APPENDIX A
Contra Costa Clean Water Program Reasonable Assurance Analysis Report

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CONTRA COSTA CLEAN WATER PROGRAM REASONABLE ASSURANCE ANALYSIS

Submitted in Compliance with Provision C.11.c.iii.(3), C.11.d.iii, C.12.b.iii.(2), and C.12.d.iii

Prepared for

Contra Costa Clean Water Program

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ACRONYMS AND ABBREVIATIONS

BASMAA	Bay Area Stormwater Management Agencies Association
CCCWP	Contra Costa Clean Water Program
g	gram
GI	Green Infrastructure
GSI	Green Stormwater Infrastructure
HRU	Hydrologic Response Unit
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PCBs	Polychlorinated Biphenyls
PG&E	Pacific Gas and Electric
RAA	Reasonable Assurance Analysis
RWSM	Regional Watershed Spreadsheet Model
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFEI	San Francisco Estuary Institute
SWMM	Stormwater Management Model
TMDL	Total Maximum Daily Load
WLA	Wasteload Allocation
WY	Water Year

1. INTRODUCTION

This report presents the results of the reasonable assurance analysis (RAA) for Contra Costa County required by the Municipal Regional Permit (MRP) for urban stormwater issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB; Order No. R2-2015-0049). MRP Provisions C.11.c, C.11.d, C.12.c, and C.12.d require an RAA for the PCBs and mercury control measures that are described in the PCBs Control Measure Plan and the Mercury Control Measure Plan. The methodologies for estimating load reductions are introduced herein; additional details on the RAA methodology are provided in the Reasonable Assurance Analysis Peer Review Package (Appendix H of the *Contra Costa PCBs and Mercury TMDL Control Measure Plan and Reasonable Assurance Analysis* report).

The following MRP reporting requirements are addressed within this report:

- A reasonable assurance analysis to demonstrate quantitatively that Contra Costa's population-based portion of PCBs reductions of at least 3 kg/yr and mercury reductions of at least 10 kg/yr will be realized by 2040 through implementation of GSI projects; all data used; a full description of models and model inputs relied on to make the demonstration; and documentation of peer review of the reasonable assurance analysis.

- A PCBs and mercury control measure implementation plan RAA that demonstrates quantitatively that the plan will result in mercury load reductions sufficient to attain the mercury TMDL wasteload allocations by 2028 and PCBs load reductions sufficient to attain the PCBs TMDL wasteload allocations by 2030.

2. METHODOLOGY

2.1 Overview

The approach used to estimate the load reductions resulting from implementation of the PCBs Control Measure Plan and the Mercury Control Measure Plan includes a number of different model components. The methodology is consistent with the *Bay Area RAA Guidance Document* (BASMAA, 2017)

The model components include:

- Baseline Pollutant Loading Model – the baseline pollutant loading model is a continuous simulation[1] hydrology model combined with pollutant loading inputs to obtain the average annual loading of PCBs and mercury across Contra Costa County

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[1] Continuous simulation models calculate outputs (e.g., runoff) "continuously", i.e., for many time steps over a long-term period of record (e.g., every 10 minutes for 10 years). Long-term "continuous" input data (e.g., hourly rainfall) is required. This is contrasted with design-event simulations which model a single rainfall event, e.g., a 24-hour storm with a 10-year recurrence frequency.

during the TMDL baseline period (i.e., 2003 – 2005, see BASMAA, 2017). See Section 3 for the baseline model results.

- Hydrology – this model component produces average annual runoff across Contra Costa County for the period of record using a hydrologic response unit (HRU) approach. The HRU approach involves modeling various combinations of land surface features (i.e., imperviousness, underlying soil characteristics, slope, etc.) present within Contra Costa County for a unit area drainage catchment.

- Water Quality – the hydrology output is combined with average annual concentrations estimated by the Regional Monitoring Program's Regional Watershed Spreadsheet Model (RWSM; SFEI, 2018) developed by SFEI to produce average annual PCBs and mercury loading for the period of record.

- GSI Performance Models – GSI performance models were developed to represent load reductions resulting from implementation of GSI.

- Source Control Measure Calculations – Calculation methods for estimating load reduction associated with implementation of the source control measures identified in the PCBs Control Measure Plan and the Mercury Control Measure Plan, as established in the *Source Control Load Reduction Accounting for Reasonable Assurance Analysis* report (BASMAA, 2020, provided in Appendix B of the *Contra Costa PCBs and Mercury TMDL Control Measure Plan and Reasonable Assurance Analysis* report).

- Future Condition Models – the RAA future condition models represent future land use changes and control measure implementation that would result in pollutant load reduction. These include the following:

  - Future Land Use – changes to land use as a result of new development and redevelopment and the associated reduction in pollutant loading (i.e., with newer building materials and practices) is represented.

  - Future GSI Performance – the GSI performance model output is applied to areas to be treated by GSI in the future based on the Permittees' Green Infrastructure Plans.

  - Source Control Measure Performance – Performance of the source control measures that have been or will be implemented is modeled based on the incidence and location of these control measures.

These components are summarized in the following sections and described in further detail in the Peer Review Package (Appendix H).

2.2 Baseline

The baseline pollutant loading model is a representation of the loading of PCBs and mercury across the County during the TMDL baseline period (i.e., 2003 – 2005, see BASMAA, 2017). The baseline model utilizes an HRU approach to estimate runoff across the County. Generic HRUs, characterized by varying the values of specific identified parameters within a defined

representative range, were modeled using USEPA's Stormwater Management Model (SWMM). HRU parameters varied included precipitation and evaporation, slope, underlying soil type (i.e., subsurface infiltration rate) and compaction (i.e., developed versus undeveloped areas), and imperviousness. Continuous simulation HRU models were run on an hourly timestep for the identified baseline period of record (water years [WYs] 2000 – 2009).

An average annual runoff volume per acre was obtained for each HRU through the continuous simulation runs. The average annual runoff volume per acre associated with each specific HRU was multiplied by the area represented by that HRU within the entire area for analysis (i.e., across the county, estimated using geospatial data). Watershed-based drainage routing was accounted for through calibration efforts. Calibration of the generic HRU models was conducted on the average annual discharge volume for WYs 2000-2009, utilizing available stream flow records. The objective of the calibration was to reasonably match the average annual runoff volume for this 10-year period (i.e., within the bounds included in BASMAA (2017).

To obtain pollutant loading, average annual concentrations estimated by the RWSM (SFEI, 2018), for each land use category (i.e., Old Industrial, Old Urban Commercial/Transportation, Old Urban Residential, New Urban, and Open Space) are multiplied by the calibrated average annual runoff volume estimated using the HRU approach. The average annual PCBs and mercury loading for the baseline period of record was validated using available in-stream concentration data.

A flow chart representing the baseline loading model is provided in Figure 2-1 below.
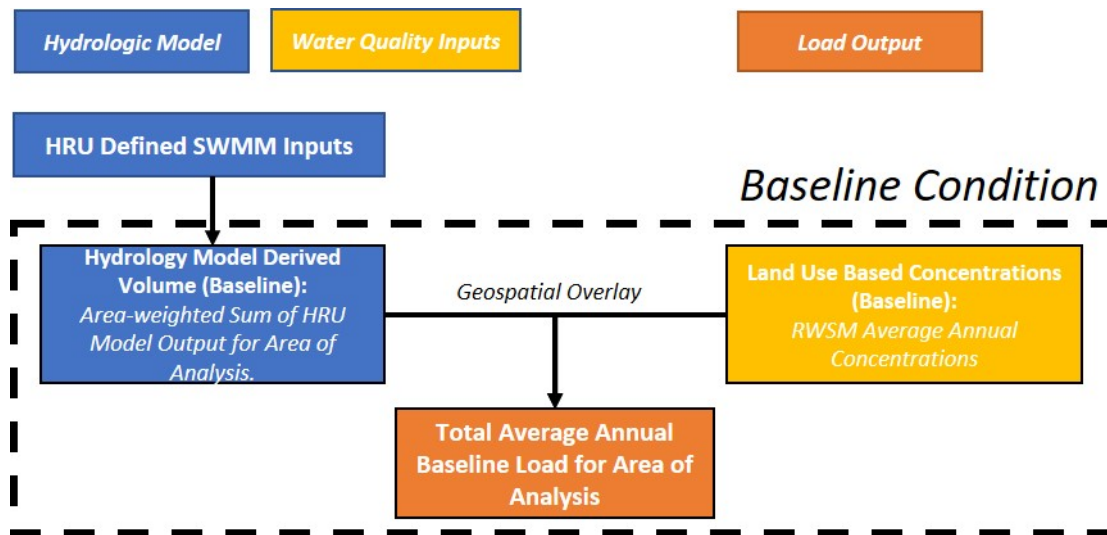
Figure 2-1: Baseline Condition Model Flow Chart

2.3 Loads Reduced

Loads reduced from baseline are estimated based on projected land use changes and control measure implementation. To calculate pollutant load reductions associated with land use changes and GSI and source control implementation for future scenarios, the difference between the pollutant loading in the baseline scenario and the total pollutant loading associated with each

future implementation scenario were calculated. Future scenarios included implementation in years 2030, 2040, and beyond 2040. Loads reduced resulting from implementation of control measures are estimated through different methods depending on control measure type. Details relating to load reductions resulting from land use changes versus those from control measures are provided in the following sections.

2.3.1   Load Reduction Resulting from Land Use Changes

Land use-based pollutant loading was based on changes to the land use through new development and redevelopment that has occurred or is projected to occur since the 2003-2005 baseline. To forecast future private development area, CCCWP used the output of UrbanSim,[2] a model developed by the Urban Analytics Lab at the University of California under contract to the Bay Area Metropolitan Transportation Commission (MTC). The UrbanSim modeling system was developed to support the need for analyzing the potential effects of land use policies and infrastructure investments on the development and character of cities and regions. The Bay Area's application of UrbanSim was developed specifically to support the development of Plan Bay Area, the Bay Area's Sustainable Communities planning effort.

MTC forecasts growth in households and jobs and uses the UrbanSim model to identify development and redevelopment sites to satisfy future demand. Model inputs include parcel-specific zoning and real estate data; model outputs show increases in households or jobs attributable to specific parcels. The methods and results of the Bay Area UrbanSim model have been approved by both MTC and Association of Bay Area Governments Committees for use in transportation projections and the regional Plan Bay Area development process.

The CCCWP process used outputs from the Bay Area UrbanSim model to map parcels predicted to undergo development or redevelopment in each Contra Costa jurisdiction at the time increments specified in the MRP (i.e., 2020, 2030, and 2040). The resulting maps were reviewed by Permittee staff for consistency with local knowledge and local planning and economic development initiatives and revised as needed.

If projected new development and redevelopment is assumed to alter the imperviousness of parcels identified for development, the HRU assigned at the parcel scale was revised from the baseline condition to represent the new imperviousness (no other HRU variables would be anticipated to change) in the future condition. Similarly, the overlying RWSM land use category designation was updated from the baseline condition to reflect new land uses from new development and redevelopment. Updated land use-based pollutant loading was then calculated for the future conditions, using the applicable updated HRU and RWSM land use category assignments.

2.3.2   Load Reductions Resulting from GSI Implementation

Load reduction through implementation of GSI facilities was estimated through the methods described as part of the *Quantitative Relationship between GSI Implementation and*

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[2] http://www.urbansim.com/

PCBs/Mercury Load Reductions Report (CCCWP, 2018; provided in Appendix H). The POC load reductions through GSI were developed through a combination of hydraulic modeling of GSI facilities combined with empirically derived effluent concentration estimates. The annual estimate of pollutant load reduction from the modeled drainage area is equivalent to the difference between the influent load and the sum of the pollutant load that bypasses the GSI facility and the effluent load. The effluent load is calculated as the proportion of runoff that is treated by the GSI facility multiplied by an effluent concentration. Water quality performance data from selected, representative studies were used to determine a method to predict effluent concentrations in stormwater following treatment through a bioretention GSI facility. A flow chart representing the GSI load reduction modeling is provided in Appendix H.

GSI implementation levels corresponding to each future implementation scenario were estimated based on GI Plan projections. The pollutant loading resulting from each of the GSI implementation scenarios was calculated by first applying the updated land use loading. Then, pollutant load reductions resulting from implementation of GSI were applied to identified GSI drainage areas (i.e., both development areas, where land uses are assumed to change, and GSI retrofit areas, where land uses are not assumed to change) to obtain a revised total pollutant loading for those land surfaces. Resulting pollutant loading for areas identified as draining to GSI and areas not draining to GSI were combined geospatially to obtain the pollutant loading associated with each GSI implementation scenario.

2.3.3   Load Reductions Resulting from Implementation of Source Controls

Pollutant load reductions from the source controls described in the implementation plans are incorporated into the RAA scenarios for the TMDL attainment date (i.e., 2030) along with future scenarios for 2040 and beyond 2040. The calculation methods used to estimate load reduction are those described in the *Source Control Load Reduction Accounting for Reasonable Assurance Analysis* (BASMAA, 2020, provided in Appendix B). The resulting load reductions from source controls implemented are combined with the land use and GSI load reduction estimations to get the total estimated load reduction for each future implementation scenario.

3.   ADJUSTED BASELINE LOADS AND LOAD REDUCTION GOALS

3.1   PCBs

3.1.1   Adjusted PCBs Baseline Load

The results of the RAA baseline modeling for PCBs are presented for Contra Costa County in Table 3-1 below.

Table 3-1: RAA Model Baseline Loading Estimates – PCBs

RWQCB Region	Above/Below Dam	Permit	Baseline Load Contra Costa County (kg/yr)
Region 2	Below Dam	MRP[1]	1.73
		NPDES[2]	0.62
		Phase II[3]	0.01
	TMDL Baseline		*2.36*
	Above Dam	MRP[1]	0.04
		NPDES[2]	<0.01
		Phase II[3]	0
Region 5	Below Dam	MRP[1]	0.13
		NPDES[2]	0.01
		Phase II[3]	<0.01
	Above Dam	MRP[1]	<0.01
		NPDES[2]	0
		Phase II[3]	0
County-wide		Total	2.55

[1] Municipal Regional Permit permitted areas, along with IGP facilities and facilities with individual NPDES Stormwater Industrial permits.

[2] Major and Non-Major dischargers with individual NPDES permits. See Appendix A.

[3] Phase II General Permit permittees. See Appendix A.

The countywide baseline load below dams estimated using the RAA model is 2.36 kg/yr. The baseline load estimated for the Permittees after deducting the estimated baseline load for the NPDES dischargers within the County is 1.73 kg/yr. This baseline load is used to establish the PCBs TMDL load reduction goal described below.

3.1.2 TMDL Attainment Load Reduction Goal (2030)

Calculations were conducted to develop the PCBs load reduction goals as described in the *Bay Area RAA Guidance Document* (BASMAA, 2017). The calculation methodology is summarized below.

$$LR_{TMDLgoal} = \text{Baseline} - WLA \text{ (kg/yr)}$$

Where:

$LR_{TMDLgoal}$ = The TMDL load reduction goal (kg/yr)

Baseline = The baseline pollutant loading as calculated through the RAA

WLA = The population-based wasteload allocation for Contra Costa County

The TMDL population-based wasteload allocation for Contra Costa County is 0.3 kg/yr. This wasteload allocation must be distributed between the MRP permittees and other permitted stormwater dischargers (i.e., individual NPDES permittees and Phase II permittees). The wasteload allocations calculated to reflect the relative percentage of the estimated baseline loads are provided in Table 3-2.

For example, as shown in Table 3-1, the MRP Permittees baseline load is estimated to be 1.73 kg/yr, which represents 73% of the total baseline load below dams (i.e., 1.73/2.36 x 100 = 73%). Thus, the PCBs wasteload allocation for the MRP Permittees is equal to 73% of 0.3 kg/yr (i.e., 0.73 x 0.3 kg/yr = 0.22 kg/yr)

Table 3-2: TMDL Wasteload Allocations for Contra Costa County

Stormwater Discharger within TMDL Baseline Area[1]	Percentage of Baseline Load (%)	PCBs WLA (kg/yr)
MRP Permittees	73%	0.22
NPDES Permittees	26%	0.08
Phase 2 Permittees	1%	0.002
Contra Costa County	100%	0.3

[1] All SFBRWQCB Region 2, above dams.
WLA – Wasteload Allocation

Using the calculated MRP Permittee proportion of the wasteload allocation and RAA-calculated baseline load, the load reduction goal is estimated to be 1.51 kg/yr (i.e., 1.73 kg/yr – 0.22 kg/yr = 1.51 kg/yr).

3.1.3 MRP Load Reduction Goal through GSI by 2040

The PCBs load reduction required to be achieved through GSI by 2040 per MRP Provision C.3.j (i.e., 3 kg/yr MRP area-wide or 0.56 kg/yr for Contra Costa County) must be adjusted to reflect the RAA-calculated load reduction goal (i.e., 1.51 kg/yr).

The MRP C.3.j load reduction requirement for GSI by 2040 (for all Permittees; 3 kg/yr) represents 20.8% of the overall load reduction required in the TMDL[3] (i.e., [3 kg/yr ÷ 14.4 kg/yr] x 100 = 20.8%). Therefore, the adjusted countywide load reduction through GSI can be calculated as:

$$LR_{MRP,\ GSI,\ 2040} = LR_{TMDLgoal} * 20.8\%$$

The adjusted countywide MRP PCBs load reduction goal through GSI by 2040 is 0.31 kg/yr (i.e., 1.51 kg/yr x 0.208 = 0.31 kg/yr).

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[3] The PCBs TMDL estimates a total urban baseline stormwater load of 20 kg/yr and assigns a wasteload allocation to urban stormwater of 2 kg/yr; thereby resulting in a required load reduction of 18 kg/yr (i.e., a 90% reduction) by 2030. Note that the MRP area is a portion of the total TMDL area, as Marin, Napa, San Francisco, and Sonoma are not within the MRP boundary. The MRP portion of the estimated TMDL baseline load is 16 kg/yr and the MRP portion of the 2 kg/yr wasteload allocation is 1.6 kg/yr, thus the TMDL load reduction goal for the MRP area is 14.4 kg/yr.

3.2 Mercury

3.2.1 Adjusted Mercury Baseline Loads

The results of the RAA baseline modeling for mercury are presented for Contra Costa County in Table 3-4 below. The countywide baseline load estimated with the RAA model is 6.25 kg/yr. The baseline load estimated for the Permittees after deducting the estimated baseline load for the NPDES dischargers within the County is 6.02 kg/yr. This baseline load is used to establish the mercury TMDL load reduction goal described below.

Table 3-3: RAA Model Baseline Loading Estimates – Mercury

RWQCB Region	Above/Below Dam	Permit	Baseline Load Contra Costa County (kg/yr)
Region 2	**Below Dam**	**MRP[1]**	**6.02**
		NPDES[2]	0.20
		Phase 2[3]	0.03
	TMDL Baseline		*6.25*
	Above Dam	MRP[1]	1.59
		NPDES[2]	0.002
		Phase 2[3]	0.00
Region 5	Below Dam	MRP[1]	1.02
		NPDES[2]	0.004
		Phase 2[3]	0.001
	Above Dam	MRP[1]	0.35
		NPDES[2]	0.00
		Phase 2[3]	0.00
County-wide		Total	9.23

[1] Municipal Regional Permit permitted areas, along with IGP facilities and facilities with individual NPDES Stormwater Industrial permits.
[2] Major and Non-Major dischargers with individual NPDES permits. See Appendix A.
[3] Phase II General Permit permittees. See Appendix A.

3.2.2 TMDL Attainment Load Reduction Goal (2028)

The mercury WLA for Contra Costa County is 11 kg/yr, while the estimated baseline load for the entire county below dams is only 6.25 kg/yr. Thus, the results of the RAA indicate that the TMDL wasteload allocation has been achieved.

3.2.3 MRP Load Reduction Goal through GSI (2040)

The mercury load reduction required to be achieved through GSI by 2040 per MRP Provision C.3.j is 10 kg/yr MRP area-wide (19% or 1.9 kg/yr for Contra Costa County). This represents 8% of the estimated TMDL baseline load of 127.7 kg/yr for the MRP area. Applying this percentage to the adjusted baseline from the RAA model, an adjusted GSI goal would be 0.48 kg/yr for Contra Costa County (i.e., 6.02 kg/yr x 0.08 = 0.48 kg/yr).

4. ESTIMATE OF LOADS REDUCED

4.1 Loads Reduced – PCBs

The total estimated annual PCBs loads reduced through implementation of control measures by 2020, 2030, 2040, and 2050 is provided in Table 4-1.

Table 4-1: Summary of PCBs Load Reductions Achieved through Control Measure Implementation

Control Measure	PCBs Load Reduction (kg/yr) by:			
	2020	**2030**	**2040**	**2050**
PCBs in Building Materials Management	0.37	0.37	0.37	0.37
Source Property Identification and Abatement	0.21	0.54	0.54	0.54
PCBs in Electrical Utilities Management	0.07	0.12	0.17	0.21
PCBs in Infrastructure	0.00	0.01	0.02	0.02
Green Stormwater Infrastructure	0.14	0.18	0.26	0.32
Full Trash Capture Treatment Control Measures	0.05	0.05	0.05	0.05
Enhanced Operations and Maintenance	0.004	0.004	0.004	0.004
Total Load Reduced	0.84	1.27	1.41	1.51
Load Reduction Goal	**1.51**	**1.51**	**1.51**	**1.51**
Remaining Load to be Reduced	0.67	0.24	0.10	0

4.1.1 PCBs TMDL Attainment (2030)

As can be seen in Table 4-1, the required load reduction to achieve the TMDL wasteload allocation (1.51 kg/yr) is not met by the TMDL compliance date of 2030 but is achieved by 2050. The RAA estimate of achieving the PCBs TMDL wasteload allocation by 2050 is based on many assumptions, and while the RAA demonstrates that Contra Costa will not achieve the PCBs load reduction goal before 2050, this goal may not be achieved until well after 2050. An analysis of scenarios needed to achieve the TMDL wasteload allocation by 2030 is presented in Appendix G of the *Contra Costa PCBs and Mercury TMDL Control Measure Plan and Reasonable Assurance Analysis* report).

4.1.2 MRP GSI Load Reduction Goal (2040)

The estimated PCBs load reduced through implementation of GSI by 2040 is 0.26 kg/yr. As discussed in Section 3.1.3, the RAA-adjusted goal is 0.31 kg/yr, thus there is a predicted 0.05 kg/yr deficit.

Table 4-2 below provides an estimate of the PCBs loads reduced by the public and private land area that will be treated through GSI implementation by 2020, 2030, and 2040. The areas modeled were summarized from the Permittees' Green Infrastructure Plans, which were submitted to the SFBRWQCB in 2019.

Table 4-2: Estimate of PCBs Load Reduced by Area Treated through GSI Implementation by 2020, 2030, and 2040 within Contra Costa County

Year	Estimated PCBs Load Reduced (kg/yr)	
	Private	Public
2020	0.13	0.01
2030	0.16	0.02
2040	0.23	0.03

As can be seen in Table 4-2, public GSI area is a small portion of the total load reduced through GSI (ranging from 8% to 13%) and is also subject to a lot of uncertainty regarding when opportunities will emerge, and funding will be available.

Public GSI retrofit opportunities that have the highest potential to reduce PCBs loads are concentrated within a small subset of Contra Costa Permittee area due to the pattern of pre-1980 industrial development within the region. Conversely, many Contra Costa Permittees have no or very few opportunities to contribute significantly toward achievement of countywide PCBs loading reductions via implementation of GSI in their communities. Further, if load reductions are not achieved on a regional or countywide scale, and load reductions are allocated at a local level (by population), these Permittees would not be able to achieve those load reduction allocations due to a lack of opportunity.

Thus, given these findings, the Contra Costa Permittees, collectively, believe that a countywide strategy would be the best way to achieve the PCBs load reduction goals in a more efficient and effective manner. For the purposes of creating their local GI Plans, Contra Costa Permittees have prioritized their GSI projects based on achieving other multiple benefits. These other benefits include controlling other stormwater pollutants, preserving and enhancing local stream hydrology, reducing localized flooding, helping communities adapt to climate change by increasing the resiliency of water supply, ancillary benefits that derive from adding landscaped areas within the urbanized environment, and mitigating the urban heat island effect.

4.2   Loads Reduced – Mercury

The total estimated mercury loads reduced through implementation of the GSI and the other treatment control measures that are implemented for PCBs by 2020, 2030, 2040, and 2050 is provided in Table 4-3.

Note that these estimated load reductions do not account for loads reduced by the Mercury Load Avoidance and Reduction source control measure. CCCWP will continue to annually compile and report the number of mercury-containing products collected at household hazardous waste facilities. Translation of that collection information to loads reduced from urban stormwater discharges is challenging and may not be necessary to show attainment of the mercury TMDL.

Table 4-3: Summary of Mercury Load Reductions Achieved through Control Measure Implementation

Control Measure	Hg Load Reduction (g/yr) by:			
	2020	**2030**	**2040**	**2050**
Green Stormwater Infrastructure	0.17	0.22	**0.28**	0.33
Full Trash Capture Treatment Control Measures	0.10	0.12	0.12	0.12
Enhanced Operations and Maintenance	0.02	0.02	0.02	0.02
Total	**0.29**	**0.36**	**0.42**	**0.47**
Adjusted Load Reduction Goal via GSI in MRP 2	--	--	**0.48**	--
Remaining Load to be Reduced via GSI			**0.20**	

4.2.1 Mercury TMDL Attainment (2028)

As is stated in Section 3.2.2 above, the mercury WLA for Contra Costa County is 11 kg/yr, while the estimated baseline load for the entire county below dams is only 6.25 kg/yr. Thus, the results of the RAA indicate that the TMDL wasteload allocation has been achieved.

4.2.2 MRP Load Reduction Goal through GSI (2040)

The predicted mercury load reduction by 2040 through GSI (0.28 kg/yr) would not achieve the adjusted load reduction goal for GSI in the MRP (0.48 kg/yr). RAA results analyzing the potential for GSI to reduce mercury loads to achieve this goal are shown in Table 4-4 below. A significant portion of the Old Industrial, Old Commercial, Old Transportation, and/or Old Urban Residential land use area would need to be treated to meet this load reduction goal in Contra Costa County (shaded rows of Table 4-4). Assuming the mercury load reduction rate that is predicted by the RAA model to occur every decade through implementation of GSI on public and private land, this MRP load reduction goal would be achieved by 2077.

Given the RAA results for baseline load in comparison to the TMDL wasteload allocation, the load reduction goal set in the MRP appears to be unnecessary for TMDL compliance.

Table 4-4: Application of GSI to All Land Use Area in Contra Costa County within Region 2 below Dams

Land Use Category	Maximum Potential Mercury Load Reduction through GSI (kg/yr)
Old Industrial	0.40
Old Commercial	0.14
Old Transportation	0.22
Old Urban Residential	2.07
New Urban	0.02

4.3 RAA Modeling Uncertainty

There are two types of uncertainty in the RAA analysis: modeling uncertainty and planning uncertainty. This section discusses modeling uncertainty, whereas planning uncertainties are

discussed in Section 6.2 of the *Contra Costa PCBs and Mercury TMDL Control Measure Plan and Reasonable Assurance Analysis* report.

As summarized in the RAA Guidance Document (BASMAA, 2017), according to USEPA's Guidance on the Development, Evaluation, and Application of Environmental Models (USEPA Model Guidance, 2009), model uncertainty describes the lack of knowledge about models, parameters, constants, data, and beliefs. The USEPA Model Guidance identifies two types of uncertainty related to models: model framework uncertainty, related to the scientific soundness of the model, and data uncertainty, arising from measurement errors, analytical imprecision, and limited data sample sizes. The methods and assumptions used for the analysis and described in detail in the appendices were developed with consideration of available data. The methods for developing baseline loading and GSI load reduction estimates went through a rigorous third-party peer review process. The source control load reduction calculations methods presented in Appendix B have been accepted by the SFBRWQCB. Therefore, the methods are considered to be reasonably rigorous given the data and resources available, and the primary source of uncertainty for these computational methods is expected to be data uncertainty.

The USEPA Model Guidance (USEPA, 2009) describes the three components that affect data uncertainty:

- Accuracy – the closeness of a measured or computed value to its "true" value.

- Variability – data differences arising from true heterogeneity or diversity in model parameters and their underlying input datasets.

- Precision – the quality of being reproducible in outcome or performance.

Due to natural variability, data limitations affect both accuracy and precision, resulting in higher data uncertainty. Because of this, data limitations will also inform the complexity of the model.

In addition, as indicated in the USEPA RAA Guide (USEPA, 2017), calibration and validation can be used to manage model uncertainty, though data limitations will still cause uncertainty in model output. Because of this, the USEPA RAA Guide suggests that it is important to update RAA modeling tools over time as additional data become available.

5. REFERENCES

Bay Area Stormwater Management Agency Association (BASMAA), 2017. Bay Area Reasonable Assurance Analysis Guidance Document. Prepared for BASMAA by Geosyntec Consultants and Paradigm Environmental. June 2017.

BASMAA, 2020. Source Control Load Reduction Accounting for Reasonable Assurance Analysis. Prepared for BASMAA by Geosyntec Consultants and EOA, Inc. June 2020.

SFEI, 2018. Regional Watershed Spreadsheet Model (RWSM) Toolbox v1.0 User Manual and Pollutant Model. Available here: https://www.sfei.org/projects/regional-watershed-spreadsheet-model#sthash.kOKnKvF2.dpbs.

United States Environmental Protection Agency (USEPA), 2009. Guidance on the Development, Evaluation, and Application of Environmental Models. Office of the Science Advisor. EPA/100/K-09/003. March 2009

USEPA, 2017. Developing Reasonable Assurance: A Guide to Performing Model-Based Analysis to Support Municipal Stormwater Program Planning. Prepared by Paradigm Environmental. February 2017.

APPENDIX A
List of NPDES Permittees Removed from Baseline

Table A-1: List of Phase II Permittees, and Facilities with Major or Minor NPDES Permits, in Contra Costa County

Permit Category	Facility Name	Facility Owner	City
Phase II	Bay Area Rapid Transit (BART)	Bay Area Rapid Transit Ditrict	Various
Phase II	Cal State East Bay Concord Campus	State of California	Concord
Phase II	Federal Correctional Instituion, Dublin (Camp Parks)	United States of America	San Ramon / Unincorporated
NPDES Major	Tesoro Golden Eagle Refinery	Tesoro Refining & Marketing Co	Concord
NPDES Major	C&H Sugar Co Inc	Sugar Acquisition Corp	Crockett (Unincorporated)
NPDES Major	C&H Sugar Co Inc	Sugar Acquisition Inc	Crockett (Unincorporated)
NPDES Major	C&H Sugar Co Inc	C & H Sugar Company Inc	Crockett (Unincorporated)
NPDES Major	Phillips 66 - San Francisco Refinery	Shore Terminals LLC	Crockett (Unincorporated)
NPDES Major	Discovery Bay WWTP	Ccc Sanitation District #19	Discovery Bay (Unincorporated)
NPDES Major	Discovery Bay WWTP	Discovery Bay Town Of	Discovery Bay (Unincorporated)
NPDES Major	Central Contra Costa WWTF	Central Cc Sanitary District	Martinez
NPDES Major	Eco Services Martinez Plant	Eco Services Operations LLC	Martinez
NPDES Major	Mt View Sanitary Dist WWTF	Mt View Sanitary District	Martinez
NPDES Major	Shell Oil Products, Martinez Refinery	Equilon Enterprises LLC	Martinez
NPDES Major	Tesoro Golden Eagle Refinery	Tesoro Refining & Marketing Co	Martinez
NPDES Major	Ironhouse Sd WWTP	Ironhouse Sanitary District	Oakley
NPDES Major	Pinole WWTF	Pinole City Of	Pinole
NPDES Major	Pittsburg Power Plant	Genon California North LLC	Pittsburg
NPDES Major	Pittsburg Power Plant	Pittsburg Power Company	Pittsburg
NPDES Major	Pittsburg Power Plant	Pacific Gas & Electric Co	Pittsburg
NPDES Major	Pittsburg Power Plant	Southern Energy Delta LLC	Pittsburg
NPDES Major	Uss-Posco Industries	Uss Posco Industries	Pittsburg
NPDES Major	Chevron Richmond Refinery	Chevron Usa Inc	Richmond
NPDES Major	Phillips 66 - San Francisco Refinery	Tosco Corporation	Rodeo (Unincorporated)
NPDES Major	Rodeo Sanitary District	Rodeo Sanitary District	Rodeo (Unincorporated)
NPDES Major	Chevron Richmond Refinery	Chevron Usa Inc	San Pablo
NPDES Minor	A1 Auto Dismantler Inc	Nguyen Theresa	Antioch
NPDES Minor	Bridgehead Marine Services	Devries Neil & Mary Tre	Antioch
NPDES Minor	Delta Diablo WWTP	Ccc Sanitation District #7 A	Antioch
NPDES Minor	Eastern Contra Costa Transit Authority	Eastern Contra Costa Transit	Antioch
NPDES Minor	Ftg Construction Materials Inc	Alegre Anthony J Tre	Antioch
NPDES Minor	Gateway Generating Station	Pacific Gas & Electric Co	Antioch
NPDES Minor	Georgia-Pacific Gypsum LLC	Georgia-Pacific Gypsum LLC	Antioch
NPDES Minor	Verco Decking, Inc	Verco Decking Inc	Antioch
NPDES Minor	Criterion Catalysts Company LP	LP Catalyst Holdings Inc	Bay Point (Unincorporated)

Permit Category	Facility Name	Facility Owner	City
NPDES Minor	Insurance Auto Auctions Inc	Borba Scott L Tre	Bay Point (Unincorporated)
NPDES Minor	Diablo Boat Works	Weltin Dan	Bethel Island (Unincorporated)
NPDES Minor	Golden Gate Petroleum	Bay Area Diablo Petroleum	Brentwood
NPDES Minor	Right Away Redy Mix	Bay Cities Blding Mat Co Inc	Byron (Unincorporated)
NPDES Minor	Concord Auto Dismantlers	Countryside Investments LLC	Concord
NPDES Minor	John A Mchugh	Mchugh John A Tre	Concord
NPDES Minor	John A Mchugh	Mchugh Mary Karen	Concord
NPDES Minor	Royal Trucking Company	Buildings 1-4 LLC	Concord
NPDES Minor	Seg Trucking	Candy Properties	Concord
NPDES Minor	Systron Donner	Systron Donner Inertial Inc	Concord
NPDES Minor	Systron Donner	Systron Business Center LLC	Concord
NPDES Minor	Stege Sewer Collection System	Stege Sanitary District	El Cerrito
NPDES Minor	Bio-Rad Laboratories	Bio-Rad Laboratories Inc	Hercules
NPDES Minor	American Stage Tours	Lucas James V & Shari	Martinez
NPDES Minor	American Stage Tours	Lucas James & Shari	Martinez
NPDES Minor	American Stage Tours	Lucas James V & Shari S	Martinez
NPDES Minor	Eagle Marine	Martinez City Of	Martinez
NPDES Minor	Delta Scrap And Salvage	Graunstadt Kenneth P Tre	Oakley
NPDES Minor	Pena Dismantler	Hulsey Tim L Tre	Oakley
NPDES Minor	E B M U D Orinda Water Trtmnt Plant	East Bay Municipal Utility Dis	Orinda
NPDES Minor	Antioch Building Materials Company	Pittsburg Industrial Park LLC	Pittsburg
NPDES Minor	Delta Diablo WWTP	Ccc Sanitation District #7 A	Pittsburg
NPDES Minor	Delta Diablo WWTP	Delta Diablo Sanitation Dist	Pittsburg
NPDES Minor	Hasa Inc	CCIP LP	Pittsburg
NPDES Minor	Koch Carbon LLC	Isle Capital Corporation Tre	Pittsburg
NPDES Minor	Los Medanos Energy Center	Uss Posco Industries	Pittsburg
NPDES Minor	Praxair, Inc	Union Carbide Ind Gases Inc	Pittsburg
NPDES Minor	Bay Cities Refuse Service, Inc.	United Refuse Service Inc	Richmond
NPDES Minor	Bragg Crane Ser	Bragg Investment Company Inc	Richmond
NPDES Minor	Bragg Crane Ser	Bragg Invewtment Co Inc	Richmond
NPDES Minor	Ecology Control Industries	255 Parr Blvd LLC	Richmond
NPDES Minor	First Student Inc 20306	Laidlaw Transit Inc	Richmond
NPDES Minor	Qualawash Holdings LLC	Quality Carriers Inc	Richmond
NPDES Minor	West Co Water Pollutional Control Plant	West County Wastewater Dist	Richmond
NPDES Minor	West Co Water Pollutional Control Plant	West County Wastewater Dist	San Pablo
NPDES Minor	USPS Walnut Creek VMF	Marasco Joseph Tre	Walnut Creek