APPENDIX H. DEVELOPMENT OF NUMERIC GOALS FOR CHOLLAS CREEK

Chollas Creek is subject to the following Total Maximum Daily Loads (TMDLs), which have been adopted by the California Office of Administrative Law, and are currently being implemented:

- TMDLs for Dissolved Copper, Lead, and Zinc in Chollas Creek (Metals TMDL); San Diego Regional Water Quality Control Board (Regional Board) Resolution No. R9-2007-0043. Approved October 22, 2008 (Regional Board, 2008); and

- The Revised TMDLs for Indicator Bacteria, Project I – Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek) (Bacteria TMDL); Regional Board Resolution No. R9-2010-0001. Approved February 10, 2010 (Regional Board, 2010).

A TMDL represents the maximum amount of a pollutant of concern that a waterbody can receive and still attain water quality standards. TMDLs can take a variety of forms, including concentration-based TMDLs, which focus on reducing pollutant sources to achieve a maximum pollutant concentration consistent with existing water quality objectives (WQOs), and load-based TMDLs, which focus on reducing sources to achieve a watershed-specific maximum load that is protective of beneficial uses. The Chollas Creek Metals TMDL represents a concentration-based TMDL, whereas the Bacteria TMDL incorporates load-based reductions that were calculated on the basis of watershed modeling results and applicable bacteria WQOs.

The following sections summarize how the Metals TMDL and Bacteria TMDL targets were derived and how these targets were translated into Water Quality Improvement Plan numeric goals. Development of numeric goals for each parameter required consideration of the applicable Basin Plan WQOs, TMDL requirements, and other regulatory requirements (e.g., California Toxics Rule). Based on this information, numeric goals were developed to meet the requirements of the Municipal Permit. Attachment E.4 of the Municipal Permit provides the following options to meet numeric goals and to demonstrate final compliance with established TMDLs:

(1) There is no direct or indirect discharge from the Responsible Party's (RP's) municipal separate storm sewer systems (MS4s) to the receiving water; OR

(2) There are no exceedances of the final receiving water limitations in the receiving water at, or downstream of, the RP's MS4 outfalls; OR

(3) There are no exceedances of the final effluent limitations at the RP's MS4 outfalls; OR

(4) The RPs develop and implement the Water Quality Improvement Plan as follows:

(a) The RPs incorporate best management practices (BMPs) to achieve the receiving water limitations and/or the effluent limitations for Chollas Creek;

(b) The RPs include an analysis in the Water Quality Improvement Plan, utilizing a watershed model or other watershed analytical tools, to demonstrate that the implementation of the BMPs achieves compliance with the final receiving water and/or effluent limitations;

(c) The results of the analysis must be accepted by the San Diego Water Board as part of the Water Quality Improvement Plan;

(d) The RPs continue to implement the BMPs; and

(e) The RPs continue to perform the specific monitoring and assessment specified to demonstrate compliance with the receiving water and effluent limitations (Regional Board, 2013a).

Compliance with the Bacteria TMDL may also be demonstrated via the following methods:

(1) The pollutant load reductions for discharges from the RP's MS4 outfalls are greater than or equal to the final effluent limitations; or

(2) The RPs can demonstrate that exceedances of the final receiving water limitations in the receiving water are due to loads from natural sources, AND pollutant loads from the RP's MS4 are not causing or contributing to the exceedances.

These options (and the resulting Water Quality Improvement Plan numeric goals) provide multiple compliance pathways that can be met within the receiving water or within the watershed to comply with the requirements of the TMDLs.

Section 3 presents the Chollas Creek Metals TMDL and Bacteria TMDL numeric goals that were developed by considering these options to demonstrate compliance. Most of the goals were derived directly from the Water Quality-Based Effluent Limitations (WQBELs) that are presented in the TMDLs and incorporated into the applicable Basin Plan WQOs (e.g., final bacteria goal of zero (0) percent dry weather days that are allowed to exceed bacteria WQOs). Goals were calculated on the basis of updated watershed modeling analyses, as described in the following sections. The modeling results provide compliance analysis that the strategies will meet the Water Quality Improvement Plan goals.

H.1 IDENTIFICATION OF METALS TMDL NUMERIC GOALS

The final numeric goals for Chollas Creek were derived from the Water Quality-Based Effluent Limits (WQBELs) that were identified in the Metals TMDL and incorporated into the Municipal Permit. As discussed above, the Metals TMDL is concentration-based, so the WQOs and TMDL receiving water numeric targets are identical (Regional Board, 2008).

H.1.1 Receiving Water and Effluent Limitations for Metals

The Metals TMDL receiving water targets were set to be equal to the California Toxics Rule (CTR) criteria for freshwater, and thus the TMDL targets are identical to the Basin Plan WQOs, as shown in Table H-1. The final receiving water limitations are expressed for acute (1-hour) and chronic (4-day) durations, and are based on hardness (Table H-1). Final effluent limitations are equal to 90 percent of the final receiving water limitations, taking into account an explicit 10 percent margin of safety (MOS) so that discharges from the MS4s will not cause or contribute to exceedances of receiving water limitations (Table H-2).

Table H-1.
Metals TMDL Targets and Basin Plan WQOs for Chollas Creek
(Receiving Water Limitations)

Metal	Numeric Target for Acute Conditions: CTR Criteria Maximum Concentration (CMC)
Copper	(0.96) * {e^[0.9422 * ln(hardness) – 1.700]} * WER
Lead	{1.46203 – [0.145712 * ln(hardness]} * {e^[1.273 * ln(hardness) – 1.460]} * WER
Zinc	(0.978) * {e^[0.8473 * ln(hardness) + 0.884]} * WER
Metal	**Numeric Target for Chronic Conditions: CTR Criteria Continuous Concentration (CCC)**
Copper	(0.96) * {e^[0.8545 * ln(hardness) – 1.702]} * WER
Lead	{1.46203 – [0.145712 * ln(hardness]} * {e^[1.273 * ln(hardness) – 4.705]} * WER
Zinc	(0.986) * {e^[0.8473 * ln(hardness) + 0.884]} * WER

Notes:
Hardness is expressed as milligrams per liter (mg/L).
Calculated concentrations should have two significant figures [40 CFR 131.38(b)(2)].
The natural log and exponential functions are represented as “ln” and “e”, respectively.
CTR = California Toxics Rule; WER = Water-Effect Ratio

Table H-2.
Metals TMDL Targets and Basin Plan WQOs for Chollas Creek
(Effluent Limitations)

Metal	Numeric Target for Acute Conditions: CTR Criteria Maximum Concentration (CMC)
Copper	(0.96) * {e^[0.9422 * ln(hardness) – 1.700]} * WER * 0.9
Lead	{1.46203 – [0.145712 * ln(hardness]} * {e^[1.273 * ln(hardness) – 1.460]} * WER * 0.9
Zinc	(0.978) * {e^[0.8473 * ln(hardness) + 0.884]} * WER * 0.9
Metal	**Numeric Target for Chronic Conditions: CTR Criteria Continuous Concentration (CCC)**
Copper	(0.96) * {e^[0.8545 * ln(hardness) – 1.702]} * WER * 0.9
Lead	{1.46203 – [0.145712 * ln(hardness]} * {e^[1.273 * ln(hardness) – 4.705]} * WER * 0.9
Zinc	(0.986) * {e^[0.8473 * ln(hardness) + 0.884]} * WER * 0.9

Notes:
Hardness is expressed as milligrams per liter (mg/L).
Calculated concentrations should have two significant figures [40 CFR 131.38(b)(2)].
The natural log and exponential functions are represented as "ln" and "e", respectively.
CTR = California Toxics Rule; WER = Water-Effect Ratio

The Water Quality Improvement Plan final numeric goals for receiving water compliance and MS4 discharges require zero (0) percent exceedance of the receiving water and effluent limitations presented above. These goals are consistent with the Metals TMDL requirements and WQOs for dissolved metals. As an option, a numeric goal that focuses on eliminating direct and indirect discharges to receiving waters was also included in the plan. Achievement of this goal would demonstrate that MS4s are not causing or contributing to receiving water exceedances and would support the conclusion that any exceedances found would likely be due to loads from non-MS4 sources.

H.1.2 Compliance Analysis for Metals and Other Compliance Pathways

Compliance analysis goals were developed to provide a better understanding of the relationship between BMP implementation and load reduction, leading to more efficient and cost-effective targeting of Water Quality Improvement Plan strategies. Updated watershed modeling analyses were performed to identify the load reduction required for each metal that would achieve the TMDL receiving water limitations, MS4 permit requirements, and Basin Plan WQOs. Load reduction goals were developed on the basis of modeling that was originally completed during development of the Metals and Bacteria TMDLs. The watershed model was first updated during development of the Chollas Creek Comprehensive Load Reduction Plan, Phase II (Chollas Creek CLRP II) (City of San Diego, 2013). During Water Quality Improvement Plan development, the model was updated for a second time to include the site-specific Water Effect Ratios (WERs) currently being finalized as part of the 2014 Chollas Creek WER Study Update (2014

WER Update). These updates provide an analysis of the adequacy and cost-effectiveness of structural and nonstructural BMPs to support evaluation of TMDL compliance through modeling to quantify required load reductions. The analysis included optimization modeling to evaluate the most cost-effective combination of BMPs to meet the requirements. The updated WER values are provided in Section H.1.2.2. The metals goals presented in Section 3 of the Water Quality Improvement Plan include the load reductions required using the site-specific WERs, anticipated for adoption in 2015.

H.1.2.1 Chollas Creek CLRP II Modeling Analysis and Metals-Related Assumptions

The Chollas Creek watershed model simulates daily flow and receiving water concentrations for metals, bacteria, and other water quality constituents. A representative Water Year (Water Year 2003) was selected to simulate weather conditions. Water Year 2003 represents typical wet and dry weather conditions within the watershed, based on an analysis of rainfall data over a 20-year time period. Implementation planning based on a representative period will allow the RPs to accurately design programs and size BMPs to meet Water Quality Improvement Plan goals.

Because the WQOs are hardness-based equations, load reductions were calculated on the basis of the modeling results and used average hardness values for wet and dry conditions based on recent Metals TMDL compliance monitoring data (95 mg/L wet; 354 mg/L dry). Average values were used because daily monitoring data were not available to calculate the total load for the representative period. Because of the amount of literature and monitoring data available regarding model parameters for total metals, the model simulates total metals rather than dissolved metals. Recent Chollas Creek monitoring data were used to develop site-specific total-to-dissolved metals conversion factors to convert the WQOs and resulting numeric goals from dissolved metals to total metals for comparison with the modeled loads. The resulting percent load reductions required based on total metals are also applicable to dissolved metals for the load reduction goals.

Acute WQOs were used to calculate the wet weather Metals TMDL load, which represents most of the total receiving water loading because of the relatively high volume of discharge during wet weather. Chronic concentrations are typically associated with longer periods of dry weather; therefore, the chronic WQOs were used to calculate the dry weather Metals TMDL receiving water loads. Model results are typically less accurate at smaller time-steps (e.g., hourly); therefore, daily average results were used to compare with the metals WQOs. The required load reduction represents the difference between the modeled load for each parameter and the Metals TMDL loads for wet and dry weather conditions (derived from the acute [CMC] and chronic [CCC] WQOs, respectively).

H.1.2.2 Water-Effect Ratio Update

Metals TMDL targets are currently being reviewed by the Regional Board to include site-specific WERs and a revision to the lead WQO equation as part of the 2014 Chollas Creek WER Study Update (2014 WER Update). Approval and the subsequent Basin Plan

amendment required to update the Chollas Creek Metals TMDL is anticipated in 2015. Accordingly, the Water Quality Improvement Plan goals include the anticipated load reductions required to meet the receiving water or effluent limitations using the updated WER, described in more detail below.

The following WERs are anticipated to be adopted and were used to develop updated percent load reduction goals:

- Copper WER = 7
- Zinc WER = 1.71

Zinc will require the greatest load reduction based on the updated WER values (29.1 percent). As discussed above, strategies that are targeted to reduce zinc will result in corresponding load reductions for copper, lead, and other associated pollutants. Note that a revision to the lead WQO is also being considered on the basis of recent United States Environmental Protection Agency (USEPA) guidance and other information that would result in the calculation of an alternative percent load reduction for lead. These results indicate that zinc would remain the limiting metals constituent for the numeric goals. Reduction goals calculated with the updated WER are in Table 4-3.

Table H-3.
Chollas Creek Metals Load Reduction Goals Using Updated WER

Metal	Pollutant Load Reduction for Acute Conditions (CMC) (2014 WER Update)	Pollutant Load Reduction for Chronic Conditions (CCC) (2014 WER Update)
Copper	0.0%	0.0%
Lead	0.0%	0.0%
Zinc	29.1%	0.0%

Notes:
% = percent; CMC = Criteria Maximum Concentration

The load reduction goals were applied equally to each RP in the compliance analysis to provide accountability on a jurisdictional basis. Because Chollas Creek is primarily influenced by storm water runoff, load reductions required to meet acute (wet weather) conditions were identified as limiting. This assumption is conservative, because the highest load reduction was identified for zinc (29.1 percent) to meet the acute WQO-derived load reduction goal. Water Quality Improvement Plan strategies target sources of metals that can impact water quality conditions during all conditions; therefore, the strategies focus on achieving the highest load reduction required, irrespective of weather or other conditions. In addition, most of the strategies target metals reduction (rather than individual constituents), resulting in significant reductions in metals overall as well as other associated pollutants. These reductions were calculated at the outlet of the Chollas

Creek watershed, but will be used to achieve water quality requirements throughout the watershed.

H.1.3 Interim Goals and Schedules

Water Quality Improvement Plan interim numeric goals for receiving water compliance and MS4 discharges allow 20 percent exceedance of the receiving water and effluent limitations presented above. Compliance with numeric goals and TMDL requirements is similar to that for final goals: (1) no direct or indirect discharges from the MS4s, (2) no exceedances of the final receiving water limitations, (3) no exceedances of the interim or final effluent limitations, or (4) submittal and full implementation by the RPs of an accepted Water Quality Improvement Plan that provides compliance analysis that the interim TMDL compliance requirements will be achieved. The Metals TMDL requires compliance with interim targets by October 22, 2018, 10 years after the TMDL effective date.

Interim numeric goals were also included in the Water Quality Improvement Plan schedule to demonstrate progress toward achieving the final load reduction goals. Interim load reduction goals were calculated by multiplying the final load reduction by 80 percent to mirror the 80 percent interim compliance requirement with the receiving water and effluent limitations Updates to existing programs, changes in municipal ordinances, and collaboration within jurisdictions, watershed management areas (WMAs), and the region have been occurring since the TMDL and the Municipal Permit were adopted. Planning efforts are currently underway, including measures to secure funding and increase general momentum to implement and expand storm water and water conservation measures.

H.2 IDENTIFICATION OF BACTERIA NUMERIC GOALS

The final numeric goals for bacteria in Chollas Creek were derived from the WQBELs that were identified in the Bacteria TMDL and the options for showing compliance with the WQBELs incorporated into the Municipal Permit. The Bacteria TMDL incorporates concentration-based receiving water limitations, and concentration-based and load-based effluent limitations that were calculated on the basis of watershed modeling results and applicable bacteria WQOs (Regional Board, 2010). The Bacteria TMDL included seasonal requirements based on precipitation: wet weather (days with at least 0.2 inch of rainfall and 72 hours after) and dry weather (days with less than 0.2 inch of rainfall observed on each of the prior 3 days).

H.2.1 Receiving Water Limitations

Wet and dry weather receiving water limitations are shown in Table H-4 and discussed below.

Table H-4.
Final Receiving Water Limitations for Chollas Creek

Bacteria Indicator	Chollas Creek WQO (MPN/100mL)	Allowable Exceedance Frequency (% Days Exceeding WQOs)	Final Compliance
Wet Weather (Single Sample Maximum)			
Fecal coliform	400	22%	2031
Enterococcus	61[1]	22%	
Dry Weather (30-Day Geometric Mean)			
Fecal coliform	200	0%	2021
Enterococcus	33	0%	

Notes:

1. The WQO is determined by usage frequency in the Basin Plan and Chollas Creek is currently listed as a designated creek. If a Basin Plan Amendment designates Chollas Creek as a "moderately to lightly used area" or an "infrequently used area," the WQO will change (Regional Board, 2010).

% = percent; mL = milliliters; MPN = most probable number; WQO = water quality objective

The Bacteria WQOs represent concentrations of bacteria indicators that are at acceptable levels for recreational contact beneficial use (REC-1). Wet weather conditions are episodic and short in duration; therefore, single-sample maximum WQOs apply. Geometric mean WQOs apply during dry weather when monitoring results over a longer time period are averaged and assessed. Total coliform WQOs are not applicable to freshwater streams; therefore, receiving water goals for Chollas Creek are identified only for fecal coliform and *Enterococcus.*

The WQOs do not account for the natural increase in bacteria loads during storm events, referred to as background concentrations. To account for background concentrations of bacteria during wet weather, the Bacteria TMDL incorporated an allowable exceedance frequency of the WQO based on a reference (mostly undeveloped) watershed.

The Bacteria TMDL specifies a final receiving water limitation allowable exceedance frequency of 22 percent during wet weather periods based on reference conditions, but allows no exceedances during dry weather. Although the number of wet and dry weather days may change from year to year because of variable weather conditions, the percentage of allowable wet weather exceedance days will remain fixed. For example, the number of wet weather days in Water Year 2003 was 42. Therefore, the number of allowable wet weather exceedance days was 9 (22 percent of 42 days, rounded). Final compliance with the dry weather WQOs and TMDL loads is required by Fiscal Year (FY) 2021. Final compliance with the wet weather WQOs and TMDL loads is required by FY 2031.

H.2.2 Concentration-Based Effluent Limitations

The Bacteria TMDL provides two expressions of effluent limitations. The first expression is equivalent to the receiving water limitations, but is assessed at MS4 outfalls (Table H-5). The second expression is a mass-based load reduction from the watershed discussed below. Per the Municipal Permit, total coliform WQOs and corresponding exceedance frequencies are applicable to MS4 outfalls that drain to the Chollas Creek mouth and are therefore included in both expressions of effluent limitations.

Table H-5.
Final Effluent Limitations for Chollas Creek

Bacteria Indicator	Chollas Creek WQO (MPN/100mL)	Allowable Exceedance Frequency (% Days Exceeding WQOs)	Final Compliance
Wet Weather (Single Sample Maximum)			
Fecal coliform	400	22%	2031
Enterococcus	61[1]	22%	
Total coliform[2]	10,000	22%	
Dry Weather (30-Day Geometric Mean)			
Fecal coliform	200	0%	2021
Enterococcus	33	0%	
Total coliform[2]	1,000	0%	

Notes:

1. The WQO is determined by usage frequency in the Basin Plan and Chollas Creek is currently listed as a designated creek. If a Basin Plan Amendment designates Chollas Creek as a "moderately to lightly used area" or an "infrequently used area," the WQO will change (Regional Board, 2010).
2. Total coliform WQOs and corresponding allowable exceedance frequencies are applicable only as effluent limitations on MS4 outfalls that discharge to Chollas Creek. Total coliform WQOs and allowable exceedance frequencies are not applicable to freshwater receiving waters, such as Chollas Creek.

% = percent; mL = milliliters; MPN = most probable number; WQO = water quality objective

H.2.3 Load-Based Effluent Limitations

The Bacteria TMDL calculated the watershed load reductions that were required to achieve the Bacteria TMDL receiving water limitations. The Municipal Permit incorporated these load reductions for wet and dry weather as effluent limitations. Watershed load reductions were recently recalculated during the development of Chollas Creek CLRP II, considering a representative period to facilitate BMP planning and implementation, as noted in Section H.1 for metals. This analysis updated the load reductions that were presented in the Bacteria TMDL and provides compliance analysis that implementation will meet the numeric goals.

Consistent with the calculation of metals numeric goals, a representative period (Water Year 2003) was selected to simulate weather conditions and bacteria loads. Per the Bacteria TMDL, the loading capacity was calculated by multiplying the WQOs by the average daily modeled flow. Modeled daily loads exceeding this threshold were flagged as an exceedance. The allowable percent exceedance loads for wet weather were calculated by summing the top 9 days (22 percent of the 42 wet weather days in the representative year) with the highest modeled daily loads. This load was then subtracted from the modeled wet weather total for the year. The difference between the remaining modeled load and the updated TMDL load represents the load reduction recommended for wet weather. The percent load reduction is calculated by dividing the exceedance load by the total annual load for the representative year. The final load reductions estimated to meet receiving water goals are presented in Table H-6.

Dry weather numeric goals were calculated using the same formula, but without an allowable load. The difference between the remaining modeled load and the TMDL load represents the required load reduction for dry weather. Dry weather modeling results are typically less reliable than wet weather modeling results because of the episodic nature of irrigation runoff and other water sources during dry periods. The percent load reduction was calculated by dividing the exceedance load by the total annual load for Water Year 2003.

Numeric goals were identified for each RP on the basis of the modeling results. As with metals, percent load reductions were applied equally to each RP to provide accountability on a jurisdictional basis.

Table H-6.
Final Numeric Goals Expressed as Percent Load Reduction in MS4 Discharges to Chollas Creek

Bacteria Indicator	Chollas Creek Percent Load Reduction[1]	Final Compliance
Wet Weather (Single Sample Maximum)		
Fecal coliform	28.8%	2031
Enterococcus	23.9%	
Total coliform	17.8%	
Dry Weather (30-day Geometric Mean)		
Fecal coliform	98.8%	2021
Enterococcus	99.3%	
Total coliform	92.1%	

Notes:
1. Percent load reductions were derived from updated modeling results and may differ from those presented in the Municipal Permit (see Sections A.2.2 and A.2.3).

% = percent; N/A = not applicable

H.2.4 Other Compliance Pathways

In addition to demonstrating compliance with receiving water and effluent limitations through implementation of a Water Quality Improvement Plan that includes compliance analysis, two additional compliance pathways are available and have been incorporated as numeric goals. A numeric goal that focuses on eliminating direct and indirect discharges to receiving waters was included as an option. Achievement of this goal would demonstrate that MS4s are not causing or contributing to receiving water exceedances. Finally, compliance could be achieved even if receiving water limitations are being exceeded if the RPs can demonstrate that exceedances are due to loads from natural or non-MS4 sources, and pollutant loads from the MS4s are not causing or contributing to the exceedances.

H.2.5 Interim Goals and Schedules

Bacteria TMDL interim compliance for wet weather was calculated as a 50 percent reduction of the "existing" receiving water load. The interim allowable exceedance frequency goal was calculated as a 50 percent reduction from the existing frequency to the final allowable frequency. For example, the Bacteria TMDL states that the existing wet weather exceedance frequency for fecal coliform at the mouth of Chollas Creek is 60 percent. A 50 percent reduction in the existing exceedance frequency (60 percent) to the final allowable exceedance frequency (22 percent) is equal to 41 percent. In the interim

compliance year, the interim goal will be met for fecal coliform if 41 percent or less of the fecal coliform load on wet weather days exceeds the fecal coliform WQO.

The same calculation is conducted for dry weather, but the allowable exceedance frequency is zero (0) percent for dry weather and the Bacteria TMDL does not identify the existing load. The exceedance frequency for dry weather was calculated for each of the indicator bacteria by analyzing the available monitoring data collected between January 1, 1996, and December 31, 2002, for comparison with 30-day geometric mean WQOs. One data point was available during this period; because of the limited sample size, additional data points are necessary to determine a representative dry weather exceedance frequency.

Bacteria TMDL interim compliance for load reductions during dry weather is also 50 percent of the existing load. For example, the updated modeling results estimate that a 28.8 percent load reduction in the Chollas Creek subwatershed is needed during wet weather to meet final goals. Therefore, the Chollas Creek interim load reduction goal is 14.4 percent.

The Municipal Permit allows an alternative interim compliance date from the original TMDL compliance date (Municipal Permit, Attachment E). Interim compliance (50 percent reduction) is most reasonably attained in FY 2024 for wet weather and FY 2019 for dry weather for both expressions of WQBELs. Updates to existing programs, changes in municipal ordinances, and collaboration within jurisdictions, WMAs, and the region have been occurring since the TMDL and the Municipal Permit were adopted. Planning efforts are currently underway, including measures to secure funding and increase general momentum to implement and expand storm water and water conservation measures. The alternative compliance dates allow for the success of the monitoring, assessment, and goal and strategy adaptation process detailed within this Water Quality Improvement Plan.

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