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CALIFORNIA REGIONAL WATER QUALITY BOARD

SAN DIEGO REGION

IN THE MATTER OF: SHIPYARD SEDIMENT SITE TENTATIVE CLEAN-UP AND ABATEMENT ORDER NO. R9-2005-0126	**CITY OF SAN DIEGO'S NOTICE OF SUBMISSION OF EXPERT REPORT**

TO THE REGIONAL WATER QUALITY CONTROL BOARD, DESIGNATED PARTIES, AND THEIR ATTORNEYS OF RECORD:

PLEASE TAKE NOTICE that the City of San Diego hereby submits the attached expert report pursuant to the October 10, 2010 Order of the California Regional Water Quality Control Board, San Diego Region.

Dated: March 11, 2011

GORDON & REES, LLP

By: _____
Brian M. Ledger
Kristin N. Reyna
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Attorneys for City of San Diego

REVIEW OF CHOLLAS CREEK INFLUENCES ON THE SAN DIEGO BAY SHIPYARD SEDIMENT SITE AS DISCUSSED IN THE DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT DATED SEPTEMBER 15, 2010

Prepared for:

Gordon & Rees, LLP

Prepared by:

REVIEW OF CHOLLAS CREEK INFLUENCES ON THE SAN DIEGO BAY SHIPYARD SEDIMENT SITE AS DISCUSSED IN THE DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT DATED SEPTEMBER 15, 2010

Prepared for: Gordon & Rees, LLP and the City of San Diego

Prepared by:

MWH Americas, Inc.	HDR, Inc.
Roy Hummell	Richard Haimann, P.E.
Principle Scientist	Section Manager - Water Resources / Storm Water

Date: 3/10/2011

DISCLAIMER

This report has been prepared in accordance with the terms set out in the contract between The City of San Diego and MWH. The information, evaluations, and opinions contained herein were based on data and results prepared by or obtained from other parties not under the direct control of MWH. In preparing this report, MWH made us of, and relied upon, data, drawings, analyses, reports, memos, letters, e-mails, and other information provided by others. MWH did not perform independent investigations to determine the validity or suitability of such items and information. Therefore, MWH, HDR, nor the City of San Diego make any warranty, express or implied, or assume any liability with respect to the use of any information, method, product, process, or statement contained in this report. Any recipient of this report, by their receipt and use of this report, hereby releases MWH, HDR and the City of San Diego from any liability for direct, indirect, or consequential loss or damage, whether arising in contract, tort (including negligence), strict liability, or otherwise.

1. INTRODUCTION

The San Diego Shipyard Sediment Site (Site) is along the eastern shore of central San Diego Bay and encompasses an area extending approximately from the Sampson Street Extension to the northwest and Chollas Creek to the southeast and from the shoreline out to the San Diego Bay main shipping channel on the southwest. This area is herein referred to as the "Site." A Draft Technical Report for Tentative Cleanup and Abatement, Order No. R9-2011-0001 is currently under review and herein referred to as the "DTR." The DTR notes the San Diego Water Board alleges that the City of San Diego has, as cited on page 4-1 of the DTR:

> "discharged urban water containing waste through its MS4 to Chollas Creek resulting in the exceedances of chronic and acute California Toxics Rule copper, lead, and zinc criteria for the protection of aquatic life. Studies indicate that during storm events, storm water plumes toxic to marine life emanate from Chollas Creek up to 1.2 kilometers into San Diego Bay, and contribute to pollutant levels at the Shipyard Sediment Site."

The DTR states that this allegation is based on (page 4-3):

> "Available studies (Schiff, 2003, Katz et al., 2003; Chadwick et al., 1999) indicate that storm water plumes emanating from Chollas Creek outflow to San Diego Bay are toxic to marine life and introduce suspended solids, copper, zinc, and lead to the Shipyard Sediment Site through settling of particles."

The available studies referred to above are:

- Schiff, Kenneth, Steven Bay, and Dario Diehl. 2003. Stormwater Toxicity in Chollas Creek and San Diego Bay, California. Environmental Monitoring and Assessment 81: 119–132, 2003. 2003 Kluwer Academic Publishers. Printed in the Netherlands. (Herein referred to as Schiff 2003)
- Katz, C.N., A. Carlson-Blake, and D.B. Chadwick 2003. Not found[1].
- Chadwick B., J. Leather, K. Richter, S. Apitz, D. Lapota, D. Duckworth, C. Katz, V. Kirtay, B. Davidson, A. Patterson, P. Wang, S. Curtis, G. Key, S. Steinert, G. Rosen, M. Caballero, J. Groves, G. Koon, A Valkirs, K. Meyers-Schulte, M. Stallard, S. Clawson, R. Streib Montee, D. Sutton, L. Skinner, J. Germano, and R. Cheng. 1999. Sediment Quality Characterization - Naval Station San Diego Final Summary Report. U.S. Navy Technical Report 1777. (Herein Referred to as Chadwick 1999).

This document reviews the studies noted above and provides our expert opinion that references noted in the DTR do not support the allegations being made.

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[1] The poster provided in the record does not identify a conference or date of presentation. Document search identified the following in a list of publications posted to the web by the US Navy: Spatial and Temporal Evolution of Storm Water Plumes Impacting San Diego Bay presented at Estuarine Research Federation Annual Meeting, St. Pete Beach, FL, November 2001. We could not obtain a copy of this reference.

2. THE REPORTS LACK INFORMATION PREVENTING A DETAILED PEER REVIEW AND THUS ARE NOT CONSISTENT WITH THE PRINCIPLES OF THE SCIENTIFIC METHOD

Scientists have biases that influence their view based on collective experiences. While these biases are not always conscious and certainly not intentional, they are widely recognized to exist. To overcome these biases, the principles of science commonly referred to as the scientific method have evolved in an attempt to be as objective as possible by embracing fundamental approaches which include:

- Adopting a practice of full disclosure by documenting, archiving, and sharing all data and methodology so they are available for careful scrutiny by other scientists giving them the opportunity to verify the results, and most importantly, reproduce them.
- Proposing hypotheses and testing these hypotheses through experimental studies using methods that are repeatable. Through this testing of hypotheses, scientific theories can be developed when independently derived hypotheses come together in a coherent and supportive structure.

The documents referenced above by the DTR do not appear to follow the scientific method. The data are not included in the reports and could not be found in California's Environmental Database Network, Geotracker or other database links as provided on the Regional Water Quality Boards Web Site as of 3/5/2011. This prevents an independent scientific review of the information. The lack of data availability and independent review of such information and its use in the DTR to assign responsibility to the City of San Diego is particularly problematic since two of the three documents are authored by employees or contractors of the U.S. Navy, and one of the documents cited is published by the U.S. Navy, a stakeholder in this process.

Specifically, an independent review of this information should include access to the following information:

a. Schiff (2003): although this document indicates that methodological details are provided in another document (Schiff et al. 2001. Stormwater Toxicity in Chollas Creek and San Diego Bay. Technical Report 340. Southern Coastal Water Research Project), our review of this document and that referenced did not identify the following:

   i. While the papers note a digital global positioning system (dGPS) was used to record the sampling locations, no table reports location data, and the one figure that is provided is so small and has such limited features, the locations are not legible or precise enough to be replicated.

   ii. While Schiff (2001) provides a summary of the toxicity tests, these data only provide statistical measures of means and standard deviations. The raw data is not provided. There are several data streams that should be monitored and reported as well and these include test chamber salinity and temperature. Notes to the toxicity test results indicate there were issues with some test chambers but are not specific.

   iii. There is no raw data for the analytical chemistry, specifically the output of the laboratory instrumentation. EPA Contract Laboratory Program (CLP) procedures require analytical results be run and reported with performance duplicates and lab blanks allowing scientists to assess the influence of contamination from labs, and the performance of lab equipment which has repeatedly been demonstrated to be highly variable. CLP procedures were developed to allow verification of procedures and duplication of results and are the industry standard for documenting environmental sample analysis.

b. Chadwick (1999)

   i. Chadwick et al. (1999) estimate total annual mass loads and percent contributions historically from different sources, including Chollas Creek, on page 95, sections 6.2 and Tables 29 and 30. The means of estimating historical storm water inputs are not presented. How the volumetric discharges are estimated is not presented. Since these methods are not provided, we cannot independently verify their accuracy, thus preventing the report from independent peer review.

   ii. On page 95, section 6.2, and Tables 29 and 30, the report does not provide measures of statistical error. Thus, the uncertainty associated with the provided estimates cannot be evaluated.

c. Katz (2003).

   i. The document has a blank cover page with the handwritten notation of "Conference 2003, April 8, 2003, and Katz et al. 2003). But the following page, which is a copy of the actual poster, has no date or indication of where it was presented or published. We are unable to verify that Katz (2003) even exists. Searches of Agricola, Google Scholar, and other databases which list such documents do not result in any findings that such a presentation was made. A poster of the same title is referenced among publications by the U.S. Navy in a now deleted web page (available through Google's cached document archive). Given the citation is incorrect and unavailable, it further demonstrates our concern that this information has not received independent scientific review.

   ii. The ability to evaluate the adequacy of the study design, sampling and analytical methodology, and the discussion of results and conclusions included in the poster is limited because of the abbreviated discussion of the overall study in this format.

3. EXTRAPOLATING TOXIC EFFECTS AND HARMFUL SUBSTANCE CONTRIBUTION TO THE SITE SEDIMENTS FROM CHOLLAS CREEK BASED ON THE PURPLE SEA URCHIN TOXICITY TEST IN SURFACE, STORMWATER PLUMES IS INVALID AND NOT SUPPORTED BY THE SITE DATA

The DTR bases conclusions that Chollas Creek releases a toxic plume impacting sediments at the Site based on purple sea urchin fertilization tests provided in Schiff (2003). Schiff (2003) (which references Schiff (2001) for detailed methods) notes (emphases added):

> "This study observed that stormwater plumes emanating from Chollas Creek extended between 0.02 and 2.25 km^2 over San Diego Bay during small to moderately-sized storm events. Plumes were easily distinguished using salinity as a conservative tracer of wet weather inputs. Turbidity was also a good tracer of the plume. ***Stormwater plumes formed relatively thin lenses of 1 to 3 m, floating on top of the more dense bay water.***

Thus, the toxicity reported by Schiff (2003) is based on the surface water plume of less than 3 m that floats above the lower water column and bottom sediments. No evidence or data is provided to demonstrate the chemicals or solids responsible for this observed toxicity in the surface are transported to the deeper portions of the water column and the bottom sediments. In fact, the data collected to evaluate sediment toxicity during the Shipyard Site remedial investigation indicate the toxicity observed at the surface water during storm events does not occur at the in waters and sediments near the bottom of the Site. Of note:

1. Purple Sea Urchin fertilization in waters associated with the bottom sediments of the Site was over 87% in all samples[2]. This is a level significantly above that seen in Schiff (2003), and comparable to the reference samples. This contradicts the allegation that Chollas Creek is contributing toxic levels of any substance to the Site.
2. Three toxicity tests including the urchin fertilization test have been conducted on the Site's sediments and there was no correlation between the chemical concentrations of copper, zinc, or lead and the toxic effects measured.

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[2] See Table 18-8, page 18-16 in DTR Volume 2

4. THE EXTENT THAT CHOLLAS CREEK INFLUENCES THE SITE IS OVERESTIMATED IN SCHIFF (2003)

Much of the site and observed toxicity is along the shoreline which has significant structural obstructions making this area quiescent with a low likelihood of exposure to the freshwater plumes from Chollas Creek. The Schiff (2003) plume maps (figures 2 through 8) which show temperature, salinity, turbidity (beam attenuation), and toxicity results right up to the shore are likely not based directly on any data collected from these areas (again it is impossible to review since locations are not provided). Nowhere in the text is there mention of the authors having received access to these restricted areas to perform the sampling. We believe the results showing the area of impacts on these figures are extrapolations based on Kriging the extent of the plume. This geostatistical method referred to as Kriging does not take into account advection, dispersion, or transformation. Where hard boundaries exist such as shorelines, Kriging will extrapolate right up to the boundary. However, in theory, advection to a hard boundary is very limited and movement toward a hard boundary tends to be via diffusion, which is a very slow process compared to advection. Schiff (2003) do not provide data indicating the Chollas freshwater plume extends up to the shoreline. The use of Kriging or other geostatistical methods to predict concentrations beyond the boundaries of sampling is incorrect. Geostatistical tools are developed for characterizing data within the sampled area. Such tools have no predictive abilities, and thus should not have been used to determine the area influenced by the surface waters of Chollas Creek.

5. THE AREA DETEREMINED AS IMPACTED BY THE HDYRODYNAMIC MODEL REPORTED IN CHADWICK (1999) IS INCORRECTLY PERFORMED AND LACKS RELEVANT INFORMATION INFLUENCING FATE AND TRANSPORT.

A similar deficiency is noted in the hydrodynamic model presented by Chadwick (1999). This model does not appear to take into account physical obstructions to flow such as ships docked at NASSCO piers 3-6 at the mouth of Chollas Creek, which is a typical situation. Such ships almost (or sometimes do) touch bottom at that location, which creates a physical impediment to flow from Chollas Creek to the Shipyard. The Doppler meters used to calibrate the hydrodynamic model were most likely placed outside of piers and probably could not show the effects of the piers on waters between them. Again, the locations of the Doppler meters are not provided in the report and so it is impossible to review this data. Also this model uses a 100 meter grid which cannot be reasonably used to conclude movements of sediments at the scale of Chollas Mouth which is less than 100 m wide. Collectively these issues with the hydrodynamic modeling efforts in the shoreline area indicate model predicted results for this area are inaccurate.

In Chadwick (1999), Section 6.4.2, page 119 describes methods for modeling the creek discharges during storms using a half sine wave function. While the use of a half sine wave may fit the mathematical functions of the tidal model used, it does not match the creek discharges, creek hydrology, or storm functions in the region. Creek discharges from a storm may be significantly longer than one-half tidal cycles and will have several local maxima due to differing rainfall intensities during the storm. This suggests that loading estimates, transport direction and distance of transport would be inaccurately predicted for time steps relevant to tidal cycles from the tidal model used.

Direct data or a well calibrated model that includes all physical influences should be used to make such conclusions. Without either, and direct data being preferred over a mathematical model, it is not possible to conclude that Chollas Creek has introduced toxicity to the Shipyards Site, which is largely along the shoreline where physical obstructions occur.

6. MEASURED CHOLLAS CREEK DISCHARGE DATA AS REFERENCED IN KATZ (2003) ARE INCONCLUSIVE AND INCOMPLETE

The study by Katz (2003) included only one precipitation event over three days and data generated using different collection methods for different areas. The data were extrapolated to derive conclusions as to the proportion of total impacts caused by Chollas Creek stormwater discharge versus stormwater water discharge from NAVSTA. Upstream Chollas Creek stormwater samples were collected by the City of San Diego's contractor from two different tributaries on a flow-weighted basis and then composited into one sample. Stormwater samples from NAVSTA outfalls adjacent to the channel were collected on a time-proportional basis and composited into one sample. Flow weighted sampling provides a sample whose concentration represents the event mean concentration. Time proportional sampling does not, unless the flow rate is constant over the period of sampling. Storm flows are not constant. Therefore, the two sampling methodologies are not comparable and conclusions as to the difference (or lack thereof) in concentrations or mass loadings cannot be made using this data.

7. URCHIN TOXICITY DATA DOES NOT ADEQUATELY CONCLUDE THAT CHOLLAS CREEK WATER IS TOXIC

Data quality issues related to copper and zinc toxicity as presented by Schiff (2003) weaken the conclusion drawn that the concentrations of each metal were high enough in the tested samples to account for the observed toxicity. Toxicity test results for the purple sea urchin (*Strongylocentrotus purpuratus*) reported by Schiff (2001) are interpreted in part on the basis of the calculation of a toxicity unit (TU). The TU is inversely proportional to the median effective concentration (EC50, concentration producing 50% reduction in fertilization). The concentrations of metals in each sample tested were estimated based on the metal concentrations measured in undiluted samples and the estimated reduction in metals concentration based on sample dilution, where appropriate. The other measure of toxicity used in the interpretation of test results is the no observed effect concentration (NOEC).

There are three observations that do not support the conclusions regarding copper toxicity by Schiff (2001 and 2003):

a) The use of an EC50 concentration for copper that lies within the range of observed NOECs

   Given the definition of NOEC is a concentration below which no effects are observed, it seems infeasible that an EC50 concentration would occur below a NOEC concentration for a quality data set. However, Schiff (2001) in Table 2 state their toxicity tests had a NOEC range from 20-44 µg/L and selected the EC50 of 31 µg/L. The authors do not explain why a EC50 value within the range of NOECs found was selected.

b) The failure of one of the copper reference toxicant tests based on variability in the urchin response.

   A reference toxicant test is included with each batch of samples evaluated for toxicity as a quality measure to ensure that the test organisms are responding in a typical manner (i.e., that they are not organisms that are too unhealthy and susceptible to toxicity or too robust and insensitive to toxicity). The reference toxicant test can be run with any toxicant that has a record of response at the laboratory with the specific test species. The bioassay lab used by Schiff (2001) consistently used copper as the reference toxicant. In the first reference toxicant test associated with samples collected on January 25, 2000, the reference toxicant test was inconclusive because as stated in the report: "the reference toxicant had high variability precluding the calculation of a copper EC50."

c) The observed range of EC50s from copper reference toxicant tests that did not fail were all above the EC50 chosen by Schiff (2003) and used by the DTR to demonstrate copper as having a toxic influence on the Site.

   The range of copper EC50 concentrations reported in Schiff (2001) Appendix A are based on successful reference toxicant tests are: 55 µg/L (February 13, 2000), > 65 µg/L (February 22, 2000), and 40.8 µg/L (March 7, 2000). These test results are all above the EC50 of 31 µg/L used to draw conclusion about sample toxicity in the Schiff (2001) report.

The allegation that Zinc is the primary chemical causing toxicity is suspect. The reported EC50 in Table 2, Schiff (2001) of 29 µg/L is substantially below levels set forth in the California Toxics Rule (CTR; Federal Register Vol. 65, No. 97, Thursday, May 18, 2000) as reproduced below.

Copper criteria in the CTR

Freshwater (µg/L)		Saltwater (µg/L)	
Acute	Chronic	Acute	Chronic
120	120	90	81

The chronic concentration is defined as "the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects". The urchin test is 40 minutes. The fact that 50% of the sea urchins failed to successfully fertilize at concentrations well below zinc concentrations in the CTR, would strongly suggest that something other than zinc is causing the toxic response.

Given the sea urchin test under the conditions used by Schiff (2001) where salinity was adjusted is abnormally sensitive relative to the studies identified in the CTR, the authors should at least discuss alternative hypotheses. For example, the practice of adding salts to freshwater samples to test toxicity with a saltwater species (purple sea urchin fertilization) which would not otherwise occur in such an environment is a source of uncertainty. Reference samples were not collected from an uncontaminated "riverine plume" and then diluted. Therefore the reference samples are actually not processed exactly the same as the Chollas Creek samples. Any differences resulting from different handling should be considered as plausible influences, particularly given the value of zinc toxicity published in the reports are more than four times below the chronic freshwater CTR.

PROOF OF SERVICE

I am a resident of the State of California, over the age of eighteen years, and not a party to the within action. My business address is: Gordon & Rees LLP 101 W. Broadway, Suite 2000, San Diego, CA 92101. On March 11, 2011, I served the within documents:

CITY OF SAN DIEGO'S NOTICE OF SUBMISSION OF EXPERT REPORT

☐ by transmitting via facsimile the document(s) listed above to the fax number(s) set forth below on this date before 5:00 p.m.

☐ by personally delivering the document(s) listed above to the person(s) at the address(es) set forth below.

☐ by placing the document(s) listed above in a sealed envelope with postage thereon fully prepaid, in United States mail in the State of California at San Diego, addressed as set forth below.

☑ By Electronic Mail Service. I caused all of the pages of the above-entitled document(s) to be electronically served on the parties listed below.

SEE ATTACHED SERVICE LIST

I am readily familiar with the firm's practice of collection and processing correspondence for mailing. Under that practice it would be deposited with the U.S. Postal Service on that same day with postage thereon fully prepaid in the ordinary course of business. I am aware that on motion of the party served, service is presumed invalid if postal cancellation date or postage meter date is more than one day after the date of deposit for mailing in affidavit.

I declare under penalty of perjury under the laws of the State of California that the above is true and correct.

Executed on March 11, 2011 at San Diego, California.

Coral M. Rogers

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