

**Table 1-2.** Summary of studies related to Huntington Beach shoreline contamination.

<b>Study</b>	<b>Description</b>	<b>Purpose</b>	<b>Time Frame</b>	<b>Result</b>
Picket Line	Microbiology samples taken along a transect parallel to shore ~1000 feet offshore.	Determine if the OCSD offshore discharge was coming onshore.	May, July and August 1999.	No samples with significantly elevated levels of bacteria. Higher values in the surfzone than along the picket line.
Closed circuit TV sewage infrastructure inspection	Inspection of OCSD, Huntington Beach and State Park sewer lines.	Identify breaks, joint offsets or significant root infiltration that could cause leakage.	June 30 to October 7, 1999	Identified breaks were repaired, with no effect on beach contamination levels.
Monitoring Wells	Groundwater sampled from five 30 to 60-foot wells via peristaltic pump.	Determine if there was a plume migrating to surf zone from Coast Trunk line or other facilities.	July 29-30, 1999	No contaminated samples were found.
Ground Penetrating Radar and Hydropunching	Near surface geology and groundwater was sampled.	Determine if the bedding around sewer lines, power plant lines, or local groundwater/ geological features were functioning as a transportation mechanism for bacterial contamination.	August 9-28, 1999	No contaminated samples were found.
Offshore triangle  Talbert Marsh (TM) and Santa Ana River (SAR) water quality and citrus studies	Water samples were collected from sites along the beach, along the outfall pipe and at depth along three offshore transect lines. Microbiological and nutrient water samples collected from TM and outfall. Grapefruit and oranges were dropped at the ocean outlets of TM and SAR and tracked.	Determine if the underground portion of the offshore OCSD outfall pipe was contributing to the beach contamination.  Determine if a transport mechanism to surf zone existed for the effluent water from TM and SAR.	August 13, 1999  August 30 and September 16, 1999.	Offshore samples did not contain significantly elevated levels of bacteria.  Fruit washed ashore onto Huntington Beach in the areas of highest bacterial counts. The water quality results did not confirm the physical info from the citrus study.
TM and SAR overnight studies	Densities of indicator bacteria were measured at the outlets to TM and SAR at 30 min. intervals.	To determine whether bacteria Leave TM or SAR at low tides and enter the surf zone.	September 8-9, 1999	Inconclusive. High bacteria levels on the beach did not correlate with TM and SAR water.

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Outfall Dye studies	Rhodamine dye was injected into the effluent and tracked.	Determine if the near-shore (buried) portion of the OCSD outfall pipe was leaking and to track the offshore plume.	September 30, 1999	No evidence of dye shoreward of the diffuser (offshore) portion of the pipe. Offshore plume was tracked moving down coast and shoreward.
OCSD Phase I Summary Report	Summarized the studies listed above and performed by OCSD during the Summer of 1999	Provide summary of the OCSD sanitary survey and related work to date.	December 1999	OCSD sewers were not leaking, outfall was not leaking, plume did not appear in the surfzone, and some local onshore contamination sources were pointed out.
UCI Talbert Marsh tidal transport study	Hydrology, bacteriology and Chemistry of water flowing in and out of TM was characterized.	Determine if the Talbert Watershed is a significant source of indicator bacteria to the near-shore area of Huntington Beach.	December 7-21, 1999	Pump station discharges increased the near-shore loading of total coliforms, but didn't explain all the contamination at the beach. TM also appeared to be a significant source of episodic near-shore loading of enterococci.
USC Sea Grant Huntington Beach Closure Investigation: Technical Review	An expert panel was convened by USC to review the 1999 OCSD investigation.	The panel was asked to address: 1) Were the proper studies done and were they correctly interpreted 2) What should the next set of studies consist of 3) What should be the longer-term research priorities for future source investigations? 4) What lessons learned could be transferred to others?	Panel Verbally Reported in February 2000 with a final report in October 2000	The panel agreed with the OCSD study conclusion that the most likely source was land-based and that the areas sewer lines and offshore outfall had been effectively eliminated as a source. They also recommended using more source-tracking techniques and developing better onshore and offshore hydrodynamic models.

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MEC: Huntington Beach Closure: Relationships Between High Counts of Bacteria on Huntington Beaches and Potential Sources	An OCSD consultant ran a series of statistical analyses (correlation study) on various available environmental factors for the summer of 1999. Based on the strongest correlations, four scenarios were hypothesized to account for the results.	To determine if statistics could reveal evidence of potential sources in the data that could not have been seen by just reviewing the data.	January 2000	Bacteria levels at the beach during High/Ebb tides and Low/Flood tides seem to have different contamination mechanisms. Variables that most correlated included: storm water pump station pump volumes, maximum tide, bird counts, shore currents, pycnocline depth and minimum tide levels.
UCI/Moffatt & Nichol/URS/Komex Huntington Beach Water Quality Investigation Phase II: An Analysis of Ocean, Surfzone, Watershed, Sediment and Groundwater Data Collected from June 1998 through September 2000	Investigation of contaminate transport by groundwater, long-shelf currents inside surfzone and onshore nuisance flows.	Evaluate transport efficacy of near-shore currents, evaluate utility of dry-weather diversion projects, and catalogue sources of indicator bacteria in the Talbert watershed.	December 15, 2000	No single contaminate source could be identified. Additional research on contribution of contaminants to surfzone by the Santa Ana River and potential interaction between the OCSD outfall and the AES power plant cooling water system.
OCSD On Shore Investigation July – October 2001	Investigate all potential on shore contamination sources in the Huntington Beach area.	Find on shore problems and fix them.	July – October 2001	A number of existing and suspected contamination sources were identified. Several potential sources were repaired during the project.

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UCI Cross-Shelf Transport at Huntington Beach.	Analyses of current and temperature data from Huntington Beach shoreline and OCSD ocean outfall.	To determine if a correlation exists between the onshore and offshore water temperatures which may imply onshore movement of offshore cold water.	March 2002	Correlation exists between onshore and offshore cold water events. However, it's not clear where the on shore cold water came from since the circulation patterns, especially in the near-shore area are complex.. No evidence of shoreline contamination associated with correlation.
UCI Coastal Runoff Impacts Study (CRIS)	Measured flow and water quality at mouth the Santa Ana River, Talbert Marsh, Greenville-Banning Channel, and Newport Slough.	To evaluate sources and dynamics of pollution in the Santa Ana River Watershed and compare to Talbert Marsh Watershed.	June/July 2001	Fecal indicator bacteria generated locally from land-based sources. Fecal indicator viruses were associated with cold ocean water.
UCSB Association of Urban Runoff with Coastal Water Quality in Orange County, California	A temporal and spatial analysis of 2 years of data	To evaluate the relationship between storm events, urban runoff, and water quality.	Data collected from 1997 through 1999.	The primary source of North Orange County's coastal pollution is urban runoff discharge by the San Gabriel, and Santa Ana Rivers.
OCSD Expert Panel Review of Huntington Beach Investigations	To evaluate the scientific work completed to date.	Determine whether data collection and analysis were appropriate to answer the scientific questions about physical transport methods.	February 2002 through October/November 2002	Initial review supports investigator position that no connection could be made between the offshore wastewater plume and surfzone bacteria.

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Huntington Beach Phase III Shoreline Contamination Investigation	Investigate hypothesis that the OCSD plume is impacting Huntington Beach shoreline.	To (1) measure physical oceanographic transport mechanisms exist and (2) determine shoreward transport of offshore plume.	June-October 2001	Transport mechanisms exist, but the data always showed a break between the offshore plume and shoreline bacteria. The 2001 elevated bacteria levels did not appear to be linked to the wastewater effluent discharges from the OCSD outfall