C.8. Water Quality Monitoring

C.8.a. Compliance Options

All Permittees shall comply with all the monitoring requirements in this Provision. Permittees may choose any of the following mechanisms, or a combination of these mechanisms, to meet the monitoring requirements:

i. **Regional Collaboration.** Permittees are encouraged to continue contributing to the Regional Monitoring Collaborative (RMC), which coordinates water quality monitoring conducted by all the Permittees. Permittees are encouraged to consider and assign additional duties to the RMC for purposes of increased efficiencies, particularly but not limited to reporting duties.

ii. **Area-wide Stormwater Program.** Permittees may contribute to their countywide or area-wide Stormwater program, so that the Stormwater Program conducts monitoring on behalf of its members.

iii. **Third-party Monitoring.** Permittees may use data collected by a third-party organization, such as the Water Board or Department of Pesticide Regulation, to fulfill a monitoring requirement, provided the data are demonstrated to meet the data quality objectives described in Provision C.8.b.

C.8.b. Monitoring Protocols and Data Quality

Where applicable, monitoring data must be SWAMP comparable. Minimum data quality shall be consistent with the latest version of the SWAMP Quality Assurance Project Plan (QAPrP) for applicable parameters, including data quality objectives, field and laboratory blanks, field duplicates, laboratory spikes, and clean techniques, using the most recent SWAMP Standard Operating Procedures.

The BASMAA Regional Monitoring Coalition (RMC) Creek Status Monitoring Program Quality Assurance Project Plan (January 2014) and Standard Operating Procedures (January 2014) have been deemed by Water Board staff as SWAMP comparable. These documents may be updated to reflect the changing state-of-the-science with Executive Officer's approval.

C.8.c. San Francisco Estuary Receiving Water Monitoring

With limited exceptions, urban runoff from the Permittees' jurisdictions ultimately discharges to the San Francisco Estuary. Monitoring of the Estuary is intended to answer questions[1] such as:

- Are chemical concentrations in the Estuary potentially at levels of potential concern and are associated impacts likely?

[1] http://www.sfei.org/rmp/objectives (9/15/2014). While the stated objectives may change over time, the intent of this provision is for Permittees to continue contributing financially and as stakeholders in such a program as the RMP, which monitors the quality of San Francisco Bay.

- What are the concentrations and masses of contaminants in the Estuary and its segments?
- What are the sources, pathways, loadings, and processes leading to contaminant related impacts in the Estuary?
- Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?
- What are the projected concentrations, masses, and associated impacts of contaminants in the Estuary?

The Permittees shall participate in implementing an Estuary receiving water monitoring program, at a minimum equivalent to the San Francisco Estuary Regional Monitoring Program (RMP), by contributing their fair-share financially on an annual basis.

C.8.d. Creek Status Monitoring

Creek status monitoring is intended to assess the chemical, physical, and biological impacts of urban runoff on receiving waters. In particular, the monitoring required by this provision is intended to answer the following questions:

- Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?
- Are conditions in local receiving waters supportive of or likely to be supportive of beneficial uses?

i. Biological Assessment including Nutrients and General Water Quality Parameters

(1) Field and Laboratory Method – The Permittees shall conduct biological assessments (also referred to herein as bioassessments) in accordance with Surface Water Ambient Monitoring Program (SWAMP) Standard Operating Procedures[2,3,4] and shall include collection and reporting of in-stream biological and physical habitat data according to the *SWAMP*

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2 Ode, P.R. 2007. *Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California*, State Water Board Surface Water Ambient Monitoring Program (SWAMP), as subsequently revised [http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/swamp_sop_bio.pdf].

3 Current methods are documented in (1) *SWAMP Standard Operating Procedure (SOP) and Interim Guidance on Quality Assurance for SWAMP Bioassessments, Memorandum to SWAMP Roundtable from Beverly H. van Buuren and Peter R. Ode, May 21, 2007*, and (2) *Amendment to SWAMP Interim Guidance on Quality Assurance for SWAMP Bioassessments, Memorandum to SWAMP Roundtable from Beverly H. van Buuren and Peter R. Ode, September 17, 2008* both available at .http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#methods.

4 The Standard Operating Procedure for algae sampling and evaluation is available in the following: Fetscher, A. and K. McLaughlin, May 16, 2008. *Incorporating Bioassessment Using Freshwater Algae into California's Surface Water Ambient Monitoring Program (SWAMP).* Technical Report 563 and current SWAMP-approved updates to Standard Operating Procedures therein. Available at http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/reports/563_periphyton_bioassessment.pdf.

Standard Operating Procedures for Bioassessment[3], including benthic algae, benthic macroinvertebrates, water chemistry, and full characterization of physical habitat. Bioassessment sampling method shall be multihabitat reach-wide. Macroinvertebrates shall be identified according to the *Standard Taxonomic Effort Level I of the Southwestern Association of Freshwater Invertebrate Taxonomists* (except Chironomids should be identified to subfamily), using the most current SWAMP-approved method. For algae, the assessment shall include all analytes in the protocol including diatom and soft algae taxonomy, biomass (ash-free dry weight), chlorophyll a, pebble count algae information, and reach-wide algal percent cover. Physical Habitat (PHab) Assessment shall include the SWAMP full physical habitat characterization method.

(2) The sampling crew shall be trained by a SWAMP-approved trainer and possess a Scientific Collection Permit from the California Department of Fish and Wildlife, and participate in a SWAMP-approved inter-calibration exercise at least once in the permit term. The Discharger may modify its sampling procedures if these referenced procedures change during the Order term. In such case, the Discharger shall notify the Regional Water Board and follow the updated SWAMP procedures.

(3) Macroinvertebrates shall be identified and classified according to the *Standard Taxonomic Effort (STE) Level I of the Southwestern Association of Freshwater Invertebrate Taxonomists (SAFIT)*[5] (except Chironomids should be identified to subfamily) using a fixed count of 600 organisms per sample. The laboratory shall follow the *SWAMP Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrates in California*.[6] All quality assurance and quality control steps specified in the *SWAMP Quality Assurance Program Plan*[1] shall be performed.

(4) Bioassessment sampling requires the collection of general water quality parameters and nutrients at the site when biological samples are collected. General water quality parameters include measuring temperature, dissolved oxygen, pH, and specific conductance using a sonde. Nutrients include total ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen (calculated), dissolved orthophosphate and total phosphorous, silica and chloride.

(5) In conducting the required bioassessment monitoring, the Permittees shall take precautions to prevent the introduction or spread of aquatic invasive species.

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5 The current SAFIT STEs (November 28, 2006) list requirements for both the Level I and Level II taxonomic effort, and are located at http://www.waterboards.ca.gov/water_issues/programs/swamp/safit.shtml. When new editions are published by SAFIT, they will supersede all previous editions. All editions will be posted at the State Water Board's SWAMP website.

6 http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/bmi_lab_sop_final.pdf.

(6) Sample Design/Locations – The Permittees shall continue to use the probabilistic sample design developed in the previous permit term 2009-2014 to select sample locations. Also, Permittees shall continue to use the sampling site order and the rationale to exclude potential sites as previously defined by the sample design and reconnaissance standard operating procedures.

(7) Frequency, Timeframe and Number of Sites – Sampling shall occur once per year during the appropriate index period (April 15- June 30) with consideration of antecedent rainfall. Sampling is a one-time grab sample for biological communities, nutrients, and general water quality collected on the same day.

Sampling Agency	Minimum Number of Samples
Alameda Permittees	20 per year
Santa Clara Permittees	20 per year
Contra Costa Permittees	10 per year
San Mateo Permittees	10 per year
Fairfield-Suisun Permittees	8 per 5-year period
Vallejo Permittees	4 per 5-year period

(8) Follow Up – The Permittees shall consider sites scoring less than 0.795 according to the California Stream Condition Index[7] (CSCI) as potentially appropriate for a Stressor Source Identification (SSID) project as defined in C.8.e. Such a score indicates a substantially degraded biological community relative to reference conditions. A SSID project shall also be considered when there is a substantial difference in CSCI score observed at a location relative to upstream or downstream sites. If many samples show a degraded biological condition, sites where water quality is most likely to cause and contribute to this degradation may be prioritized by the Permittee for a SSID project.

ii. Chlorine

(1) Field and Laboratory Method – Permittees shall collect a grab sample and analyze for free and total chlorine using methods specified in the BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Standard Operating Procedures.

(2) Sample Design/Locations – Sample locations may be selected by the Permittees to monitor locations near known or suspected potable water line breaks; to coincide with bioassessment sites; to coincide with creek restoration sites; or to resample a location where chlorine has been found in the past.

(3) Frequency, Timeframe and Number of Samples – Samples shall be collected in spring or summer. Vallejo and Fairfield-Suisun Permittees

[7] Documentation for the CSCI and information on calculating scores can be found at http://www.swrcb.ca.gov/plans_policies/biological_objective.shtml.

each shall collect their samples by the end of the second year of the permit term.

Sampling Agency	Minimum Number of Locations Sampled
Alameda Permittees	20 per year
Santa Clara Permittees	20 per year
Contra Costa Permittees	10 per year
San Mateo Permittees	10 per year
Fairfield-Suisun Permittees	8 per 5-year period
Vallejo Permittees	4 per 5-year period

(4) Follow Up – The Permittees shall immediately resample if the chlorine concentration is greater than 0.1 mg/L. If the resample is still greater than 0.1 mg/L, then resample 1-7 days later to document persistence of the exceedance. If third sample remain > 0.1 mg/L then report to local stormwater program or water purveyor to find source of chlorine.

iii. Temperature

(1) Field Method – The Permittees shall monitor temperature of their streams using a digital temperature logger or equivalent.

(2) Sample Design/Locations – The Permittees shall monitor stream reaches that are documented to support cold water fisheries and where either past data or best professional judgment indicates that temperatures may negatively affect that beneficial use.

(3) Frequency, Timeframe and Number of Sites – Loggers shall be installed so that water temperatures are recorded at 60-minute intervals from April through September at the number of sites specified below.

Sampling Agency	Minimum Number of Stream Reaches Sampled
Alameda Permittees	8 per year
Santa Clara Permittees	8 per year
Contra Costa Permittees	4 per year
San Mateo Permittees	4 per year
Fairfield-Suisun Permittees	2 per 5-year period
Vallejo Permittees	2 per 5-year period

(4) Follow Up – The Permittees shall consider conducting a SSID project when results in one water body (stream reach) exceed the applicable temperature trigger or demonstrate a spike in temperature with no obvious natural explanation. The temperature trigger is defined as a Maximum Weekly Average Temperature of 14.8°C for Coho and 17.0°C for a Steelhead stream, or any single instantaneous measurement above 24°C.[8]

[8] This weekly average trigger correspond to a 10% reduction in growth as listed in Table 7.3 in Sullivan K., Martin, D.J., Cardwell, R.D., Toll, J.E., Duke, S. 2000. *An Analysis of the Effects of Temperature on Salmonids of the Pacific Northwest with Implications for Selecting Temperature Criteria*, *Sustainable Ecosystem Institute*). The 24°C acute threshold is cited on page THIS WILL GO INTO THE FACT SHEET

Permittees shall calculate the weekly average temperature by breaking the measurements into non-overlapping, 7-day periods. If two or more weekly average temperatures are above the appropriate Maximum Weekly Average Temperature trigger, the stream reach is suitable for a SSID.

iv. Continuous Monitoring of Dissolved Oxygen, Temperature and pH

(1) Field and Laboratory Method – The Permittees shall monitor general water quality parameters of streams using a water quality sonde or equivalent. Parameters shall include dissolved oxygen (mg/L and % saturation), pH, specific conductance (µS), and temperature (°C).

(2) Sample Design/Locations – The Permittees shall monitor stream reaches that are documented to support cold water fisheries and where either past data or best professional judgment indicates that general water quality parameters may negatively affect that beneficial use.

(3) Frequency, Timeframe and Number of Sites – Sondes shall be installed so that parameters are recorded at 15-minute intervals over 1-2 weeks in the spring concurrent with bioassessment sampling and 1-2 weeks in summer at the same sites. The required number of samples is specified below.

Sampling Agency	**Minimum Number of Sample Sites in Spring**	**Minimum Number of Sample Sites in Summer**
Alameda Permittees	3 per year	3 per year
Santa Clara Permittees	3 per year	3 per year
Contra Costa Permittees	2 per year	2 per year
San Mateo Permittees	2 per year	2 per year
Fairfield-Suisun Permittees	2 per permit term	2 per 5-year period
Vallejo Permittees	2 per permit term	2 per 5-year period

(4) Follow Up – The Permittees shall consider conducting a SSID project when results in one water body (stream reach) exceed the applicable temperature or dissolved oxygen trigger or demonstrate a spike in temperature or drop in dissolved oxygen with no obvious natural explanation. The Permittees shall calculate the weekly average temperature and dissolved oxygen by separating the measurements into non-overlapping, 7-day periods. The temperature trigger is defined as the Maximum Weekly Average Temperature of 14.8°C for Coho and 17.0°C for a Steelhead stream, or any single instantaneous measurement above 24°C.[9] If the average weekly temperature is above the appropriate Maximum Weekly Average Temperature trigger, the trigger is exceeded. A trigger is exceeded if 20% of instantaneous measurements for pH are < 6.5 or > 8.5. A trigger is exceeded if 20% of the instantaneous specific conductance readings are > 2000µS, or there is a spike in readings with no obvious natural explanation. A trigger is exceeded if 20% of instantaneous dissolved oxygen readings are > 7 mg/L in a cold water fishery stream.

v. Toxicity in Water Column

(1) Field and Laboratory Method – The Permittees shall collect grab samples of receiving (creek) water using applicable SWAMP comparable methodology. These samples shall be analyzed for the pollutants listed and by the methods described on Table 8.1.

Toxicity test biological endpoint data must be analyzed using the Test of Significant Toxicity (TST) t-test approach.[9] Each sample shall be subject to determination of "Pass" or "Fail" and "Percent Effect" from a single-effluent concentration chronic toxicity test at the in-stream waste concentration (IWC) (100% receiving water or 100% storm drain outfall effluent, as applicable) using the TST. The null hypothesis (H_o) for the TST approach is: Mean IWC response $\leq 0.75 \times$ Mean control response. A test result that rejects this null hypothesis is reported as "Pass." A test result that does not reject this null hypothesis is reported as "Fail." The relative "Percent Effect" at the IWC is defined and reported as: ((Mean control response – Mean IWC response) ÷ Mean control response)) × 100.

Table 8.1 Water Column Aquatic Toxicity Analytical Procedures

Organism	Units	Test	USEPA Protocol
Pimephales promelas (Fathead Minnow)	Pass or Fail, % Effect (TST)	Larval Survival and Growth	EPA-821-R-02-013[10] EPA 833-R-10-003[11]
Ceriodaphnia dubia (Freshwater Amphipod)	Pass or Fail, % Effect (TST)	Survival and Production	EPA-821-R-02-013 EPA 833-R-10-003
Hyalella Azteca (Freshwater Amphipod)	Pass or Fail, % Effect (TST)	Survival	EPA-821-R-02-012[12] EPA 833-R-10-003
Chironomus dilutes (midge)	Pass or Fail, % Effect (TST)	Survival	EPA-821-R-02-012[13] EPA 833-R-10-003
Selenastrum capricornutum (Green Algae)	Pass or Fail, % Effect (TST)	Growth	EPA-821-R-02-013 EPA 833-R-10-003

[9] National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document (EPA 833-R-10-003, 2010), Appendix A, Figure A-1, and Table A-1.

[10] *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms.* EPA/821/R-02/013, 2002; Table IA, 40 CFR Part 136.

[11] *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003) 2010.

[12] *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/821/R-02/012, 2002; Table IA, 40 CFR Part 136).

[13] *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/821/R-02/012, 2002; Table IA, 40 CFR Part 136).

(2) Sample Design/Locations – Sample locations may be selected by the Permittees to monitor locations where toxicity could be likely; to coincide with bioassessment sites; to coincide with creek restoration sites; or to resample a location where toxicity has been found in the past.

(3) Frequency, Timeframe and Number of Sites – The Permittees shall collect samples annually in the dry season. The required number of samples is specified below.

Sampling Agency	Minimum Number of Sample Sites[a]
Alameda Permittees	~~3~~ 2 per year
Santa Clara Permittees	~~3~~ 2 per year
Contra Costa Permittees	~~2~~ 1 per year
San Mateo Permittees	~~2~~ 1 per year
Fairfield-Suisun & Vallejo Permittees Collectively	1 per 5-year period

[a]In the case that a statewide coordinated pesticides and pesticides-related toxicity monitoring program begins collecting data on an ongoing basis during the permit term, the Permittees may request the Executive Officer reduce or eliminate this monitoring requirement accordingly.

(4) Follow Up – The Permittees shall consider conducting a SSID project when a sample result indicates 50% or greater effects relative to the control for a chronic toxicity test, or 40% or greater effect relative to the control for an acute toxicity test.

vi. Toxicity and Pollutants in Sediment

(1) Field and Laboratory Method – The Permittees shall collect grab samples of creek sediment using applicable SWAMP comparable methodology. These samples shall be analyzed for the pollutants listed and by the methods described on Table 8.2.

Table 8.2 Sediment Toxicity & Pollutants Analytical Procedures

Organism or Pollutant	Units	Test	Laboratory Method[a]
Hyalella Azteca (Freshwater amphipod)	Pass/Fail, % effect (TST)	Survival	EPA-821-R-02-012[14] EPA 833-R-10-003
PCBs			
Mercury			MPSL-107 followed by MPSL-103
Pyrethroids[b]: bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin			EPA 3540C followed by EPA 8270D by NCI-GCMS
Carbaryl[2]			
Fipronil[2]			
Organochlorine pesticides[2]: Chlordane, Dieldrin, Sum DDD, Sum			

[14] *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/821/R-02/012, 2002; Table IA, 40 CFR Part 136).

Organism or Pollutant	Units	Test	Laboratory Method[a]
DDE, Sum DDT, Endrin, Heptachlor epoxide, Lindane (gamma-BHC)			
Total PAHs			
Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc			Modified EPA 3052M followed by EPA 200.8
Total organic carbon			
Grain size			Plumb, 1981

[a] Methods shown are from the SWAMP SPoT QAPP. When no protocol is listed, use RMC QAPrP methods.
[b] In the case that a statewide coordinated pesticides and pesticides-related toxicity monitoring program begins collecting data on an ongoing basis during the permit term, the Permittees may request the Executive Officer reduce or eliminate this monitoring requirement accordingly.

(2) Sample Design/Locations – Samples shall be collected at fine-grained depositional, bottom of watershed locations. Such sample locations may be selected by the Permittees to monitor locations where toxicity could be likely, to coincide with bioassessment sites, or to resample a location where toxicity has been found in the past, for example.

(3) Frequency, Timeframe and Number of Sites – The Permittees shall collect samples annually during the dry season. The required number of samples is specified below.

Sampling Agency	Minimum Number of Sample Sites
Alameda Permittees	~~3~~ 2 per year
Santa Clara Permittees	~~3~~ 2 per year
Contra Costa Permittees	~~2~~ 1 per year
San Mateo Permittees	~~2~~ 1 per year
Fairfield-Suisun & Vallejo Permittees Collectively	1 per 5-year period

(4) Follow Up – The Permittees shall consider conducting a SSID project when a sample result indicates 50% or greater effects relative to the control for a chronic toxicity test, or 40% or greater effect relative to the control for an acute toxicity test. The Permittees shall consider conducting a SSID project when sample results indicate a pollutant is present at a concentration exceeding its water quality objective in the Basin Plan. For pollutants without WQOs, Permittees shall consider conducting a SSID project when sample results exceed PECs or TECs from MacDonald 2000.[15]

vii. Pathogen Indicators

(1) Field and Laboratory Method – The Permittees shall collect and analyze samples for Enteroccoci and *E. coli* in accordance with the most recent U.S. EPA protocols.[16]

[15] TEC and PEC are found in MacDonald, D.D., G.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems. *Archives of Environ. Contamination and Toxicology* 39(1):20–31.

[16] U.S. EPA protocols available at http://water.epa.gov/scitech/methods/cwa/methods_index.cfm. Analytical methods listed here are also acceptable: http://water.epa.gov/grants_funding/beachgrants/chapter4.cfm

(2) Sample Design/Locations – The Permittees shall collect one or more samples in a creek and at an area where water-contact recreation is likely, or at an opportunistic location where there is potential to detect leaking sewerage infrastructure.

(3) Frequency, Timeframe and Number of Sites – The Permittees shall collect samples in the dry season. The required number of samples is specified below.

Sampling Agency	Minimum Number of Sample Sites
Alameda Permittees	5 per year
Santa Clara Permittees	5 per year
Contra Costa Permittees	5 per year
San Mateo Permittees	5 per year
Fairfield-Suisun Permittees	3 per 5-year period
Vallejo Permittees	3 per 5-year period

(4) Follow Up – If U.S. EPA's statistical threshold value[17] for 36 per 1000 primary contact recreators is exceeded, the water body reach shall be considered for a Stressor/Source Identification project per C.8.e.

C.8.e. Stressor/Source Identification (SSID) Projects

When any Creek Status Monitoring result triggers follow up or potential follow up action as indicated within the provisions of C.8.d, the Permittees shall take the following actions, as also required by Provision C.1. If the trigger stressor or source is already known, proceed directly to step 2 below. Further explanation of the SSID project steps is provided in Appendix C.8-X. Permittees shall initiate the first follow up action as soon as possible, and no later than the second fiscal year after the sampling event that triggered the SSID Project.

i. Conduct a site specific study (or non-site specific if the problem is wide-spread) in a stepwise process to identify and isolate the cause(s) of the trigger stressor/source. This study shall follow guidance for Toxicity Reduction Evaluations (TRE)[18] or Toxicity Identification Evaluations (TIE).[19] A TRE, as adapted for urban stormwater data, allows Permittees to use other sources of

[17] USEPA. 2012. *Recreational Water Quality Criteria*. Office of Water 820-F-12-058. Table 4.

[18] USEPA. August 1999. *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants*. EPA/833B-99/002. Office of Wastewater Management, Washington, D.C.

[19] Select TIE methods from the following references: For sediment: (1) Ho KT, Burgess R., Mount D, Norberg-King T, Hockett, RS. 2007. *Sediment toxicity identification evaluation: interstitial and whole methods for freshwater and marine sediments*. USEPA, Atlantic Ecology Division/Mid-Continental Ecology Division, Office of Research and Development, Narragansett, RI, or (2) Anderson, BS, Hunt, JW, Phillips, BM, Tjeerdema, RS. 2007. *Navigating the TMDL Process: Sediment Toxicity*. Final Report- 02-WSM-2. Water Environment Research Federation. 181 pp. For water column: (1) USEPA. 1991. *Methods for aquatic toxicity identification evaluations. Phase I Toxicity Characterization Procedures.* EPA 600/6-91/003. Office of Research and Development, Washington, DC., (2) USEPA. 1993. *Methods for aquatic toxicity identification evaluations. Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity*. EPA 600/R-92/080. Office of Research and Development, Washington, DC., or (3) USEPA. 1996. *Marine Toxicity Identification Evaluation (TIE), Phase I Guidance Document*. EPA/600/R-95/054. Office of Research and Development, Washington, DC.

information (such as industrial facility stormwater monitoring reports) in attempting to determine the trigger cause, potentially eliminating the need for a TIE. If a TRE does not result in identification of the stressor/source, Permittees shall conduct a TIE.

ii. Identify and evaluate the effectiveness of options for controlling the cause(s) of the trigger stressor/source.

iii. Implement one or more controls.

iv. Confirm the reduction of the cause(s) of trigger stressor/source.

v. Stressor/Source Identification Project Cap: Permittees who conduct this monitoring through a regional collaborative shall initiate a minimum of eight new Stressor/Source Identification projects during the Permit term. Because these SSIDs are being conducted through a regional collaborative, all SSID project reports shall be presented in a unified, regional-level reports when submitted to the Water Board.

If conducted through a stormwater countywide program, the Santa Clara and Alameda Permittees each shall be required to initiate no more than five (two for toxicity); the Contra Costa and San Mateo Permittees each shall be required to initiate no more than three (one for toxicity); and the Fairfield-Suisun and Vallejo Permittees each shall be required to initiate no more than one Stressor/Source Identification project(s) during the Permit term.

vi. As long as Permittees have complied with the procedures set forth above, they do not have to repeat the same procedure for continuing or recurring exceedances of the same receiving water limitations unless directed to do so by the Water Board.

C.8.f. Pollutants of Concern Monitoring

Pollutants of Concern (POC) monitoring is intended to assess inputs of Pollutants of Concern to the Bay from local tributaries and urban runoff, provide information to support implementation of TMDLs and other pollutant control strategies, assess progress toward achieving wasteload allocations (WLAs) for TMDLs and help resolve uncertainties associated with loading estimates and impairments associated with these pollutants.

In particular, monitoring required by this provision must be directed toward addressing the following five priority POC management information needs:

1. **Source Identification** - identifying which sources or watershed source areas provide the greatest opportunities for reductions of POCs in urban stormwater runoff;
2. **Contributions to Bay Impairment** - identifying which watershed source areas contribute most to the impairment of San Francisco Bay beneficial uses (due to source intensity and sensitivity of discharge location);

3. **Management Action Effectiveness** - providing support for planning future management actions or evaluating the effectiveness or impacts of existing management actions;
4. **Loads and Status** - providing information on POC loads, concentrations, and presence in local tributaries or urban stormwater discharges; and
5. **Trends** - evaluating trends in POC loading to the Bay and POC concentrations in urban stormwater discharges or local tributaries over time.

Not all information needs apply to all POCs (see Table 8.4 below for details).

i. Sampling Methods – The Permittees shall implement or cause to be implemented the monitoring components shown in Table 8.3 in order to address each of the five POC management information needs.

Table 8.3 POC Monitoring Methods

Monitoring Type	Information Need	Monitoring Methods
1	Identify Source Areas	Monitoring methods to identify watershed sources of POCs should include: • Collection and analysis of POCs on sediments in urban stormwater runoff that are transported through MS4s or receiving waters during stormwater runoff events; or • Collection and analysis of POCs on bedded sediments deposited in MS4s or receiving waters; or • Collection and analysis of POCs in stormwater runoff or bedded sediments on source area properties (e.g. private property); or, • Other monitoring methods designed to identify specific sources or uses of POCs (e.g., caulk in roadways or building materials) or watershed source areas.
2	Identify watershed areas contributing most to Bay impairment	Monitoring methods to identify watershed areas contributing most to Bay impairment should include: • Methods described for Monitoring Type #1; or • Collection of small fish tissue (or equivalent indicator) near tributary confluences with the Bay and analysis for POCs; or • Collection of bedded sediments near tributary confluences with the Bay and analysis for POCs
3	Provide support for future or existing management actions	Monitoring methods to support future or existing management actions should include: • Methods described for Monitoring Type #1, with a focus on monitoring the effectiveness of specific management actions in reducing or avoiding POCs in MS4 discharges.
4	Provide information on POC loads, concentrations, or presence / absence	Monitoring methods to provide information on POC loads, concentrations or presence/absence should include: • Methods described for Monitoring Type #1, in combination with quantitative modeling associated with quantifying POC loads from MS4s or small tributaries to the Bay.
5	Evaluate POC	Monitoring methods to provide information on trends in POC

Monitoring Type	Information Need	Monitoring Methods
	trends	loads and concentrations overtime may include: Methods described for Monitoring Type #1 or #2.

ii. Parameters and Monitoring Frequency – The Permittees shall conduct POC monitoring consistent with the monitoring intensity and frequency specified in Table 8.4. Monitoring frequencies are described as the total and minimum number of samples that Permittees within a countywide Stormwater Program shall collectively collect and analyze in a Water Year (October 1 – September 30). Minimum number of samples that Permittees within a countywide Stormwater Program shall collect by the end of the fourth Water Year (i.e., September 30, 2019) to address each monitoring type are also specified.

Table 8.4 POC Monitoring Parameters, Effort and Type

Pollutant of Concern	**Total Samples[1] Collected/Analyzed (yearly minimum) for each Countywide Program: Alameda, Contra Costa, Santa Clara, and San Mateo**	**Minimum Number of Samples for each Monitoring Type[2]**
Polychlorinated Biphenyls (PCBs)	80 (8)	8 samples minimum for monitoring types 1-5
Total Mercury	80 (8)	8 samples minimum for monitoring types 1-5
Copper	20 (2)	4 samples minimum for monitoring types 4-5
Pesticides: Pyrethroids (water and sediment): bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin Indoxacarb Fipronil Carbaryl (in sediments)	20 (2) for each	4 samples minimum for monitoring types 4-5
Toxicity: Water Column (during storms) Sediment (wet season, not necessarily during storms)	~~20~~ 10 (~~2~~1) for each	20 samples for monitoring type 4
Emerging Contaminants: Perfluorooctane Sulfonates (PFOS, in sediment) Perfluoroalkyl sulfonates (PFAS, in sediment) Alternative flame retardants	See footnote 3	See footnote 3
Ancillary Parameters[4]: Total organic carbon Suspended sediments (SSC)	as necessary to address management questions for other POCs – see footnote 4	

Hardness		
Nutrients: Ammonium, Nitrate, Nitrite, Total Kjeldahl Nitrogen, Orthophosphate, Total Phosphorus (all nutrients collected together for each sample)	20 (2) for each nutrient species	20 samples for monitoring type 4 for each nutrient species.

[1]This column indicates the total number of samples, across all applicable monitoring types (i.e., monitoring types 1-5 from Table 8.3), that must be collected during the permit term. The number in parentheses indicates the minimum number of samples that must be collected, across all applicable monitoring types, during each of the five years of the permit. For example, 80 total samples must be collected for both total PCBs and mercury by each set of Santa Clara County, San Mateo County, Alameda County, and Contra Costa County Permittees during the term of the permit. There must be a minimum of 8 PCBs samples collected during every year of the permit, including the final year.

[2]This column indicates the monitoring types from Table 8.3 that are applicable to this POC along with the minimum number of samples that shall be collected by each set of Permittees (i.e., Santa Clara County, San Mateo County, Alameda County, and Contra Costa County) to address the applicable monitoring types by the end of year four of the permit. For example, each set of Permittees (i.e., Santa Clara County, San Mateo County, Alameda County, and Contra Costa County) must collect and analyze at least 8 samples to address monitoring types 1-5 in Table 8.3 for both total PCBs and total mercury. Some collected samples may address multiple management questions.

[3]The Permittees shall conduct or cause to be conducted a special study that addresses relevant management information needs for emerging contaminants. The special study would address at least PFOS, PFAS, and alternative flame retardants being used to replace PBDEs. The study would identify the relevant alternative flame retardants to assess and the appropriate media in which to monitor.

[4]Total Organic Carbon (TOC) data are not used independently. Rather, TOC can be useful for normalizing PCBs data collected in water and sediment. TOC shall be collected concurrently with PCBs data that should be normalized to TOC. Similarly, suspended sediment concentrations (SSC) samples should be collected and analyzed when water samples are collected that will be used to assess loads, loading trends, or BMP effectiveness for PCBs and Mercury. Hardness data are used in conjunction with copper concentrations collected in fresh water.

iii. POC Parameters and Analytical Methods – Samples collected consistent with Table 8.4 shall be analyzed for parameters listed in Table 8.5. Permittees may use.

Table 8.5 POC Analytes and Analytical Methods

Pollutant of Concern	Matrix	Analyte(s)	Laboratory Analytical Methods[1]
Polychlorinated Biphenyls (PCBs)	Water	Total PCBs	USEPA 1668 (RMP 40)
		Total Organic Carbon	
		Suspended sediments (SSC)	

Pollutant of Concern	Matrix	Analyte(s)	Laboratory Analytical Methods[1]
	Bedded Sediment	Total PCBs	USEPA 1668 (RMP 40)
		Total organic carbon	
Mercury	Water	Total Mercury	
	Bedded Sediment	Total Mercury	
Copper	Water	Total Copper	
		Dissolved Copper	
		Hardness	
Pesticides[2]	Water	Pyrethroids: bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin Imidacloprid	
		Fipronil and Carbaryl (bedded sediment only)	
	Bedded Sediment	Total Organic Carbon	
Toxicity[2]	Water	*Pimephales promelas* (Fathead Minnow)	Use methods stated in Provision C.8.d.vi. and vii.
		Ceriodaphnia dubia & Hyalella Azteca (Freshwater Amphipod)	
		Chironomus dilutes (midge)	
		Selenastrum capricornutum (Green Algae)	
	Bedded Sediment	*Hyalella azteca*	
Nutrients	Water	Ammonium	
		Nitrate	
		Nitrite	
		Total Kjeldahl Nitrogen	
		Orthophosphate	
		Total Phosphorus	

[1]Where no method is listed, use RMC QAPrP methods alternative methods. Other analytical laboratory methods may be used provided that similar data quality is employed to answer the management information needs.

[2]In the case that a statewide coordinated pesticides and pesticides-related toxicity monitoring program begins collecting data on an ongoing basis during the permit term, the Permittees may request the Executive Officer reduce or eliminate this monitoring requirement accordingly.

C.8.f. Reporting

i. Water Quality Standard Exceedence – When data collected pursuant to C.8.a.-C.8.f. indicate that discharges are causing or contributing to an exceedance of an applicable water quality standard, the Permittees shall notify the Water Board within no more than 30 days of such a determination and submit a follow up report in accordance with Provision C.1 requirements. This reporting requirement shall not apply to continuing or recurring exceedances of water quality standards previously reported to the Water Board or to

exceedances of pollutants that are to be addressed pursuant to Provisions C.8 through C.14 of this Order in accordance with Provision C.1.

ii. Electronic Reporting – The Permittees shall submit to the California Environmental Data Exchange Network (CEDEN) all results from monitoring conducted pursuant to Provisions C.8.d. Creek Status, C.8.e. SSID Projects (as applicable), and C.8.f. Pollutants of Concern. Data that CEDEN cannot accept are exempt from this requirement.

(1) Data shall be submitted in SWAMP formats and with the quality controls required by CEDEN.

(2) Data collected during the foregoing October 1–September 30 period shall be submitted by March 15 of each year.

iii. Urban Creeks Monitoring Report – The Permittees shall submit a comprehensive Creek Status Monitoring Report no later than March 15 of each year, reporting on all data collected during the foregoing October 1–September 30 period. Each Urban Creeks Monitoring Report shall contain summaries of Creek Status, SSID Projects, and Pollutants of Concern Monitoring including, as appropriate, the following:

(1) Immediately following the Table of Contents, a completed Water Year Summary Table that combines each Program's monitoring sites, with a row for each site. The table columns contain: Site ID; creek name; land use; latitude; longitude; bioassessment, nutrient; chlorine; water column toxicity; sediment toxicity and chemistry; pathogens; temperature loggers; and general water quality (sonde data). For each site, check the parameters sampled. This will provide a summary of all Creek Status Monitoring conducted that water year.

(2) A SSID Update Table listing all the SSID Projects to be initiated, being conducted, or completed through the Regional Monitoring Collaborative. This table shall state the date the project was started; hyperlink to the project work plan; summary of work completed during the reporting year; follow-up actions taken or planned, with dates, to reduce the source or stressor; and responsible agency.

(3) For all data, a statement of the data quality;

(4) An analysis of the data, which shall include the following:

- Identification and analysis of any trends in stormwater or receiving water quality;
- Calculations of CSCI scores and physical habitat endpoints;
- Comparison of CSCI scores to:
  - Each other;
  - Any applicable, available reference site(s);
  - Physical habitat endpoints.

(5) A discussion of the data for each monitoring program component, which shall:

- Discuss monitoring data relative to prior conditions, beneficial uses and applicable water quality standards as described in the Basin Plan, the Ocean Plan, or the California Toxics Rule or other applicable water quality control plans;
- Where appropriate, develop hypotheses to investigate regarding pollutant sources, trends, and BMP effectiveness;
- Identify and prioritize water quality problems;
- Identify potential sources of water quality problems;
- Describe follow-up actions;
- Evaluate the effectiveness of existing control measures;
- Identify management actions needed to address water quality problems.

iv. Stressor/Source Identification Reports – The Permittees shall submit a report on each completed SSID Project in a stand-alone format suitable for posting and distribution. Completed SSID Project reports shall be submitted no later than March 15 of the year following project completion.

v. Integrated Monitoring Report – No later than March 15 of the fifth year of the permit term, Permittees shall submit an Integrated Monitoring Report in lieu of the annual Creek Status Monitoring Report. This report will be part of the next Report of Waste Discharge for the reissuance of this Permit. The Integrated Monitoring Report shall report on all the data collected during the permit term and shall contain the following:

(1) The Water Year Data Table, as described in Provision C.8.g.iii above, containing information pertaining to the fourth year monitoring data;

(2) The Integrated Monitoring Report shall include a comprehensive analysis of all data collected pursuant to Provision C.8. across years 1 through 4 of the permit, and may include other pertinent studies;

(3) For Pollutants of Concern, the report shall include methods, data, calculations, load estimates, and source estimates for each Pollutant of Concern Monitoring parameter;

(4) The Integrated Monitoring Report shall include a budget summary for each monitoring requirement and recommendations for future monitoring.

vi. Standard Report Content –All monitoring reports shall include the following:

(1) The purpose of the monitoring and briefly describe the study design rationale;

(2) Quality Assurance/Quality Control summaries for sample collection and analytical methods, including a discussion of any limitations of the data;

(3) Brief descriptions of sampling protocols and analytical methods;

(4) Sample location description, including water body name and segment and latitude and longitude coordinates;

(5) Sample ID, collection date (and time if relevant), media (e.g., water, filtered water, bed sediment, tissue);

(6) Concentrations detected, measurement units, and detection limits;

(7) Assessment, analysis, and interpretation of the data for each monitoring program component;

(8) Pollutant load and concentration at each mass emissions station;

(9) A listing of volunteer and other non-Permittee entities whose data are included in the report;

(10) Assessment of compliance with applicable water quality standards;

(11) A signed certification statement.

C.8.g. Pacifica TMDL Implementation Monitoring – placeholder if needed

Stressor/Source Identification (SSID) Project Elements

Based in part on U.S. EPA's Causal Analysis/Diagnosis Decision Information System[1]

Note: Permittee and Water Board staff have discussed development of guidance to clarify what a SSID project entails. This is Water Board staff's first effort to draft the guidance, and we provide it to Permittees as a discussion tool.

Review WY*current* Creek Status Monitoring results

- List all results that could potentially trigger follow up per provisions of MRP C.8.d.
- Long-term and Pollutant of Concern Monitoring results may be included as appropriate
- Maintain a running list of potential trigger results that includes data from WY2009 forward
- **Submit one list of all RMC potential trigger results in each Urban Creeks Monitoring Report** [decide if we truly want/need this]

Select follow up projects (SSIDs) from the trigger list

- Selection criteria shall include analyte (for a variety of analytes); magnitude and frequency of threshold exceedance; potential for lesson learned; geographical coverage; etc.
- Prioritize sites with many data points, spatially and temporally. Prioritize water quality problems for which management actions are likely to reduce the problem
- Engage municipal personnel and/or others (e.g., park staff) who may have useful knowledge of problem either during the selection process or immediately after follow up projects are selected, as appropriate

Begin SSID project

- An SSID project is begun when the problem location is resampled to confirm the continued presence of the problem or a decision is made to follow up with management action(s)
- As projects are begun, inform and engage municipal personnel who would have authority to direct management actions related to project
- Begin one or more SSID project region-wide annually until the number of projects specified in C.8.e.v. has been initiated in the permit term
- **Submit one list of all RMC SSID projects with projected or actual start date, as appropriate to the project, in each Urban Creeks Monitoring Report**

Project Step 1: Define the problem

- State the water quality issue (problem), including its nature, magnitude and temporal extent, to the extent known
- Estimate the geographic scope of the problem
- Describe the SSID project's objectives, including the management context within which the results of the investigation will be used
- **To the list of all RMC SSID projects submitted in each Urban Creeks Monitoring Report, as SSID problems are defined, add a very brief problem definition**

[1] U.S. EPA (Environmental Protection Agency). 2010. Causal Analysis/Diagnosis Decision Information System (CADDIS). Office of Research and Development, Washington, DC. Available online at http://www.epa.gov/caddis. Last updated September 23, 2010.

Project Step 2: Evaluate data and identify candidate causes

- Evaluate data from the case and elsewhere (e.g., data in CEDEN, other previously collected data)
- Consider the problem within a watershed context and look at multiple types of related indicators, where possible (e.g., basic water quality data and biological assessment results)
- Discussion of this step can be found at http://www.epa.gov/caddis/si_step3_indepth.html
- List candidate causes of the problem (e.g., biological stressors, pollutant sources, physical stressors) based on this evaluation and staff knowledge

Project Step 3: Determine whether management actions can be taken to reduce problem without further study. If so, skip to Project Step 5. If not, proceed to Project Step 4.

- For a biological stressor, study may be necessary to identify the probable cause before action can be taken
- For toxicity, the cause in urban areas in California is often pesticides. Over a five-year permit term, further study to determine the toxicant should be conducted for two toxicity problems in a minimum of two distinct geographic areas (e.g., east bay, south bay, peninsula). This will provide information on any changes in causes of toxicity and in pesticide usage. Further studies are not likely to provide "lessons learned;" instead, further toxicity problems should be followed up with enhanced management actions.
- For pollutant problems, including temperature, determine whether a probable source or cause is likely known and whether taking management action(s) could eliminate or minimize the problem without further study
- **On the list of RMC SSID projects, indicate which projects will receive direct follow up actions and which will receive further study. Submit the list in each Urban Creeks Monitoring Report.**

Project Step 4: Conduct Further Studies to Determine Cause of Stressor/Toxicity/Pollutant Source

- For physical habitat, physical pollutants (dissolved oxygen, pH, conductivity, temperature), nutrients, metals, pH and other stressors, generally follow the Causal Analysis/Diagnosis Decision Information System (CADDIS) at http://www.epa.gov/caddis/si_step5_overview.html, Step 5: Identify Probable Causes
- For an SSID for toxicity, where there is no chemical pollutant associated with the toxic samples, conduct a Toxicity Identification Evaluation (TIE). Where chemical data indicate a pollutant, such as fipronil or a pyrethroid, are present in the sample location, it is not necessary to conduct a TIE, and the SSID would be considered complete
- For chemical or biological pollutants, identify the most likely cause of the water quality problem through laboratory studies using the most appropriate methods. For example, for pathogens, use the California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches, 2013
- **Submit a work plan with schedule for the Causal Analysis, TIE, or source study in the Urban Creeks Monitoring Report within one calendar year of beginning a project**. Begin conducting the study as amended by comments from Water Board Monitoring staff by the following September
- Conduct the study on the schedule as agreed by Water Board Monitoring staff and proceed to Project Step 5. If all evidence indicates that management actions cannot reduce the water quality problem significantly, submit a summary report to the Water Board Monitoring staff for a determination of whether the SSID project is complete.

Project Step 5: Take Management Action to Abate Stressor/Toxicity/Pollutant Source

- Select and implement control measures/actions that are likely to minimize or eliminate the cause of the water quality problem
- When follow up action is not complex (e.g., communicate presence of chlorine to water distribution agency and follow up as needed), conduct the action as expeditiously as possible
- For complex actions, prepare a timeline of actions and responsible party(s). **Submit the timeline in the Urban Creeks Monitoring Report**. Continue to report on progress in completing follow up management actions annually.
- For complex projects that require planning for funding or construction, the action or construction shall begin within two calendar years of the date on which the project was begun; Upon request by Permittees, the Executive Officer may grant additional time to start construction.
- **On the list of RMC SSID projects, summarize SSID project follow up actions taken each year and submit with each Urban Creeks Monitoring Report**

Project Step 6: Monitor and reevaluate management actions

- Resample the project area over an appropriate timeframe to determine whether the water quality problem has been reduced or eliminated
- **On the list of RMC SSID projects, summarize SSID monitoring results each year and submit with each Urban Creeks Monitoring Report**

Project completion - An SSID project is complete when:

- resampling confirms the absence of the water quality problem the project addresses, or
- Project Step 4 and/or 5 are completed and all evidence indicates that the problem cannot be corrected by management action(s), and the Water Board Monitoring Contact concurs in writing with this conclusion

RMS SSID Summary Table – Example Format

SSID Project Description	Step 1 Problem Definition	Step 2 Eval-ate Data & Probable Causes	Step 3 Decision Point	Step 4 Conduct SSID Study	Step 5 Take Management Actions	Step 6 Monitor & Reevaluate
Low DO, Camel Crk, Smallville						
Toxicity, Nursery Crk, Plantsville						
Etc						