

Comment Summary and Responses

Comment Deadline: June 30, 2016

Amendment to the Water Quality Control Plan for the San Francisco Bay Basin to Establish a Total Maximum Daily Load (TMDL) and Implementation Plan for Bacteria at San Francisco Bay Beaches

Comment Reference	Organization	Representative(s)
1	San Francisco Public Utilities Commission (SFPUC)	Mr. Tommy T. Moala, Assistant General Manager, Wastewater Enterprise

SFPUC’s overarching comments, stated in the letter’s introductory and concluding remarks, are addressed in comments numbered 1 through 4, below, followed by the more detailed or specific comments.

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Overarching Comments			
1	SFPUC	The SFPUC is concerned that the TMDL numeric target and the wasteload allocation for urban runoff are likely unattainable due to non-controllable sources.	<p>Regional Water Board staff previously addressed this comment about non-controllable sources of bacteria (see Responses to Comments January 15, 2016, by the Regional Water Board, Comment A, 4.3b, and 4.3c).</p> <p>We agree with the underlying concept that natural sources of <i>Enterococci</i> may be present in waters at the beaches. However, given the clear evidence of human bacteria sources to the beaches, we disagree that the naturally occurring bacteria should be addressed before adopting the Basin Plan amendment or beginning efforts to control human bacteria sources and restore recreational uses of the beaches.</p> <p>The TMDL allows time for implementing parties to refine their understanding of bacteria sources at the beaches, using source tracking</p>

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			<p>tools that have been developed recently or are in pilot stages of development. <i>The California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches</i>, published in 2013, provides implementing parties with a useful guide for obtaining data on nonhuman bacteria sources. In combination with ongoing beach monitoring programs, such tools will allow implementing parties to more effectively (1) identify anthropogenic bacteria sources; (2) target control efforts, and, (3) identify natural sources of bacteria at the beaches that cannot be controlled.</p> <p>Further, of the beaches in San Francisco (Aquatic Park, Crissy Field, and three beaches in Candlestick Park), it is quite possible that at least three could achieve the numeric targets through implementation actions established in the TMDL, because even a modest reduction in the <i>Enterococcus</i> objective exceedance rate will make these beaches eligible for delisting. The two beaches with higher exceedance rates are co-located in a shallow embayment at Candlestick Park. Depending on the results of implementation actions and land use changes in the Candlestick Park catchment, which is undergoing redevelopment, it may or may not be necessary to consider a natural source exclusion in the future. However, it is reasonable and necessary to address controllable human sources of bacteria to these beaches before identifying or accounting for all natural or non-controllable sources.</p>
2	SFPUC	Establishing a recreational water TMDL based on cultured <i>Enterococcus</i> monitoring data is premature given that the underlying indicator is fraught with uncertainties. Continued reliance on <i>Enterococcus</i> as the basis for	Regional Water Board staff previously addressed many of the uncertainties associated with the use of <i>Enterococcus</i> as an indicator of human health impacts (see Responses to Comments January 15, 2016 by the Regional Water Board, Comments 2.1 and 4.3.a-b). This topic is discussed further in responses 3, 4, 9, 12, and 15, provided below. We acknowledge that <i>Enterococcus</i> is not a direct indicator of illness in humans exposed to water at a beach (see TMDL Staff Report Sections

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		<p>implementing a bacteria TMDL at beaches with non-point sources of fecal pollution does not make sense without first bringing the new molecular tools to bear. Given the limitations of <i>Enterococcus</i> as an indicator, the SFPUC requests that the TMDL not be approved before more investigative work, specifically microbial source tracking, is done.</p>	<p>4.1 and 7.1, which also acknowledge other uncertainties related to <i>Enterococcus</i>). Nonetheless, epidemiological investigations conducted by the U.S. Environmental Protection Agency (U.S. EPA) from 2003 to 2009 reaffirm earlier studies, all of which have found that the presence of <i>Enterococcus</i> in recreational water bodies is associated with gastrointestinal illness in humans (Section 4.2.2, TMDL Staff Report). These studies relied on culture methodologies to measure <i>Enterococcus</i>.</p> <p>In cases where uncertainties exist in the nature or measurement of a pollutant, the Regional Water Board seeks out the best scientific information available, with the goal of developing TMDLs that reflect this scientific information and contain appropriate implementation measures. To ensure technically and scientifically sound approaches, the Regional Water Board submits TMDLs and implementation plans for external peer review as required by California Law (Health and Safety Code section 57004). The San Francisco Bay Beaches Bacteria TMDL used the best available scientific information and was submitted for peer review. The two scientific peer reviewers provided positive reviews of the TMDL and implementation plan. (See Staff Report, Appendix E.)</p>
3	SFPUC	<p>Approval of this TMDL is premature without first investigating how much of the offending bacteria are naturally occurring versus anthropogenic and whether BMPs are available that could successfully address the problem. The SFPUC requests that the Water Board delay approval of this TMDL until these and related questions can be</p>	<p>As Regional Water Board staff stated in the January 15, 2016, Response to Comments, we agree that the relative contribution of natural sources of <i>Enterococci</i> is not quantified yet. However, given the clear evidence of human bacteria sources to the beaches, we disagree that the naturally occurring bacteria should be quantified before adopting the Basin Plan amendment or beginning efforts to control human bacteria sources and restore recreational uses of the beaches.</p> <p>It is both reasonable and necessary to begin controlling human sources of bacteria to Bay beaches before identifying or accounting for all natural</p>

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		answered.	<p>or non-controllable sources. Commenters do not dispute that human fecal bacteria are present at the Bay Beaches or that these bacteria reach the beaches in the ways the TMDL identifies. The public health benefit to controlling human sources is significant, whether or not the contributions of natural sources have been precisely defined. Our approach is not unique to this TMDL. For example, the Los Angeles Regional Water Board also rejected a natural source exclusion in its update of the 2002 Malibu Creek and Lagoon Bacteria TMDL, concluding that “a natural sources exclusion approach was premature when not all anthropogenic sources of bacteria to the lagoon have been controlled.” The San Francisco Bay Beaches Bacteria TMDL takes a similar approach, calling for anthropogenic sources of bacteria to be controlled, before a natural source exclusion is considered.</p> <p>Regarding the availability of BMPs that can successfully address the problem, the Staff Report clearly outlines the array of standard management practices for reducing bacteria loads, with information on the applicability and effectiveness of the various practices (see Section 10.1.2, Staff Report). Where monitoring studies determine that natural sources are the cause of impairment (i.e., controllable sources have been controlled), we will address modifying the numeric targets for that beach to include a natural source exclusion.</p>
Detailed Comments			
4	SFPUC	Despite the long use of enterococci as a human fecal contamination indicator, the efficacy of using the bacteria for this purpose has come under scrutiny in recent years. It is now known that <i>Enterococcus</i>	As stated in our response to Comment 2, Regional Water Board staff acknowledges uncertainties associated with <i>Enterococcus</i> . Here the Commenter also states that “their presence does not correlate with the presence of human pathogens at beaches with non-point sources of fecal contamination.” See our response to Comment 2, above, regarding the epidemiology studies linking <i>Enterococcus</i> to health effects. Further, this

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		<p>concentrations exhibit extreme variability in recreational waters, they occur naturally and grow in the environment, and their presence does not correlate with the presence of human pathogens at beaches with non-point sources of fecal contamination. These revelations introduce uncertainty into the evaluation of Enterococcus monitoring data.</p>	<p>comment’s reference to beaches with non-point sources of fecal contamination may not be entirely germane. As used here, “non-point sources” refers to natural sources of bacteria associated with birds, wildlife, and large open spaces. Because the Commenter is an implementing party at beaches in the City of San Francisco, which have small, entirely urban watersheds largely served by a combined wastewater and storm water treatment system, birds would be the major “non-point” source. Uncontrollable sources such as birds will be present to some extent in San Francisco watersheds; however, controllable sources, such as sewer collection systems and urban runoff are likely present to a greater extent.</p>
5	SFPUC	<p>Technological advances in microbial source tracking have outpaced regulations. The advent of molecular techniques provides the opportunity to greatly improve monitoring programs by identifying sources. Recognizing the inadequacy of current indicators, Boehm and others have stated that “In some situations, [beach] managers find themselves spending valuable resources issuing swimming advisories, establishing TMDLs, and developing implementation strategies to address perceived pollution problems at a beach where no real threat to public health exists to recreational swimmers.”</p>	<p>Regional Water Board staff concurs that microbial source tracking methods are improving rapidly. The TMDL implementation plan accounts for this by providing a phased approach. The first phase calls for early action to control anthropogenic sources closest to the beach. During this time, implementing parties also may investigate bacteria sources in order to (1) direct their subsequent actions to reduce bacteria loads, and/or (2) document natural, uncontrollable sources of bacterial at the beaches. If the TMDL targets are not met within five years, the second phase of implementation requires taking action over a broader area and conducting further source investigations.</p> <p>Based on data collected weekly for seven years, we disagree that there is no real threat to recreational swimmers.</p>

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6	SFPUC	Epidemiological studies have found, at beaches impacted by point source fecal contamination, that a 30- day average (geometric mean) of <i>Enterococcus</i> concentrations correlates with increased risk of gastrointestinal and other illness for persons engaged in water contact recreation. However, other studies have shown that the correlation of enterococci with gastrointestinal illness breaks down at beaches impacted by non-point sources of fecal contamination in California and elsewhere (<i>citations omitted.</i>)	So noted. Please see our response to Comment 4, above.
7	SFPUC	It is important to note that enterococci are (usually) not themselves pathogenic and the causative pathogens were not identified in the epidemiological studies (<i>citation omitted.</i>)	So noted. Please see our response to Comment 2, above.
8	SFPUC	Concentrations of enterococci are extremely variable. Two samples taken within minutes of each other can have significantly different results. Enterococci concentrations vary by time of day and tidal cycle. Boehm stated that “Policy makers... are cautioned that a single sample of	This comment, in referring to swimmers on a particular day, pertains to the action of posting warning signs at beaches that are monitored by public health agencies (or their proxies) for <i>Enterococci</i> . The TMDL is based on data collected weekly and generally at the same time of day over a seven-year period. Thus, daily variations in <i>Enterococcus</i> densities are not a significant factor in the development of the TMDL

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		<p>water reveals little about the true water quality at a beach.” For example, an analysis of <i>Enterococcus</i> monitoring data at Huntington Beach found that even if posting decisions were revised every 10 minutes the error rate could still be as high as 30%. Given the extreme variability in concentrations of <i>Enterococci</i> and the impracticality of frequent sampling, there is huge uncertainty that the results from a single sample represent the enterococci concentrations encountered by swimmers on that day (<i>citations omitted.</i>)</p>	
9	SFPUC	<p>The risk of illness from recreating in waters contaminated by non-human feces is largely unknown. One study has shown that the risk of illness from exposure to waters impacted by cattle feces may be similar to the risk from waters impacted by human sources, but the risk to humans from waters impacted by gull, chicken, or pig feces is substantially less. Similar studies have not been done for most wildlife or pet species. Standard methods for enumerating</p>	<p>We agree that the state of the science is not sufficiently developed to determine the precise human health risk from recreating in waters contaminated by the feces of various warm-blooded mammals. However, as we stated in Comment 2, there is a well-documented correlation between human health risk from water contaminated with human feces, and all the beaches addressed in the TMDL have inputs of human fecal bacteria. Our response to Comment 4 is also pertinent, in regards to non-point sources of bacteria. Note, however, that the TMDL is not focused on the health risks from a single sample; it is based on data collected over a seven-year period.</p>

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		<p><i>Enterococci</i> do not identify sources, so it is impossible to know the true risk to human health from a single sample with enterococci above a selected threshold (<i>citation omitted.</i>)</p>	
10	SFPUC	<p>Some species of <i>Enterococci</i> occur naturally and are ubiquitous in the environment associated with plants, soils, and maybe food. <i>Enterococci</i> can survive and grow in sediment, eel grass, beach wrack, and other environments long after a contamination event. A study of beach sands at 55 beaches along the California coast found that <i>Enterococci</i> were nearly ubiquitous. <i>Enterococci</i> in beach sands and eel grass have been shown to contribute to water quality exceedances. The association of pathogens with these environmental and naturalized enterococci is largely unknown. Furthermore, human associated <i>Enterococci</i> are not all fecal, but are also found externally and in bodily fluids, abscesses and wounds. Thus, bathers at the beach can contribute to water quality exceedances of <i>Enterococci</i>. There is huge</p>	<p>As stated in our response to Comment 2, Water Board staff acknowledges there are uncertainties associated with <i>Enterococcus</i> and notes that, despite these uncertainties, a correlation between <i>Enterococcus</i> in water and human illness has been established.</p>

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		uncertainty that detection of <i>Enterococci</i> in recreational waters represents recent fecal contamination (<i>citations omitted.</i>)	
11	SFPUC	<i>Enterococci</i> are generally not pathogenic themselves, but because they occur in human guts and feces they are associated with human fecal contamination and thus their presence is assumed to indicate the presence of human pathogens.	Comment noted.
12	SFPUC	<i>Enterococci</i> measurements do not identify the species or the source, thus there is huge uncertainty that swimmers are exposed to pathogens even when enterococci sample results exceed water quality standards. An epidemiology study at a southern California beach impacted by non-point sources of fecal contamination found “No correlation was observed between enterococcus, fecal coliform, or total coliform and the risk of illness. Using diarrhea as an example, there was no notable elevation in risk with enterococcus...”. Boehm and Sassoubre have stated “There is a striking lack of data to support an	We disagree with the characterization of the level of uncertainty that <i>Enterococci</i> are associated with human pathogens, and thus human illness. The first study described in this comment was done at a beach with non-point sources – please see our response to Comment 4. In addition, the study used diarrhea as the necessary endpoint to indicate human illness, while the U.S. EPA studies use less severe endpoints, including nausea, in order to fully protect the recreational beneficial use. As stated in our response to Comment 2, we acknowledge there is uncertainty in the use of <i>Enterococcus</i> as an indicator for fecal bacteria (and indirectly of pathogens), but we maintain that it is a useful and valid indicator.

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		<p>association between enterococcal and virus concentrations, or the concentration of pathogens in general, in recreational waters”. Further, a study in Santa Monica Bay found “There was no significant correlation between the presence of enteroviruses and microbiological indicators of fecal contamination, specifically total coliforms, fecal coliforms, or enterococci”. There is huge uncertainty that detection of <i>Enterococci</i> in recreational waters is associated with the presence of human pathogens (<i>citation omitted.</i>)</p>	
13	SFPUC	<p>Because culture methods of identifying and enumerating bacteria take 18 to 24 hours and even polymerase chain reaction (PCR) takes hours, notification to the public is necessarily after the fact and frequently not indicative of current conditions.</p>	<p>As with Comment 8, this comment pertains to the action of posting warning signs at beaches that are monitored by public health agencies (or their proxies) for <i>Enterococci</i>. It is not germane to the TMDL.</p>
14	SFPUC	<p>There are analytical uncertainties associated with measuring <i>Enterococcus</i> concentrations. Thoe and others point out that “...although analytically a measurement of 106</p>	<p>This comment pertains to the action of posting warning signs at beaches, but it could be germane to the TMDL if the TMDL were based on a minimal amount of data. The TMDL is based on hundreds of data points collected over a seven-year period, which minimizes the impacts of any statistically variability.</p>

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		<p>MPN/100 mL may not be statistically different from 103 MPN/100 mL at the 95% confidence level, the former will result in a beach posting for ENT [enterococci] and the latter will not". When investigating the relationship between most probable number (MPN) and colony forming unit (CFU) estimates of fecal coliform concentrations, Gronewold & Wolpert found that "...MPN and CFU intra- sample variability does not stem from human error or laboratory procedure variability, but is instead a simple consequence of the probabilistic basis for calculating the MPN"(citations omitted.)</p>	
15	SFPUC	<p>The uncertainties discussed above are unlikely to be eliminated until we monitor pathogens directly. Rapidly developing molecular technologies have put this possibility within reach, although there is more work to be done. However, some available technologies (e.g., quantitative and digital polymerase chain reaction and molecular microarrays such as the PhyloChip and ViroChip) now allow detection and quantification of</p>	<p>Comment noted. Please see the response to Comment 1. The new technologies referred to in this comment do not eliminate all of the uncertainties described in the comments above; however, these tools should prove useful in implementing this TMDL. For example, additional monitoring, including molecular testing when deemed necessary, should help answer the following questions:</p> <ul style="list-style-type: none"> • Could bacteria sources be reduced by placing enhanced urban runoff BMPs in a certain location? • Could bacteria sources be reduced by focusing sewer system investigations and repairs in a certain location? • Are natural sources of bacteria contributing to a significant

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		human and non-human sources of fecal contamination. Species identification methods can determine fecal vs. environmental <i>Enterococcus</i> , and quantitative microbial risk assessment source-apportionment can determine the contributions of <i>Enterococcus</i> from various sources and allow a health-risk based approach to managing beach water quality (<i>citation omitted.</i>)	degree to the impairment at the beach?