United States Department of the Interior

U. S. GEOLOGICAL SURVEY
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June 25, 2010

Mr. James Thorsen,
City Manager,
City of Malibu,
23815 Stuart Ranch Road,
Malibu, California 90265

Dear Mr. Thorsen;

This letter summarizes preliminary results from Task 1 (Synoptic sample collection) of our cooperatively funded water resources program to identify sources of fecal indicator bacteria (FIB) and nutrients to Malibu Lagoon and near-shore ocean water, Malibu, California. The purpose of the synoptic sample collection was to provide a snap-shot in time of the occurrence and distribution of FIB nutrients, and other constituents in shallow groundwater, Malibu Lagoon (including its tributary Malibu Creek) and near-shore ocean water. The study was done under the direction of Dr. John Izbicki in our San Diego Projects Office.

Data were collected as part of Task 1 from April 17-22, 2010. The sample period was selected to reflect conditions near the end of the rainy season for comparison and contrast with data previously collected during the dry summer season between July 21-27, 2009. The primary hydrologic differences between the July 2009 and April 2010 sample periods were:

1. During the July sample period, the sand berm at the mouth of Malibu Lagoon was closed and seawater water did not exchange freely with lagoon water during tidal cycles. However, during July, seawater overtopped the berm and entered the lagoon during high tide, and lagoon water moved through the sand berm at the mouth of the lagoon to discharge to the near-shore ocean during low tide. During the April sample period, the berm of the lagoon was open to the ocean and seawater flowed into the lagoon during high tide and water from the lagoon flowed into the ocean during low tide. Water levels in the lagoon were lower during the April sample period than during the July sample period.
2. Malibu Creek was not flowing during the July sample period, whereas, the creek was flowing during the April sample period. Streamflow measured at the U.S. Geological Survey streamgage upstream from the lagoon (Malibu Creek at Malibu, Calif 11105510) during April 17-19 varied daily from about 11 to 20 cubic feet per second (cfs) as a result of upstream discharges. Precipitation in the Malibu Creek

watershed, beginning late in the day on April 19, increased streamflow at the gage to a maximum of 30 cfs on April 20.

3. Groundwater levels in many of the sampled wells, especially wells near Malibu Lagoon, were lower in April 2010 than in July 2009.

More than 230 samples were collected during the April 2010 sample period. Samples were collected once from selected wells in the study area, from Malibu Creek upstream from residential and commercial development in the Malibu Civic Center area, and from selected sites in Malibu Lagoon. Samples also were collected daily during the sample period at high, low, mid-high, and mid-low tide from Malibu Lagoon, the discharge of the lagoon to the near-shore ocean, and from three selected recreational beaches. Additional samples were collected hourly during a falling tidal cycle from high to low tide from pieziometers and seepage samplers installed in the sand berm at the mouth of Malibu Lagoon and near Malibu Colony, and from associated sites in the lagoon and the near-shore ocean. Groundwater sample sites are shown in figure 1 and surface-water sites are shown in figure 2. On-site wastewater treatment systems sampled previously were not sampled during the April 2010 sample period, but will be sampled later as part of Task 1.

USGS staff set up a temporary laboratory in the Malibu Civic Center area and FIB were analyzed on site using Colilert and Enterolert. On most days, samples were analyzed within 6 hours after collection, the recommended holding time for sample collected for regulatory purposes. On some days, samples were held for slightly longer prior to analysis. All samples were analyzed within 24 hours of collection, the recommended holding time for samples collected for scientific purposes. In addition to routine laboratory Quality Assurance data, selected FIB samples analyzed within 6 hours after collection were reanalyzed 24 hours after collection to determine how differences in sample holding time may affect results, and selected samples analyzed for FIB using Colilert and Enterolert also were analyzed using membrane filtration to determine how different analytical methods may affect results. FIB data for water from wells, Malibu Lagoon, and the near-shore ocean are summarized in the following paragraphs.

Total coliform were detected at concentrations greater than the detection limit of 1 Most Probable Number (MPN) per 100 milliliters (ml) in water from 10 of 15 sampled wells, and concentrations were as high as 2,400 MPN per 100 ml in three wells during the April sample period. The frequency of detection and concentration of total coliform was greater during April 2010 than during July 2009; however, total coliform occur naturally in the environment and are not necessarily associated with fecal sources. Enterococci was detected in only four sampled wells at concentrations generally near the detection limit of 1 MPN per 100 ml. Well SMBRP-2, in the undeveloped riparian area east of the lagoon, had an enterococci concentration of 96 MPN per 100 ml. *Escherichia coli* concentrations were less than the detection limit of 1 MPN per 100 ml in samples from all wells. In general, Enterococcus and *E. coli* concentrations in water from wells sampled in April 2010 were similar to concentrations measured during July 2009.

During the April 2010 sample period, Total coliform, *E. coli*, and enterococcus concentrations in Malibu Lagoon were as high as 105,000, 8,400, and 19,900 MPN per

100 ml, respectively. In general, FIB concentrations were lower in the lagoon during April 2010 than during July 2009. FIB concentrations in the lagoon during both sample periods were several orders of magnitude greater than concentrations in water from sampled wells. During April 2010, FIB concentrations varied widely between low and high tide. Concentrations in the lagoon were low (often near the detection limit of 10 MPN per 100 ml for *E. coli* and enterococcus) during high tide when seawater having low FIB concentrations entered the lagoon. FIB concentrations increased to high values by the next low tide when water from the lagoon discharged to the ocean.

FIB concentrations in samples from the near-shore ocean at Puerco Beach (OF-A, fig. 2) and at Malibu Colony (AF-B, fig. 2) generally were less than the detection limit during low tide when radon-222 data collected as part of this study show that groundwater discharge to the ocean was occurring. FIB concentrations increased slightly during high tide when groundwater discharge to the ocean was not occurring. A similar increase in FIB at high tide also was observed in July 2009 and was attributed to wave run-up on the beach washing FIB from kelp accumulated at the wrack line. High FIB concentrations were measured in water extracts from kelp during both the July 2009 and April 2010 sample periods. Enterococcus concentrations in near-shore ocean samples collected at Puerco Beach or Malibu Colony during the April 2010 sample period did not exceed the U.S. Environmental Protection Agency (USEPA) single sample standard of 104 MPN per 100 ml. In contrast, enterococcus concentrations in near-shore ocean samples collected at at Surfrider Beach (site OF-C, fig. 2) west of Malibu Lagoon commonly exceeded the USEPA single sample standard for enterococcus in marine recreational water at low tide when the lagoon was discharging to the ocean. The occurrence and concentrations of FIB at Surfrider Beach closely parallel the occurrence and concentrations of FIB data collected from the discharge of the lagoon. Of the three beach sites sampled, FIB concentrations were lowest in the near-shore ocean adjacent to unsewered residential development in the Malibu Colony area in both the July 2009 and April 2010 sample periods.

FIB data collected during both July 2009 and April 2010 have been entered into the U.S. Geological Survey's computerized data base NWIS (National Water Information System) and are publicly available on line at http://waterdata.usgs.gov/nwis. Chemical, isotopic, and genetic analyses of samples collected during the April 2010 sample period have not yet been completed. Please contact me at 619-225-6127 or John Izbicki at 619-225- 6131 if you have any questions concerning these preliminary results. We look forward to working with you and your staff on the completion on this important study.

Sincerely,

for
Peter Martin
Program Chief

Figure 1.—Sampled wells, July 2009 to April 2010, Malibu, California

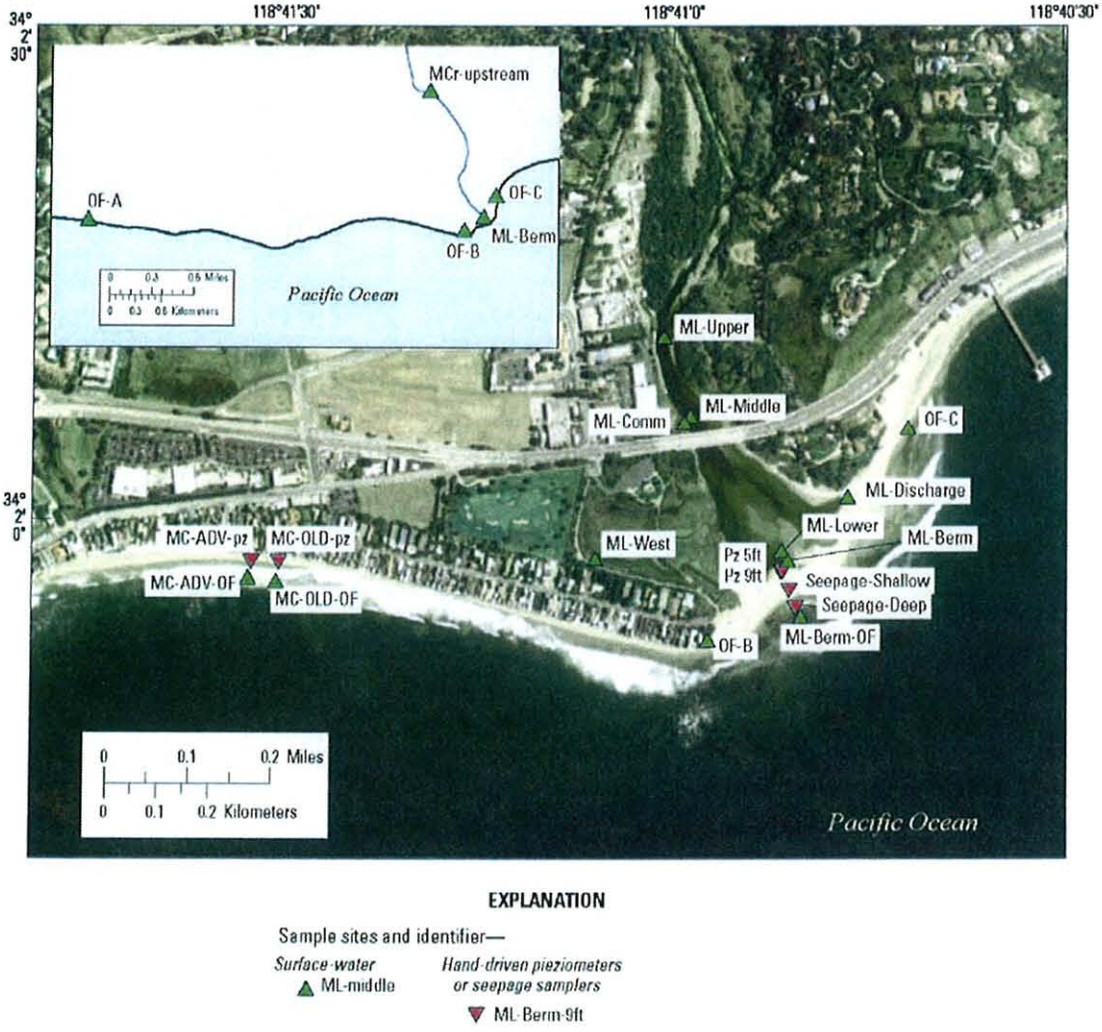

Figure 2.—Surface water sample sites, July 2009 to April 2010, Malibu, Calif.