Economic Considerations of Proposed Whole Effluent Toxicity Control Provisions for California

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Acronyms and Abbreviations

BAT	Best available technology economically achievable
BCT	Best conventional pollutant control technology
BMP	Best management practice
CEQA	California Environmental Quality Act
CTR	California Toxics Rule
CWA	Clean Water Act
CWAD	Conditional Waiver for Agricultural Discharges
CWC	California Water Code
EPA	Environmental Protection Agency
IWC	Instream waste concentration
MDEL	Maximum daily effluent limitation
MEP	Maximum extent practicable
MHI	Median household income
MGD	Million gallons per day
MS4	Municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
NSEC	No significant effect concentration
PCS	Permit compliance system
POTW	Publicly owned treatment works
RMD	Regulatory management decision
RTA	Refractory toxicity assessment
SIC	Standard industrial classification
SIP	Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries
SWMP	Storm water management plan
SWPPP	Storm Water Pollution Prevention Plan
TIE	Toxicity identification evaluation
TMDL	Total maximum daily load
TRE	Toxicity reduction evaluation

TST	Test of significant toxicity
TU	Toxicity unit
WDR	Waste discharge requirement
WET	Whole effluent toxicity
WRP	Water reclamation plant
WWTP	Wastewater treatment plant

Executive Summary

The State Water Resources Control Board is proposing to amend the statewide *Water Quality Control Plans for Inland Surface Waters, Enclosed Bays and Estuaries* to include updated water quality objectives for toxicity consistent with the U.S. Environmental Protection Agency's Test of Significant Toxicity (TST). Under a contract with the United States Environmental Protection Agency, Abt Associates provided the State Water Board with an analysis of economic factors related to the proposal, including compliance with the water quality objective options, available methods to achieve compliance with these options, and the costs of those methods.

The proposed amendment establishes toxicity objectives applicable to all inland surface waters, enclosed bays, and estuaries to protect freshwater and saltwater aquatic life.

The chronic toxicity objective is expressed as a null hypothesis and a regulatory management decision (RMD) of 0.75 for chronic toxicity methods, where the following null hypothesis shall be used:

H_o: Mean response (ambient receiving water) $\leq$ 0.75 • mean response (control)

Attainment of the water quality objective is demonstrated by rejecting this null hypothesis in accordance with the TST statistical approach.

The acute toxicity objective is expressed as a null hypothesis and an RMD of 0.80 for acute toxicity methods, where the following null hypothesis shall be used:

Ho: Mean response (ambient receiving water) < 0.80 • mean response (control)

Attainment of the water quality objective is demonstrated by rejecting this null hypothesis in accordance with the TST statistical approach.

Based on a number of sample facilities which represent a variety of discharge categories present in the state (e.g., municipal wastewater, metals manufacturers and finishers, petroleum refineries, pulp and paper mills, and other industries), an extrapolation of estimated potential incremental statewide costs associated with the Amendment are presented in Exhibit ES-1.

Exhibit ES-1 shows the calculation of incremental statewide costs.

Exhibit ES-1. Extrapolation of Compliance Costs for Major Dischargers[1]					
Discharger Category	**Total Cost to Sample Dischargers**	**Number of Sample Dischargers**	**Average Cost per Discharger**	**Number of Dischargers Statewide**	**Total Statewide Cost**
Certainty Sample[2]	-$76,300	2	-$38,200	2	-$76,300
Municipal Wastewater	-$9,100 to $200	6	$0 to $1,500	125	$0 to $187,500
Metals Manufacturing and Finishers	-$4,400	1	-$4,400	1	-$4,400
Petroleum Refineries	$27,000 to $36,700	2	$13,500 to $18,400	9	$121,500 to $165,600
Pulp and Paper	$12,300	1	$12,300	1	$12,300
Other Industrial	$9,100	2	$4,600	27	$124,200
Total	**NA**	**14**	**NA**	**165**	**$10,200 to $221,400**

Note: detail may not add to total due to independent rounding.
NA = not applicable
1. Includes cost of routine monitoring, follow-up monitoring, accelerated monitoring, and TRE implementation; does not include cost of treatment controls because information on specific pollutant(s) causing toxicity is not available.
2. Represents the largest facility in the north and the largest facility in the south to incorporate the facilities with highest potential for cost in the two regions.

1 Introduction

This report updates previous analyses in 2008 and 2012 by Science Applications International Corporation (SAIC) and Abt Associates, respectively, on the economic considerations associated with the State Water Resources Control Board's (State Water Board) Amendment to the Water Quality Control Plan for Enclosed Bays and Estuaries of California (Provisions) incorporating statewide numeric whole effluent toxicity (WET) objectives for aquatic life beneficial use protection and minimum requirements for implementation.

1.1 Background

The Clean Water Act (CWA) directs states, with oversight by the U.S. Environmental Protection Agency (EPA), to adopt water quality standards to protect the public health and welfare, enhance the quality of water, and serve the purposes of the CWA. Under Section 303, state water quality standards must include: (1) designated uses for all water bodies within their jurisdictions, (2) water quality criteria sufficient to protect the most sensitive of the uses, and (3) an antidegradation policy consistent with the regulations at 40 CFR 131.12. The CWA also requires states to hold public hearings once every three years for the purpose of reviewing applicable water quality standards and, as appropriate, modifying and adopting standards. The results of this triennial review must be submitted to EPA, and EPA must approve or disapprove any new or revised standards.

In implementing the CWA, the State Water Board and the Regional Water Quality Control Boards (Regional Water Boards; together the Water Boards) follow the integrated approach to water quality-based toxics control recommended by EPA. This approach combines the use of chemical-specific and WET limits to control the discharge of toxics to surface waters. Chemical-specific limits provide control of known pollutants in a discharge; WET limits provide control of unknown pollutants and the aggregate effects of combined pollutants in a discharge. Both chemical-specific and WET limits are crucial to water quality-based control in California.

The California Toxics Rule (CTR) establishes chemical-specific criteria applicable to inland surface waters, enclosed bays, and estuaries. The Amendment for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP) provides procedures for implementing the criteria in National Pollutant Discharge Elimination System (NPDES) permits. The SIP also addresses toxicity control. As directed by the State Water Board, the Provisions will supersede the toxicity control provisions in the SIP to clarify the appropriate form of WET effluent limits in NPDES permits and standardize implementation in the permitting process. The Provisions also applies to Waste Discharge Requirements (WDR), storm water permits, and the irrigated lands regulatory program, and supersedes numeric toxicity provisions in the Regional Water Board Basin Plans.

1.2 Scope of the Analysis

The California Water Code (CWC) requires the Regional Water Boards to take "economic considerations," among other factors, into account when they establish water quality objectives.

In doing so, State Water Board (1999; 1994) concluded that, at a minimum, the Water Boards must analyze:

- Whether the proposed objective is currently being attained
- If not, what methods are available to achieve compliance
- The cost of those methods.

If the economic consequences of adoption are potentially significant, the Regional Water Boards must explain why adoption is necessary to ensure reasonable protection of beneficial uses or prevent nuisance. The Regional Water Boards can adopt objectives despite significant economic consequences; there is no requirement for a formal cost-benefit analysis.

Consistent with State Water Board (1999; 1994) guidance, this report provides analysis of whether dischargers are likely to be able to comply with the Provisions, the potential control methods to achieve compliance for dischargers that would be in violation, and the potential cost of such controls. The evaluation is based on currently available data only, and needed controls and costs reflect only incremental expenditures associated with the Provisions (not controls needed to comply with existing regulatory requirements). This analysis does not address potential benefits of the Provisions.

1.3 Organization of Report

The remainder of this report is organized as follows:

- **Section 2: Current Regulatory Framework** – describes the current applicable toxicity criteria and implementation procedures that provide the baseline for the analysis of the incremental impact of the Provisions.
- **Section 3: Proposed Provisions** – describes the toxicity control amendment.
- **Section 4: Method for Evaluating Compliance and Costs** – describes the method for evaluating compliance under the current regulatory framework and the Provisions and estimating potential incremental Provisions costs.
- **Section 5: Results of the Analysis** – provides the estimates of compliance and costs, and discusses the uncertainties associated with the estimates.
- **Section 6: References** – provides the references used in the analysis.
- **Appendix A**: Facility Analyses**:** provides information on individual sample facilities and the detailed compliance analyses.

2 Current Regulatory Framework

This section identifies the current framework for regulating discharges to inland surface waters, enclosed bays, and estuaries. The current regulatory framework is the baseline against which cost changes associated with the Provisions are determined. Thus, only costs that are greater or less than the costs associated with the baseline (i.e., incremental costs) would be attributable to the Provisions.

2.1 Existing Toxicity Provisions

Exhibit 2-1 shows the toxicity provision in existing Regional Water Board Basin Plans.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions

Regional Water Board	Basin Plan Toxicity Provisions
North Coast (1)	• All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. • The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay. • Effluent limits based on acute bioassays of effluents will be prescribed. Where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.
San Francisco Bay (2)	• All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms, including but not limited to, decreased growth rate and reproductive success of resident or indicator species. • There shall be no acute toxicity in ambient waters, defined as a median of less than 90% survival, or less than 70% survival, 10% of the time, of test organisms in a 96-hour static or continuous flow test. • There shall be no chronic toxicity in ambient waters, defined as a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. • The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those in areas unaffected by controllable water quality factors.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions	
Regional Water Board	**Basin Plan Toxicity Provisions**
Central Coast (3)	• All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. • Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions, shall not be less than that for the same water in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with the requirements for "experimental water" described in Standard Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay. • Effluent limits based on acute bioassays of effluents will be prescribed; where appropriate, numeric receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances is encouraged.
Los Angeles (4)	• All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. • Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions shall not be less than that for the same water in areas unaffected by the discharge or, when necessary, for other control water. • There shall be no acute toxicity in ambient waters, including mixing zones. The acute toxicity objective for discharges dictates that the average survival in undiluted effluent for any 3 consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test having less than 70% survival when using an established EPA, State Board, or other protocol authorized by the Regional Water Board. • There shall be no chronic toxicity in ambient waters outside of mixing zones. To determine compliance with this objective, critical life stage tests for at least three test species with approved testing protocols shall be used to screen for the most sensitive species. The test species used for screening shall include a vertebrate, an invertebrate, and an aquatic plant. The most sensitive test species shall then be used for routine monitoring. • Effluent limits for specific toxicants can be established by the Regional Water Board to control toxicity identified under TIEs.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions	
Regional Water Board	**Basin Plan Toxicity Provisions**
Central Valley (5)	• All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. • The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors shall not be less than that for the same water in areas unaffected by the waste discharge, or, when necessary, for other control water consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay. • In addition, effluent limits based on acute biotoxicity tests of effluents will be prescribed where appropriate; additional numerical receiving water quality objectives for specific toxicants will be established as sufficient data become available; and source control of toxic substances will be encouraged.
Lahontan (6)	• All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. • The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water in areas unaffected by the waste discharge, or when necessary, for other control water consistent with the requirements for "experimental water" as defined in Standard Methods for the Examination of Water and Wastewater. • For acute toxicity, compliance shall be determined by short-term toxicity tests on undiluted effluent using an established protocol. • For chronic toxicity, compliance shall be determined using the critical life stage toxicity tests. At least three approved species shall be used to measure compliance with the toxicity objective: a vertebrate, an invertebrate, and an aquatic plant. After an initial screening period, monitoring may be reduced to the most sensitive species.
Colorado River (7)	• All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or indigenous aquatic life. • Effluent limits based on bioassays of effluent will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged. • The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water in areas unaffected by the waste discharge, or other control water which is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay.

Exhibit 2-1. Existing Regional Water Board Toxicity Provisions	
Regional Water Board	**Basin Plan Toxicity Provisions**
Santa Ana (8)	• Toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health. • The concentrations of toxic substances in the water column, sediments, or biota shall not adversely affect beneficial uses. • The Regional Water Board requires the initiation of a TRE if a discharge consistently exceeds its chronic toxicity effluent limit. The Regional Water Board, to date, has interpreted the "consistently exceeds" trigger as the failures of three successive monthly toxicity tests, each conducted on separate samples. Initiation of a TRE has also been conditioned on a determination that a sufficient level of toxicity exists to permit effective application of the analytical techniques required by a TRE.
San Diego (9)	• All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. • The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water in areas unaffected by the waste discharge or, when necessary, for other control water consistent with requirements specified in EPA, State Water Board, or other protocol authorized by the Regional Water Board. As a minimum, compliance with this objective shall be evaluated with a 96-hour acute bioassay. • Effluent limits based on acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.
TIE = Toxicity identification evaluation TRE = Toxicity reduction evaluation	

In addition, the provisions in the SIP supplement Basin Plan requirements; they do not supersede existing Regional Water Board toxicity requirements.

The SIP contains minimum chronic toxicity control requirements for implementing the narrative toxicity objectives for aquatic life protection contained in Regional Water Board Basin Plans. Under the SIP, Regional Water Boards impose chronic toxicity limits for discharges that have the reasonable potential to cause instream chronic toxicity. Compliance with toxicity objectives and limits is determined through short-term chronic toxicity tests performed on at least three test species (a plant, an invertebrate, and a vertebrate) during a screening period, after which the most sensitive species can be used alone.

If repeated toxicity tests reveal toxicity or if a discharge causes or contributes to chronic toxicity in a receiving water body, the SIP requires that dischargers perform a toxicity reduction evaluation (TRE) study, which may include a toxicity identification evaluation (TIE). The TRE study is used to identify the sources of toxicity, after which the discharger must take all reasonable steps necessary to eliminate the toxicity. Permit writers should then assign chemical-specific permit limits for pollutants identified by the TRE. Failure to comply with required

toxicity testing and TRE studies within a designated period will result in the addition of chronic toxicity limits in the permit or appropriate enforcement action.

2.2 Affected Dischargers

The types of discharges potentially affected by the Provisions include NPDES-permitted dischargers as well as some dischargers subject to WDRs (municipal and industrial wastewater dischargers, storm water discharges, and irrigated agriculture).

2.2.1 Municipal and Industrial Wastewater Dischargers

In municipal wastewater effluents, toxicity has been attributed to several chemicals commonly found in or added during treatment including chlorine used for disinfection, and ammonia produced from the breakdown of organic substances (SETAC, 2004). Indirect industrial or commercial dischargers may also contribute to effluent toxicity if discharging toxic chemicals in violation of pretreatment limits or that are not removed with conventional wastewater treatment controls. In addition, toxicity may result from household chemicals that are improperly disposed of down the drain, including organic solvents and pesticides or commonly used soaps and detergents that can be highly toxic if inadequately treated prior to discharge.

In industrial wastewater, effluent toxicity can result from the use of chemicals known as biocides (e.g., chlorine) added to control nuisance biological growth in plumbing or cooling water systems (SETAC, 2004). Also, ions such as potassium, magnesium, and calcium can be toxic when the ions are added or taken out of water during various industrial processes (SETAC, 2004). Industrial chemicals or byproducts, if not treated properly, can cause effluent toxicity as well.

Most pollutants in the effluents of municipal and industrial wastewater treatment facilities that may cause instream acute or chronic toxicity are currently regulated through the NPDES permit program. However, effluents may still be toxic despite compliance with existing permit limits due to interactions of regulated pollutants as well as the presence of unregulated pollutants (alone or in combination).

There are 465 individually permitted facilities (not including storm water) that discharge to inland surface waters, enclosed bays, and estuaries in California (U.S. EPA, 2012). Of these facilities, approximately 60% are minor discharges. Data in EPA's integrated compliance information system (ICIS-NPDES) database indicate that most major dischargers have effluent limits and/or monitoring requirements for acute and chronic toxicity in their NPDES permits; data on limits and effluent data in ICIS-NPDES for minor dischargers is limited. However, the form of the effluent limits (e.g., narrative or numeric) and the monitoring frequencies vary significantly among dischargers.

Exhibit 2-2 summarizes these facilities.

Exhibit 2-2. Summary of Potentially Affected Facilities		
Discharger Category	Number of Dischargers[1]	
	Major Dischargers	Minor Dischargers
Municipal Wastewater	148	70
Metals Manufacturing and Finishers	1	1
Petroleum Refineries	9	11
Pulp and Paper	1	12
Other Industrial	27	181
Total	186	275
1. Source: U.S. EPA (2012).		

2.2.2 Storm Water Dischargers

Regional Water Boards regulate most storm water discharges under general permits. General permits often require compliance with standards through an iterative approach based on storm water management plans (SWMP), rather than through the use of numeric effluent limits. In other words, permittees implement management practices and best management practices (BMPs) identified in their SWMPs. Then, if those BMPs do not result in attainment of water quality standards, Regional Water Boards would require additional practices until pollutant levels are reduced to the necessary levels. Because Regional Water Boards use this iterative approach that increases requirements until water quality objectives are met, current levels of implementation may not reflect the maximum level of control required to meet existing standards. The State Water Board has four existing programs for controlling pollutants in storm water runoff to surface waters: municipal, industrial, construction, and California Department of Transportation (Caltrans).

Municipal

The State Water Board's municipal program regulates storm water discharges from municipal separate storm sewer systems (MS4s). The MS4 permits require the discharger to develop and implement a SWMP, with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP). MEP is the performance standard specified in Section 402(p) of the CWA. The management programs specify BMPs addressing public education and outreach; illicit discharge detection and elimination; construction and post-construction; and good housekeeping. In general, medium and large municipalities must conduct chemical monitoring, but not small municipalities.

Larger MS4s usually represent a group of co-permittees encompassing an entire metropolitan area. There are 21 area-wide medium and large MS4 permitted discharges in California that discharge, at least in part, to inland waters, enclosed bays, or estuaries (SWRCB, 2016). Some of the permittees monitor chronic and/or acute toxicity in receiving waters; others monitor specific pollutants identified as causing toxicity (e.g., diazinon and chlorpyrifos). **Exhibit 2-3** shows existing toxicity requirements in permits for large and medium MS4s.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]		
Region	**Name (NPDES No.; Permit No.)**	**Requirements**
1	County of Sonoma, City of Cloverdale, City of Cotati, City of Healdsburg, City of Rohnert Park, City of Santa Rosa, City of Sebastopol, Sonoma County Water Agency, City of Ukiah, Town of Windsor (CA0025054; R1-2015-0030)	Chronic tests twice per year during storm events, three locations in receiving waters and downstream from discharge outfalls; test species shall be *Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum*.
2	San Francisco Bay Regional (CAS612008; R2-2015-0049)	The permittees shall collect a minimum of 6.2[1] samples per year during the dry season, and 4.2[1] samples per year during wet weather. All samples shall be analyzed for *Selenastrum* growth and *Ceriodaphnia* and *Pimephales* with lethal and sublethal endpoints; *Hyalella azteca* and *Chironomus dilutus* for lethal endpoint.
3	City of Salinas (CA0049981; R3-2012-0005)	Monitoring background and receiving water sites for chronic toxicity once during the first runoff of the wet season, and once during dry weather for *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum*. If receiving water samples are toxic, the permittee shall conduct a TIE.
4	Long Beach (CAS004003; R4-2014-0024)	Monitoring shall occur a minimum of twice per year, with one sample collected during the first rainfall, and once per month during the month with the historically lowest flows. For freshwaters, multiple species toxicity testing (*Pimephales promelas, Ceriodaphnia dubia, and Raphidocelis subcapitata*) is required. For marine and estuarine waters, multiple species toxicity testing (*Atherinops affinis, Strongylocentrotus purpuratus,* and *Macrocystis pyrifera*) is required and TIE/TRE studies.
4	County of Los Angeles (CAS004001; R4-2012-0175)	Monitoring shall occur a minimum of twice per year, with one sample collected during the first rainfall, and once per month during the month with the historically lowest flows. For freshwaters, multiple species toxicity testing (*Pimephales promelas, Ceriodaphnia dubia, and Raphidocelis subcapitata*) is required. For marine and estuarine waters, multiple species toxicity testing (*Atherinops affinis, Strongylocentrotus purpuratus,* and *Macrocystis pyrifera*) is required and TIE/TRE studies.

[1] The minimum sample number is reported fractionally due to a 1/5 years sampling frequency required at on sampling site.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]		
Region	**Name (NPDES No.; Permit No.)**	**Requirements**
4	Ventura County (CAS004002; R4-2010-0108)	Toxicity monitoring twice during the first year of the permit term (once in the wet season and once in the dry season), and once during the first storm event of the wet season for the following four years. During the first year, toxicity testing will be performed using three-species testing and the most sensitive species in the following years. For freshwaters, multiple species toxicity testing (*Pimephales promelas, Ceriodaphnia dubia, and Raphidocelis subcapitata*) is required. For marine and estuarine waters, multiple species toxicity testing (*Atherinops affinis, Strongylocentrotus purpuratus,* and *Macrocystis pyrifera*) is required. A TIE must be performed when significant toxicity is present.
5	Bakersfield-Kern County (CA00883399; R5-2013-0153-01)	Narrative receiving water limit and for the development and implementation of a stormwater management plan containing; no specific toxicity monitoring requirements.
5	Contra Costa Clean Water (CA083313; R5-2010-0102)	Toxicity monitoring twice per year with one event during dry season and one event during a storm event at a minimum of two sites. If toxicity results < 50% of control results, repeat sample. If 2nd sample yields < 50% of control results, conduct a TRE.
5	Fresno (CA0083500; R5-2013-0080)	Narrative receiving water limit; no specific toxicity monitoring requirements.
5	Modesto (CAS083526; R5-2015-0025)	Chronic toxicity monitoring during two storm events and one dry weather monitoring event using *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected, must conduct dilution series; if statistically significant toxicity is detected and a greater than or equal to 50% increase in either mortality, or reduction in reproduction compared to the control is observed, then TIEs shall be conducted on the initial sample that caused toxicity.
5	Port of Stockton (CAS084077; R5-2011-0005)	Chronic toxicity monitoring of *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected, must conduct dilution series; if statistically significant toxicity is detected, then TIEs shall be conducted on the initial sample that caused toxicity.
5	Sacramento (CAS082597; R5-2015-0023)	Conduct toxicity testing at each receiving water station during two of the five fiscal years of the Order including samples from two storm events and one during the dry season from each receiving water station; species should be *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected within 24 hours of test initiation, then a dilution series shall be initiated. If statistically significant toxicity is detected and there is more than a 50% increase in mortality compared to the laboratory control, then TIEs shall be conducted; a TRE shall be conducted whenever a toxicant is successfully identified through the TIE.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]		
Region	**Name (NPDES No.; Permit No.)**	**Requirements**
5	Stockton and San Joaquin County (CAS083470; R5-2015-0024)	Conduct toxicity testing at each receiving water station annually including samples from two storm events and one during the dry season from each receiving water station; species should be *Pimephales promelas* and *Ceriodaphnia dubia*. If 100% mortality is detected within 24 hours of test initiation, then a dilution series shall be initiated. If statistically significant toxicity is detected and there is more than a 50% increase in mortality compared to the laboratory control, then TIEs shall be conducted; a TRE shall be conducted whenever a toxicant is successfully identified through the TIE.
6	South Lake Tahoe, El Dorado and Placer County (CAG616001; R6T-2011-0202A1)	No toxicity provisions.
7	Riverside County Flood Control and Water Conservation District (CAS617002 R8-2013-0011)	No toxicity provisions.
8	Orange County (CAS618030; R8-2009-0030 as amended by R-2010-0062)	*Ceriodaphnia dubia* and *Strongylocentrotus purpuratus* shall be used to evaluate toxicity from the first rain event, plus one other wet weather sample and two dry weather samples; TIEs and TREs if monitoring indicates studies are needed.
8	Riverside County (CAS618033; R8-2010-0033)	*Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum* shall be used to evaluate toxicity on the sample from the first rain event, plus one other wet weather sample. In addition, where applicable, collect two dry weather samples or propose equivalent procedures in the CMP. Identify criteria which will trigger the initiation of TIEs and TREs.
8	San Bernardino County (CAS618036; R8-2010-0036)	Collect a minimum of one sample per year during the dry weather index period using *Ceriodaphnia dubia* or *Hyalella azteca* if conductivity is too high for survival of control organisms.
9	Orange County (CAS108740; R9-2013-0001 as amended by R9-2015-0001)	During the term of the permit, the permittee must sample during at least three dry weather events and at least three wet weather events at each monitoring station. Monitoring shall encompass three species testing for freshwaters (*Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum*) and one species testing for marine and estuarine waters (*Strongylocentrotus purpuratus*).
9	Riverside County (CAS108766; R9-2015-0100)	The Permittees shall analyze all storm samples (at least three annually) using three species: *Ceriodaphnia dubia* (water flea); *Hyalella azteca* (freshwater amphipod); and *Pseudokirchneriella subcapitata*, (unicellular algae). TIEs shall be used to determine the cause of toxicity, and TREs shall be used to identify sources and implement management actions to reduce pollutants in urban runoff causing toxicity.

Exhibit 2-3. Toxicity Requirements in Large and Medium MS4 Permits[1]		
Region	**Name (NPDES No.; Permit No.)**	**Requirements**
9	San Diego (CAS108758)	The following toxicity testing shall be conducted for each monitoring event at each station as follows: (1) 7-day chronic test with *Ceriodaphnia dubia* (2) Chronic test with the freshwater algae *Selenastrum capricornutum* (3) Acute survival test with amphipod *Hyalella azteca*. TIEs shall be conducted to determine the cause of toxicity.

CMP = Coordinated Monitoring Program
NPDES = National Pollutant Discharge Elimination System
RMP = Regional Monitoring Program
SFEI = San Francisco Estuary Institute
TIE = Toxicity identification evaluation
TRE = Toxicity reduction evaluation
TU = toxicity unit (chronic or acute)
1. Permits at http://www.swrcb.ca.gov/water_issues/programs/stormwater/phase_i_municipal.shtml. Accessed May 2016.

The State Water Board adopted a Phase II MS4 general permit for smaller municipalities, including nontraditional small MS4s such as military bases, public campuses, and prison and hospital complexes. Few of these permittees currently monitor for toxicity as part of their SWMPs.

Industrial

Under the industrial program, the State Water Board issues a general NPDES permit that regulates discharges associated with ten broad categories of industrial activities. This general permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT). The permit also requires that dischargers develop a Storm Water Pollution Prevention Plan (SWPPP) and a monitoring plan. Through the SWPPP, dischargers are required to identify sources of pollutants, and describe the means to manage the sources to reduce storm water pollution. For the monitoring plan, facility operators may participate in group monitoring programs to reduce costs and resources.

Construction

The construction program requires dischargers whose projects disturb one or more acres of soil or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres to obtain coverage under the storm water general permit for construction activity. The construction general permit requires the development and implementation of a SWPPP that lists BMPs the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for nonvisible pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body impaired for sediment.

The permit also contains specific toxicity provisions for active treatment system[2] dischargers. Any of these dischargers operating in batch treatment mode must initiate acute toxicity testing using *Pimephales promelas* or *Oncorhynchus mykiss* for effluent samples representing effluent from each batch prior to discharge. The permit does not contain specific toxicity requirements for any other discharger types.

Caltrans

Caltrans is responsible for the design, construction, management, and maintenance of the state highway system, including freeways, bridges, tunnels, Caltrans' facilities, and related properties. Before July 1999, storm water discharges from Caltrans' storm water systems were regulated by individual NPDES permits issued by the Regional Water Boards. On September 19, 2012, the State Water Board issued a statewide permit (Order No. 2012-0011-DWQ) which regulated all storm water discharges from Caltrans-owned MS4s, maintenance facilities and construction activities.

The existing permit allows Caltrans to implement BMPs rather than require compliance with numeric effluent limits. The BMPs must reflect pollutant reduction based on either MEP (MS4s) or BAT/BCT (construction activities), whichever is applicable. In addition, if receiving water quality standards are exceeded, Caltrans is required to submit a written report providing additional BMPs or other measures to be taken that will be implemented to achieve water quality standards. The permit requires Caltrans to develop and implement a SWMP describing the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters and includes discharge monitoring requirements for acute and chronic whole effluent toxicity.

2.3 Irrigated Agricultural Lands

Agricultural activities that may affect aquatic life can be caused by farming activities that cause excessive erosion, resulting in sediment entering receiving waters; improper use and over application of pesticides; and over application of irrigation water resulting in runoff of sediments and pesticides.

Potential sources of funding for agricultural water quality programs include:

- Private financing by individual sources;
- Bonded indebtedness or loans from government institutions;
- Surcharge on water deliveries to lands contributing to the drainage problem;
- Ad Valorem tax on lands contributing to the drainage problem;
- Taxes and fees levied by a district created for the purpose of drainage management;
- State or federal grants or low-interest loan programs such as:
    - USDA Environmental Quality Incentive Program grants, administered by the Natural Resources Conservation Service

[2] An active treatment system is a treatment system that employs chemical coagulation, chemical flocculation, or electro-coagulation in order to reduce turbidity caused by fine suspended sediment

    - Consolidated grant program administered by the State Water Resources Control Board, including Proposition 40 grants, 319 NPS Implementation Program grants, and Proposition 50 CalFed Watershed Program
    - State Revolving Fund Loan program for NPS pollution
- Single purpose appropriations from federal or state legislative bodies (including land retirement programs).

Agricultural dischargers do not receive NPDES permits. In California, the Water Boards regulate discharges from irrigated land including storm water runoff, irrigation tailwater, and tile drainage through WDRs or waivers of WDRs. CWC Section 13269 allows the Regional Water Boards to waive WDRs if it is in the public interest.

Most historical waivers require that discharges not cause violations of water quality objectives, but do not require water quality monitoring. In 1999, Senate Bill 390 amended CWC Section 13269 and required Regional Water Boards to review and renew waivers or replace them with WDRs by January 1, 2003; otherwise, the waivers expired.

The Central Coast, Los Angeles, Central Valley, and San Diego Regional Water Boards have established conditional waivers for agricultural discharges. The Santa Ana Water Board is, as of this writing, in the process of developing and implementing an irrigated lands regulatory program.

The Central Coast Regional Water Board's waiver requires monitoring focused on nutrients and toxicity. Toxicity testing is used to determine if applied pesticides and other constituents are impacting beneficial uses. More detailed characterization, involving additional toxicity testing, chemical analysis, analysis of pesticide application data, and/or TIEs are required as necessary in areas where toxicity problems are documented (CCRWQCB, 2012).

The Los Angeles Regional Water Board's conditional waiver requires dischargers to determine the most sensitive species for toxicity monitoring and use the results to trigger further investigations into the cause of toxicity. Dischargers must implement a TIE when there is more than 50% mortality in any test. In addition, if Basin Plan or CTR objectives or total maximum daily load (TMDL) allocations are not attained, the waiver requires that the discharger submit a Corrective Action Plan that identifies time-specific management modifications (LARWQCB, 2016).

Central Valley Regional Water Board issues both group and individual waivers for agricultural growers with emphasis on group participation. Under the group and individual waivers, growers must implement management practices, as necessary, to improve and protect water quality and to achieve compliance with applicable water quality standards. The waivers require that water column toxicity analyses be conducted on 100% (undiluted) samples for the initial screening. If toxicity is detected, the grower must initiate, at a minimum, a Phase I TIE to determine the general class (e.g., metals, non-polar organics, and polar organics) of the chemical causing toxicity (CVRWQCB 2006a; 2006b). Growers may also use Phase II TIEs to confirm and identify toxicant(s).

The San Diego Regional Water Board adopted a conditional waiver for agricultural and nursery operations requiring these dischargers to implement BMPs to minimize or eliminate the discharge of pollutants and form or join a monitoring group by December 31, 2010. Operators must also prevent the direct or indirect discharge of products used in operations (e.g., pesticides) into surface waters (SDRWQCB, 2007).

The Santa Ana Regional Water Board proposed that all operators of irrigated or dry-farmed land, and other agricultural or livestock operations not already regulated by the Regional Water Board, enroll in the Conditional Waiver for Agricultural Discharges (CWAD) program. The Regional Board adopted an Order (Order No. R8-2016-0003) establishing a CWAD program. The CWAD program allows agricultural operators to discharge waste to waters of the state from their operations, provided they also comply with TMDLs by paying implementation fees, taking steps to implement BMPs to reduce the pollutant load of their discharge, and regularly report and monitor water quality (SARWQCB, 2009). The CWAD program allows some conditions to be met through the collective action of a group or groups of agricultural operators who are enrolled in the program, or by a third party representing a coalition of enrollees. Agricultural operators who do not enroll in the program will be required to apply for individual WDRs and will have full responsibility for their own compliance (SARWQCB, 2009).

San Francisco Bay Water Board staff developed a conditional waiver for vineyard properties in the Napa and Sonoma watersheds to require that effective management practices be implemented to control human-caused discharges of pollutants from vineyard facilities. Four Third-Party Programs were approved on January 12, 2018 by Regional Water Board to help farmers comply with the requirements of the General Permit for Vineyard Properties. The vineyard waiver covers existing vineyards, vineyard replants, as well as new vineyard development. The Regional Water Board also adopted a conditional waiver for grazing operations in the Napa River and Sonoma Creek watersheds on September 14, 2011. The goals of the waiver are to reduce the discharge of sediment and pathogens to the Napa River and Sonoma Creek, and to protect stream and riparian areas. This program is a key element to implementing TMDLs for these two watersheds.

The Colorado River Basin and North Coast Regional Water Boards have adopted conditional prohibitions for agriculture in their respective Basin Plans as part of TMDL implementation, and the Lahontan Regional Water Board does not have waivers for agricultural discharges.

Exhibit 2-4 summarizes baseline regional toxicity monitoring programs for agricultural dischargers.

Exhibit 2-4. Regional Agricultural Toxicity Monitoring Programs
Region 3 (Central Coast)

Exhibit 2-4. Regional Agricultural Toxicity Monitoring Programs
• Conduct the following water column toxicity tests for each site, twice in the dry season and twice in the wet season: (1) 4-day test with the algae *Selenastrum capricornutum* (2) 7-day chronic test with the water flea *Ceriodaphnia* (3) 7-day chronic test with the fathead minnow *Pimephales promelas*. At sites where persistent unresolved toxicity is found, the Executive Officer may require a TIE. • Schedule toxicity tests once during the wet season and once during the dry season. • At sites where persistent unresolved toxicity is found, the Executive Officer may require concurrent toxicity and chemical analyses and a TIE to identify the individual discharges causing of the toxicity.
Region 4 (Los Angeles)
• Conduct chronic toxicity tests for the three test species: (1) fathead minnow, *Pimephales promelas* (2) water flea, *Ceriodaphnia* (3) green algae, *Selenastrum capricornutum*. After one toxicity sample has been collected and analyzed in the first year, the most sensitive species is to be selected for subsequent toxicity monitoring. • Schedule toxicity tests once during the wet season and once during the dry season. • Annual monitoring consisting of 4 sampling events: 2 in the dry season and 2 in the wet season. • If a 50% or greater difference in *Ceriodaphnia dubia* or *Pimephales promelas* mortality, or a 50% or greater reduction in *Selenastrum capricornutum* growth, as compared to the laboratory control, is detected at any time in an acceptable test, a TIE is required.
Region 5 (Central Valley)
• Conduct water column toxicity tests for the following species: (1) *Ceriodaphnia dubia* (2) *Pimephales promelas* (3) *Selenastrum capricornutum*. • If a 50% or greater difference in *Ceriodaphnia dubia* or *Pimephales promelas* mortality, or a 50% or greater reduction in *Selenastrum capricornutum* growth, as compared to the laboratory control, is detected at any time in an acceptable test, a TIE is required within 48 hours. • If within the first 96 hours of the initial toxicity screening, the mortality reaches 100%, initiate a multiple dilution test. The dilution series must be initiated within 24 hours of the sample reaching 100% mortality, and must include a minimum of five (5) sample dilutions in order to quantify the magnitude of the toxic response. • Daily sample water renewals shall occur during all acute toxicity tests to minimize the effects of rapid pesticide losses from test waters. • A feeding regime of 2 hours prior to test initiation and 2 hours prior to test renewal shall be applied. • If more than one exceedance of the same parameter at the same location occurs within a three-year period, then a schedule for Management Plan development and implementation shall be provided to the Regional Water Board staff within 10 business days.
SWAMP = Surface Water Ambient Monitoring Program TIE = Toxicity Identification Evaluation

3 Description of Provisions

This section describes the toxicity Provisions (June 2017 draft version of the Provisions) which supersedes some of the numeric toxicity objectives and implementation provisions for toxicity in the Basin Plans. The Provisions does not supersede the narrative toxicity objectives established in the Basin Plans.

3.1 Objectives

The Provisions establishes toxicity objectives applicable to all inland surface waters, enclosed bays, and estuaries to protect freshwater and saltwater aquatic life.

3.1.1 Chronic Toxicity

The chronic toxicity objective is expressed as a null hypothesis and a regulatory management decision (RMD) of 0.75 for chronic toxicity methods, where the following null hypothesis shall be used:

$$H_o\text{: Mean response (ambient receiving water)} \leq 0.75 \cdot \text{mean response (control)}$$

Attainment of the water quality objective is demonstrated by rejecting this null hypothesis in accordance with the Test of Significant Toxicity (TST) statistical method. Chronic aquatic toxicity generally refers to an adverse response that is sub-lethal.

3.1.2 Acute Toxicity

The acute toxicity objective is expressed as a null hypothesis and an RMD of 0.80 for acute toxicity methods, where the following null hypothesis shall be used:

$$\text{Ho: Mean response (ambient receiving water)} < 0.80 \bullet \text{mean response (control)}$$

Attainment of the water quality objective is demonstrated by rejecting this null hypothesis in accordance with the TST statistical approach. Acute aquatic toxicity refers to adverse response (typically lethality) from a short-term exposure.

3.2 Implementation Procedures

The Provisions establishes minimum requirements for implementing the numeric toxicity objectives that apply to discharges to inland surface waters, enclosed bays, and estuaries covered under NPDES permits, WDRs, or the irrigated lands regulatory program. The requirements supersede some existing Regional Water Board Basin Plan requirements.

3.2.1 Species Sensitivity Screening

The Provisions requires all dischargers to conduct a minimum of four WET tests for purposes of chronic species sensitivity screening—one test per calendar quarter for four consecutive quarters—for each species, either prior to, or within 18 months after the first permit issuance and reissuance, or reopening (to address toxicity requirements) of the permit after the effective date of toxicity provisions. Chronic WET test species must, at a minimum, include one aquatic plant, one vertebrate, and one invertebrate. The Regional Water Boards may require a species

sensitivity screening for chronic toxicity prior to every subsequent permit issuance and reissuance, or reopening (to address toxicity requirements). At a minimum, a species sensitivity screening shall be required no less than once every 10 years.

Except for POTW dischargers, all non-storm water NPDES dischargers shall conduct acute WET tests for acute species sensitivity screening, once per quarter for four consecutive quarters. Acute toxicity species sensitivity screening, at a minimum, shall include one vertebrate and one invertebrate. The Regional Water Boards may require a species sensitivity screening for acute toxicity prior to every subsequent permit issuance and reissuance, or reopening (to address toxicity requirements). Except for POTWs, a species sensitivity screening for acute toxicity shall be required no less than once every 10 years at a minimum.

3.2.2 Reasonable Potential

Except for POTW dischargers who are authorized to discharge at a rate equal to or greater than 5 MGD, all non-storm water NPDES dischargers are required to conduct a reasonable potential analysis for chronic toxicity prior to every permit issuance, reissuance, or reopening (to address toxicity requirements). POTW dischargers who are authorized to discharge at a rate equal to or greater than 5 MGD, are not required to conduct a reasonable potential analysis since the Regional Water Boards are required to establish chronic toxicity limitations for these dischargers. Except for POTW dischargers, all non-storm water NPDES dischargers are required to conduct a reasonable potential analysis for acute toxicity prior to every permit issuance, reissuance, or reopening (to address toxicity requirements) and the Regional Water Board may, at its option, require a reasonable potential analysis for POTW dischargers prior to any permit issuance, reissuance, or reopening (to address toxicity requirements).

Under the Provisions, a non-storm water NPDES discharger is considered to have reasonable potential to cause or contribute to an excursion above for chronic or acute toxicity water quality objectives, respectively, if any chronic or acute test analyzed using the TST results in a “fail” at the instream waste concentration (IWC) or if a chronic or acute test has a percent effect greater than 10 percent at the IWC. The percent effect is calculated as the difference between the mean control response and the mean response at the IWC divided by the mean control response. Other information (e.g., fish die off observation, existing data on toxic pollutants) may be also be used to make a reasonable potential determination.

3.2.3 Effluent Limits

The Provisions requires that Regional Water Boards apply the objectives for chronic WET directly in permits as numeric limits expressed as a maximum daily effluent limitation (MDEL), and a median monthly effluent limitation (MMEL) for dischargers with reasonable potential. If reasonable potential is demonstrated for chronic toxicity, or if the discharger is a POTW discharger authorized to discharge 5 MGD or more, then chronic toxicity effluent limitations shall be established. In addition, if reasonable potential is found for acute toxicity, then the Regional Water Boards shall establish an MDEL and MMEL for acute toxicity.

A MDEL is an effluent limit based on the outcome of the TST statistical test and the percent effect. For chronic toxicity, the MDEL is exceeded when a chronic toxicity test, using the TST,

results in a fail at the IWC, and the percent effect for the survival endpoint is equal to or greater than 50% for chronic toxicity tests or 50%. If the most sensitive species chronic toxicity test does not include a lethal endpoint then the MDEL is exceeded when a chronic toxicity test results in a fail for any endpoint at the IWC, with a percent effect for that endpoint of greater than or equal to 50%. For acute toxicity, the MDEL is exceeded when a most sensitive species test at the IWC results in a fail for the survival endpoint with a percent effect for the survival endpoint of greater than or equal to 50%.

The MMEL is an effluent limit based on the median TST statistical results of three independent toxicity tests taken within the same calendar month. The MMEL is exceeded when the median TST result (i.e. two out of three) result in a fail at the IWC.

3.2.4 Mixing Zones

To the extent authorized by the applicable Basin Plan, a Regional Water Board may grant a mixing zone for toxicity. Allowance of a mixing zone is discretionary. If a Regional Water Board grants a mixing zone, compliance with the objectives for toxicity shall be met at the edge of the authorized mixing zone. The permitting authority shall not grant a mixing zone for acute toxicity.

When a mixing zone and dilution credit is granted by the Regional Water Board, the IWC is the concentration of effluent in the receiving water after mixing (i.e., the inverse of one plus the dilution credit; IWC = 1/ (1 + D)) as determined by the Regional Water Board. The Regional Water Board may set the IWC at a concentration of effluent greater than the inverse of one plus the dilution credit in order to protect beneficial uses, or because of site-specific conditions. However, the IWC should not be established at a level less than the inverse of one plus the dilution credit. If no dilution credit is granted for toxicity, then the undiluted effluent shall be used as the IWC. The Dilution Credit may be equal to the dilution ratio for completely mixed discharges. For incompletely mixed discharges, the dilution credit shall be determined based on a site-specific mixing zone and dilution study.

The economic analysis in this report was developed based on a June 2017 draft of the Policy Amendment document. In the June 2017 draft, the IWC was calculated as the inverse of the dilution credit (i.e., IWC = 1 / D). Subsequently, the IWC equation was updated in the most recent version of Draft Policy Amendment document (received on December 2017) to IWC = 1 / (1 + D). This change was introduced late in the development of this analysis and development of a revised analysis was infeasible. However, Abt Associates has determined the changes in estimated costs produced by the definition change are likely be relatively small and to result in realized costs lower than those estimated in this report.

The reasonable potential and effluent limitation compliance feasibility analyses in this study are based on the June 2017 IWC definition (IWC = 1 /D). While use of the June 2017 IWC definition introduces a bias into the results of the study, the error is relatively small and biases estimated cost in a more conservative (i.e., higher cost) direction. Use of the June 2017 IWC results in a larger IWC than the definition in the proposed Provisions. For example, a dilution of 10:1 will result in an IWC of 10% under the June 2017 definition, and of 9% under the proposed

definition. A larger IWC represents a more highly concentrated effluent which will result in more frequent findings of reasonable potential, more frequent exceedances of toxicity limits, and more frequent triggers of accelerated and confirmatory monitoring. Therefore, performing the analysis with a slightly higher IWC would result in increased expected costs due to more frequent routine and compliance monitoring.

From an economic viewpoint, higher IWC (derived from the IWC= 1/D equation) will lead to an increase in compliance cost compared to the lower IWC (derived from IWC=1/ (1+D) equation) considering the additional requirement for routine monitoring, accelerated monitoring, TREs, and TIEs. Therefore, estimated overall cost using IWC=1/D will be higher and more conservative than the potential cost estimated using IWC=1/ (1+D).

3.2.5 Routine Monitoring

The Provisions requires POTW dischargers authorized to discharge at a rate greater than or equal to 5 MGD and other non-storm water NPDES dischargers with reasonable potential to conduct routine chronic WET monitoring using the most sensitive species. The chronic and acute toxicity methods manuals required by the Provisions specify that chronic and acute toxicity tests include five concentrations of test water sample compared to the control. However, the dischargers or laboratories may receive an approved alternative test procedure. The number of concentrations approved in an alternative test procedure may vary, but tests must include a minimum of one test concentration at the IWC and a control.

POTW dischargers authorized to discharge at a rate greater than or equal to 5 MGD and other non-storm water NPDES dischargers with reasonable potential, that are authorized to discharge at a rate of greater than or equal to 5 MGD, must conduct monthly routine monitoring for chronic toxicity in every month in which there is at least 15 days of discharge.

Non-storm water NPDES dischargers authorized to discharge less than 5 MGD, with reasonable potential, must conduct quarterly routine monitoring for chronic toxicity in every quarter in which there is at least 15 days of discharge.

If required, dischargers shall also conduct acute toxicity monitoring at intervals determined by the applicable Water Board, but no less than once per calendar year. Water Boards also may, at their discretion, require periodic monitoring for chronic or acute toxicity of NPDES wastewater and point source WDR dischargers even in the absence of reasonable potential.

3.2.6 Compliance

A chronic toxicity test result indicating a “fail” with a percent effect at or above 50 percent for the survival endpoint is an exceedance of the chronic MDEL, unless the chronic toxicity test does not have a survival endpoint. If a chronic toxicity test does not have a survival endpoint, then a chronic toxicity test result indicating a “fail” for any endpoint with a 50 percent effect for that endpoint is an exceedance of the chronic MDEL. An acute toxicity test result indicating a fail for the survival endpoint with a percent effect at or above 50 percent for the survival endpoint is an exceedance of the acute MDEL.

When there is one violation of the MDEL or MMEL, but not two violations in a single calendar month, dischargers with a routine monitoring frequency of less than monthly are to conduct an additional test. This additional test is not required if the discharger is already conducting a TRE, or if the discharger is required to conduct routine monitoring at or more frequent than a monthly frequency.

If a chronic or acute toxicity test results in a "fail" at the IWC, dischargers shall conduct maximum of two additional toxicity tests within the same calendar month in order to determine compliance with the MMEL. These two MMEL compliance test must be initiated in the same calendar month as the initial routine toxicity test that resulted in a "fail". If either of these two additional tests results in a "fail," the median monthly result is "fail" and the discharger will be in exceedance of the MMEL. If the first chronic MMEL compliance test results in a "fail" at the IWC, then the second MMEL compliance test is waived.

A TRE is required when a discharger has any combination of two or more chronic or acute MDEL or MMEL violations within a single calendar month or within two successive calendar months. In addition, if other information indicates toxicity (e.g., results of additional monitoring, fish kills, or intermittent recurring toxicity, etc.), then the Regional Water Board may require a TRE at its discretion.

As noted above, if a non-storm water NPDES discharger with a less than monthly monitoring frequency has a single violation in any calendar month, the discharger is required to conduct a routine monitoring test in the following month. There are also some economic considerations that have been taken into account when considering the necessity of additional tests. They are as follows:

a. There is no pre-determined requirement of accelerated monitoring. The need for a TRE is determined using the existing routine monitoring tests and MMEL compliance tests.

b. For non-storm water NPDES dischargers that monitor on a less than monthly basis, there will be an additional 1 to 3 monitoring tests whenever there is a single violation in any month (a routine monitoring test and a maximum of 2 MMEL compliance tests if that routine monitoring test results in a "fail").

3.2.7 Compliance Schedules

The applicable Water Board has the discretion to grant a compliance schedule to NPDES wastewater and point source WDR dischargers in order to achieve the objectives. Compliance schedules must be consistent with the State Water Board's Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits.

3.2.8 Exceptions

Regional Water Boards may exempt small disadvantaged communities and insignificant dischargers from some or all of the implementation requirements of the Provisions including effluent limits, routine monitoring, and compliance provisions of the Provisions unless the applicable Water Board finds them to have an impact on receiving water quality. Small communities are communities with populations of 20,000 or less, and a median household

income (MHI) below 80% of the statewide MHI. Insignificant dischargers have an insignificant impact on receiving water quality and must discharge less than one MGD on a non-continuous basis.

Although disadvantaged communities and insignificant dischargers may be exempted from some or all of the implementation requirements in the Toxicity Provisions, the Water Boards still need to determine the potential of that discharger having reasonable potential to cause or contribute to an exceedance of the water quality objectives. Nonetheless, to make this determination, the Water Boards does not need to follow the reasonable potential analysis procedure in the Toxicity Provisions. Additionally, the Provisions allows the Water Boards to assign routine monitoring as necessary, even if the discharger is exempted and the discharger will still have receiving water limitations based on the water quality objectives.

The Provisions also allows the Water Boards, after compliance with the California Environmental Quality Act (CEQA), to grant short-term or seasonal exceptions from meeting the toxicity objectives if determined to be necessary to implement control measures either:

- For resources or pest management (e.g. vector or weed control, pest eradication, or fishery management) conducted by public entities or mutual water companies to fulfill statutory requirements, including, but not limited to, those in the California Fish and Game, Food and Agriculture, Health and Safety, and Harbors and Navigation codes; or

In addition, where site-specific conditions in individual water bodies or watersheds differ sufficiently from statewide conditions and those differences cannot be addressed through other provisions of this Provisions, the State Water Board may, in compliance with CEQA, subsequent to a public hearing, and with the concurrence of the U.S. EPA, grant an exception to meeting the toxicity objectives or any other provision of the Provisions where the State Water Board determines:

- The exception will not compromise protection of enclosed bay, estuarine, and inland surface waters for beneficial uses; and
- The public interest will be served.

3.2.9 Storm Water Dischargers

Under the Provisions, all storm water dischargers subject to existing toxicity monitoring requirements will be required to analyze toxicity data using the TST approach and to report results as a “pass” or “fail”, if the discharger is using test methods described in Section IV.B.1.b. of the Toxicity Provisions.

3.2.10 Nonpoint Source Dischargers

Under the Provisions, nonpoint source dischargers subject to existing toxicity monitoring requirements under a conditional waiver or nonpoint source WDR will be required to analyze toxicity data using the TST approach and to report results as a “pass” or “fail”, if the discharger is using test methods described in Section IV.B.1.b. of the Toxicity Provisions.

4 Method for Evaluating Compliance and Costs

This section describes the method for evaluating compliance with the Provisions and estimating incremental cost impacts. **Appendix A** contains the detailed analyses for NPDES point sources and the attached spreadsheets provide the data used in the analyses.

4.1 Municipal and Industrial Wastewater

The method for evaluating potential impacts of the Provisions for municipal and industrial wastewater dischargers is based on a sample of facilities and involves determining reasonable potential, evaluating compliance with revised effluent limits based on analyzing existing data using the TST, determining the necessary compliance mechanisms, and estimating the cost of those mechanisms.

4.1.1 Identifying Potentially Affected Facilities

There are a total of 465 (218 municipal WWTP and 247 industrials) individually-permitted NPDES dischargers that discharge wastewaters to inland surface waters, enclosed bays, and estuaries in California. However, some of these dischargers are exempt from routine monitoring, sensitive species testing, and effluent limit requirements in the Provisions. For example, small communities, defined as having populations less than 20,000 and MHI less than 80% of the state average MHI. Abt Associates excluded small communities from this analysis as unlikely to incur incremental costs associated with the Provisions.

To identify small communities, Abt Associates first assumed that any municipal WWTP with a flow (as reported in EPA's PCS database in August 2008) greater than 3 MGD is likely serving more than 20,000 people based on a maximum of 150 gallons of water per day per person (typical water consumption is 75 to 130 gallons per person per day; Metcalf and Eddy, 2003). Abt Associates then used facility names to match Census population and MHI data to identify small communities. Abt Associates assumed that any community with less than 20,000 people and MHI greater than 80% of the state average MHI would not be small. Thus, Abt Associates identified 53 municipal WWTPs (21 majors and 32 minors) likely to be classified as small communities and exempt from the Provisions. Selecting a Sample

Most of the dischargers potentially affected by the Provisions currently have WET provisions in their permits. However, minor dischargers are not as likely as majors to discharge toxic pollutants in toxic amounts. For example, the State Water Board and EPA are reclassifying one major industrial facility as a minor discharger because it had substantially improved operations and effluent quality. Minor municipal dischargers have, by definition, capacities below 1 million gallons per day (MGD); they also treat wastewater primarily from the residential sector which is not likely to contain as many toxics as indirect industrial and commercial dischargers, if any. Thus, compliance analysis of the affected major dischargers is likely to capture most, if not all, of the potential compliance-related costs.[3]

[3] Analysis of major facilities also likely captures the bulk of incremental monitoring costs. Available permits from different Regions indicate a wide range of existing WET monitoring requirements for minors, including frequencies

Factors that may affect the potential magnitude of compliance costs include:

- Facility type (municipal/industrial)
- Flow (for process controls)
- Industrial processes
- Dilution allowances.

The CWA requires municipal dischargers to have secondary treatment or an equivalent, and most major WWTPs treat wastewater from a combination of residential, commercial, and industrial sources. Thus, treatment controls are likely to be similar across municipal dischargers. Larger flows are typically associated with the largest treatment costs, although per-unit costs may decrease due to economies of scale.

For industrial dischargers, minimum treatment requirements vary based on the type of industry. Treatment processes and potential effluent quality also vary based on industry type. Categories of concern for WET include chemical manufacturers, metal manufacturers and finishers, petroleum refineries, and pulp and paper mills. Indeed, effluent data from major dischargers in California in EPA's ICIS-NPDES database indicate that some of the facilities in these categories have violated current toxicity permit limits.

The availability of dilution may also be indicative of compliance costs. In waters for which mixing zones would not be allowed (e.g., ephemeral and low flow streams, impaired water bodies), the IWC would be based on 100% effluent samples. Ephemeral and low flow streams are more common in the southern region of the state due to a drier climate.

Given these considerations, to evaluate potential compliance costs Abt Associates evaluated the potential impact of the Provisions on major facilities using the sample SAIC selected for analysis of the draft Provisions. For major municipal dischargers, SAIC selected the largest facility in the north and the largest facility in the south to incorporate the facilities with highest potential for cost in the two regions.[4] For remaining municipal facilities, SAIC selected a representative sample based on flow (five facilities). In addition, a minor facility was selected and added to the sample to reflect minor municipal dischargers.

To reflect the importance of industrial type for major industrial discharges, SAIC selected a stratified random sample using four industrial categories: metals manufacturers and finishers, petroleum refineries, pulp and paper mills, and other industries.

Exhibit 4-1 summarizes the facilities by discharge category.

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of none to monthly; for either acute or chronic to both; and using single- and multiple-concentration tests. Under the Amendment, requirements are standardized to include quarterly single-concentration monitoring of either chronic or chronic and acute tests. Under a worst-case scenario of a minor POTW having no existing toxicity monitoring requirements and then being required to monitor for chronic toxicity quarterly using single-concentration tests, annual costs could be approximately $2,600 (based on average of *Pimephales promelas*, *Ceriodaphnia dubia*, and *Selanastrum capricornutum*). However, given the variability of existing monitoring requirements and the fact that many minor facilities may meet the small community exemption, incremental monitoring costs would be minimal.

[4] Because the probability of selecting each of the facilities was one (100%), these two facilities represent a certainty sample.

Exhibit 4-1. Summary of Potentially Affected Facilities and Sample		
Discharger Category	**Number of Dischargers**	
	Total Major Dischargers[1]	**Sample for Evaluation**
Municipal Wastewater	127	8
Metals Manufacturing and Finishers	1	1
Petroleum Refineries	9	2
Pulp and Paper	1	1
Other Industrial	27	2
Total	165	14
1. Source: U.S. EPA (2008).		

Exhibit 4-2 lists the sample facilities.

Exhibit 4-2. Summary of Sample Facilities			
NPDES Number	**Name**	**Discharge Category**	**Flow (MGD)[1]**
Certainty Sample			
CA0077682	Sacramento Regional Sanitation District WWTP	Municipal	181
CA0053911	LA County Sanitation District, San Jose Creek WRP (East and West)	Municipal	100
Municipal Wastewater			
CA8000304	San Bernardino WWTP	Municipal	40
CA0102822	Victor Valley Regional WWTP	Municipal	14
CA0079049	Davis WWTP	Municipal	7.5
CA0048127	Lompoc Regional WWTP	Municipal	5
CA0023043	Forestville Water District WWTP	Municipal	0.13
CA0059501	Camrosa Water District WWTP	Municipal	1.5
Industrial Wastewater			
CA0005002	USS POSCO Industries	Metal Manufacturing and Finishing	28
CA0005789	Shell Oil, Martinez Refinery	Petroleum Refinery	5.8
CA0005134	Chevron, Richmond Refinery	Petroleum Refinery	27.5
CA0004821	Pactiv Corporation, Molded Pulp Mill	Pulp and Paper	2.7
CA0059188	Department of Water Resources, Warne Power Plant	Other	1.97
CA0085243	Meridian Beartrack Co., Royal Mountain King Mine	Other	3.0
MGD = million gallons per day WRP = water reclamation plant WWTP = wastewater treatment plant 1. Source: U.S. EPA (2008).			

4.1.2 Evaluating Compliance with Existing Requirements

The method for evaluating compliance with existing WET requirements for the sample facilities involves obtaining NPDES permits and toxicity test results, evaluating existing monitoring requirements, and determining the frequency of toxicity violations, exceedance of monitoring triggers, and exceedance of TIE/TRE triggers, if applicable.

Current permit requirements range from narrative or numeric acute and/or chronic limitations to accelerated monitoring and/or TIE/TRE triggers only. The expression of limits and triggers also range from thresholds for single test results to median values for a series of consecutive tests. Limits and triggers for some facilities reflect dilution credits while those for other facilities do not.

Evaluation of existing permit requirements is necessary to determine the incremental impacts of the Provisions. Baseline compliance actions would need to be undertaken even in the absence of the Provisions. Thus, only those actions above and beyond baseline activities are attributable to the Provisions.

4.1.3 Determining Reasonable Potential under the Provisions

Under the Provisions, all POTW dischargers authorized to discharge at a rate greater than or equal to 5 MGD are required to monitor chronic toxicity. For major industrial facilities, Abt Associates estimated reasonable potential to cause or contribute to instream toxicity based on data from 2013 through 2015 analyzed using the TST (as a proxy for the potential outcome of the acute or chronic WET tests submitted to the Regional Water Board for reasonable potential determination under the Provisions) and the percent effect. Under the Provisions, if any of the chronic (or acute) toxicity tests have a percent effects at the IWC greater than 10%, it indicates reasonable potential to cause or contribute to an instream excursion above toxicity water quality objectives.

4.1.4 Evaluating Compliance under the Provisions

For all POTW dischargers authorized to discharge at a rate greater than or equal to 5 MGD, as well as POTW dischargers and industrial facilities in the sample with reasonable potential, Abt Associates evaluated potential compliance with chronic effluent limits under the Provisions based on three years of existing data (2013 through 2015) analyzed using the TST. For those facilities that may receive dilution, Abt Associates evaluated compliance based on the percent of effluent that corresponds to the dilution ratio. For example, for 9:1 dilution, compliance is based on comparing the 10 percent effluent sample to the control using the TST approach. In cases of data not reflecting the exact IWC, Abt Associates evaluated the effluent percentages closest to the actual IWC and estimated a range of compliance scenarios if necessary.

Under the Provisions, the chronic MDEL is exceeded when a chronic toxicity test, using the TST, results in a fail and the percent effect for the survival endpoint is equal to or greater than 50%. If the most sensitive species chronic toxicity test does not include a lethal endpoint then the MDEL is exceeded when a chronic toxicity test results in a fail for any endpoint at the IWC, with a percent effect for that endpoint of greater than or equal to 50%. For acute toxicity, the MDEL is exceeded when a most sensitive species test at the IWC results in a fail for the survival endpoint with a percent effect for the survival endpoint of greater than or equal to 50%

If a chronic or acute toxicity test results in a “fail” at the IWC, dischargers must conduct a maximum of two additional toxicity tests (MMEL compliance tests) within the same calendar month in order to determine compliance with the MMEL. If the first MMEL compliance test results in a “fail” the second MMEL compliance test may be waived. The MMEL compliance

tests must be conducted regardless of the MDEL exceedance of toxicity tests or not. These two MMEL compliance test must be initiated in the same calendar month as the initial routine toxicity test that resulted in a "fail".

4.1.5 Estimating Potential Compliance Mechanisms

The potential for incremental actions under the Provisions reflects a comparison of compliance with current permit requirements compared to the Provisions. Under the Provisions, there may be incremental differences in monitoring frequencies and test types (e.g., chronic or acute; single-concentration or multiple-concentration tests) that could result in additional costs or cost savings. For example, under the Provisions, POTW dischargers are not required to conduct a reasonable potential analysis for acute toxicity. The Regional Water Boards have the discretion to include acute reasonable potential analyses, which may result in effluent limits for acute toxicity if they deem such testing necessary.

However, current NPDES permit regulations indicate that effluent limits should be based on the more stringent of acute or chronic long-term averages. With toxicity, long term averages based on chronic toxicity tests are the more stringent in most cases. In addition, the Provisions requires permit writers to justify in the permit why both acute and chronic toxicity limits would be necessary. Thus, for this analysis Abt Associates assumed that POTW dischargers will only receive chronic toxicity monitoring requirements.

In addition to changes in monitoring requirement, incremental differences in test evaluation may result from use of the TST compared to the statistical evaluations currently in use. For the sample facilities, Abt Associates compared the current (baseline) and Provisions results to identify potential changes in compliance status.

To identify compliance actions under the Provisions, Abt Associates first identified all samples that could exceed the chronic MDEL (i.e., "fail" with percent effect at or above 50%) or result in the need to assess compliance with the MMEL (i.e., "fail" at the IWC for any endpoint).

Then, depending on data availability, Abt Associates evaluated a verification test (to determine compliance with the MDEL) and additional monthly monitoring (to determine compliance with the MMEL). Based on any combination of two or more MDEL or MMEL violations within a single calendar month or within two successive calendar months, Abt Associates assumed a TRE would be necessary. Abt Associates then compared the compliance actions under the Provisions with those that would be required under the existing permit; only those actions that would not also be needed for compliance with existing permit requirements are attributable to the Provisions.

Abt Associates also evaluated the potential for incremental costs to result from the need for facilities to add replicates to an analysis. The TST is designed to declare a chronic test toxic (i.e., a "fail") when the treatment mean at the IWC is ≥25% compared to the control mean, and nontoxic (i.e., a "pass") when the treatment mean at the IWC is ≤10% compared to the control mean. At effects between these boundaries (10% and 25% effect for chronic tests), the TST is designed to "pass" most tests if within-test variability is at or below the national average for the method. One way to lower within-test variability is for laboratories to add additional replicates to

the test to ensure that results indicating toxicity truly represent the presence of toxicity in the effluent. However, the State Board (2011) found that the few cases of the TST indicating toxicity at effects less than the toxic RMD (25%) but above the nontoxic RMD (10%) are due to high variability between replicates in the controls and/or IWC treatments (SWRCB, 2011). The State Board (2011) found that adding a minimal number of replicates to these tests would have resulted in the sample being declared nontoxic using the TST procedure in most cases. Thus, Abt Associates assumed that incremental costs associated with the addition of replicates would be minimal.

Monitoring Costs

Incremental monitoring costs could result from species sensitivity screening, reasonable potential analysis screening, routine monitoring, and verification/follow-up monitoring. The California Department of Health Services (DHS) has accredited 62 laboratories under the Environmental Laboratories Accreditation Program (ELAP) to perform WET tests (ELAP, 2017). These laboratories have demonstrated capability to analyze environmental samples using approved methods (CA DHS, 2012). The accredited laboratories include both commercial and university testing facilities.

Unit costs vary with species and test type (e.g., acute or chronic, single-concentration or multiple dilutions). In addition, laboratories may offer discounts related to the number of tests or longer turnaround times, or charge additional fees related to delivery charges, shorter turnaround times, or the type of control water (laboratory water versus ambient water).

Some municipal and industrial dischargers with DHS-accredited laboratories collect samples and perform toxicity tests onsite. These dischargers may not keep record of per sample testing costs; rather, testing costs may be rolled up into the facility's operating budget. Presumably, both municipal and private industrial dischargers perform in-house testing because it is less expensive than contracting the work out to a commercial or university laboratory, or they want to perform the tests themselves. Thus, price information from commercial and university laboratories establishes market costs relevant to the potential impacts of changes in WET test requirements; these prices may overstate costs to dischargers using in-house laboratories.

Exhibit 4-3 shows acute and chronic toxicity test species and methods for fresh and marine waters.

Exhibit 4-3. Aquatic Toxicity Test Types

Common Name (Species)	EPA Method	Endpoint	Test Type
Freshwater Acute Tests			
Fathead minnow (*Pimephales promelas*)	2000.0	Mortality	Static, renewal, or flow-through
Water flea (*Ceriodaphnia dubia*)	2002.0	Mortality	Static, renewal, or flow-through
Rainbow trout (*Oncorhynchus mykiss*)	2019.0	Mortality	Static, renewal, or flow-through
Brook trout (Salvelinus fontinalis)	2019.0	Mortality	Static, renewal, or flow-through

Exhibit 4-3. Aquatic Toxicity Test Types			
Common Name (Species)	**EPA Method**	**Endpoint**	**Test Type**
Water flea (*Daphnia magna*)	2021.0	Mortality	Static, renewal, or flow-through
Water flea (*Daphnia pulex*)	2021.0	Mortality	Static, renewal, or flow-through
Freshwater Chronic Tests			
Fathead minnow (*Pimephales promelas*)	1000.0	Larval survival and growth	Renewal
Water flea (*Ceriodaphnia dubia*)	1002.0	Survival and reproduction	Renewal
Green alga (*Selenastrum capricornutum*)	1003.0	Growth	Static
Marine Acute Tests			
Sheepshead minnow (*Cyprinodon variegatus*)	2004.0	Mortality	Static, renewal, or flow-through
Bannerfish shiner (*Cyprinella leedsi*)	2004.0	Mortality	Static, renewal, or flow-through
Inland silverside (*Menidia beryllina*)	2006.0	Mortality	Static, renewal, or flow-through
Silverside (*Menidia menidia*)	2006.0	Mortality	Static, renewal, or flow-through
Silverside (*Menidia peninsulae*)	2006.0	Mortality	Static, renewal, or flow-through
Mysid (*Mysidopsis bahia*)	2007.0	Mortality	Static, renewal, or flow-through
Topsmelt (*Atherinops affinis*)	NA	Mortality	Static, renewal, or flow-through
West Coast mysid (*Holmesimysis costata*)	NA	Mortality	Static, renewal
Marine Chronic Tests			
Pacific Oyster (*Crassostrea gigas*) and Mussel (*Mytilus sp.*)	1005.0	Larval development	Renewal
Topsmelt (*Atherinops affinis*)	1006.0	Survival and growth	Renewal
West Coast Mysid (*Holmesimysis costata*)	1007.0	Survival and growth	Renewal
Purple Urchin (*Strongylocentrotus purpuratus*)	1008.0	Fertilization	Static
Giant Kelp (*Macrocystis pyrifera*)	1009.0	Germination and germ tube growth	Static
Purple Urchin (*Strongylocentrotus purpuratus*)	NA	Embryo development	Static
Red abalone (*Haliotis rufescens*)	NA	Larval development	Static
Sources: U.S. EPA (2002a); U.S. EPA (2002b); U.S. EPA (2002c); U.S. EPA (1995). NA = not applicable.			

Abt Associates collected toxicity test price information from a number of the California DHS-accredited laboratories, as summarized in **Exhibit 4-4**

Exhibit 4-4. Summary of WET Test Costs						
Test Method and Species	**Multiple-Concentration**			**Single-Concentration**		
	N	**Range (2016 $)**	**Average (2016 $)**	**N**	**Range (2016 $)**	**Average (2016 $)**
Acute						
EPA Method 2000.0 - *Cyprinodon variegatus*	2	$389 - $431	$410	4	$273 - $442	$347
EPA Method 2000.0 - *Oncorhynchus mykiss*	2	$389 - $431	$410	4	$273 - $442	$347
EPA Method 2000.0 - *Pimephales promelas*	11	$237 - $841	$554	19	$189 - $631	$370
EPA Method 2002.0 - *Ceriodaphnia dubia*	9	$289 - $841	$621	12	$189 - $631	$391
EPA Method 2004.0 - *Cyprinodon variegatus*	3	$526 - $789	$701	1	$315	$315
EPA Method 2006.0 - *Menidia beryllina*	6	$410 - $894	$721	4	$205 - $670	$442
EPA Method 2006.0 - *Menidia*	2	$789	$789	0	ND	ND
EPA Method 2006.0 - *Menidia peninsulae*	2	$789	$789	0	ND	ND
EPA Method 2007.0 - *Mysidopsis bahia*	5	$526 - $815	$710	3	$315 - $526	$403
EPA Method 2019.0 - *Oncorhynchus mykiss*	5	$421 - $1,008	$748	11	$273 - $473	$407
EPA Method 2019.0 - *Salvelinus fontinalis*	2	$789	$789		ND	ND
EPA Method 2021.0 - *Daphnia magna*	2	$473 - $789	$631	8	$263 - $591	$422
EPA Method 2021.0 - *Daphnia pulex*	1	$946	$946	1	$710	$710
N/A - *Atherinops affinis*	4	$415 - $894	$689	4	$210 - $670	$444
N/A - *Holmesimysis costata*	2	$789	$789		ND	ND
Chronic						
EPA Method 1000.0 - *Pimephales promelas*	2	$1,262 - $1,314	$1,288	1	$631	$631
EPA Method 1002.0 - *Ceriodaphnia dubia*	7	$1,126 - $1,525	$1,301	5	$473 - $1,144	$708
EPA Method 1003.0 - *Selenastrum capricornutum*	6	$736 - $1,314	$967	4	$368 - $986	$575
EPA Method 1005.0 - *Crassostrea gigas or Mytilus sp.*	3	$1,472 - $2,313	$1,910	2	$1,104 - $1,367	$1,236
EPA Method 1006.0 - *Atherinops affinis*	6	$1,125 - $1,525	$1,300	5	$578 - $1,144	$733
EPA Method 1007.0 - *Holmesimysis costata*	2	$1,314 - $1,945	$1,630	1	$526	$526
EPA Method 1008.0 - *Strongylocentrotus purpuratus*	4	$899 - $1,577	$1,133	3	$542 - $868	$591
EPA Method 1009.0 - *Macrocystis pyrifera*	4	$1,262 - $1,945	$1,512	3	$631 - $1,183	$850
N/A - *Haliotis rufescens*	5	$1,009 - $2,103	$1,579	4	$505 - $1,262	$889
N/A - *Strongylocentrotus purpuratus*	3	$1,472 - $2,313	$1,788	3	$452 - $1,367	$974

ND = not cost data available
N/A = no method number specified
N = number of per test costs available from certified commercial and university labs performing WET tests

In addition, costs for three-species chronic WET testing to determine the most sensitive species are needed for those sample facilities not currently conducting such tests. **Exhibit 4-5** summarizes these costs based on average species type costs for freshwater and marine tests.

Exhibit 4-5. Average Costs for Three-Species Chronic WET Tests

Test Type	Single-Concentration	Multiple-Concentration
Freshwater 3-species[1]	$1,621	$3,516
Marine 3-species[2]	$2,442	$4,445

1. Based on the sum of average costs of *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum*
2. Based on the sum of average costs of *Atherinops affinis, Macrocystis pyrifera*, and the combined average of *Crassostrea gigas or Mytilus sp,, Haliotis rufescens, Holmesimysis costata, and Strongylocentrotus purpuratus.*

Abt Associates collected replicate toxicity test price information from a number of the California DHS-accredited laboratories. Abt Associates estimated that the cost for adding an additional 1 to 2 replicates (SWRCB, 2011) could range from $50 to $200 as show in **Exhibit 4-6**.

Exhibit 4-6. Summary of Replicate Costs

	One Replicate		Two Replicates	
Test and Species[1]	Number of Estimates	Average Cost	Number of Estimates	Average Cost
EPA Method 1001.0 - *Pimephales promelas*	1	$100	3	$183
EPA Method 1002.0 - *Ceriodaphnia dubia*	2	$88	3	$150
EPA Method 1003.0 - *Selanastrum capricornutum*	2	$75	2	$125
EPA Method 1005.0 - *Crassostrea gigas* or *Mytilus sp*.	1	$75	0	NA
EPA Method 1006.0 - *Atherinops affinis*	2	$100	2	$200
EPA Method 1008.0 - *Strongylentrotus purpuratus*	1	$50	0	NA
EPA Method 1009.0 - *Macrocystis pyrifera*	2	$88	1	$200
N/A - *Haliotus rufescens*	1	$75	1	$200
N/A - *Strongylentrotus purpuratus*	1	$75	0	NA

1. Replicate costs for EPA Method 1007.0 - *Holmesimysis costata* are not available.

However, the purpose of adding replicates to toxicity tests would be to reduce costs associated with false positives resulting in toxicity limit violations (e.g., accelerated monitoring and TREs). That is, dischargers would likely only add replicates to save costs. Therefore, adding replicate costs should reduce the more costly MMEL compliance tests and possibly TREs that could be needed to address permit violations, which could decrease the overall incremental costs for a given facility. Because of the potential for cost savings, Abt Associates did not include replicate costs in estimates for municipal and industrial dischargers.

In addition, Abt Associates did not include costs associated with sample collection and shipping in the per test unit costs. For major POTW dischargers required to monitor chronic toxicity monthly under the Provisions, information from the sample facilities indicates that these

dischargers all likely have monthly monitoring requirements for other pollutants. For minor POTW dischargers required to monitor chronic toxicity quarterly under the Provisions, available permits indicate that most facilities are currently required to conduct quarterly monitoring for conventional pollutants (e.g., BOD, TSS, bacteria). Thus, the WET samples under the Provisions can be collected at the same time as other pollutant samples with minimal additional effort. For those non-storm water dischargers that do not use in-house laboratories, sample transportation and shipping costs are likely the same in that the additional WET samples can be shipped with other samples for a minimal additional cost. Therefore, Abt Associates did not include an estimate of incremental labor and transportation costs of the Provisions.

Toxicity Reduction Evaluation Unit Costs

If any combination of two or more MDEL or MMEL compliance tests indicate a violation in a single month or within two successive months then the Provisions requires dischargers to conduct a TRE. EPA defines a TRE as a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and confirm the reduction in effluent toxicity (U.S. EPA, 1991). TREs comprise all measures taken to reduce WET to required levels. TREs can involve many steps and are seldom the same for all situations. Major components of a TRE include (U.S. EPA, 1999):

- Information and data acquisition
- Facility performance evaluation
- Toxicity identification evaluation
- Toxicity source evaluation
- Toxicity control evaluation
- Toxicity control implementation.

The exact components of a TRE will vary for each discharger. For example, if toxicity occurred after the addition of a new treatment chemical or process change, the investigation can likely be conducted in-house and for a minimal cost. However, in many situations simply examining operational records is of little value without knowledge of the specific toxicant causing the problem (Pillard and Hockett, 2002). Identifying the toxicant of concern often increases treatment and control options while decreasing total control costs.

A TIE is a set of procedures that uses physical and chemical treatments to identify or classify the specific chemical compounds causing toxicity in an effluent sample (U.S. EPA, 2001). EPA recommends that permittees conduct TIEs early in the TRE process (U.S. EPA, 2001). TIE procedures are commonly performed in three phases: characterization, identification, and confirmation. The phases can be performed sequentially (using the results of one phase to influence the next) or simultaneously. TIE costs vary based on effluent complexity and the number of phases conducted. For example, Nautilus Environmental (2012) indicates that a Phase I TIE would cost $5,200 to $7,300; however, costs for Phase II and III TIEs are site-specific. GEI Consultant indicates that Phase I TIE costs vary, but are approximately an additional $100 to $260 per test, depending on effluent manipulations required, data review needs, etc. (GEI Consultants, 2012).

The difficulty in conducting a TIE, and the time required to complete it, will likely increase in direct proportion to the complexity of toxicants in wastewater. As the number of chemical constituents in wastewater increases, the interactions of those chemicals (e.g., with biological and analytical systems and with each other in the wastewater) can increase the difficulty of identifying toxicants (U.S. EPA, 2001). However, TIE studies do not need to be prohibitively expensive. ENSR indicates that relatively low-cost investigations can be extremely useful in providing cost-effective solutions to effluent toxicity problems (Pillard and Hockett, 2002).

Based on TIE results, the permittee may decide to conduct treatability tests on the effluent or source investigations to determine the appropriate control actions. However, not all TREs need to include TIEs. In some cases, dischargers may first conduct treatability tests that use bench-scale treatment units to identify process changes that reduce toxicity through changes in treatment type, arrangement, or method. While these tests may not identify which toxicant is being removed or reduced, they can still be effective in reducing WET.

Costs for a TRE (not including implementation of specific control actions) can range from $26,000 to $42,000 (Pillard and Hockett, 2002). For example, the City of Bryan (Texas) received bids from two laboratory service providers to perform a TRE of $36,222 and $28,560, plus up to an additional $5,000 for all 3 phases of a TIE. For this analysis, Abt Associates used a TRE cost of $42,000 to be conservative (i.e., err on the side of higher costs).

Process Controls

EPA considers any technically reasonable actions taken to resolve WET as TRE activities (EPA, 2001). Such actions may include chemical substitution/addition, process optimization or enhancements, pretreatment modifications, or treatment of process streams.

Chemical substitution removes the source of toxicity in effluents. Common chemicals for which substitution may be an option include cooling tower slimicides, ammonia nutrients, lime, polymers, and oxidizing agents (U.S. EPA, 1989). Adding chemicals to the treatment process may also improve toxicant or toxicity removal. EPA (1999) provides a number of examples:

- Nutrients can be added to influent wastewaters that have low nutrient levels (relative to their organic strength) to improve biological treatment
- Lime or caustic chemicals can be used to adjust wastewater pH for optimal biological treatment or for coagulation and precipitation treatment
- Other chemical coagulants are used to aid in removal of insoluble toxicants and to improve sludge settling
- Powdered activated carbon may be applied in activated sludge systems to remove toxic organic compounds.

Process optimization entails modifying existing operations and facilities to improve operation, maintenance, and performance (Metcalf and Eddy, 2003). Optimization usually involves two main steps: process analysis and process modifications. Process analysis is an investigation of the performance-limiting factors of the treatment process and is a key factor in achieving optimum treatment efficiency. Process modifications include activities short of adding new treatment technology units (conventional or unconventional) to the treatment train. For example,

modifications could include modifying baffles, adding chemicals to enhance coagulation and solids removal, equalizing flow, training operators, and installing automation equipment including necessary hardware and software. Potential modifications vary based on the type of facility and existing treatment train.

The primary advantages of pretreatment control of toxicity are that a smaller volume of waste can be managed by addressing individual sources and the costs are usually the responsibility of the industrial users. Pretreatment requirements may involve a public education effort or the implementation of narrative or numerical limitations for dischargers to POTWs. If the problem toxicant is not already regulated under the existing pretreatment program, municipalities may need to (U.S. EPA, 1999):

- Investigate public education approaches, if the toxicant is widely used in the service area (e.g., organophosphate insecticides)
- Perform an allowable headworks loading analysis
- Decide whether to establish local limits or implement a more directed approach, such as industrial user management or case-by-case requirements
- Develop a monitoring program to evaluate compliance with the requirements.

Treatment of wastewater is another option for controlling effluent toxicity. However, end-of-pipe treatment can be costly, making dischargers more likely to first pursue lower cost options such as process optimization and pollution prevention (e.g., chemical substitution and pretreatment modifications). The treatment technology selected will depend on the toxicant of concern. For example, enhanced biological nutrient removal technologies target reductions in nutrients such as ammonia, whereas, reverse osmosis primarily removes dissolved contaminants (e.g., mercury and pesticides).

Exhibit 4-7 provides examples of the types of control actions that may be necessary for different discharger categories. Note that unit costs for these actions are not readily available, and Abt Associates could not develop unit costs for these specific actions due to a lack of site-specific data for each facility and activity.

Exhibit 4-7. Examples of WET Control Actions

Discharger Category	Pollutants of Concern	Control Actions	Source
Municipal wastewater	Copper	Implemented additional pretreatment controls/requirements	U.S. EPA (1999)
Municipal wastewater	Diazinon and chlorpyrifos	Public awareness program; source control program; identify processes and operations that remove organophosphate insecticides	U.S. EPA (1999)
Municipal wastewater	Surfactants	Pretreatment to minimize or eliminate industrial chemicals	U.S. EPA (1999)
Municipal wastewater	Ammonia, non-polar organic compounds, surfactants	Developed pretreatment limits specific to ammonia and general toxicity limits for non-ammonia pollutants	U.S. EPA (1999)
Municipal wastewater	Bacteria regrowth in effluent samples	Replaced old auto samplers; revised sample tubing replacement protocol; optimized sample collection to reduce bacterial growth	SRCSD (2008)

Exhibit 4-7. Examples of WET Control Actions			
Discharger Category	**Pollutants of Concern**	**Control Actions**	**Source**
Petroleum refinery	Organic chemicals	Installed granular activated carbon to treat 5-10 MGD (in addition to existing biological treatment)	Calgon Carbon (no date)
Petroleum refinery	Semi-volatile aromatics, high MW aliphaties, substituted phenols, aromatic amine and indole compounds, long-chain fatty acid esters, and substituted PAHs	Added more aeration horsepower to combined equalization/aeration tank; modified secondary clarifiers; and added new permanent pumps, piping, instrumentation, and controls for return and waste activated sludge flow control	Stover and Walls (2004)
Petroleum refinery	Neutral organic Chemicals	Ammonia recovery and foul water stripper; preliminary bench scale testing indicated that activated carbon will reduce final effluent toxicity to acceptable levels	U.S. EPA (1989)
Steel production	Bacteria	Improved housekeeping and increased frequency of clarifier cleaning and floc removal	Hall and Lockwood (2004)
Latex production	Mixture of nitrite and ammonia	Upgrades in solids pretreatment and the biological nitrification system (i.e., an anoxic basin and additional nitrification)	Hall and Lockwood (2004)
Organic chemicals	Calcium and chloride salts	Implemented source controls	Hall and Lockwood (2004)
Gas-fired power plant	Copper	Using commercial additive containing EDTA chelating agent	ENSR (2008)

Control costs are highly site-specific. However, in general, pretreatment modifications, source controls, and process optimization are less costly to implement than end-of-pipe treatment. As shown in the exhibit, in certain cases, such as removal of organics from petroleum refinery wastewater, end-of-pipe treatment may be the most technologically and economically feasible alternative for compliance.

4.1.6 Estimating Potential Incremental Statewide Costs

To estimate total statewide costs, Abt Associates calculated average per facility costs for each discharger category by dividing total compliance costs for the sample facilities by the number of sample facilities in each discharger category. Abt Associates then multiplied average per facility costs by the total number of facilities in the applicable category. Note that because WET monitoring costs are not likely to vary based on flow, Abt Associates did not extrapolate the estimated incremental costs for the sample facilities to all facilities based on a cost per MGD of flow. In comparison, costs for compliance technologies to reduce WET would likely be related to flow. However, Abt Associates did not estimate process control costs for the sample facilities.

4.2 Storm Water Discharges

Under the Provisions, the only change to permit requirements for storm water dischargers with existing toxicity monitoring requirements is that toxicity data must be analyzed using the TST

approach to analyze toxicity test data and will be required to report the results along with the percent effect to the Water Boards. There are no toxicity monitoring data from storm water dischargers from which to determine the change in compliance actions for storm water dischargers under the Provisions and thus, the incremental controls that may be needed under the Provisions. However, the State Water Board (2011) evaluated storm water samples collected during dry weather, storm events, and irrigation seasons in agricultural areas and found that using the TST approach is not expected to result in a change in the number of enforcement actions compared to use of the current toxicity methods.

These dischargers may decide to add replicates to samples to decrease the likelihood of a "false positive." As discussed above, this may add anywhere from $50 to $200 per test but would be motivated by efforts to reduce total costs by avoiding accelerated monitoring and possibly TREs that could be needed to address violations. Stormwater dischargers required to run a dilution series after detecting 100% mortality would not add additional replicates.

4.3 Nonpoint Source Dischargers

Under the Toxicity Provisions, the only change to permit requirements for all nonpoint source dischargers required to monitor for toxicity, using test methods specified in the Toxicity Provisions will be required to use the TST approach to analyze test data and will be required to report the results, along with the percent effect to the Water Boards. However, the State Water Board (2011) evaluated storm water samples collected during dry weather, storm events, and irrigation seasons in agricultural areas and found that using the TST approach is not expected to result in a change in the number of enforcement actions compared to use of the current toxicity methods. These dischargers may decide to add replicates to samples to decrease the likelihood of a "false positive." As discussed above, this may add anywhere from $50 to $200 per test but would be motivated by efforts to reduce total costs by avoiding accelerated monitoring and possibly TREs that could be needed to address violations.

The conditional waivers in the Central Coast, Los Angeles, and Central Valley regions already contain toxicity monitoring requirements and TRE/TIE provisions for addressing potential toxicity. Thus, to the extent that toxicity results analyzed using the TST approach would remain unchanged, incremental compliance costs would consist primarily of replicate costs, and thus could be minimal in these regions.

The North Coast, San Francisco, Colorado River and San Diego Regional Water Boards' conditional waivers for agriculture do not contain any specific monitoring or control requirements for toxicity. Thus, if permit writers require specific toxicity provisions in the waiver as a result of the Provisions, there could be some incremental cost associated with compliance. However, the magnitude of this incremental cost, if any, is uncertain due to uncertainty associated with baseline activities for individual growers and estimates of the number of growers covered by each waiver.

The Santa Ana Regional Water Board's conditional agriculture waiver is still being developed and implemented. Thus, it is uncertain whether baseline conditions would include toxicity monitoring provisions and whether incremental costs are likely. In addition, it is uncertain how

many farmers are covered by the waiver and whether they would participate in the group or individual monitoring programs.

The Lahontan Regional Water Board does not currently have conditional waivers for agricultural lands. Whether those waivers would have included toxicity monitoring in the absence of the Provisions or whether permit writers will revise waivers to include monitoring provisions is uncertain.

5 Results

This section summarizes the potential incremental Provisions actions and statewide costs. Incremental impacts represent the costs of activities above and beyond those that would be necessary in the absence of the Provisions under baseline conditions. This section also discusses the limitations and uncertainties associated with the analysis.

5.1 Municipal and Industrial Wastewater

Exhibit 5-1 summarizes the potential incremental costs to the sample facilities of complying with the Provisions. Negative values represent cost savings associated with reduced WET testing requirements and reduced accelerated monitoring and TRE activities associated with the change in statistical method, under the Provisions. Reduced monitoring costs are typically attributable to removing acute WET testing requirements. Reduced TRE costs may result if effluent data analyzed under existing methods trigger permit requirements to implement a TRE and no such requirements are triggered under the Provisions using the TST approach.

Exhibit 5-1. Potential Incremental Provisions Costs for the Sample Facilities

Name	Monitoring[1]	Compliance Actions[2]	Total
Municipal Wastewater			
Sacramento Regional County Sanitation District WWTP	-$77,200	$500	-$76,700
Los Angeles County Sanitation District, San Jose Creek WRP (East and West)	$400	$0	$400
Camrosa Water District WWTP	$0	ND	$0
Colton/San Bernardino RIX	$1,400	$500 to $9,800	$1,900 to $11,200
Davis WWTP	-$15,000	$0	-$15,000
Lompoc Regional WWTP	$3,500	$400	$3,900
Forestville WWTP	-$7,500	$0	-$7,500
Victor Valley Regional WWTP	$7,600	$0	$7,600
Industrials			
Chevron, Richmond Refinery	$12,600	$0	$12,600
Pactiv Corporation, Molded Pulp Mill	$13,300	-$1,000	$12,300
DWR, Warne Power Plant	$800	$0	$800
Shell Oil, Martinez Refinery	$13,700	$700 to $10,400	$14,400 to $24,100
USS POSCO Industries	-$4,400	$0	-$4,400
Royal Mount King Mine	-100	$8,400	$8,300

ND = No data to evaluate compliance
WRP = water reclamation plant
WWTP = wastewater treatment plant
1. Includes cost of routine monitoring and species sensitivity screening.
2. Includes cost of follow-up monitoring, accelerated monitoring, and TREs.

Based on the number of dischargers in each category (e.g., municipal wastewater, metals manufacturers and finishers, petroleum refineries, pulp and paper mills, and other industries), the results from the sample facilities can be extrapolated to estimate the potential incremental statewide costs associated with the Provisions.

Exhibit 5-2 shows the calculation of incremental statewide costs.

Exhibit 5-2. Extrapolation of Compliance Costs for Major Dischargers[1]					
Discharger Category	**Total Cost to Sample Dischargers**	**Number of Sample Dischargers**	**Average Cost per Discharger**	**Number of Dischargers Statewide**	**Total Statewide Cost**
Certainty Sample[2]	-$76,300	2	-$38,200	2	-$76,300
Municipal Wastewater	-$9,100 to $200	6	$0 to $1,500	125	$0 to $187,500
Metals Manufacturing and Finishers	-$4,400	1	-$4,400	1	-$4,400
Petroleum Refineries	$27,000 to $36,700	2	$13,500 to $18,400	9	$121,500 to $165,600
Pulp and Paper	$12,300	1	$12,300	1	$12,300
Other Industrial	$9,100	2	$4,600	27	$124,200
Total	**NA**	**14**	**NA**	**165**	**$10,200 to $221,400**

Note: detail may not add to total due to independent rounding.
NA = not applicable
1. Includes cost of routine monitoring, follow-up monitoring, accelerated monitoring, and TRE implementation; does not include cost of treatment controls because information on specific pollutant(s) causing toxicity is not available.
2. Represents the largest facility in the north and the largest facility in the south to incorporate the facilities with highest potential for cost in the two regions.

5.2 Storm Water Dischargers

Incremental compliance costs to storm water discharges associated with additional enforcement actions due to a change in test analysis methods under the Provisions are unlikely based on the State Water Board (2011) comparison of toxicity results for storm water data using the TST approach and current toxicity methods. However, these dischargers may decide to add replicates to samples to decrease the likelihood of a “false positive.” As discussed above, this may add anywhere from $50 to $200 per test but would be motivated by efforts to reduce total costs by avoiding accelerated monitoring and possibly TREs that could be needed to address violations.

5.3 Nonpoint Source Dischargers

Incremental costs to discharges from nonpoint source dischargers required to monitor toxicity associated with additional enforcement actions due to a change in test analysis methods under the Provisions are unlikely based on the State Water Board (2011) comparison of toxicity results for storm water runoff from agriculture areas using the TST approach and current toxicity methods.

5.4 Limitations and Uncertainties

There are a number of uncertainties associated with the analysis of potential compliance and costs under the Provisions due to data limitations. **Exhibit 5-3** summarizes the key uncertainties and the potential effect on estimated costs.

Exhibit 5-3. Key Limitations and Uncertainties in the Analysis of Compliance and Costs		
Issue or Assumption	**Impact on Estimated Costs**	**Comments**
Treatment costs not estimated.	–	If a TRE is necessary, dischargers could incur some costs for reducing effluent toxicity. However, without information on the pollutants causing the toxicity, the magnitude of those costs cannot be estimated. It is unlikely that a significant number of dischargers, if any, would need to implement additional treatment controls under the Provisions that would not already be needed to meet existing toxicity permit requirements.
Compliance with Provisions and thus estimated costs based on WET tests from 2013 through 2015.	?	Dischargers may test different species (due to rescreening and changes in acceptable test species) under the Provisions, which could change compliance results. Effluent quality may have changed over time.
Incremental costs associated with a change in monitoring requirements are not estimated for nonpoint source required to monitor toxicity.	?	Costs to dischargers with existing toxicity provisions may be minimal or there may be cost savings. Dischargers with no existing toxicity provisions could incur costs if permit writers choose to include them in permits; however, such costs could be offset by potential cost savings from nonpoint source dischargers.
June 2017 IWC definition used in analysis.	+	Use of the June 2017 IWC definition result in increased estimated costs relative to those which would be predicted using the proposed IWC definition. Under the proposed IWC definition, reasonable potential analyses and compliance assessments are run with a lower IWC which will result in fewer findings of reasonable potential and increased compliance with effluent limitations.
'?' = uncertain '-' = estimated costs may be understated		

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Appendix A: Facility Analyses

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A.1 Camrosa WRP

The following sections document the incremental compliance analysis for the sample facility.

A.1.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Camrosa WRP

Name	Camrosa WRP
NPDES No.	CA0059501
Category	Major municipal
Flow (MGD)	1.5
Receiving water	Calleguas Creek
Existing treatment level	Tertiary
Existing treatment train	Bar screen, headworks lift station, denitrification extended aeration system, anoxic denitrification, secondary clarification, upflow sand filtration, chlorination, and impoundment for reclamation.

A.1.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Camrosa WRP

Permit issue date	11/06/2014
Permit expiration date	12/31/2019
Dilution	None
Acute monitoring	None
Acute limits	None
Chronic monitoring	Monthly; 1 species with re-screening every 24 months (*Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*); 100% effluent
Chronic limits	Pass or percent effect <50
Accelerated monitoring trigger	Median monthly result = fail (if >1 discharge day per month); or maximum daily result = fail and percent effect >50 (if only 1 discharge day per month)
TRE trigger	If the result of any accelerated toxicity test results in a result of fail, the Discharger shall cease accelerated monitoring and initiate a TRE to investigate the cause(s) of and identify corrective actions to reduce or eliminate effluent toxicity.
Resume regular testing condition	If the results of four consecutive accelerated monitoring tests result in a pass, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring.

A.1.3 Baseline Compliance

There are no effluent toxicity data available for this facility because it has not discharged since 1998.

A.1.4 Provisions Compliance

There are no data available from which to determine compliance with the Provisions because the facility has not discharged to surface water since 1998.

A.1.5 Potential Incremental Impact Summary

The potential for compliance with WET requirements is similar under the Provisions compared to the current permit. Thus, incremental control costs are zero. In addition, monitoring costs are zero because the facility is not currently discharging.

A.2 Chevron, Richmond Refinery

The following sections document the incremental compliance analysis for the sample facility.

A.2.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Chevron, Richmond Refinery

Name	Chevron, Richmond Refinery
NPDES No.	CA0005134
Category	Major industrial (petroleum refining)
Flow (MGD)	25
Receiving water	San Pablo Bay
Existing treatment level	Tertiary
Existing treatment train	The treatment system first consists of oil and water separators. Wastewater is then routed to a bioreactor that consists of 4 quadrants. The first 2 quadrants provide biological treatment through aeration, while the next 2 quadrants are used as settling basins. After the settling basins, the Discharger routes a portion of bioreactor effluent to its water enhancement wetland. The remaining bioreactor effluent, and typically all wetland effluent, is routed through granular activated carbon before discharge through a deepwater diffuser.

A.2.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Chevron, Richmond Refinery

Permit issue date	12/14/2016
Permit expiration date	1/31/2022
Dilution	10:1
Acute monitoring	Weekly; 1 species (*Oncorhynchus mykiss*)
Acute limits	The survival of organisms in undiluted effluent not less than an 11-sample median of not less than 90%, and an 11-sample 90th percentile value of not less than 70%.
Chronic monitoring	Quarterly; 1 species (*Ceriodaphnia dubia*); 40%, 20%, 10%, 5%, and 2.5% dilutions; screening phase monitoring data from within 5 years of permit expiration date required in application for permit reissuance
Chronic limits	Single-sample value < 10 TUc.
Accelerated monitoring trigger	Single-sample value >= 10 TUc. Accelerate frequency to monthly.
TRE trigger	Submit TRE work plan based on required generic Work Plan within 30 days of exceeding an accelerated monitoring trigger
Resume regular testing condition	If data from accelerated monitoring data points are found to be in compliance with the evaluation parameter, then regular monitoring shall be resumed.

A.2.3 Baseline Compliance

The following tables summarize WET data reported in 2013 – 2015.

Baseline Compliance, Acute Toxicity: Chevron, Richmond Refinery

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	157
# exceeding limit	0

Baseline Compliance, Chronic Toxicity: Chevron, Richmond Refinery

Species	*Ceriodaphnia dubia*
Test	Survival and reproduction
# of tests	15
# exceeding limit	1
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	Y

The discharger exceeded accelerated monitoring and TIE/TRE triggers over the period of the data.

A.2.4 Provisions Compliance

Regional Water Boards can allow dilution at their discretion. Under the existing permit, the discharger receives a dilution ratio of 10:1 for toxicity, then the applicable IWC would correspond to a 10% effluent sample.

The following table summarizes WET data reported from 2013 – 2015 under the Provisions based on comparison of 10% effluent sample to a control.

Effluent Data Analysis under the Provisions, Chronic Toxicity: Chevron, Richmond Refinery

Species	*Macrocystis pyrifera*
Test	Germination and growth
# of tests	16
# of fails	11
# with percent effect >10%	13
"fail" = statistically significant using the TST approach	

Based on existing chronic monitoring data, the discharger would demonstrate reasonable potential under the Provisions because there are "fail" results and percent effects greater than 10%.

Under the Provisions, the discharger will have to conduct three-species screening to determine the most sensitive species for chronic monitoring. Existing data is only available for *Ceriodaphnia dubia*. In addition, existing data indicate exceedances of both the MDEL and MMEL under the Provisions.

A.2.5 Potential Incremental Impact Summary

The discharge is out of compliance with baseline requirements and would demonstrate reasonable potential under the Provisions. Thus, incremental control costs are zero.

Abt Associates assumed that permit writers would continue to require flow-through acute monitoring under the Provisions and routine chronic monitoring, as shown in the table below.

Routine Monitoring Costs: Chevron, Richmond Refinery

Component	Baseline	Provisions	Incremental
Acute			
Frequency	52/yr	52/yr	NA
# Species	1	1	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	$407 (*Oncorhynchus mykiss*)	NA
Annual cost	$21,176	$21,176	$0
Chronic			
Frequency	4/yr	12/yr	NA
# Species	1	1	NA
Unit costs	$1,301 (*Ceriodaphnia dubia*)	$1,185 (Uncertain[1])	NA
Annual cost	$5,204	$14,224	$9,020
Total			
Annual cost	$26,380	$35,400	$9,020

NA = not applicable.
1. Represents unit cost of $1,185 per test (average of 3 freshwater species tests).

Incremental costs associated with routine monitoring would be approximately $9,020 per year.

There will also be an incremental cost associated with initial reasonable potential monitoring (chronic three-species testing) of approximately $9,800 (based on four samples per species and average multiple-concentration chronic test costs for saltwater test species) because the facility does not currently have the data necessary to determine the most sensitive species for routine monitoring. Dividing the total cost over the length of a permit cycle (5 years), annual costs would be approximately $3,600 per year. Note that Regional Boards may allow facilities to use data from previous permit cycles, so the estimated annual costs of initial reasonable potential monitoring may be overestimated.

Incremental compliance costs associated with exceedance of permit limitations are expected to be zero since TREs and accelerated monitoring costs are incurred under both the baseline and Policy scenarios.

Thus, total incremental costs for the discharger may be approximately $12,600 per year.

Potential Total Annual Incremental Compliance Costs: Chevron, Richmond Refinery

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$9,000	$3,600	$0	$12,600

A.3 Colton/San Bernardino Regional Tertiary Treatment Facility

The following sections document the incremental compliance analysis for the sample facility.

A.3.1 Facility Information

The San Bernardino WWTP is a secondary plant that discharges (along with the Colton WWTP) to the Colton-San Bernardino Regional Tertiary Plant. Toxicity monitoring is required for the regional plant and not the individual plants. The following exhibit summarizes general information for the regional treatment facility.

General Information: Colton/San Bernardino Regional Tertiary Treatment Facility

Name	Colton/San Bernardino Regional Tertiary Treatment Facility
NPDES No.	CA8000304
Category	Major municipal
Flow (MGD)	40
Receiving water	Santa Ana River
Existing treatment level	Tertiary
Existing treatment train	The treatment system at the San Bernardino and Colton WWTPs consist of secondary treatment. Treatment at the regional tertiary facility is rapid infiltration and extraction (RIX), which consists of infiltration of wastewater to local groundwater from a series of ponds, and extraction of the wastewater along with native groundwater. The extracted water is passed through a UV disinfection system prior to discharge.

A.3.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Colton/San Bernardino Regional Tertiary Treatment Facility

Permit issue date	7/19/2013
Permit expiration date	7/31/2018
Dilution	None
Acute monitoring	None
Acute limits	No acute toxicity in the effluent (narrative limitation).
Chronic monitoring	Monthly; 1 species (*Ceriodaphnia dubia*); at least five dilutions (within 60% to 100% effluent concentration) and a control
Chronic limits	No chronic toxicity in the effluent (narrative limitation).
Accelerated monitoring trigger	Any single test > 1 TUc
TIE/TRE trigger	2-month median test value >1 TUc for survival or reproduction endpoint; any single test value >1.7 TUc for survival endpoint
Resume regular testing condition	2 consecutive data points result in 1.0 TUc, or when the results of the Initial Investigation Reduction Evaluation have adequately addressed the identified toxicity problem

A.3.3 Baseline Compliance

The following table summarizes WET data reported for 2013 – 2015.

Baseline Compliance, Chronic Toxicity: Colton/San Bernardino Regional Tertiary Treatment Facility

Species	*Ceriodaphnia dubia*
Test	Survival and reproduction
# of tests	36
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger did not exceed accelerated monitoring or TIE/TRE triggers during the period 2013 – 2015.

A.3.4 Provisions Compliance

The discharger would be subject to chronic toxicity monitoring and testing under the Provisions because it is a major WWTP. The following table summarizes WET data from 2013 – 2015 under the Provisions.

Effluent Data Analysis under the Provisions, Chronic Toxicity: Colton/San Bernardino Regional Tertiary Treatment Facility

Species	*Ceriodaphnia dubia*
Test	Survival and reproduction
# of tests	37
# of potential exceedances of MDEL	0
Failure of MDEL verification test	No
# of potential exceedances of MMEL	1*
"fail" = statistically significant using the TST approach *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

Under the Provisions, the discharger will have to conduct three-species screening to determine the most sensitive species for chronic monitoring. Existing data is only available for *Ceriodaphnia dubia*. In addition, the existing data indicate that there is one potential exceedance of the MMEL. If a toxicity test result is a "fail," but the percent effect is below the MDEL, dischargers must collect two additional toxicity samples within the same calendar month in order to determine compliance with the MMEL by conducting maximum of 2 MMEL compliance tests. If the first MMEL compliance test results in a "fail" the second MMEL compliance test may be waived. If either of these two additional samples results in a "fail," the median monthly result is "fail" and the discharger will be in exceedance of the MMEL. Because the data to assess compliance with the MMEL are not available, Abt Associates estimated potential compliance based on both potential outcomes: 1) monitoring indicates exceedance of the MMEL and 2) monitoring indicates compliance with the MMEL.

A.3.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL, the compliance actions under the Provisions would result in an incremental TRE and accelerated monitoring costs. These, along with MMEL monitoring, would result in an incremental cost of approximately $9,800 per year.

Under the scenario in which additional monitoring indicates that the facility is in compliance with the MMEL, incremental costs would only reflect the additional monitoring associated with determining compliance with the MMEL, or approximately $500 per year.

Potential Incremental Permit Limit Compliance Costs: Colton/San Bernardino Regional Tertiary Treatment Facility

Scenario	Potential to Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with MMEL	No	$0	$2,400	$0	$0	$500
Exceed MMEL	No	$0	$2,400	$4,700	$42,000	$9,800

1. Represents unit cost of $1,185 per test (average of 3 freshwater species tests) multiplied by 2 follow-up tests for MMEL monitoring trigger.
2. Total incremental costs divided the length of the permit term (5 years).

In addition, routine monitoring requirements would change under the Provisions in that chronic monitoring will be monthly with one species (most sensitive), but with a multiple-concentration test.

Routine Monitoring Costs: Colton/San Bernardino Regional Tertiary Treatment Facility

	Baseline	Provisions	Incremental
Chronic			
Frequency	12/yr	12/yr	NA
# Species	1	1	NA
Unit costs	$1,301 (*Ceriodaphnia dubia*)	$1,185 (Uncertain[1])	NA
Annual cost	$15,612	$14,224	-$1,388

NA = not applicable.
1. Sensitive species is uncertain because facility only has monitoring data for a single species; cost represents average of three freshwater species.

Incremental cost savings associated with routine monitoring would be approximately $1,300 per year.

There will also be an incremental cost associated with initial reasonable potential monitoring (chronic three-species testing) of approximately $14,000 (based on four samples per species and average multiple-dilution chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants) because the facility does not currently have the data necessary to determine the most sensitive species for routine monitoring. Dividing the total cost over the length of a permit cycle (5 years), annual costs would be approximately $2,800 per year. Note that Regional Boards may allow facilities to use data from previous permit cycles, so the estimated annual costs of initial reasonable potential monitoring may be overestimated.

Thus, total incremental costs may range from approximately $1,900 to $11,200 per year.

Potential Total Annual Incremental Compliance Costs: Colton/San Bernardino Regional Tertiary Treatment Facility

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$1,400	$2,800	$500 to $9,800	$1,900 to $11,200

A.4 Davis WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.4.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Davis WWTP

Name	Davis WWTP
NPDES No.	CA0079049
Category	Major municipal
Flow (MGD)	7.5
Receiving water	Willow Slough Bypass (Outfall 001) and Conaway Ranch Toe Drain (Outfall 002)
Existing treatment level	Secondary
Existing treatment train	The treatment system consists of a mechanical bar screen, an aerated grit tank, three primary sedimentation tanks, a primary anaerobic digester, a secondary anaerobic digester, three sludge lagoons, two aeration ponds (typically used in winter), three facultative oxidation ponds, a Lemna pond, an overland flow system, a chlorine contact tank, and restoration wetlands (used when discharging to Conaway Toe Drain). Biosolids are dewatered in on-site lagoons and the dried biosolids are land applied on-site in the overland flow fields.

A.4.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Davis WWTP

Permit issue date	10/04/2013
Permit expiration date	11/01/2018
Dilution	None
Acute monitoring	Monthly for both outfalls for any month when a discharge occurs; 1 species (*Oncorhynchus mykiss*);
Acute limits	Survival of aquatic organisms in 96-hr bioassays of undiluted waste shall be no less than: 70%, minimum for any one bioassay; and 90%, median for any three consecutive bioassays.
Chronic monitoring	Quarterly for both outfalls for any month when a discharge occurs; 3 species (*Ceriodaphnia dubia*, survival and reproduction; *Pimephales promelas*, survival and growth; *Selenastrum capricornutum*, growth); dilution series and controls
Chronic limits	There shall be no chronic toxicity in the effluent discharge (narrative limitation).
Accelerated monitoring trigger	The numeric toxicity monitoring trigger is > 1 TUc (where TUc = 100/NOEC).
TRE trigger	If the result of any accelerated toxicity test exceeds the monitoring trigger (>1 TUc), the Discharger shall cease accelerated monitoring and initiate a TRE to investigate the cause(s) of and identify corrective actions to reduce or eliminate effluent toxicity.
Resume regular testing condition	If the results of four consecutive accelerated monitoring tests do not exceed the monitoring trigger, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring.

A.4.3 Baseline Compliance

The following tables summarize WET data reported between 2013 – 2015 for Discharge Point 001 and Discharge Point 002.

Baseline Compliance, Acute Toxicity: Davis WWTP Outfall 001

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	30
# exceeding limit	0
# exceeding accelerated monitoring trigger	NA
Exceeding TRE trigger? (Y/N)	NA

NA = Not applicable

Baseline Compliance, Acute Toxicity: Davis WWTP Outfall 002

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	5
# exceeding limit	0
# exceeding accelerated monitoring trigger	NA
Exceeding TRE trigger? (Y/N)	NA

NA = Not applicable

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 001

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	15
# exceeding accelerated monitoring trigger	3
Exceeding TRE trigger? (Y/N)	Y
Pimephales promelas	
Test	Survival and growth
# of tests	15
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	16
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	Y

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 002

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	4
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	Y
Pimephales promelas	
Test	Survival and growth
# of tests	6

Baseline Compliance, Chronic Toxicity: Davis WWTP Outfall 002

# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	5
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger exceeded both accelerated monitoring and TRE triggers for chronic toxicity at both outfalls over the period of the data.

A.4.4 Provisions Compliance

The discharger will be required to monitor toxicity under the Provisions because it is a major WWTP. The following tables summarize WET data from 2013– 2015 under the Provisions for Outfall 001 and Outfall 002.

Effluent Data Analysis under the Provisions, Chronic Toxicity: Davis WWTP Outfall 001

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	15
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	15
# of potential exceedances of MDEL	1
# of potential exceedances of MMEL	1*
Selenastrum capricornutum	
Test	Growth
# of tests	16
# of potential exceedances of MDEL	5
# of potential exceedances of MMEL	11
"fail" = statistically significant using the TST approach *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

Effluent Data Analysis under the Provisions, Chronic Toxicity: Davis WWTP Outfall 002

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	6
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

Effluent Data Analysis under the Provisions, Chronic Toxicity: Davis WWTP Outfall 002

Selenastrum capricornutum	
Test	Growth
# of tests	5
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
*Uncertain because there were no additional tests in the same calendar month to determine compliance.	

Based on the analysis of effluent data under the Provisions, *Selenastrum capricornutum* may be the most sensitive for Outfall 001 and Outfall 002. The analysis also indicates that there may be exceedances of the chronic MMEL for both outfalls because there is at least one "fail" result for each with a percent effect less than 50%. The exceedance at Outfall 001 is certain.

A.4.5 Potential Incremental Impact Summary

Given the number of exceedances under the Provisions, the facility would likely need to conduct accelerated monitoring and a TRE. However, as a result of baseline toxicity, the facility has already been conducting TREs and accelerated monitoring. Thus, incremental controls costs are likely zero.

In addition, routine monitoring requirements would change under the Provisions in that Abt Associates assumed that permit writers would not require routine acute monitoring under the Provisions, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive).

Routine Monitoring: Davis WWTP

Component	Baseline	Provisions	Incremental
Acute			
Frequency	12/yr (at 2 outfalls)	NA	NA
# Species	1	NA	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$9,773	NA	-$9,773
Chronic			
Frequency	4/yr (at 2 outfalls)	12/yr (at 2 outfalls)	NA
# Species	3	1	NA
Unit costs	$1,301 (*Ceriodaphnia dubia*) $1,288 (*Pimephales promelas*) $967 (*Selenastrum capricornutum*)	$967 (*Selenastrum capricornutum* [1])	NA
Annual cost	$28,448	$23,205	-$5,243
Total			
Annual cost	$38,222	$23,205	-$15,017

NA = not applicable.
Note: Detail may not add to total due to independent rounding.
1. Based on *Selenastrum capricornutum* as most sensitive species for both outfalls.

Incremental cost savings associated with routine monitoring would be approximately $15,000 per year.

There is no incremental cost associated with initial reasonable potential monitoring (chronic three-species testing) because the permit already requires such testing quarterly.

Thus, total incremental cost savings for the discharger are approximately $15,000 per year.

Potential Total Annual Incremental Compliance Costs: Davis WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$15,000	$0	$0	-$15,000

A.5 California Department of Water Resources, Warne Power Plant

The following sections document the incremental compliance analysis for the sample facility.

A.5.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: California DWR, Warne Power Plant

Name	California Department of Water Resources, Warne Power Plant
NPDES No.	CA0059188
Category	Major industrial (other)
Flow (MGD)	1.97
Receiving water	Pyramid Lake (Outfalls 001 and 002)
Existing treatment level	None
Existing treatment train	None

A.5.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: California DWR, Warne Power Plant

Permit issue date	06/09/2016
Permit expiration date	06/30/2021
Dilution	None
Acute monitoring	None
Acute limits	None
Chronic monitoring	Annually; vertebrate, invertebrate, plant initial test for 3 consecutive months; most sensitive species thereafter.
Chronic limits	None
Accelerated monitoring trigger	None.
TIE/TRE trigger	Median monthly result of “Fail” or maximum daily single sample result of “Fail and % Effect greater or equal to 50”.
Resume regular testing condition	Not applicable.

A.5.3 Baseline Compliance

The following table summarizes WET data from 2013 – 2015.

Effluent Data Analysis under Baseline, Chronic Toxicity: California DWR, Warne Power Plant 001

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	6
# of potential exceedances of MDEL	0

Effluent Data Analysis under Baseline, Chronic Toxicity: California DWR, Warne Power Plant 001

# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	1
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

Effluent Data Analysis under Baseline, Chronic Toxicity: California DWR, Warne Power Plant 002

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

A.5.4 Provisions Compliance

The following table summarizes WET data reported from 2013 – 2015 under the Provisions. Based on the available data, the facility does not possess reasonable potential to exceed the proposed objectives under the Provisions.

Effluent Data Analysis under the Provisions, Chronic Toxicity: California DWR, Warne Power Plant 001

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	6
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

Effluent Data Analysis under the Provisions, Chronic Toxicity: California DWR, Warne Power Plant 001

Selenastrum capricornutum	
Test	Growth
# of tests	1
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

Effluent Data Analysis under the Provisions, Chronic Toxicity: California DWR, Warne Power Plant 002

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

A.5.5 Potential Incremental Impact Summary

Abt Associates assumed that permit writers would not require routine acute monitoring under the Provisions. In addition, since the discharger does not have reasonable potential, there will not be routine chronic monitoring but monitoring will be required in the final year to support a reasonable potential determination during reissuance.

Routine Monitoring: California DWR, Warne Power Plant

Component	Baseline	Provisions	Incremental
Acute			
Frequency	NA	NA	NA
# Species	NA	NA	NA
Unit cost	NA	NA	NA
Annual cost	NA	NA	NA
Chronic			
Frequency	1/yr at 2 outfalls	4 in final year at 2 outfalls	NA
# Species	1	1	NA
Unit costs	$638 (Uncertain[1])	$638	NA
Annual cost	$1,276	$1,021	-$255
Total			
Annual cost	$1,276	$1,021	-$255

NA = not applicable.
Note: detail may not add to total due to independent rounding.
1. The most sensitive species is uncertain; costs represent average across freshwater species.

The incremental routine monitoring costs saving will be approximately $255 per year.

There is an incremental annual cost of $1,137 associated of with initial species sensitivity monitoring. The permit requires single-concentration chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants for Outfalls 001 and 002 at the beginning of each permit cycle. Under the provisions, the permittee will be required to perform the same monitoring using a multiple dilutions test.

Under the policy, the total annual incremental cost is approximately $800.

Potential Total Annual Incremental Compliance Costs: DWR, Warne Power Plant

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$300	$1,100	$0	$800

A.6 Forestville Water District

The following sections document the incremental compliance analysis for the sample facility.

A.6.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Forestville Water District

Name	Forestville Water District Wastewater Treatment, Reclamation, and Disposal Facility
NPDES No.	CA0023043
Category	Minor
Flow (mgd)	0.13
Receiving water	Jones Creek, tributary to Green Valley Creek, thence to the Russian River
Existing treatment level	Tertiary
Existing treatment train	The treatment train consists of a headworks, an aeration pond, a settling pond, microfiltration, chlorine disinfection, and dechlorination. Biosolids accumulate in the aeration and settling ponds, where they undergo anaerobic digestion and compaction.

A.6.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Forestville Water District

Permit issue date	3/1/2012
Permit expiration date	2/28/2017
Dilution	None
Acute monitoring	Monthly; 1 species (*Oncorhynchus mykiss*); 100% effluent
Acute limits	Survival of aquatic organisms in 96-hr bioassays of undiluted waste shall be no less than: 70%, minimum for any one bioassay; and 90%, average for any three consecutive bioassays.
Chronic monitoring	Annually; vertebrate, invertebrate, plant initial test for 3 consecutive months; most sensitive species thereafter.
Chronic limits	None
Accelerated monitoring trigger	Single test less than 70% survival (acute); Single test exceeds 1.0 TUc (chronic).
TIE/TRE trigger	If the results of either of the two accelerated tests are less than 90% survival, then the Discharger shall immediately begin a Toxicity Identification Evaluation (TIE) and implement the Initial Investigation Toxicity Reduction Evaluation (TRE) workplan. For chronic toxicity, if any accelerated toxicity test exceeds 1 TUc, Discharger must begin a TRE.
Resume regular testing condition	If the additional data points indicate compliance with acute toxicity limitation, the Discharger may resume regular testing. Executive Officer may end accelerated schedule once TRE/TIE initiated if no longer needed.

A.6.3 Baseline Compliance

The following table summarizes acute WET data from 2013 – 2015.

Baseline Compliance, Chronic Toxicity: Forestville Water District

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	7
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	3
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	3
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger exceeded the accelerated monitoring trigger for chronic toxicity once over the period of the data.

A.6.4 Provisions Compliance

The following table summarizes WET data reported from 2013 – 2015 under the Provisions. Based on the available data, the facility does not possess reasonable potential to exceed the proposed objectives under the Amendment.

Effluent Data Analysis under the Amendment, Chronic Toxicity: Forestville Water District

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	7
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	3
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricornutum	
Test	Growth
# of tests	3
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

A.6.5 Potential Incremental Impact Summary

Abt Associates assumed that permit writers would not require routine acute monitoring under the Amendment. In addition, since the discharger does not have reasonable potential, there will not be routine chronic monitoring.

Routine Monitoring: Forestville WWTP

Component	Baseline	Amendment	Incremental
Acute			
Frequency	12/yr	NA	NA
# Species	1	NA	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$4,887	NA	-$4,887
Chronic			
Frequency	1/yr	4 in final year	NA
# Species	3	1	NA
Unit costs	$1,301 (*Ceriodaphnia dubia*) $1,288 (*Pimephales promelas*) $967 (*Selenastrum capricornutum*)	$1,185 (Uncertain[1])	NA
Annual cost	$3,556	$948	-$2,608
Total			
Annual cost	$8,443	$948	-$7,495

NA = not applicable.
Note: detail may not add to total due to independent rounding.
1. The most sensitive species is uncertain; costs represent average across freshwater species.

Incremental routine monitoring cost savings will be approximately $7,500 per year.

There is also no cost of initial species sensitivity monitoring because the permit already requires multiple-dilution chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants at the beginning of each permit cycle.

Potential Total Annual Incremental Compliance Costs: Forestville WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$7,500	$0	$0	-$7,500

A.7 LACSD San Jose Creek WRP

The following sections document the incremental compliance analysis for the sample facility.

A.7.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: LACSD San Jose Creek WRP

Name	LACSD San Jose Creek WWRP
NPDES No.	CA0053911
Category	Major municipal
Flow (MGD)	100 (62.5 MGD East Plant and 37.5 MGD West Plant)
Receiving water	San Gabriel River (Outfalls 001 and 003) and San Jose Creek (Outfall 002)
Existing treatment level	Tertiary
Existing treatment train	Facility consists of two treatment plants with separate sewer systems. Treatment trains for both plants are the same and consist of primary sedimentation, nitrification-denitrification activated sludge biological treatment, secondary sedimentation with coagulation, inert media filtration, chlorination and dechlorination. Sewage solids separated from the wastewater are returned to the trunk sewer for conveyance to Joint Water Pollution Control Plant for treatment and disposal.

A.7.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: LACSD San Jose Creek WRP

Permit issue date	06/01/2015
Permit expiration date	05/31/2020
Dilution	None
Acute monitoring	NA
Acute limits	NA
Chronic monitoring	Monthly; 1 species with re-screening for most sensitive species every 24 months (*Ceriodaphnia dubia, Pimephales promelas*, *Selenastrum capricornutum*); 100% effluent and control
Chronic limits	Permit implements same MMEL and MDEL limitations proposed in the Provisions.
Accelerated monitoring trigger	Accelerated monitoring is initiated when Median Monthly Summary Result: “Fail”; and for Maximum Daily Single Result: “Fail and %Effect ≥50.
TRE trigger	If one of the accelerated toxicity tests results in “Fail”, the Permittee shall immediately implement the TRE Process conditions set forth below
Resume regular testing condition	if monitoring finds there is no longer toxicity, the TRE may be ended and the Discharger may resume regular testing.

A.7.3 Baseline and Provisions Compliance

The following tables summarize WET data from 2013 – 2015 for each of the treatment plants. The Regional Water Board implements the same limitations and TST approach proposed in the Provisions.

Baseline and Provisions Compliance, Chronic Toxicity: LACSD San Jose Creek WRP East

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	47
# exceeding limit	3
# exceeding accelerated monitoring trigger	3
Exceeding TRE trigger? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	16
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	5
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

Baseline and Provisions Compliance, Chronic Toxicity: LACSD San Jose Creek WRP West

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	20
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	15
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	4
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

Based on the analysis of effluent data under the Provisions, *Ceriodaphnia dubia* may be the most sensitive species and would be used to assess compliance with the Provisions. The available data indicate that the discharger would be in exceedance of the MDEL and MMEL for the East plant but demonstrates no compliance issues at the West plant.

A.7.5 Potential Incremental Impact Summary

Because the TST policy is currently implemented in the permit, no incremental compliance costs are anticipated under the Provisions. Abt Associates assumed that permit writers would continue to not require routine acute monitoring under the Provisions, as shown in the table below. Chronic monitoring will be monthly. In addition, there is no incremental cost associated with initial reasonable potential monitoring (chronic three-species testing) because the permit already requires such testing biannually.

Routine Monitoring: LACSD San Jose Creek WRP

Component	Baseline	Provisions	Incremental
Acute			
Frequency	NA	NA	NA
# Species	NA	NA	NA
Unit cost	NA	NA	NA
Annual cost	NA	NA	NA
Chronic			
Frequency	12/yr for most sensitive species; 3 samples every 2 years for other 2 species; for 2 outfalls	12/yr at 2 outfalls	NA
# Species	Varies	1	NA
Unit costs	$708 (*Ceriodaphnia dubia*) $631 (*Pimephales promelas*) $575 (*Selenastrum capricornutum*)	$708 (*Ceriodaphnia dubia*)	NA
Annual cost	$18,222	$16,997	-$1,225
Total			
Annual cost	$18,222	$16,997	-$1,225
NA = not applicable.			

Incremental annual costs savings associated with routine monitoring would be approximately $1,225 per year.

Under the existing permit, the discharger is required to conduct single concentration, 3-species sensitivity screening once every 24 months at each outfall. Under the Provisions, the permittee will be required to conduct sensitivity testing using a multiple dilutions test. The incremental 3-species monitoring cost is $1,600.

Limit compliance would be similar under both the baseline and Provisions scenarios, resulting in no net cost increment.

Thus, total incremental cost may be approximately $400 per year.

Potential Total Annual Incremental Compliance Costs: LACSD San Jose Creek WRP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$1,200	$1,600	$0	$400

A.8 Lompoc Regional WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.8.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Lompoc Regional WWTP

Name	Lompoc Regional WWTP
NPDES No.	CA0048127
Category	Major municipal
Flow (MGD)	5 (average dry weather flow)
Receiving water	Santa Miguelito Creek
Existing treatment level	Secondary
Existing treatment train	Mechanical bar screens, an aerated grit tank, two parallel oxidation ditches, three secondary clarifiers, tertiary filters, and UV disinfection.

A.8.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Lompoc Regional WWTP

Permit issue date	1/13/2012
Permit expiration date	1/13/2017
Dilution	None
Acute monitoring	Monthly; 1 species (*Pimephales promelas*); 100% effluent
Acute limits	No differential statistically significant mortality between 100% effluent and controls.t-test and 95 percent confidence was used.
Chronic monitoring	Quarterly; 3 species screening (*Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*), after which may be reduced to most sensitive; dilutions of 100%, 85%, 70%, 50%, and 25%
Chronic limits	1.0 TUc
Accelerated monitoring trigger	Statistically different at 95% confidence (acute) or chronic toxicity in effluent > 1.0 TUc
TRE/TIE trigger	If 2 of three accelerated toxicity tests are failed, perform TIE
Resume regular testing condition	If accelerated monitoring indicates that toxicity triggers are not exceeded, return to regular monitoring.

A.8.3 Baseline Compliance

The following tables summarize WET data from 2013 – 2015.

Baseline Compliance, Acute Toxicity: Lompoc Regional WWTP

Test	Survival
# of tests	36
# exceeding limit	2
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

Baseline Compliance, Chronic Toxicity: Lompoc Regional WWTP

Selenastrum capricornutum	
Test	Growth
# of tests	23
# exceeding limit	21
# exceeding accelerated monitoring trigger	21
Exceeding TRE trigger? (Y/N)	Y

The discharger is out of compliance for chronic toxicity under the existing permit over the period of the data.

A.8.4 Provisions Compliance

The discharger would be required to comply with effluent limits under the Provisions because it is a major WWTP. The following table summarizes WET data from 2013 – 2015 under the Provisions.

Potential Provisions Compliance, Chronic Toxicity: Lompoc Regional WWTP

Selenastrum capricornutum	
Test	Growth
# of tests	23
# of potential exceedances of MDEL	17
Failure of verification tests	Yes
# of potential exceedances of MMEL	21*
"fail" = statistically significant using the TST approach *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

Based on the analysis of effluent data under the Provisions, the discharger is exceeding both the chronic MDEL and MMEL.

A.8.5 Potential Incremental Impact Summary

Given exceedances of both the MDEL and MMEL under the Provisions, the facility would likely need accelerated monitoring and a TRE. However, given the *Selenastrum capricornutum* results, the discharger would likely need to conduct accelerated monitoring and a TRE under the baseline as well. Thus, incremental controls costs are likely zero.

Abt Associates assumed that permit writers would not require routine acute monitoring under the Provisions. Chronic monitoring will be monthly. In addition, incremental cost savings associated with initial reasonable potential monitoring (chronic three species testing) would likely be minimal (approximately $700) because the permit already requires at least three multiple dilution tests per species (the Provisions requires four multiple concentration tests per species).

Routine Monitoring: Lompoc Regional WWTP

Component	Baseline	Provisions	Incremental
Acute			
Frequency	12/yr	NA	NA
# Species	1	NA	NA
Unit cost	$370 (*Pimephales promelas*)	NA	NA
Annual cost	$4,440	NA	-$4,440
Chronic			
Frequency	4/yr for most sensitive species; 2 additional species for 1st quarter	12/yr	NA
# Species	Varies (*Selenastrum capricornutum* most sensitive)	1	NA
Unit costs	$1,301 (*Ceriodaphnia dubia*) $1,288(*Pimephales promelas*) $967 (*Selenastrum capricornutum*)	$967 (*Selenastrum capricornutum*)	NA
Annual cost	$4,385	$11,603	$7,217
Total			
Annual cost	$8,825	$11,603	$2,777
NA = not applicable.			

Under the Provisions, MMEL compliance monitoring will be necessary at a cost of $400 per year. Thus, total incremental costs for the discharger may be $3,900 per year.

Potential Total Annual Incremental Compliance Costs: Lompoc Regional WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$2,800	$700	$400	$3,900

A.9 Pactiv Corporation

The following sections document the incremental compliance analysis for the sample facility.

A.9.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Pactiv Corporation

Name	Pactiv Corporation Molded Pulp Mill, Tehama County
NPDES No.	CA0004821
Category	Major industrial (pulp and paper)
Flow (MGD)	2.7
Receiving water	Sacramento River
Existing treatment level	Secondary
Existing treatment train	Primary clarification, aeration, coagulation, and final clarification.

A.9.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Pactiv Corporation

Permit issue date	2/24/2017
Permit expiration date	3/31/2022
Dilution	None
Acute monitoring	Quarterly; 1 species (*Oncorhynchus mykiss*)
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than 70% for one bioassay, and the median for any three or more consecutive bioassays shall be no less than 90%.
Chronic monitoring	Annually; 3 species (*Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum*); For regular and accelerated chronic toxicity monitoring, the testing may be performed using 100% effluent and two controls. For TRE monitoring, the chronic toxicity testing shall be performed using 100%, 75%, 50%, 25% and 12.5% dilution series.
Chronic limits	None.
Accelerated monitoring trigger	If a sample exhibits toxicity of > 1 TUc, the Discharger shall perform four chronic toxicity tests conducted once every two weeks (in a six-week period) using species that exhibited toxicity.
TIE/TRE trigger	If a pattern of toxicity is demonstrated, specifically if any of the four chronic toxicity tests subsequent to the initial failure demonstrates toxicity, a TRE is required. Executive Officer may also require a TRE if other evidence indicates toxicity occurs >20% of the time. A TIE may be required if appropriate.
Resume regular testing condition	If source of toxicity is readily identified, four consecutive accelerated tests that do not exceed the monitoring trigger will be considered sufficient to assume regular monitoring

A.9.3 Baseline Compliance

The following tables summarize WET data from 2013 – 2015.

Baseline Compliance, Acute Toxicity: Pactiv Corporation

Species	*Oncorhynchus mykiss*
Test	Survival and reproduction
# of tests	52
# exceeding limits	0

Baseline Compliance, Chronic Toxicity: Pactiv Corporation

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	6
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	No data available
Pimephales promelas	
Test	Survival and growth
# of tests	6
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	2
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger exceeded the accelerated monitoring trigger for chronic toxicity for *Ceriodaphnia dubia* over the period of the data. In addition, although there are no accelerated monitoring data from which to determine whether a TRE would be needed under the existing permit, given that all observations exceed the chronic monitoring trigger, it is likely that a TRE would be needed under baseline requirements.

A.9.4 Provisions Compliance

The following table summarizes WET data from 2013 – 2015 under the Provisions.

Analysis of Effluent Data under the Provisions, Chronic Toxicity: Pactiv Corporation

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	6
# of fails	0
# with percent effect >10%	1
Pimephales promelas	
Test	Survival and growth
# of tests	6
# of fails	0
# with percent effect >10%	0
Selenastrum capricornutum	
Test	Growth
# of tests	2
# of fails	0
# with percent effect >10%	0
"fail" = statistically significant using the TST approach	

Based on the analysis of effluent data under the Provisions, the discharger would have reasonable potential because one of the test results for *Ceriodaphnia dubia* have a percent effect above 10%. However, the available data indicates that the facility will be able to comply with effluent limitations under the Provisions.

A.9.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL, compliance actions under the baseline are likely the same as those under the Provisions (i.e., accelerated monitoring and a TRE). Thus, incremental costs would be zero.

Routine monitoring requirements would change in that Abt Associates assumed that permit writers would not require routine acute monitoring under the Provisions, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive) and multiple-concentration tests.

Routine Monitoring: Pactiv Corporation

Component	Baseline	Provisions	Incremental
Acute			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$1,629	NA	-$1,629
Chronic			
Frequency	1 permit term	12/yr	NA
# Species	3	1	NA
Unit costs	$1,301 (*Ceriodaphnia dubia*) $1,288 (*Pimephales promelas*) $967 (*Selenastrum capricornutum*)	$1,301 (*Ceriodaphnia dubia*)	NA
Annual cost	$711	$15,612	$14,901
Total			
Annual cost	$2,340	$15,612	$13,272
NA = not applicable.			

Total incremental costs associated with routine monitoring for the discharger may be approximately $13,300.

There is also no incremental cost associated with initial reasonable potential monitoring (chronic three-species testing) because the permit already requires three-species testing annually. Insufficient data is available to assess the need for a TRE under baseline; however, given that most data did not exceed the limit or trigger, Abt Associates conservatively assumed zero TRE costs associated with baseline. Permit compliance cost savings anticipated under the amendment include $1,000 per year for reduced accelerated monitoring costs.

Thus, total incremental costs may be approximately $12,300 per year.

Potential Total Annual Incremental Compliance Costs: Pactiv Corporation

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$13,300	$0	-$1,000	$12,300

A.10 Sacramento Regional WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.10.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Sacramento Regional WWTP

Name	Sacramento Regional WWTP
NPDES No.	CA0077682
Category	Major municipal (POTW)
Flow (MGD)	181 (Permitted average dry weather flow)
Receiving water	Sacramento River
Existing treatment level	Secondary
Existing treatment train	Treatment operation consists of influent pumps, septage receiving stations, coarse screening by mechanical bar screens, aerated grit removal using grit chambers, washing and dewatering grit by grit classifiers, primary sedimentation, pure oxygen activated sludge aeration, secondary sedimentation, chlorine disinfection with dechlorination.

A.10.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

Permit Requirements: Sacramento Regional WWTP

Permit issue date	06/01/2016
Permit expiration date	05/31/2021
Dilution	8:1
Acute monitoring	Weekly; 1 species (*Oncorhynchus mykiss, as of July 1, 2011*)
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste of no less than 70%, minimum for any one bioassay; and 90%, median for any 3 consecutive bioassays.
Chronic monitoring	Monthly; 3 species (*Pimephales promelas*, *Ceriodaphnia dubia*, *Selenastrum capricornutum*); standard 5 dilution series (ranging from 100 to 6.25% sample)
Chronic limits	None
Accelerated monitoring trigger	TUc >= 8; toxicity present exceeding the monitoring trigger more than 20 percent of the time, accelerated monitoring shall consist of four chronic toxicity tests conducted once every two weeks using the species that exhibited toxicity.
TRE trigger	If there is adequate evidence of effluent toxicity or if the result of any accelerated toxicity test exceeds monitoring trigger (8 TU). Executive Officer may also require a TRE if other evidence indicates toxicity occurs >20% of the time. A TIE may be required if appropriate.
Resume regular testing condition	If the results of four (4) consecutive accelerated monitoring tests do not exceed the monitoring trigger, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring. Upon confirmation that the effluent toxicity has been removed, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring

A.10.3 Baseline Compliance

The following tables summarize WET data from 2013 to 2015.

Baseline Compliance, Acute Toxicity: Sacramento Regional WWTP

Species	*Pimephales promelas*
Test	Survival
# of tests	142
# exceeding limit	3

Baseline Compliance, Chronic Toxicity: Sacramento Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	50
# exceeding accelerated monitoring trigger	11
Exceeding TRE trigger? (Y/N)	Y
Pimephales promelas	
Test	Survival and growth
# of tests	40
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Selenastrum capricornutum	
Test	Growth
# of tests	38
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger exceeded limits and both accelerated monitoring and TRE triggers for acute and chronic toxicity over the period of the data.

A.10.4 Provisions Analysis

The discharger would be required to comply with effluent limits under the Provisions because it is a major WWTP. The following table summarizes WET data from 2013 - 2015 under the Provisions.

Effluent Data Analysis under the Provisions, Chronic Toxicity: Sacramento Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	37
# of potential exceedances of MDEL	2
Failure of verification tests	Not Available
# of potential exceedances of MMEL	4*
Pimephales promelas	
Test	Survival and growth
# of tests	29
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

Effluent Data Analysis under the Provisions, Chronic Toxicity: Sacramento Regional WWTP

Selenastrum capricornutum	
Test	Growth
# of tests	36
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
"fail" = statistically significant using the TST approach *Uncertain because there were no additional tests in the same calendar month to determine compliance.	

Based on the analysis of effluent data under the Provisions, *Ceriodaphnia dubia* is the most sensitive species and would be used to assess compliance with the projected effluent limit. The existing permit does not contain effluent limitations for chronic toxicity but does include a chronic aquatic life mixing zone which suggests that a dilution credit would be authorized under the Provisions. In addition, the permit prohibits discharge when there is a 14:1 river to effluent flow ratio, and the accelerated monitoring trigger assumes an 8:1 dilution ratio. Therefore, Abt Associates assumed that at least an 8:1 dilution credit would be authorized for chronic toxicity under the Provisions. All of the test results under the Provisions were evaluated at 12.5 percent IWC.

A.10.5 Potential Incremental Impact Summary

Given the number of exceedances under the Provisions, the facility would likely need to conduct accelerated monitoring and a TRE. However, as a result of baseline toxicity, the facility has been conducting a TRE since April 2004 (SRCSD, 2008). However, additional MMEL monitoring would be required under the amendment at an annual cost of approximately $500 per year.

Abt Associates assumed that permit writers would not require routine acute monitoring under the Provisions, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive).

Routine Monitoring: Sacramento Regional WWTP

Component	Baseline	Provisions	Incremental
Acute			
Frequency	52/yr	NA	NA
# Species	1	NA	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$21,176	NA	-$21,176
Chronic			
Frequency	12/yr for all species; for 3 outfalls[1]	12/yr for most sensitive species; for 3 outfalls[1]	NA
# Species	3	1	NA
Unit costs (single concentration test type)	$708 (*Ceriodaphnia dubia*) $631 (*Pimephales promelas*) $575 (*Selenastrum capricornutum*)	$708 (*Ceriodaphnia dubia*)	NA
Unit costs (multiple dilutions test type)	$1,301 (*Ceriodaphnia dubia*) $1,288 (*Pimephales promelas*) $967 (*Selenastrum capricornutum*)	$1,301 (*Ceriodaphnia dubia*)	NA
Annual cost	$88,613	$32,609	-$56,004

Routine Monitoring: Sacramento Regional WWTP

Component	Baseline	Provisions	Incremental
Total			
Annual cost	$1,09,789	$32,609	-$77,180
1. Single concentration test are conducted at two outfalls and multiple concentration tests at one outfall. NA = not applicable.			

Thus, total incremental cost savings for the discharger may be $76,700 per year.

Potential Total Annual Incremental Compliance Costs: Sacramento Regional WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$77,200	$0	$500	-$76,700

A.11 Shell Oil, Martinez Refinery

The following sections document the incremental compliance analysis for the sample facility.

A.11.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Shell Oil, Martinez Refinery

Name	Shell Oil, Martinez Refinery
NPDES No.	CA0005789
Category	Major industrial (petroleum refining)
Flow (MGD)	Discharge Point No. 001: 8.2 million gallons per day (MGD) (maximum reported daily flow); 5.8 MGD (long-term average flow)
Receiving water	Carquinez Strait
Existing treatment level	Tertiary
Existing treatment train	The treatment system consists of 3 oil-water separators, 4 dissolved nitrogen flotation units, a number of equalization and diversion tanks, 2 activated sludge biological treatment systems, a number of ponds, a chemical precipitation unit for the removal of selenium, and a GAC adsorption system for polishing treated wastewater.

A.11.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Shell Oil, Martinez Refinery

Permit issue date	10/12/2017
Permit expiration date	11/30/2022
Dilution	10:1
Acute monitoring	Weekly; 1 species (*Oncorhynchus mykiss*)
Acute limits	The survival of organisms in undiluted effluent 11-sample median value of not less than 90%, and 11-sample 90th percentile value of not less than 70%.
Chronic monitoring	Quarterly; 1 species (*Americamysis bahia*); 100%, 50%, 25%, 10%, and 5%, and 2.5% dilutions; 3-species screening for sensitive species at permit reissuance.
Chronic limits	A single-sample value of <= 10 TUc
Accelerated monitoring trigger	A single-sample value > 10 TUc. Accelerated monitoring shall consist of monthly monitoring.
TRE trigger	If accelerated monitoring data points continue to exceed the evaluation parameter, then the Discharger shall initiate a chronic TRE.
Resume regular testing condition	If data from accelerated monitoring data points are found to be in compliance with the evaluation parameter, then regular monitoring shall be resumed.

A.11.3 Baseline Compliance

The following tables summarize WET data from 5/6/06 to 5/31/08 under the existing permit.

Baseline Compliance, Acute Toxicity: Shell Oil, Martinez Refinery

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	161
# exceeding limit	0
# exceeding accelerated monitoring trigger	0

Baseline Compliance, Chronic Toxicity: Shell Oil, Martinez Refinery

Species	*Americamysis bahia*
Test	Growth and Survival
# of tests	12
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger is in compliance under the existing permit for the period of data.

A.11.4 Provisions Compliance

Permit writers can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 10:1 as in the existing permit, the IWC would represent a 10% effluent sample.

The following table summarizes WET data from 2013 through 2015 under the Provisions based on comparison of 10% effluent sample to a control.

Analysis of Effluent Data under the Provisions, Chronic Toxicity: Shell Oil, Martinez Refinery

Species	Americamysis bahia
Test	Growth and Survival
# of tests	24
# of fails	1
# with percent effect >10%	2
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	1*
"fail" = statistically significant using the TST approach *Uncertain because there were no additional tests in the same calendar month to determine compliance	

The permit indicates that *Americamysis bahia* is the most sensitive species. Based on these data, the discharger would have reasonable potential under the Provisions because two samples have a percent effect greater than 10%.

Compliance with the projected chronic limits is based on 10% effluent sample. The monitoring data in the table indicate that the one "fail" result with percent effect below 50% would result in the need for additional monitoring to assess compliance with the MMEL. Because the data to assess compliance with the MMEL are not available, Abt Associates estimated potential compliance based on both potential outcomes: 1) monitoring indicates exceedance of the MMEL and 2) monitoring indicates compliance with the MMEL.

A.11.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MMEL under the Provisions, the discharger could incur incremental costs associated with accelerated monitoring and a TRE (the discharger is in compliance with baseline limits).

Under the scenario in which additional monitoring indicates that the facility is in compliance with the MMEL, incremental costs reflect the cost of additional monitoring of $700 per year.

Potential Incremental Permit Limit Compliance Costs: Shell Oil, Martinez Refinery

Scenario	Exceed MDEL	Verification Test Costs	Total Incremental Costs			Incremental Annual Costs[2]
			MMEL Monitoring[1]	Accelerated Monitoring	TRE	
Comply with MMEL	No	$0	$3,300	$0	$0	$700
Exceed MMEL	No	$0	$3,300	$6,500	$42,000	$10,400

1. Represents unit cost of $526 per test (*Holmesimysis costata*) for follow-up tests.
2. Total incremental costs divided by permit term (five years).

In addition, Abt Associates assumed that permit writers would continue to require routine flow-through acute monitoring, as shown in the table below. Chronic monitoring will be monthly with multiple-concentration tests.

Routine Monitoring: Shell Oil, Martinez Refinery

Component	Baseline	Provisions	Incremental
Acute			
Frequency	52/yr	52/yr	NA
# Species	1	1	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	$407 (*Oncorhynchus mykiss*)	NA
Annual cost	$21,176	$21,176	$0
Chronic			
Frequency	4/yr	12/yr	NA
# Species	1	1	NA
Unit costs	$1,630 (*Americamysis bahia*)[1]	$1,630 (*Americamysis bahia*[1,2])	NA
Annual cost	$6,519	$19,558	$13,039
Total			
Annual cost	$27,695	$40,734	$13,039

NA = not applicable.
1. EPA WET test methods for *Americamysis bahia* and *Holmesimysis costata* are the same; costs represent WET test for *Holmesimysis costata* survival and growth.
2. Assumed most sensitive species per existing permit.

Total incremental costs associated with routine monitoring for the discharger may be $13,000.

Also, incremental costs associated with initial reasonable potential monitoring (chronic three species testing) would likely be minimal ($700 annually) because the permit already requires at least three multiple dilution tests per species prior to permit reissuance (the Provisions requires four multiple dilution tests per species).

Thus, total incremental costs may range from approximately $14,400 to $24,100 per year.

Potential Total Annual Incremental Compliance Costs: Shell Oil, Martinez Refinery

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$13,000	$700	$700 to $10,400	$14,400 to $24,100

A.12 USS-POSCO Industries

The following sections document the incremental compliance analysis for the sample facility.

A.12.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: USS-POSCO Industries

Name	USS-POSCO Industries
NPDES No.	CA0005002
Category	Major industrial (metals)
Flow (MGD)	28
Receiving water	New York Slough, part of the Sacramento-San Joaquin Delta
Existing treatment level	Secondary
Existing treatment train	The wastewater treatment plant consists of a pump station, Oil/water separator, a mixer two clarifiers and two neutralization tanks for final pH adjustment.

A.12.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: USS-POSCO Industries

Permit issue date	11/9/2016
Permit expiration date	4/1/2021
Dilution	4:1
Acute monitoring	Biweekly; 1 species (*Oncorhynchus mykiss*); 96 hour continuous flow-through bioassay using dechlorinated effluent
Acute limits	The survival of organisms in undiluted effluent shall be an 11-sample median value of not less than 90% survival, and an 11-sample 90 percentile value of not less than 70% survival.
Chronic monitoring	Quarterly; 1 species (*Haliotis rufescens*); multiple concentrations; screening for most sensitive species at permit reissuance
Chronic limits	3.3 TUc average monthly, 6.6 TUc maximum daily
Accelerated monitoring trigger	Single-test value greater than 6.6 TUc or monthly average greater than 3.3 TUc. Accelerated monitoring is monthly.
TRE trigger	If accelerated monitoring data points continue to exceed chronic toxicity limitation(s) then the discharger shall initiate a chronic toxicity reduction evaluation and continue accelerated monitoring.
Resume regular testing condition	If data from accelerated monitoring data points are found to be in compliance with the chronic toxicity effluent limitations, then regular monitoring shall be resumed.

A.12.3 Baseline Compliance

The following tables summarize WET data from 2013 through 2015.

Baseline Compliance, Acute Toxicity: USS-POSCO Industries

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	Unavailable
# exceeding limit	Unknown

Baseline Compliance, Chronic Toxicity: USS-POSCO Industries

Species	*Haliotis rufescens*
Test	Larval development
# of tests	12
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N

The discharger has not exceeded chronic limits and acute data is unavailable for review over the period of data.

A.12.4 Provisions Compliance

Permit writers can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 4:1 as in the existing permit, the IWC would represent a 25% effluent sample.

The following table summarizes WET data from 2013 to 2015 under the Provisions. The analysis is based on comparison of 25% effluent sample to a control.

Analysis of Effluent Data under the Provisions, Chronic Toxicity: USS-POSCO Industries

Species	*Haliotis rufescens*
Test	Larval development
# of tests	12
# of fails	0
# with percent effect >10%	0
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
"fail" = statistically significant using the TST approach	

Based on the 25% effluent sample the discharger would not have reasonable potential because no test results demonstrate percent effects greater than 10%.

A.12.5 Potential Incremental Impact Summary

Abt Associates assumed that permit writers would not require routine acute monitoring under the Provisions, as shown in the table below. Chronic monitoring will be quarterly for one year of the permit term in order to collect sufficient data for a reasonable potential analysis. In addition, there is no incremental cost associated with initial reasonable potential monitoring (chronic three-species testing) because the permit suggests that *Haliotis rufescens* is the most sensitive species.

Routine Monitoring: USS-POSCO Industries

Component	Baseline	Provisions	Incremental
Acute			
Frequency	26/yr	26/yr	NA
# Species	1	1	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	$407 (*Oncorhynchus mykiss*)	NA
Annual cost	$10,588	$10,588	$0
Chronic			
Frequency	4/yr	4 in final year	NA
# Species	1	1	NA
Unit costs	$1,579 (*Haliotis rufescens*)	$1,579 (*Haliotis rufescens* [1])	NA
Annual cost	$6,318	$1,264	-$5,054
Total			
Annual cost	$16,906	$11,851	-$5,054

NA = not applicable.
1. Based on *Haliotis rufescens* as most sensitive species under the Provisions because the permit indicates that it is the most sensitive species under the baseline.

Total incremental cost savings associated with routine monitoring for the discharger may be $5,100 per year.

Also, incremental costs associated with initial species sensitivity monitoring (chronic three species testing) would likely be minimal ($700 annually) because the permit already requires at least three multiple dilution tests per species for permit renewal.

Thus, total incremental cost savings are -$4,400 per year.

Potential Total Annual Incremental Compliance Costs: USS-POSCO Industries

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
-$5,100	$700	$0	-$4,400

A.13 Victor Valley Regional WWTP

The following sections document the incremental compliance analysis for the sample facility.

A.13.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Victor Valley Regional WWTP

Name	Victor Valley Regional WWTP
NPDES No.	CA0102822
Category	Major municipal
Flow (MGD)	14
Receiving water	Mojave River
Existing treatment level	Tertiary
Existing treatment train	The treatment system consists of screening (two influent channels equipped with aquascreens and one influent channel equipped with a manually cleaned bar rack), two aerated grit chambers, primary sedimentation (eight primary clarifiers), flow equalization, secondary biological treatment (12 aeration basins), secondary clarification (10 secondary clarifiers, five with a 55-foot diameter and five with an 80-foot diameter), coagulation, cloth media filtration, and Ultraviolet Light (UV) disinfection.

A.13.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Victor Valley Regional WWTP

Permit issue date	09/05/2013
Permit expiration date	09/05/2018
Dilution	None
Acute monitoring	Quarterly; 1 species (*Pimephales promelas*)
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than: 70%, minimum for any one bioassay; and 90%, median for any three consecutive bioassays.
Chronic monitoring	Annually; 2 species (*Ceriodaphnia dubia, Pimephales promelas*); 100% effluent
Chronic limits	None
Accelerated monitoring trigger	Acute: survival of < 90% in 2 consecutive quarterly samples, the discharger shall increase frequency to once per month. Chronic: statistically significant difference between sample of 100% effluent and a control, increase frequency to once per month.Accelerated chronic WET testing shall use a series of five dilutions and a control. The dilutions shall be 12.5, 25, 50, 75, and 100 percent effluent, along with the control (0 percent effluent).
TRE trigger	Acute: If any of the accelerated (monthly) tests demonstrate a survival rate of less than 70 percent, the Discharger shall initiate a TRE. Chronic: If any accelerated (monthly) tests demonstrate chronic toxicity greater than 1 TUc, the Discharger shall initiate a TRE.

WET Permit Requirements: Victor Valley Regional WWTP

Resume regular testing condition	Acute: When 3 consecutive monthly tests demonstrate a survival rate of >90%, the Discharger may resume acute WET testing at a frequency of once per calendar quarter. Chronic: When 3 consecutive accelerated monthly tests demonstrate no chronic toxicity, which is defined as WET test results not exceeding 1.0 TUc, the Discharger may resume regular chronic WET testing at a frequency of once per calendar year.

A.13.3 Baseline Compliance

The following tables summarize WET data from 2014 – 2015 for acute data and 2013 – 2015 for chronic data under the existing permit.

Baseline Compliance, Acute Toxicity: Victor Valley Regional WWTP

Species	*Pimephales promelas*
Test	Survival
# of tests	8*
# exceeding limit	0*
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
* Acute monitoring data for 2013 was unavailable.	

Baseline Compliance, Chronic Toxicity: Victor Valley Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	3
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	4
# exceeding accelerated monitoring trigger	1*
Exceeding TRE trigger? (Y/N)	N
* A re-test was performed during the same calendar month which was measured at 1 TUc and used to determine the previous exceedances was not a valid exceedance of the accelerated monitoring trigger.	

The discharger is in compliance with WET requirements in the current permit.

A.13.4 Provisions Compliance

The discharger would be required to comply with effluent limits under the Provisions because it is a major WWTP. The following table summarizes WET data from 2013 – 2015 under the Provisions.

Effluent Data Analysis under the Provisions, Chronic Toxicity: Victor Valley Regional WWTP

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	3

Effluent Data Analysis under the Provisions, Chronic Toxicity: Victor Valley Regional WWTP

# of potential exceedances of MDEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	4
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0

Under the Provisions, the discharger will have to conduct three-species screening to determine the most sensitive species for chronic monitoring. Existing data are only available for *Ceriodaphnia dubia* and *Pimephales promelas*.

A.13.5 Potential Incremental Impact Summary

The potential for compliance with WET requirements is similar under the Provisions compared to the current permit. Therefore, incremental limit compliance costs are likely to be zero.

In addition, routine monitoring requirements would change under the Provisions in that Abt Associates assumed that permit writers would not require acute monitoring under the Provisions, as shown in the table below. Chronic monitoring will be monthly, but with one species (most sensitive).

Routine Monitoring: Victor Valley Regional WWTP

Component	Baseline	Provisions	Incremental
Acute			
Frequency	4/yr	NA	NA
# Species	1	NA	NA
Unit cost	$370 (*Pimephales promelas*)	NA	NA
Annual cost	$1,480	NA	-$1,480
Chronic			
Frequency	1/yr	12/yr	NA
# Species	2	1	NA
Unit costs	$708 (*Ceriodaphnia dubia*) $631 (*Pimephales promelas*)	$638 (Uncertain[1])	NA
Annual cost	$1,339	$7,657	$6,318
Total			
Annual cost	$2,819	$7,657	$4,838

NA = not applicable.
1. Sensitive species is uncertain; cost represents average of all freshwater species.
Note detail may not add to totals due to independent rounding.

Incremental costs associated with routine monitoring would be $4,838 per year.

There will also be a cost of initial species sensitivity monitoring of approximately $14,000 at the beginning of each permit cycle (based on four samples per species and average multiple-concentration chronic test costs for freshwater vertebrates, invertebrates, and aquatic plants), because the facility does not currently have the data necessary to determine the most sensitive species for routine monitoring. Dividing the total cost over the length of a permit cycle (5 years), annual costs would be approximately $2,800 per year. Note that Regional Boards may allow

facilities to use data from previous permit cycles, so the estimated annual costs of initial species sensitivity monitoring may be overestimated.

Thus, total incremental costs for compliance with the Provisions may be $7,600 per year.

Potential Total Annual Incremental Compliance Costs: Victor Valley Regional WWTP

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$4,800	$2,800	$0	$7,600

A.14 Royal Mountain King Mine

The following sections document the incremental compliance analysis for the sample facility.

A.14.1 Facility Information

The following exhibit summarizes general information about the facility.

General Information: Royal Mountain King Mine

Name	Royal Mountain King Mine
NPDES No.	CA0085243
Category	Major industrial
Flow (MGD)	43
Receiving water	Littlejohns Creek
Existing treatment level	Not Applicable
Existing treatment train	Contaminated water collected onsite are held in retention basins and treated in leachate collection and removal systems. Treated wastewater is stored in Skyrocket Pit Lake prior to final discharge to the receiving water.

A.14.2 Existing Permit Requirements

The following exhibit summarizes the existing permit requirements related to WET testing for the sample facility.

WET Permit Requirements: Royal Mountain King Mine

Permit issue date	02/01/2018
Permit expiration date	01/31/2023
Dilution	7:1
Acute monitoring	Annually; 1 species (*Oncorhynchus mykiss*)
Acute limits	Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than: 70%, minimum for any one bioassay; and 90%, median for any three consecutive bioassays, 100% effluent
Chronic monitoring	Annually; 3 species (*Ceriodaphnia dubia, Pimephales promelas, and Pseudokirchneriella subcapitata*); chronic WET testing shall use a series of five dilutions and a control. The dilutions shall be 12.5, 25, 50, 75, and 100 percent effluent, along with the control (0 percent effluent)
Chronic limits	None.
Accelerated monitoring trigger	**Chronic:** If the result of routine monitoring exhibits toxicity demonstrated by 7 chronic toxicity units (TUc) (as 100/NOEC) and a percent effect greater than 25 percent at 14.3 percent effluent, the discharger shall conduct two additional compliance monitoring event and performing chronic toxicity testing using the species that exhibited toxicity in order to calculate a median. The optional compliance monitoring events shall occur at least one week apart, and the final monitoring event shall be collected no later than 6 weeks from the routine monitoring event that exhibited toxicity. The Discharger may elect to take additional samples to determine the 3-sample median. Accelerated chronic WET testing shall use a series of five dilutions and a control. The dilutions shall be 12.5, 25, 50, 75, and 100 percent effluent, along with the control (0 percent effluent)

WET Permit Requirements: Royal Mountain King Mine

TRE trigger	If the 6-week median is greater than 7 TUc (as 100/NOEC), the Discharger will initiate TRE. Otherwise, the Discharger shall check for any operation or sample collection issues and return to routine chronic toxicity monitoring
Resume regular testing condition	**Chronic:** When accelerated monitoring (6-week median) demonstrate no chronic toxicity, which is defined as WET test results not exceeding 7.0 TUc, the Discharger may check to see if there is an operational or sample collection issue. If no issue was found, the Discharger may resume regular chronic WET testing at a frequency of once per calendar year

A.14.3 Baseline Compliance

The following tables summarize WET data from 2014 – 2015 (no discharge occurred from the facility in 2013) for acute and chronic data under the existing permit.

Baseline Compliance, Acute Toxicity: Royal Mountain King Mine

Species	*Oncorhynchus mykiss*
Test	Survival
# of tests	1*
# exceeding limit	0
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
* Acute monitoring data for 2013 and 2015 was unavailable due to insufficient discharge.	

Baseline Compliance, Chronic Toxicity: Royal Mountain King Mine

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
Pimephales promelas	
Test	Survival and growth
# of tests	1*
# exceeding accelerated monitoring trigger	0
Exceeding TRE trigger? (Y/N)	N
* An accelerated monitoring related to follow-up testing from December 2014 WET testing was conducted during January 2015 which was measured at 7 TUc and used by the Regional Water Board to determine the previous exceedances was not a valid exceedance of the accelerated monitoring trigger. Also, the discharge was insufficient for remaining 2015 to conduct annual WET testing.	
Selenastrum capricorutum	
Test	Survival and growth
# of tests	3*
# exceeding accelerated monitoring trigger	1
Exceeding TRE trigger? (Y/N)	N
* An accelerated monitoring related to follow-up testing from December 2014 WET testing was conducted during January 2015 which was measured at 7 TUc and used by the Regional Water Board to determine the previous exceedances was not a valid exceedance of the accelerated monitoring trigger. Also, the discharge was insufficient for the remainder of 2015 to conduct annual WET testing.	

The discharger does not have chronic toxicity effluent limitations under the permit; however, effluent data did exceed accelerated monitoring triggers.

A.14.4 Provisions Compliance

Permit writers can allow dilution at their discretion. However, assuming that the facility would receive a dilution ratio of 7:1 as in the existing permit, the IWC would represent a 12.5% effluent sample.

The following table summarizes WET data from 2014 to 2015 under the Provisions. The analysis is based on comparison of 12.5% effluent sample to a control. No discharges occurred in 2013, thus effluent data was not available for that year.

Effluent Data Analysis under the Provisions, Chronic Toxicity: Royal Mountain King Mine

Ceriodaphnia dubia	
Test	Survival and reproduction
# of tests	2
# of fails	1
# with percent effect >10%	1
# of potential exceedances of MDEL	1
# of potential exceedances of MMEL	0
Pimephales promelas	
Test	Survival and growth
# of tests	1
# of potential exceedances of MDEL	0
# of potential exceedances of MMEL	0
Selenastrum capricorutum	
Test	Growth
# of tests	3
# of fails	1
# with percent effect >10%	3
# of potential exceedances of MDEL	1
# of potential exceedances of MMEL	0

Under the Provisions, *Selenastrum* appears to be the most sensitive species.

Based on the 12.5% sample, the discharger would demonstrate reasonable potential and be subject to effluent limitations because the results demonstrate percent effects greater than 10%. Data indicates compliance with the MMEL. In addition, the confirmed exceedance indicates that a TRE may be necessary.

A.14.5 Potential Incremental Impact Summary

Under the scenario in which additional monitoring indicates that the facility is exceeding the MDEL, compliance actions under the Policy indicate that a TRE will be necessary to bring the discharge into compliance with effluent limitations. The incremental costs associated with a TRE are approximately $42,000 as a one-time cost.

In addition, routine monitoring requirements would change under the Provisions in that Abt Associates assumed that permit writers would not require acute monitoring under the Provisions, as shown in the table below. Chronic monitoring will be quarterly, but with one species (most sensitive).

Routine Monitoring: Royal Mountain King Mine

Component	Baseline	Provisions	Incremental
Acute			
Frequency	1/yr	NA	NA
# Species	1	NA	NA
Unit cost	$407 (*Oncorhynchus mykiss*)	NA	NA
Annual cost	$407	NA	-$407
Chronic			
Frequency	1/yr	4/yr	NA
# Species	3	1	NA
Unit costs	$1,301 (*Ceriodaphnia dubia*) $1,288 (*Pimephales promelas*) $967 (*Selenastrum capricornutum)*	$967 (*Selenastrum capricornutum*)	NA
Annual cost	$3,556	$3,867	$311
Total			
Annual cost	$3,963	$3,867	-$96
NA = not applicable. Note detail may not add to totals due to independent rounding.			

Incremental cost savings associated with routine monitoring would be $96 per year.

The incremental costs associated with

Thus, total incremental costs for compliance with the Provisions may be $8,400 per year.

Potential Total Annual Incremental Compliance Costs: Royal Mountain King Mine

Routine Monitoring	3-Species Sensitivity Monitoring	Permit Limit Compliance	Total Annual
$-100	$0	$8,400	$8,338