appointments

Feb-Jun 2024	Fulbright Senior Researcher	Izmir Institute of Technology, Izmir, Turkey
2013-2023	Program Chief, Estuarine Hydrodynamics and Sediment Transport	U.S. Geological Survey, California Water Science Center, Sacramento, California
2016-2017	Adjunct Professor	College of Engineering, California State University - Sacramento
2002-2013	Associate Professor, Civil and Environmental Engineering Associate Chair 2007-2013	Georgia Institute of Technology
2008-2013	Adjunct Professor	Skidaway Institute of Oceanography, Savannah, Georgia
1993-2001	Associate Professor, 98-01 Assistant Professor, 93-98 Civil Engineering	Clemson University, Clemson, SC
1999-2000	Fulbright Senior Scholar	Boğaziçi University, Istanbul, Turkey
1988-1992	Graduate Research Assistant	University of Florida
1990-1991	Instructor, NSF Young Scholars program (summers)	McNeese State University, Lake Charles, LA
1988	Coastal Engineer	U.S. Army Corps of Engineers, Los Angeles District
1986-1987	Engineering Trainee	Alameda County Flood Control District, Hayward, CA
1986-1987	Teaching Assistant	University of California – Berkeley

## Professional Registration

Diplomate, Coastal Engineering, Academy of Coastal, Ocean, Port and Navigation Engineers, 2012.

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Professional Engineer, South Carolina, 6/28/96, Reg. No. 17663. Valid through 6/30/24.

Professional Engineer, Florida, 11/10/98, PE No. 53622. Valid through 2/28/25.

Engineer-in-training (EIT) certificate, State of California, XE069403, 1/23/87

## **Honors and Awards**

Senior Researcher, Fulbright Scholar Program, Izmir, Turkey, Feb-Jun 2024.

Member of DAAD (German Academic Exchange program) Science Tour, Marine Environmental Protection Technology and Maritime Energy Generation, June, 2012.

Member of DAAD (German Academic Exchange program) Science Tour, Renewable Energy, December, 2009.

Senior Scholar, Fulbright Scholar Program, Istanbul, Turkey, 1999-2000.

Byars Prize for Excellence in Teaching, Clemson University College of Engineering and Science, 1997.

Byars Prize for Excellence in Teaching, Clemson University College of Engineering and Science, 1996.

## **Research Overview**

Most of my research and consulting projects have been related to movement of water, sediments, and contaminants in natural and built environments, with particular emphasis on coastal and estuarine environments. Projects have included numerical modeling, laboratory, and field investigations of these transport processes. USGS work focused on hydrodynamics, sediment transport, and water quality, particularly in the Sacramento-San Joaquin Delta and San Francisco Bay, where my team maintained a network of 40+ continuous, real-time stations for reporting hydrodynamics and water quality via the USGS NWIS system.

## **Selected Refereed Publications (Students, Post-Docs and Employees supervised shown in bold)**

Work, P., 2023. Evaluation of Hydrodynamic Mixing in an Afterbay Reservoir. ASCE J of Env Eng, <https://ascelibrary.org/doi/epdf/10.1061/JOEEDU.EEENG-7287>.

Naranjo, R., Work, P., Heyvaert, A., Schladow, G., Cortes, A., Watanabe, S., Tanaka, L., and Elci, S., 2022. Seasonal and long-term clarity trend assessment of Lake Tahoe, California–Nevada: U.S. Geological Survey Scientific Investigations Report 2022–5070, 86 p., <https://doi.org/10.3133/sir20225070>.

Work, P., and **Livsey, D.**, 2021. American and Sacramento Rivers, California, erodibility measurements and model: U.S. Geological Survey Scientific Investigations Report 2021–5052, 30 p., <https://doi.org/10.3133/sir20215052>.

**Downing-Kunz, M.A.**, Work, P.A., and **Schoellhamer, D.H.**, 2021. Tidal Asymmetry in Ocean-Boundary Flux and In-Estuary Trapping of Suspended Sediment Following Watershed

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- Storms: San Francisco Estuary, California, USA. *Estuaries and Coasts*, <http://doi.org/10.1007/s12237-021-00929-y>.
- Work, P.A., **Downing-Kunz, M.**, and Drexler, J.D., 2020. Trapping of suspended sediment by patches of submerged aquatic vegetation: field observations and long-term trends. *Estuaries and Coasts*, 44(3), 734-749. <https://doi.org/10.1007/s12237-020-00799-w>.
- Work, P.A., and **Livsey, D.N.**, 2019. Sediment Lithology and Borehole Erosion Testing, American and Sacramento Rivers, California. US Geological Survey Scientific Investigations Report, <https://pubs.usgs.gov/sir/2020/5063/sir20205063.pdf>, 104 pp.
- Work, P.A., **Downing-Kunz, M.A.**, and **Livsey, D.**, 2017. Record-high specific conductance and water temperature in San Francisco Bay during water year 2015: U.S. Geological Survey Open-File Report 2017–1022, 4 p., <https://doi.org/10.3133/ofr20171022>, IP-079162.
- Karasu, S.**, Work, P.A., Uzlu, E., Kankal, M., and Yuksek, O., 2016. Beach nourishment alternative assessment to constrain cross-shore and longshore sediment transport. *Applied Ocean Research*, 59, 459-471.
- Srisuwan, C.** and Work, P., 2014. Beach Profile Model with Size-Selective Sediment Transport. II: Numerical Modeling. *J. Waterway, Port, Coastal, Ocean Eng.*, 10.1061/(ASCE)WW.1943-5460.0000274, 04014033.
- Srisuwan, C.**, Work, P., Karasu, S., and Özölçer, İ., 2014. Beach Profile Model with Size-Selective Sediment Transport. I: Laboratory Experiment and Sensitivity Study. *J. Waterway, Port, Coastal, Ocean Eng.*, 10.1061/(ASCE)WW.1943-5460.0000255, 04014032.
- Srisuwan, C.**, and Work, P.A., 2013. Directional wave spectra from acoustic Doppler current profiler data in sheared and stratified flows. *Ocean Engineering*, 72, 149-159, <http://dx.doi.org/10.1016/j.oceaneng.2013.06.003>.
- Work, P.A., Haas, K.A., Defne, Z., and **Gay, T.**, 2013. Tidal stream energy site assessment via three-dimensional model and measurements. *Applied Energy*, 102, 510-519, <http://dx.doi.org/10.1016/j.apenergy.2012.08.040>.
- Ozeren, Y.**, Wren, D.G., Altinakar, M., and Work, P.A., 2011. Experimental investigation of cylindrical floating breakwater performance with various mooring configurations. *J. of Waterway, Port, Coastal and Ocean Eng.*, 1(58), DOI:10.1061/(ASCE)WW.1943-5460.0000090.
- Yoo, J., Fritz, H.M., Haas, K., Work, P.A., and Barnes, C.F., 2011. Depth inversion in the surf zone with inclusion of wave nonlinearity using video-derived celerity. *ASCE J. of Waterway, Port, Coastal and Ocean Eng.* doi: 10.1061/(ASCE)WW.1943-5460.0000068.

REVISION DATE: 1/24/23



# Robert Battalio, PE

## Senior Engineer

### EDUCATION

M.E., Civil Engineering  
(Coastal Engineering),  
University of California,  
Berkeley

B.S., Civil Engineering,  
Virginia Polytechnic  
Institute and State  
University, Summa Cum  
Laude

### 38 YEARS OF EXPERIENCE

### CERTIFICATIONS/ REGISTRATION

Civil Engineer, State of  
California, C41765

Professional Engineer,  
State of Washington,  
#42109;

State of Louisiana,  
#34927

State of Oregon, #83446

State of Florida, #80940

State of Alabama,  
#37035-E

### PROFESSIONAL AFFILIATIONS

American Society of Civil  
Engineers

American Shore and  
Beach Preservation  
Association

The Surfrider  
Foundation

Appointed, Engineering  
Criteria Review Board,  
San Francisco Bay  
Conservation and  
Development  
Commission

Bob Battalio has over 30 years of experience with flood management, restoration design, coastal engineering, preparation of construction documents, and project management. His training and work experience is focused in the coastal and estuarine areas, wetland and creek restoration design, and waterfront civil engineering projects. Bob has extensive experience with design of public works projects, including responsible charge for the engineering design of waterfront facilities, coastal structures, and multi-objective restoration of wetlands, lagoons, beaches and creeks. Bob has been responsible for more than 4,000 acres of wetland restoration constructed on the west coast of the USA. He has extensive experience with dredging in San Francisco Bay, and littoral processes along the Pacifica Ocean and Bay shores. His prior experience includes investigating the effects of sand mining in southern Monterey Bay. He was the lead coastal engineer for managed retreat shore enhancement projects constructed at Surfers Point, Ventura, CA and Pacifica State Beach, Pacifica, CA. Bob has also served as principal co-investigator / author for several guidance documents: Guidelines for Pacific Coast Floods Studies (FEMA 2005), Technical Methods Manual for Relating Future Coastal Conditions to Existing FEMA Flood Hazard Maps (CA DWR and OST 2016) and Natural Shoreline Infrastructure: Technical Guidance for the California Coast (CA and TNC 2017). Bob is licensed to practice civil engineering in six coastal states, including California.

### Professional Experience

Environmental Science Associates (ESA) 1997 – 2024;  
(includes Philip Williams and Associates, Ltd. (PWA) 1997 – 2010.

Moffatt & Nichol Engineers 1985 – 1997

1984-1985 Research Assistant  
University of California, Berkeley, CA

1982-1984 Technician  
US Army Corps of Engineers, Field Research Facility, Duck, NC

### Relevant Experience for Bay Sand Mining Studies

**Sunset Natural Resilience Project, San Francisco, CA (2022-2024).** Senior coastal engineer. ESA provided coastal engineering and geomorphology to the San Francisco Estuary Institute (SFEI). In collaboration with Peter Baye, PhD and SFEI, the project supports Coastal Zone Planning for Ocean Beach, San Francisco and the staff of City and County of San Francisco and National Park Service, Golden Gate Natural Recreation Area. ESA assessed beach widths and the space available for vegetated dune construction to achieve multiple objectives. ESA also updated coastal flood hazards resulting from wave runup (i.e. total water levels and landward extents) and provided summaries of prior work and project



histories. ESA also supported the assessment of natural area opportunities associated with realignment of the Great Highway.

**Ocean Beach Master Plan, San Francisco, CA (2010-2015).** Bob was the senior, lead coastal engineer supporting development of a plan to adapt to rising sea levels on the Pacific Coast of San Francisco. Provided coastal processes and engineering to the San Francisco Urban Planning + Research (SPUR) in support of a Master Plan for San Francisco's Ocean Beach. Key considerations were coastal processes and erosion / flood hazards, sea-level rise, infrastructure and property vulnerability and maintenance of the natural shore. ESA subsequently led a team of engineers which further developed the shore modifications to protect a \$100M wastewater tunnel in the erosion hazard zone while maintaining a beach with public access. ESA also contributed to a strategy to manage risks in the interim until the project can be implemented, including a monitoring program and sand placement, as well as technical support for the Long-Term project for South Ocean Beach (ongoing through 2023).

**San Francisco Littoral Cell Coastal Regional Sediment Management Plan (CRSMP), San Francisco, CA. (2010 - 2012)** *Project Director.* A CRSMP is a comprehensive guidance and policy document that discusses how regional sediment management can be implemented in an expeditious, cost-effective, and resource-protective manner. ESA developed the CRSMP for a segment of the Golden Gate Littoral Cell along the San Francisco and San Mateo County Pacific coastline. The study analyzed future erosion with sea-level rise and the benefits and costs associated with a range of alternative hazard mitigation strategies in accordance with US Army Corps' procedures.

**Coastal Processes for Doyle Drive/Crissy Field Storm Drain Outfall, San Francisco, CA. (2009-2011).** Project Director. ESA PWA provided preliminary coastal design criteria for a storm drain outfall on the Crissy Field (National Park) shore as part of the seismic reconstruction of Doyle Drive. The outfall dating back to the Crissy Army Air Field was blocked by deposited sand and growing beach. The project entailed characterizing coastal processes, anticipating future conditions from climate change, developing design criteria and engineering designs. The project was completed in November 2011 and collaborative presentations on the findings with USGS scientists were delivered in December 2011.

**National Park Service, Golden Gate Parks Conservancy, and Presidio Trust, Crissy Field Wetland Inlet Studies, San Francisco, CA. (1997 – 2007).** Led the coastal processes evaluation of the inlet and adjacent shore following construction of a new tidal lagoon in Crissy Field Park. One study resulted in a quantified conceptual model of inlet closure and natural breaching frequency to aid in the adaptive management of the system and evaluation of the benefits of expansion of the wetland. The work includes significant monitoring, including directional wave spectra, sand transport calculations, surveys of inlet morphology, and tracking of sand erosion and deposition.

**Sediment Transport Processes Study, Ocean Beach, San Francisco, California, (1992-1996).** For the US Army Corps of Engineers. Conducted sediment budget analysis for Ocean Beach to identify likely directions and rates of sand transport as part of an erosion control project. Supervised the mapping and analysis of

bathymetric and shoreline maps dating back to the 1850's, and shoreline positions from aerial photographs dating back to the 1930's. Identified erosion rates and evaluated erosion control concepts.

**California State Coastal Conservancy, Department of Fish & Game and U.S. Army Corps of Engineers, Napa River Salt Marsh Restoration, Pablo Bay / Napa River, CA.** *Project Director.* A series of studies and design for restoration for the 10,000-acre Napa Salt Ponds Complex. Included conceptual design, modeling of hydrodynamics, sediment transport and salinity, habitat conversion modeling, engineering feasibility, final design and construction period services. Also, field data collection and analysis, and coordination with surveying and EIR/EIS preparation, and conformance with Corps' procedures. Engineer-in-charge of construction documents for the restoration of tidal wetlands in Ponds 3, 4 and 5, which comprised 3,000 acres, constructed in 2006.

**Alameda County, Alameda County Coastal Flood Study, CA.** Reviewed coastal flood studies by the US Army Corps and FEMA contractors, and recommending a methodology to complete the coastal flood studies in southern Alameda County. A range of technical aspects include hydrodynamic bay models, wave generation and propagation modeling, statistical analyses of joint probability and extreme value distributions, wave runup, overtopping and dissipation over mudflats and marshes.

**East Bay Regional Park District, Hayward Shoreline Sea-Level Rise Study, San Francisco Bay, CA. (2009-2011).** *Project Director.* ESA conducted a preliminary study on the effect of sea-level rise over a 50-year planning horizon on the resources of the Hayward shoreline and the actions that could be taken to protect both the wetlands and shoreline development in this area. ESA examined potential impacts to the Hayward area to the north of Highway 92 and provided recommendations for possible mitigation measures to protect existing and planned uses along the shoreline. This study initiated the development of a waste-water-supported horizontal living- levee that utilizes the biomass generation of emergent vegetation to "keep up" with sea level rise for ecology as well as ecosystem services such as flood protection.

**US Army Corps of Engineers, Hamilton Army Airfield Restoration: Tidal Wetlands Design Support, Novato, CA. (1997-2014).** *Project Director.* Directed wind wave analysis to develop estimates of total water levels criteria for new levees. Bob led investigation of potential levee erosion and design of a dissipative vegetated bench as ecologically preferred approach to erosion control (vs. rock slope protection). In collaboration with other ESA staff and the project sponsors, he developed the methodology to apply traditional coastal engineering analysis techniques in concert with applied geomorphology to develop the levee bench design. Bob also served as the senior engineer for ESA oversight of construction documents for several project elements. The project construction was completed in 2014.

**Association of Monterey Bay Area Governments (AMBAG), Southern Monterey Bay Coastal Regional Sediment Management Plan and Erosion Mitigation Alternatives, CA. (2008; 2012)** For the Association of Monterey Bay Area Governments (AMBAG), with funding from the Coastal Sediment Management Workgroup (CSMW), Bob helped develop the first coastal regional sediment management plan in CA in 2008. The study addressed the effects of sand mining

on coastal erosion. This project also applied a cost- benefit analysis that included ecological and recreational values along with the more easily estimated land, development and shore protection values. The work was led by the Monterey Bay Marine Sanctuary Foundation, and included an advisory body called the Southern Monterey Bay Coastal Erosion Workgroup.

**Monterey Regional Water Pollution Control Agency, Southern Monterey Bay Coastal Erosion Studies, Monterey County, CA. (2004).** Project Director.

Assessed the Risks to regional sanitary sewer facilities from coastal erosion over the next 50 years; prioritized facilities based on their vulnerability to future erosion and the severity of anticipated damages; and recommended a plan to minimize damages. The assessment included shore morphology and the response to sea level rise, shore recession due to a sand deficit, seasonal and storm-induced responses, and wave runup.

**Sand City Shore Erosion Study, Southern Monterey Bay, CA (1989-1995).** Bob investigated the Impacts of Sand Mining on Shoreline Erosion for the City of Sand City, and others, with funding from the California State Coastal Conservancy. Conducted a sediment budget analysis for southern Monterey Bay and quantified the impacts of coastal sand mining on shoreline erosion, as well as other factors such as sea level rise. Work included analysis of historic maps and aerial photographs for shoreline positions, erosion rate calculations, numerical modeling of sand mining impacts to shoreline position, wave runup analysis, recommended development setbacks, and erosion control alternative concepts.

**California State Coastal Conservancy, South San Francisco Bay Salt Ponds Restoration Studies, Counties of Alameda, Santa Clara and San Mateo, CA.**

Technical support of a programmatic evaluation of the feasibility of restoring up to 15,000 acres of salt ponds in south San Francisco Bay, and the associated flood protection needs. Bob led the analysis of coastal flood criteria for conceptual description of a new coastal flood protection system. Analysis included extreme high estuarine water levels, wind set up, wind wave generation, transformations and run up, and effects of marshes, and relative sea level rise. Bob is the engineer of record for the wetland restoration constructed in Eden Landing (just south of San Mateo Bridge), which one of the Phase 1 restoration actions.

**Albany Beach Restoration Feasibility Study, San Francisco Bay Area, CA.**

**(2009 – 2013).** Project Director. ESA PWA is providing engineering, coastal and geomorphic analyses related to tidal, subtidal and upland processes focusing on beach and dune restoration and enhancement, public access and shoreline protection to the collaborative, multi-disciplinary project team. Assessments include consideration of sea level rise and flood evaluations to guide design of sustainable, low maintenance project elements and EBRPD decision-making process. ESA PWA will provide project management, translation and application of technical analyses for conceptual design alternatives of project program elements, regulatory agency coordination and project presentations.

**Marin Audubon Society, Bahia Wetland Restoration Project, Lower Petaluma River and Black John Slough, Novato, CA. (2006-2013).** *Engineer-in-charge.*

The planning, design, construction period services and monitoring approximately 400 acres of wetland restoration and other improvements on a project area of about 600 acres. Construction was completed successfully in 2008, and the site is now being monitored.

**Marin Audubon Society, Petaluma Marsh Restoration Design, Novato, CA.**

*Project Director.* The design of 100-acre tidal wetland restoration tributary to the Petaluma River. Included design of a flood control levee to mitigate tidal flooding and wave action to adjacent rail corridor. The project was successfully constructed in 2005-2007.

**Martinez Regional Shoreline Marsh Restoration Project, CA. (1998-2002).**

Directed construction document preparation construction support activities for this combined flood control and tidal wetlands restoration project at the mouth of Alhambra Creek. The project satisfied mitigation requirements for Caltrans by providing Delta Smelt and other habitat.

**Maintenance Dredging of Larkspur Ferry Terminal, CA., 1989 - 2000.** *Project Engineer.* Responsible for construction documents and permit applications for five episodes of maintenance dredging of the Larkspur Ferry Terminal Berthing Basin and Channel, including over 1,000,000 cubic yards of dredging and disposal.

**Coastal Engineering and Dredging Studies, Northern California, 1989-1996.**

For the U.S. Army Corps of Engineers, San Francisco District, on several retainer contracts. Conducted numerous studies for coastal engineering aspects of Corps projects. Also detailed dredging studies, primarily regarding beneficial reuse / upland disposal of material dredged from San Francisco Bay as part of the Long Term Management Strategy (LTMS).

**Published Papers**

King, Philip G., Chad Nelsen, Jenifer E. Dugan, David M. Hubbard, Karen L. Martin, and Robert T. Battalio, Valuing beach ecosystems in an age of retreat, *Shore & Beach* Vol. 86, No. 4, Fall 2018.

Behrens, Dane, Ph.D., P.E., Matt Brennan, Ph.D., P.E., and Bob Battalio, P.E., 2015. A quantified conceptual model of inlet morphology and associated lagoon hydrology, *Shore & Beach*, Vol. 83, No. 3, Summer 2015, p 33-42.

Battalio, Bob, 2014. Littoral processes along the Pacific and bay shores of San Francisco, California, USA, *Shore & Beach*, Vol. 82, No. 1, Winter 2014, 19pp.

Revell, D.L., Battalio, R., Spear, B., Ruggiero, P, and Vandever, J. 2011. A Methodology for Predicting Future Coastal Hazards due to Sea level Rise on the California Coast. *Journal of Climatic Change* 2011 109 (Suppl 1): S251-S276, DOI 10.1007/s10584-011-0315-2, 10 December 2011 # Springer Science+Business Media.

Brew, David S., Robert T. Battalio, Edward B. Thornton, Clifton Davenport, Brad Damitz, Coastal Regional Sediment Management Planning in Southern Monterey Bay, California, *Littoral* 2010, 05009 (2011).

Battalio, R.T., D. Danmeier and P. Williams, Predicting Closure and Breaching Frequencies of Small Tidal Inlets –A Quantified Conceptual Model. *Proceedings of the 30th International Conference of Coastal Engineering*, 2006, ASCE 2007, Vol. 4, 3937 - 3949.

Garrity, Nicholas J., Robert Battalio PE, Peter J. Hawkes PhD, Dan Roupe, Evaluation of Event and Response Approaches to Estimate The 100-Year Coastal

Flood for Pacific Coast Sheltered Waters, Proceedings of the 30th International Conference of Coastal Engineering, 2006, ASCE, 2007, Vol. 2, pp 1651-1663.

MacArthur, Robert C., Robert G. Dean and Robert Battalio, Wave Processes in Nearshore Environment for Hazard Identification Proceedings of the 30th International Conference of Coastal Engineering, 2006, ASCE, 2007, Vol. 2, pp 1775- 1787.

Coulton, Kevin G., Bob Battalio, Nick Garrity, Carmela Chandrasekera and Paula Cooper, Coastal Flood Studies in Puget Sound, Washington State, USA, Solutions to Coastal Disasters '02, Conference Proceedings, February 24–27, 2002, San Diego, CA, ASCE, pp 267–281.

Brendan DeTemple, R.T. Battalio, and James Kulpa, Measuring Key Physical Processes in a California Lagoon, Proceedings of the 1999 Conference of the California Shore and Beach Preservation Association, Sand Rights '99, September 23–26, 1999, Ventura, CA, ASCE, pp 133–147.

Battalio, R.T. and R.B. Dornhelm, 1997. Sea level rise in San Francisco Bay, California. Proceedings of the 1997 National Marina Research Conference, International Marina Institute, 16 pp.

Battalio R.T., and D. Trivedi 1996. "Sediment transport processes at Ocean Beach, San Francisco, CA." Proc. 25th Int. Conf. Coastal Engineering, Orlando, FL. ASCE, 2691-2704.

Battalio, R.T. and A. Bertolotti, 1987. Modeling Applications in Coastal Engineering. Proceedings: Coastal Zone '87 Conference, 5th Symposium on Coastal and Ocean Management, Vol. 2, pp. 1630 1643.

# Craig A. Jones, Ph.D.

## Managing Principal



### Education and Credentials

Ph.D., Mechanical and Environmental Engineering, University of California, Santa Barbara, California, 2000

M.S., Fluid Mechanics (minors: Environmental Ocean and Environmental Engineering) University of California, Santa Barbara, California, 1996

B.S., Coastal Engineering, Texas A&M University, Galveston, Texas, 1994

### Professional Affiliations

American Society of Civil Engineers

Marine Technology Society

American Geophysical Union

American Shore and Beach Preservation Association

### Achievements and Awards

United States Utility Patent No. 61/857,057 (provisional). A device and method for measuring wave motion.

Recipient of J.C. Stevens Award, recognizing excellence in a paper published by the American Society of Civil Engineers. The paper is in the field of hydraulics, including fluid mechanics and hydrology. See Jones and Gailani (2009) below.

### Professional Profile

Dr. Craig Jones is a principal ocean and environmental engineer with 21 years of experience in developing and executing sediment engineering and science projects for government agencies and the private sector. His experience includes riverine, lacustrine, estuarine, and coastal processes involving hydrodynamics, waves, sediment, and contaminant transport. Dr. Jones' expertise includes the application of state-of-the-science field measurements and modeling analysis to characterize and quantify transport processes in all aquatic systems. He actively participates in the design of field activities and instrumentation to develop data sets in support of clients' needs. Dr. Jones is adept at incorporating this information to efficiently address challenging sediment management questions.

Dr. Jones has testified in federal court and in front of public utility commissions as an expert on environmental issues and regulatory concerns, including sediments and contaminants in support of allocation activities. Dr. Jones continues to work on preparation of materials for various environmental litigation cases in the United States.

### Relevant Experience

**Hamilton Wetland Restoration, San Pablo Bay, California**—Served as project manager for the assessment of an open-water dredge material storage facility for beneficial reuse and restoration of Hamilton Wetlands in California. Evaluations were conducted for a temporary dredge material transfer facility in San Pablo Bay to support the restoration at the former Hamilton Army Airfield and surrounding land. The aquatic transfer facility (ATF) is designed to handle 24 million cubic yards of material over a 10- to 15-year operational life. Knowledge of the fate of the dredged material in and around the ATF, developed using SEDflume and modeling studies, was critical to the selection of an optimal location for the ATF, and for guiding the design and configuration so that impacts to the surrounding environment will be minimized.

**Contaminated Sediment Transport Evaluation, Berry's Creek Study Area, New Jersey**—Serving as project manager for field and modeling studies related to the risk assessment, remedial investigation, and feasibility of the Berry's Creek Study Area (BCSA) wetland in New Jersey. Historical releases of contaminants into the BCSA have



resulted in the need for an RI/FS for the site. The study goals are to characterize the fate and transport of sediment-bound contaminants. Responsibilities include acting as a technical advisor on the design and implementation of the sediment remedies for the site. By working in concert with the natural marsh system, opportunities for beneficial reuse of sediment are being explored to effectively meet the site needs.

***United Heckathorn Superfund Site, Richmond, California***—Served as project manager for a DDT fate and transport study that was performed for the Lauritzen Channel as part of a focused feasibility study. The objectives were to develop a quantitative contaminant fate and transport conceptual site model and DDT mass balance for the Lauritzen Channel, based on available analyses, and assess trends in DDT mass and concentration in the channel. Overall, the sediment transport analysis showed that the Lauritzen Channel is accumulating relatively clean sediment from San Francisco Bay. The assessment of potential remedies included the beneficial reuse of sediment to decrease the average DDT concentrations in the young bay mud sediment in the channel.

***Development of a Guide for Assessing Sediment Transport at Navy Facilities, U.S. Navy***— Authored a U.S. Navy guidance document to ensure that sediment investigations and remedial actions are successful and cost effective. The guidance provides information on evaluating sediment transport at contaminated sediment sites, and describes how to use sediment transport information to support sediment management decisions. The framework developed in this report has been applied at three demonstration sites: Hunters Point Naval Shipyard (HPS) in San Francisco, California; Bremerton Naval Complex in Puget Sound, Washington; and Naval Station Newport in Newport, Rhode Island.

***Remedial Investigation and Feasibility Study, Hunters Point Naval Shipyard, California***—During the feasibility study phase of the work at HPS, provided the U.S. Navy with advice and analysis regarding the stability of PCB-contaminated sediments onsite and the effectiveness of potential remedies. The work included the development of an agency-approved, “weight of evidence” approach to sediment evaluation at HPS. Conducted the evaluation of the mobility of bottom sediment in areas of potential chemical contamination in the vicinity of HPS, in south San Francisco Bay, California. Also performed analysis of beneficial reuse scenarios in the feasibility study to select remedial options.

***Dredge Disposal, Santa Cruz, California***—Co-managed the design and implementation of the inner Santa Cruz Harbor dredge evaluation program. Before these dredge monitoring programs, it was considered too great a risk to place dredged sediment containing more than 20 percent mud into the surf zone because it might have damaging effects on the coastal environment. The project demonstrated negligible sedimentary changes occurred on the beaches and in nearshore benthic habitats of the Santa Cruz Bight during the dredging period. A variety of data collection efforts were utilized to monitor the experimental dredging event, including local stream flow, wave, and current data collection; beach and offshore sediment sampling; pre- and post-dredging multi-beam surveys and benthic habitat mapping; and sediment transport modeling.



*Technical Advisor, San Francisco Estuary Institute*—Acted as an advisory member of a contaminated sediment advisory group for the Estuary Institute. In addition, continue to provide technical advice on the development of modeling studies to evaluate water quality issues in the San Francisco Bay region.

## Selected Publications

Kramer, S., C. Jones, G. Klise, J. Roberts, A. West, and Z. Barr. 2020. Environmental permitting and compliance cost reduction strategies for the MHK industry: Lessons learned from other industries. *J. Mar. Sci. Engr.* 8:554. doi:10.3390/jmse8080554.

Jones, C., G. Chang, K. Raghukumar, S. McWilliams, A. Dallman, and J. Roberts. 2018. Spatial Environmental Assessment Tool (SEAT): A modeling tool to evaluate potential environmental risks associated with wave energy converter deployments. *Energies* 11(8):2036. doi:10.3390/en11082036.

Jones, C.A., and B.E. Jaffe. 2013. Influence of history and environment on the sediment dynamics of intertidal flats. *Mar. Geol.* 345:294–303.

James, S.C., C.A. Jones, M.D. Grace, and J.D. Roberts. 2010. Advances in sediment transport modeling. *J. Hydraul. Res.* 48(6):754–763.

Jones, C., and J. Gailani. 2009. Discussion of “comparison of two techniques to measure sediment erodibility in the Fox River, Wisconsin” by T. Ravens. *J. Hydraul. Eng.* 135(5):432–434.

Zimmerman, J.R., J.D. Bricker, C. Jones, P.J. Dacunto, R.L. Street, and R.G. Luthy. 2008. The stability of marine sediments at a tidal basin in San Francisco Bay amended with activated carbon for sequestration of organic contaminants. *Water Res.* 42:4133–4145.

Blake, A.C., D.B. Chadwick, P.J. White, and C.A. Jones. 2007. User’s guide for assessing sediment transport at Navy facilities. Technical Report 1960. Available at: [http://www.epa.gov/superfund/health/conmedia/sediment/pdfs/Sed\\_transport\\_guide\\_2007.pdf](http://www.epa.gov/superfund/health/conmedia/sediment/pdfs/Sed_transport_guide_2007.pdf). U.S. Navy, SPAWAR Systems Center, San Diego, CA.

Jones, C.A., S.C. James, J.D. Roberts, and P.L. Shrestha. 2005. Continuous treatment of cohesive and non-cohesive sediment dynamics in a three-dimensional hydrodynamics model. Ninth International Conference on Estuarine and Coastal Modeling, 9A.

Short course titled “Evaluating Sediment Transport: Best Practices, Tools, Techniques, and Application to Site Management.” Tenth International Conference on Remediation of Contaminated Sediments. January 2019.





# David H. Schoellhamer

d.schoellhamer@comcast.net

## RELEVANT EXPERIENCE

From 1993 to 2016 Dr. Schoellhamer lead the USGS San Francisco Bay suspended sediment transport processes project. The primary database for the project is continuous time series of suspended-sediment concentration (SSC) from 16 sites in the Bay and Delta, the longest (begun December 1991) and largest such data set ever collected in an estuary. Time series analyses, statistical analyses, tidal analyses, conceptual models, and numerical models are developed and used to analyze these and ancillary data. He was responsible for the study design, technical direction, technical quality, research products, funding, reporting, colleague and agency relations, supervision, and administration of the project.

## EDUCATION

<u>School</u>	<u>Major</u>	<u>Degree</u>
University of Florida (1989-1993)	Coastal and Oceanographic Engineering	Ph.D. (1993)
University of California, Davis (1982-1983)	Civil Engineering	M.S. (1983)
University of California, Davis (1978-1982)	Civil Engineering	B.S. (1982)

## SELECTED PROFESSIONAL EXPERIENCE

2014-present: Adjunct Professor of Civil Engineering, Portland State University  
2003-2009: Adjunct Professor of Civil and Environmental Engineering, UC Davis  
1984-2018: Research Hydrologist, US Geological Survey

## SELECTED SCIENTIFIC PANELS AND LEADERSHIP

2012: Co-editor, *Marine Geology* special issue on sediment transport in San Francisco Bay  
2010: Co-chair, Bay/Delta Science Conference  
2008-present: Associate Editor, *San Francisco Estuary and Watershed Science*  
2003-2007: Co-editor of the Proceedings of the INTERCOH2003 cohesive sediment conference

## SELECTED PUBLICATIONS

- Barnard, P.L., Schoellhamer, D.H., Jaffe, B.E., and McKee, L.J., 2013, Introduction to sediment transport in the San Francisco Bay Coastal System: An overview: *Marine Geology*, v. 345, p. 3-17.
- Maa, J.P.-Y., Sanford, L.P., and Schoellhamer, D.H., ed., 2007, *Estuarine and Coastal Fine Sediments Dynamics*: Elsevier Science B.V.
- Manning, A.J., and Schoellhamer, D.H., 2013, Factors controlling flocculation settling velocity along a longitudinal estuarine transect: *Marine Geology*, v. 345, p. 266-280.
- Schoellhamer, D.H., 2011, Sudden clearing of estuarine waters upon crossing the threshold from transport- to supply-regulation of sediment transport as an erodible sediment pool is depleted: *San Francisco Bay, 1999: Estuaries and Coasts*, v. 34, p. 885-899.
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- Schoellhamer, D.H., Lionberger, M.A., Jaffe, B.E., Ganju, N.K., Wright, S.A., and Shellenbarger, G.G., 2005, Bay Sediment Budgets: Sediment Accounting 101: The Pulse of the Estuary: Monitoring and Managing Water Quality in the San Francisco Estuary, San Francisco Estuary Institute, Oakland, California, p. 58-63. URL [http://www.sfei.org/rmp/pulse/2005/RMP05\\_PulseoftheEstuary.pdf](http://www.sfei.org/rmp/pulse/2005/RMP05_PulseoftheEstuary.pdf)
- Schoellhamer, D., McKee, L., Pearce, S., Kauhanen, P., Salomon, M., Dusterhoff, S., Grenier, L., Marineau, M., and Trowbridge, P. 2018. Sediment Supply to San Francisco Bay, WY 1995 - WY 2016: Data, trends, and monitoring recommendations to support decisions about tidal wetlands and resilience to sea level rise. Published by the San Francisco Estuary Institute, Richmond, CA. SFEI Contribution Number 842. <https://www.sfei.org/documents/sediment-supply-san-francisco-bay>
- Schoellhamer, D.H., Wright, S.A., and Drexler, J.Z., 2013, Adjustment of the San Francisco estuary and watershed to reducing sediment supply in the 20th century: *Marine Geology*, v. 345, p. 63-71.
- Schoellhamer, D.H., Wright, S.A., Monismith, S., and Bergamaschi, B., 2016, Recent advances in understanding flow dynamics and transport of water-quality constituents in the Sacramento–San Joaquin River Delta: *San Francisco Estuary and Watershed Science*, v. 14, no. 4. <https://doi.org/10.15447/sfews.2016v14iss4art1>
- Schoellhamer, D.H., Wright, S.A., and Drexler, J.Z., 2012, Conceptual Model of Sedimentation in the Sacramento – San Joaquin River Delta: *San Francisco Estuary and Watershed Science*, v. 10, no. 3, <http://escholarship.org/uc/item/2652z8sq>
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