Monitoring Water Quality at Lake Merritt, Oakland, CA Following Improvements to the Tidal Channel of the San Francisco Bay

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Introduction:

Lake Merritt is a saltwater tidal lagoon that forms a portion of a wildlife refuge just east of downtown Oakland, California and is significant in its role as both a recreational center, as well as a refuge for migratory wild birds. It is, however, surrounded by streets and freeways, and even experiences a large amount of water traffic by motor-driven boats and pontoons. In fact, Lake Merritt has been designated as an impaired water body by the Environmental Protection Agency due to low dissolved oxygen levels. Thus, fluctuating quality of Lake Merritt waters has been a major concern for community members for many years. In response to such concerns the City of Oakland sponsored the construction of a 230-meter long channel to connect Lake Merritt with the San Francisco Bay as a means of improving water flow and quality. In an effort to assess the impact of this channel and to contribute to a better understanding of the Lake's water quality, members of an elective science class at MetWest High School located in an area adjacent to the the Lake Merritt Channel collected and analyzed water samples from four sites over a span of four months.

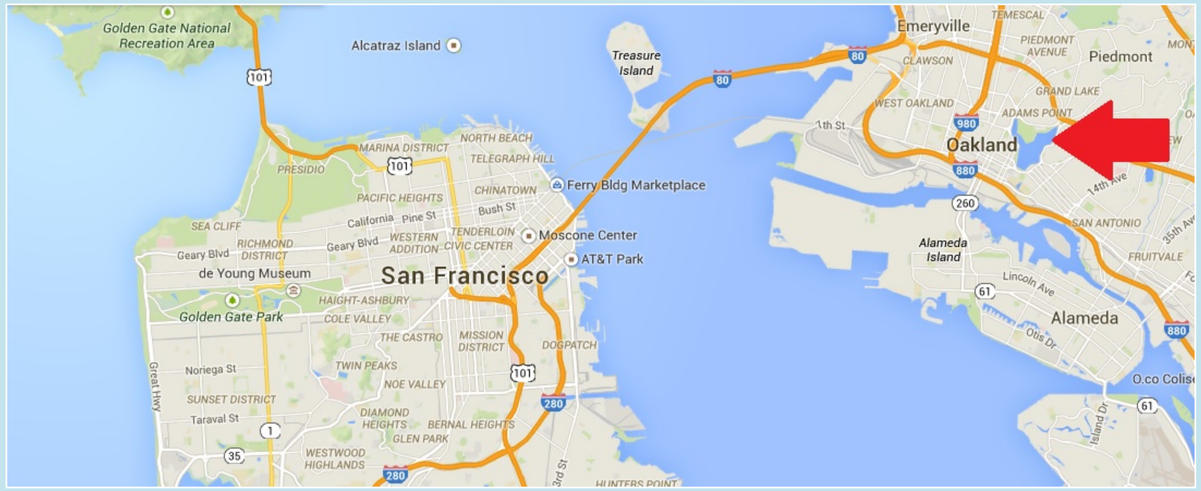
Materials and Methods:

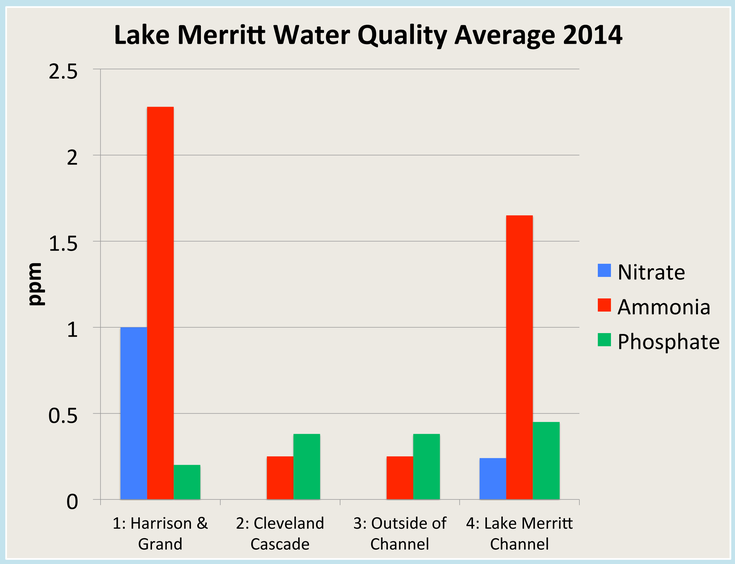
Test kits produced by Aquarium Pharmaceuticals Incorporated (API) were used to measure nitrate, phosphate, and ammonia concentrations in collected water samples. Nitrate, phosphate and ammonia levels were investigated because in high concentrations they affect habitats and often point to anthropogenic sources. For each test, a small sample of Lake water was obtained and mixed with indicator chemicals. The results were then compared to a color scale.

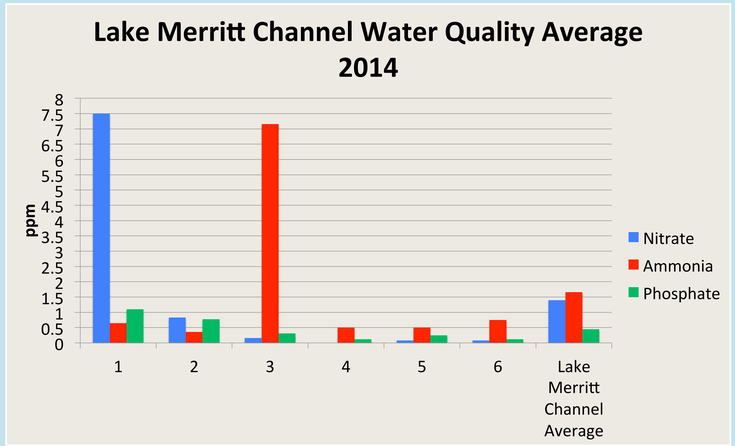
Samples were collected from four different sites located in and around Lake Merritt on multiple days. These sites included those located at the intersection of Harrison Street and Grand Avenue – Site 1, Cleveland Cascade – Site 2, Outside of Lake Merritt Channel – Site 3, and within the Lake Merritt Channel – Site 4. In addition, samples were collected from six sites located within the Lake Merritt Channel.

Results and Discussion:

Results of analyses are shown in Figures 3 and 4. As the figures indicate, high levels of ammonia were detected in waters collected from two of the four primary sample sites (Harrison Street/Grand Avenue and Lake Merritt Channel). In addition, measurable amounts of nitrate were detected in waters collected from the Harrison Street/Grand Avenue sample site. The City of Oakland uses the Regional Water Quality Control Board limit for un-ionized ammonia discharged into the San Francisco Bay of 0.4 mg/l.







Results and Discussion (continued)

The average concentration of ammonia in the Lake Merritt Channel area is 1.7mg/l for the study period. Analysis of samples collected from the six sites within the Lake Merritt Channel revealed that sub-site 3 had the highest average concentration of 7mg/l. This sub-site is a tidal channel cut by storm drain through a recently exposed tidal mudflat. In close proximity to a grate that leads to this storm drain student researchers found homeless encampments. The high levels of ammonia may be due to direct input of urine into the storm drain from transient human populations. Sewage leakage may also be a source for the high ammonia concentrations.

Site 1 at Harrison and Grand has a high ammonia concentration of 2.28mg/l. This site is the inlet for Glen Echo Creek. The source for the ammonia input may be prove to be difficult to determine as Glen Echo Creek has numerous storm drains that empty into the stream.

Nitrate levels are higher than average concentrations found in bodies of water open to the sea but are not at levels that pose major health hazards to humans or wildlife. Sub-site 1 in the Lake Merritt Channel has a nitrate concentration of 7.0ppm, many fish can live within the range of 5ppm to 10ppm.

Phosphate levels of 1.0ppm and higher can induce algal blooms that can further degrade water bodies. Concentrations of phosphates found during the study are all under 1.0ppm and are likely due to naturally occurring processes of decay.

Conclusions:

Based on findings generated thus far, recent construction projects aimed at improving the overall water quality of Lake Merritt appear also to be having a negative impact. In particular, the project surrounding the Lake Merritt Channel has created temporary sites of waste and storage of construction materials, which has encouraged occupation of these areas by transient communities. Additionally, observed high concentrations of ammonia in samples collected at the Harrison and Grand site, where no construction sites or homeless encampments exist may indicate a larger problem of sewage leaks or widespread public urination into Oakland's creek system.

As a contribution to understanding the impact of new construction projects on the quality of Lake Merritt waters, results generated through this research will be shared with environmental service staff affiliated with the City of Oakland in the near future. In addition, this information will be shared with other local agencies engaged in watershed protection efforts. Given recently awarded support from the National Oceanic and Atmospheric Administration (NOAA), Lake Merritt monitoring efforts initiated in 2014 will continue throughout the coming year.