

## Memorandum

TO: Janet B. O'Hara, SFBRWQCB

CC: Gerald Bowes, SWRCB

FR: Patricia A. Holden, UCSB

DATE: 11-15-15

RE: Peer Review of the Scientific Basis of the "San Francisco Bay Beaches Bacteria Total Maximum Daily Load and Associated Implementation Plan"

This memo provides the requested peer review of the "San Francisco Bay Beaches Bacteria Total Maximum Daily Load and Associated Implementation Plan", herein referred to as the Staff Report. The primary charge to peer reviewers is to assess the data and analytical methodologies used to develop the Staff Report, which recommends load reductions and numeric targets that are necessary to attain bacterial water quality standards. For each finding, assumption or conclusion of the Staff Report, the reviewers are to determine whether each is "based on sound scientific knowledge, methods, and practices". The date of the Staff Report reviewed is October 1, 2015.

### **1. Nature of the water quality problem**

The scientific basis is sound for establishing the conclusion that "the Bacteria Water Quality Objective is not being fully supported in the subject watershed". This assessment is based upon the indicator bacterial results as reported in the Staff Report. The magnitude of the water quality problem varies by beach, but the assessment overall is sound.

### **2. Desired Target Conditions**

The numeric target emphasizes Enterococcus and is consistent with EPA guidelines according to the Staff Report (Table 6.1). However, it is noted that strains of *E. coli* are known to be pathogenic and thus continued monitoring of *E. coli* may improve the relatedness of fecal indicator data to actual threats to human health.

The implementation of numeric targets in section 6.2 uses two different cut-offs for rejecting the null hypothesis versus the alternate hypothesis. A ten percent proportion could strictly be used, and it is recommended that this be considered as it could be more protective.

### **3. Source Analysis**

The potential sources discussed are logical and, as described, are hypothetical. Since there are no data to determine if the sources are real, one can comment on the logic related to the "sanitary survey" dimension of this report which, again, is logical and shows a reasonably good understanding of the study areas, infrastructure, and possibly influential fecal sources. Further studies would be needed, for each beach, to examine actual sources that could be controlled to bring beaches into compliance.

A question regards the SSOs: as mentioned in the detailed comments, it is unclear how the analysis was performed to rule these out as influential. The time period intervening the SSO event and sampling, even though sampling was after the

SSO event, may be influential in determining the effect of SSOs on water quality. This deserves to be examined more carefully.

#### **4. TMDL. Loading Capacity, and Allocations, and Margin of Safety**

The density basis of the TMDL is sound. The allocations as per Table 8.2 are sound. However, *E. coli* is a regulated fecal indicator that also includes pathogenic strains, and thus allocations of *E. coli* could be additionally protective.

#### **5. Linkage Analysis**

In this report, the sources are not identified, but are preliminarily hypothesized. The allocations in Table 8.2 are protective on the basis of Enterococcus. Because the allocations prohibit discharge of Enterococcus from human waste sources, these are likely to protect beneficial use as defined by the regulated water quality criteria. However, the absence of Enterococcus doesn't equate to the absence of pathogens.

#### **6. Implementation Plan**

The implementation plan involves invoking all relevant existing regulations regarding source controls (e.g. SSOs, sanitary sewer inspection and repair, pet waste cleanup enforcement, etc.) and performing MST according to State of California (Griffith et al. 2013) guidelines to determine sources of fecal indicator bacteria. This is reasonable, and can be reasonably applied to the already-hypothesized sources, including completing sanitary surveys and refining hypotheses, then designing study plans, and performing MST.

#### **Other Issues**

##### Broad comments

The discharge of WWTP effluent from multiple treatment plants into the areas described likely delivers other than fecal indicator bacteria: nutrients, contaminants of emerging concern and, as already noted, viruses and other infectious microbial forms resistant to disinfection practices. The State of California should be evaluating such issues in aggregate, not in isolation of one another. The health of the public and the waters in which recreation occurs is simultaneously affected by multiple contaminants. Rarely are individual contaminants in a mixture singularly effective in causing harm to receiving streams and organisms within. A holistic approach to addressing co-occurring contaminants would be more protective overall.

##### Detailed comments about the Staff Report

Overall, this is a very readable and accessible Report. Below are some recommendations or comments that are intended as helpful.

Section 1, page 1: It would be helpful to mention if the beaches in Figure 1.1 that are not included in this TMDL are not impaired, or if there are other reasons that they are not addressed.

Section 4.1, P12: The second bullet at the bottom states: "Fecal coliform are a subset

of total coliform and are more specific than total coliform to wastes from warm-blooded animals, but not necessarily to humans. As discussed further below, the U.S. EPA no longer recommends total coliform be used as FIB.” The question is if the last “total coliform” is in error and therefore if the author meant “fecal coliform” here, since “total coliform” was addressed in the preceding bullet.

Tables 5.1, 5.3 – 5.5, 5.7: The text regarding these tables emphasizes that wet weather was when most exceedances occurred. The basis for this conclusion would be more clear if the Tables were modified to show exceedances in wet, versus dry, weather, and noted when those occurred during AB411.

Table 5.6: Why doesn't Windsurfer Circle have a column in this Table?

P24: It is stated, as with most other beaches in the prior sections that, although Crissy Field Beach is exceeding water quality criteria mostly during wet weather, exceedances at Crissy Field Beach are not significantly from CSDs. How is this concluded? Table 5.8 displays overflow events relative to weekly sampling, but we don't know when the latter was. Was weekly sampling with a day, 2 days, etc. after the event? The timing of the overflow relative to weekly sampling at the beach could make a difference to this interpretation of the CSD not having an impact. Epidemiological studies guide swimmers to not swim within the vicinity of drains during 72 hours following a storm. Using 72 hours as a guide, does this window change the interpretation?

P37, Section 7.1.1: With the number of outfalls discharging to a Bay, the strict reliance on fecal indicator bacteria seems inadequate. It is known that viruses are more resistant to destruction by common disinfection approaches. The possibility for all of this discharge impinging on public health is the bigger issue that needs to be addressed, not just whether fecal indicator bacteria are being discharged. This would require other monitoring, e.g. for viruses, other resistant pathogens, and other inputs that can synergistically impair water quality.

Table 7.3: The relationships are unclear regarding these locations relative to the beaches that are the foci of the Staff Report.

P54, section 7.2.4, Conclusions: The Staff Report should be careful to not interchange “pathogens” with “fecal indicator bacteria” since, as pointed out early in the report, they are not the same, and the latter is all that are reported in the data used to drive this plan.