

# Implementation Strategy Report

## Total Maximum Daily Load for Total Phosphorus to Address Cyanobacterial Blooms

### *in* Pinto Lake

Santa Cruz County, California



*Alum application  
Pinto Lake, April 2017  
Photo credit: Shanta Keeling*



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**TMDL  
Implementation Strategy  
Report**

**July 2020**

**California Environmental Protection Agency  
State Water Resources Control Board**

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# 1 INTRODUCTION

## 1.1 Preface

This Implementation Strategy Report follows up and supplements the report entitled *Total Maximum Daily Load for Total Phosphorus to Address Cyanobacteria Blooms in Pinto Lake* (hereafter, TMDL Report). The TMDL Report contains information and reference material which ultimately support the development of this Implementation Strategy Report. The purpose of the Implementation Strategy is to outline a series of actions the Central Coast Regional Water Quality Control Board (Central Coast Water Board) may take or support to improve water quality in Pinto Lake.

## 1.2 Purpose and Goal of an Implementation Strategy

*“Where waters are not meeting their beneficial uses from anthropogenic sources of pollutants, the Water Boards will use the Total Maximum Daily Load (TMDL) program to craft an **implementation plan** to ensure that the waters meet all applicable standards as soon as is practicable.”*

*→ State Water Resources Control Board (State Water Board) Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options Adopted by Resolution 2005-0050 (June 16, 2005).*

*Emphasis added by Central Coast Water Board staff*

The purpose of this report is to present recommendations for actions the Central Coast Water Board can take to support the implementation of a [total maximum daily load](#) project to improve water quality in Pinto Lake.

A total maximum daily load (TMDL) project includes a written plan that describes how polluted waterbodies will be improved to meet water quality standards. An implementation strategy is a component of a TMDL project. An implementation strategy includes a description of recommended actions needed to restore the waterbody and achieve water quality standards leading to the removal of the impaired water designation. Recommended actions can be regulatory or non-regulatory<sup>1</sup>.

To frame, focus, and guide the development of the Pinto Lake TMDL implementation strategy, this report will address the following questions:

<sup>1</sup> State of California S.B. 469 TMDL Guidance: A Process for Addressing Impaired Waters in California (June 2005). Approved by Resolution 2005-0050.

Text Box 1-1. Questions posed to guide development of this Implementation Strategy Report.

- *What are the actions (regulatory or non-regulatory) needed to achieve waste load allocations, load allocations<sup>2</sup>, and water quality standards in Pinto Lake?*
- *What are reasonable schedules and milestones for the completion of actions to be taken?*
- *What watershed monitoring and surveillance needs to be undertaken to determine progress towards achieving and attainment of water quality standards?*

### 1.3 Federal Law and Implementation Strategies

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TMDL implementation strategies are not required by federal law at this time. The U.S. Environmental Protection Agency (USEPA) is not authorized by the federal Clean Water Act or its implementing regulations to approve or disapprove implementation strategies submitted with TMDLs<sup>3</sup>. USEPA can and does support and encourage the implementation of TMDLs through its authorities pertaining to point source control (NPDES permitting) technical support, and grant funding for nonpoint sources.

### 1.4 State Law and Implementation Strategies

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In California, implementation strategies must be developed in conjunction with TMDLs. State law requires the Regional Water Quality Control Boards to incorporate TMDLs in their water quality control plans (basin plans). In turn, "programs of implementation" are a required component of basin plans<sup>4</sup>.

The implementation program must include a description of actions that are necessary to achieve the objectives, a time schedule for these actions, and a description of surveillance to determine compliance with the objectives (see Text Box 1-2).

Text Box 1-2. Required elements of a "program of implementation" pursuant to the Porter-Cologne Water Quality Control Act (Porter-Cologne Act).

Porter-Cologne Act section 13242

The **program of implementation** for achieving water quality objectives shall include, but not be limited to:

- (a) A description of the nature of actions which are necessary to achieve the objectives, including recommendations for appropriate action by any entity, public or private.
- (b) A time schedule for the actions to be taken.
- (c) A description of surveillance to be undertaken to determine compliance with objectives.

*(emphasis added by Central Coast Water Board staff)*

According to state policy, all impaired waters being addressed through TMDLs may use any authorized combination of existing regulatory tools and/or non-regulatory actions to correct the impairment<sup>5</sup>. Existing regulatory tools include individual or general waste discharge

<sup>2</sup> Waste load allocations are the portion of a receiving water's loading capacity that is allocated to NPDES-permitted point sources of pollution. Load allocations are the portion of the receiving water's loading capacity attributed to (1) nonpoint sources of pollution and (2) natural background sources.

<sup>3</sup> State Water Resources Control Board, Office of Chief Counsel, legal memo by William R. Attwater Chief Counsel dated March 1, 1999 and entitled "Do TMDLs Have to Include Implementation Plans?"

<sup>4</sup> Porter-Cologne Act §13242

<sup>5</sup> State Water Resources Control Board Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options Adopted by Resolution 2005-0050 (June 16, 2005).



requirements, individual or general waivers of waste discharge requirements, enforcement actions, interagency agreements, regulations, basin plan amendments, and other policies for water quality control. The regional boards may also rely upon the regulatory actions of other agencies, or the non-regulatory actions of another entity, if the regional boards find that these actions will correct the impairment, in lieu of adopting a redundant program.

## 2 WATERSHED SETTING

*“Healthy lakes enhance our quality of life. We use lakes for drinking water, energy production, food, and recreation. Fish, birds, and other wildlife rely on them for habitat and survival.”*

→ U.S. Environmental Protection Agency, [National Lakes Assessment 2012](#)

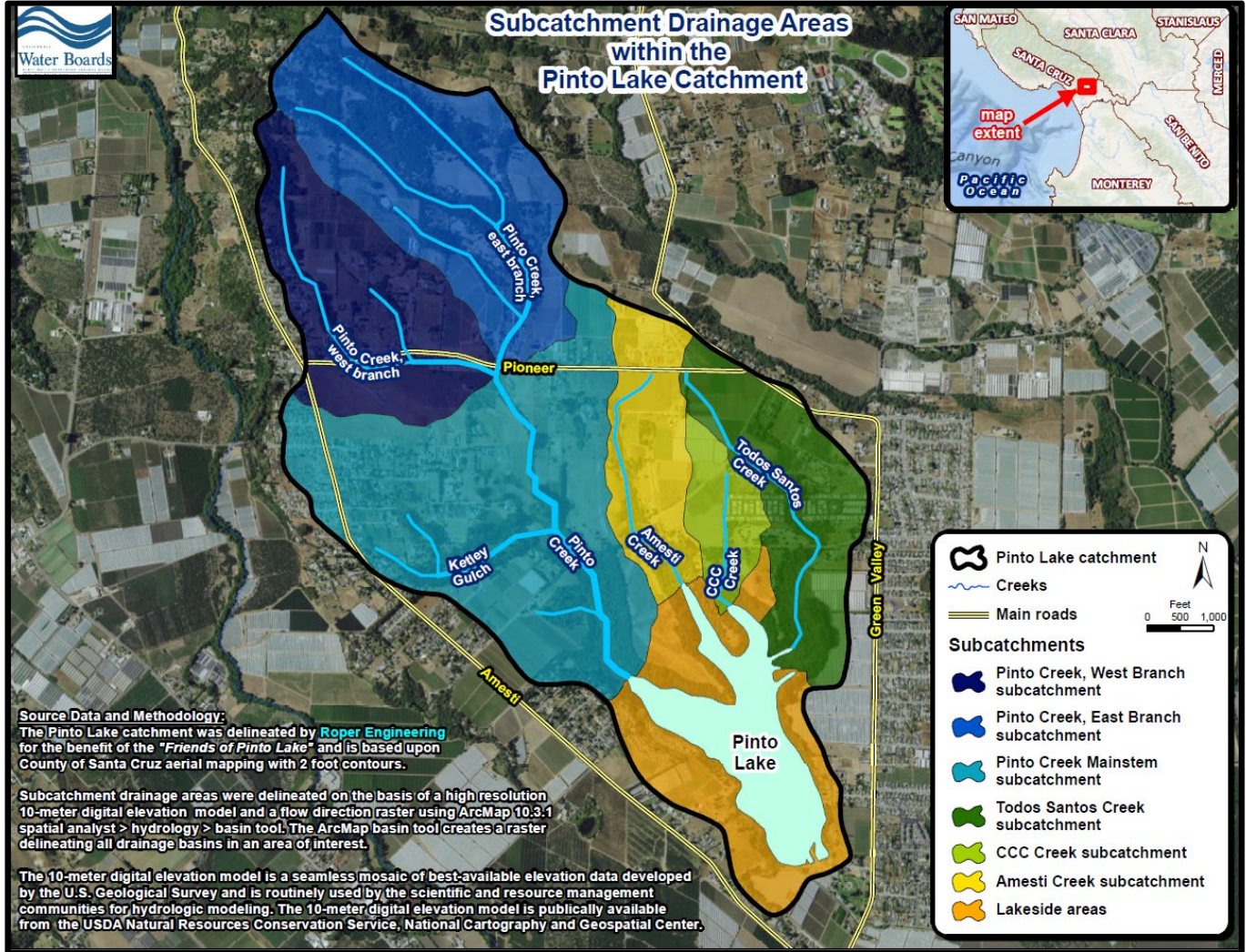
This TMDL project includes [Pinto Lake](#) (see Figure 2-1 and Figure 2-2) and surrounding areas that drain to the lake (the Pinto Lake catchment). Based on GIS spatial analysis, Pinto Lake drains a 1,400-acre catchment of Santa Cruz County, north of the City of Watsonville.

Figure 2-1. Photo of Pinto Lake, August 2013.





Figure 2-2. Subcatchment-scale drainage areas within the Pinto Lake catchment.



Pinto Lake is a natural, perennial lake that has existed for at least 8,000 years as a result of a tectonically-driven local topographic depression (Plater et al., 2006). The lake is an important recreational and aesthetic resource for the public, and historically has provided high quality habitat for aquatic species and wildlife.

Elevations in the Pinto Lake catchment range from 112 feet above mean sea level (MSL) at the City of Watsonville's Pinto Lake Park located at the southeastern margin of the lake, to 513 feet above MSL in the northwestern, upland reaches of the lake catchment. According to Plater et al. (2006), lake bathymetry is generally in the range of 2 to 6 meters (about 6½ feet to 20 feet); maximum depths range to about 8 meters (~25 feet) in the central part of the lake.

[Roper Engineering](#), a civil engineering and surveying firm in Watsonville, generously provided us Autocad® digital linework for the Pinto Lake catchment (refer back to Figure 2-2). Roper Engineering produced the catchment delineation for the benefit of [Friends of Pinto Lake](#). The Autocad® linework is based upon County of Santa Cruz aerial mapping with two-foot contours.



### 3 EXISTING WATERSHED PLANNING AND IMPROVEMENT EFFORTS

In 2013, resource professionals from the California State University, Monterey Bay (CSUMB) and the Resource Conservation District of Santa Cruz County (Santa Cruz RCD) prepared the report entitled *Implementation Strategies for Restoring Water Quality in Pinto Lake*. This report outlined the causes of algal cyanobacteria blooms in Pinto Lake and identified management practices and measures which could be taken to reduce phosphorus loading to lake waters, and to eliminate or substantially reduce these algal blooms and their toxins. The management measures identified can generally be outlined as follows:

- In- lake treatments to limit release of phosphorus from lake sediments.
- Erosion control/sediment capture practices to reduce nutrient loadings from agricultural and/or urban properties in the watershed.
- Irrigation and nutrient management programs for agricultural, commercial and residential properties in the watershed.
- Public education regarding management of on-site wastewater systems, gray water disposal and landscaping practices.
- Investigating options for sewer system extensions.

#### Text Box 3. Pinto Lake Watershed Implementation Strategies Report (2013).

Note that TMDLs adopted in California need to have associated implementation strategies to improve water quality and provide for the attainment of water quality standards. Therefore, for reference purposes, **Attachment A** to this TMDL Implementation Strategy Report contains the entire Pinto Lake Watershed: Implementation Strategies for Restoring Water Quality in Pinto Lake report (CSUMB and Santa Cruz RCD, 2013). This report serves as an informational tool and guidance document for this TMDL implementation plan.

### 4 TMDL IMPLEMENTATION STRATEGY: RECOMMENDED ACTIONS TO CORRECT THE 303(d) LISTED IMPAIRMENTS

#### 4.1 Introduction

The purpose of the proposed TMDL Implementation Strategy is to describe the steps necessary to reduce phosphorus loads and to achieve the TMDL. The TMDL Implementation Strategy provides a series of actions and schedules for implementing parties to implement management practices to achieve the TMDL. The TMDL Implementation Strategy is designed to provide implementing parties flexibility to implement appropriate management practices and strategies to address nutrient-related impairments. Implementation consists of 1) identification of parties responsible for taking these actions; 2) development of management/monitoring plans to reduce controllable sources of phosphorus loading to surface waters; 3) mechanisms by which the Central Coast Water Board will assure these actions are taken; 4) reporting and evaluation requirements that will indicate progress toward completing the actions; 5) and a timeline for completion of implementation actions.

Through funding from a three federal Clean Water Act section 319(h) grants<sup>67</sup> (hereafter, 319(h) grants) completed in 2013 and Prop 84 Agricultural Water Quality Grants, CSUMB and the Santa Cruz RCD identified a number of management measures and practices that would help reduce nutrient loading and availability. The management measures include:

- In-lake treatments to limit release of phosphorus from lake sediments.
- Erosion control/sediment capture practices to reduce nutrient loadings from agricultural and/or urban properties in the watershed.
- Irrigation and nutrient management programs for agricultural, commercial and residential properties in the watershed.
- Public education regarding management of on-site wastewater systems, gray water disposal and landscaping practices.
- Investigating options for sewer system extensions.

Further detail about these grant funded management measures is provided in Section 4.15.

## 4.2 Legal and Regulatory Framework

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This section presents information on the legal authority and regulatory framework which provides the basis for assigning specific responsibilities and accountability to implementing parties for implementation and monitoring actions. We identify the laws and policies pertaining to point sources and nonpoint sources. The legal authority and regulatory framework are described in terms of the following:

- Controllable Water Quality Conditions
- Manner of Compliance
- Antidegradation Policies
- Point Source Discharges (NPDES-permitted discharges)
- Nonpoint Source Discharges

### 4.2.1 Controllable Water Quality Conditions

In accordance with the Water Quality Control Plan for the Central Coastal Basin (Basin Plan), controllable water quality shall be managed to conform or to achieve the water quality objectives and load allocations contained in this TMDL. The Basin Plan defines controllable water quality conditions as follows:

*“Controllable water quality conditions are those actions or circumstances resulting from man's activities that may influence the quality of the waters of the State and that may be reasonably controlled..”*

→ *Basin Plan, Chapter 2*

Examples of non-controllable water quality conditions may include atmospheric deposition of nitrogen and phosphorus, and non-controllable natural sources of nutrient compounds.

<sup>6</sup> Grant no. 10-443-553-02, Pinto Lake TMDL Planning and Assessment.

<sup>7</sup> Under Clean Water Act Section 319, states, territories and tribes can receive grant money that supports a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, and monitoring to assess the success of nonpoint source implementation projects.

### 4.2.2 Manner of Compliance

In accordance with section 13360 of the Porter-Cologne Act the Water Board cannot specify or mandate the specific type, manner, or design of on-site actions necessary to reduce nutrient loading, or to meet allocations by the various responsible parties. Specific types of potential management practices identified in this TMDL Implementation Strategy Report constitute examples or suggestions of management practices known to mitigate or reduce nutrient loading to waterbodies. Stakeholders, local public entities, property owners, and/or resource professionals are in the best position to identify appropriate management measures, where needed, to reduce nutrient loading based on site-specific conditions, with the Water Board providing an oversight role in accordance with adopted permits, waivers, or prohibitions.

### 4.2.3 Antidegradation Policies

State and federal antidegradation policies require, in part, that where surface waters are of higher quality than necessary to protect designated beneficial uses, the high quality of those waters must be maintained unless otherwise provided by the policies. The beneficial uses of waterbodies, water quality objectives, and antidegradation policies collectively constitute water quality standards. Therefore, antidegradation requirements are a component of every water quality standard. High quality waters are determined on a “pollutant-by-pollutant” “parameter-by-parameter” basis, by determining whether water quality is better than the criterion for each parameter using chemical or biological data<sup>8</sup>.

Both the U.S. Environmental Protection Agency (40 Code of Federal Regulations (CFR) section 131.12) and the State of California (State Water Board Resolution 68-16) have adopted antidegradation policies as part of their approach to regulating water quality. Both state and federal antidegradation policies apply to point source and nonpoint source discharges that could degrade water quality (refer to footnote 8). Although there are some differences, where the federal and state policies overlap, they are consistent with each other. Further, state antidegradation policy incorporates the federal policy where applicable. The Central Coast Water Board must ensure that its actions do not violate the federal or state antidegradation policies. These policies acknowledge that minor or repeated activities, even if individually small, can result in violation of antidegradation policies through cumulative effects.

#### ➤ Federal Antidegradation Policy

The federal antidegradation policy, 40 CFR section 131.12(a), states in part:

- (1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.
- (2) ...Where the quality of waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State’s continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located...

<sup>8</sup> See: State Water Resources Control Board (2008), *Water Quality Standards Academy, Basic Course, Module 14*. Presented by U.S. Environmental Protection Agency, Region 9 – Office of Science and Technology (May 12, 2008).

(3) Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

➤ State Antidegradation Policy

Antidegradation provisions of State Water Board Resolution No. 68-16 ("Statement of Policy with Respect to Maintaining High Quality Waters in California") state, in part:

(1) Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

Also noteworthy, Chapter 3, Section 3.2. of the Central Coast Basin Plan explicitly references antidegradation requirements, and states:

II.A. Antidegradation Policy

Wherever the existing quality of water is **better than the quality of water established herein as objectives, such existing quality shall be maintained\*** unless otherwise provided by the provisions of the State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," including any revisions thereto.

\* *emphasis added*

Accordingly, antidegradation policies apply to the proposed concentration-based waste load and load allocations proposed in these TMDLs, and can be summarized as follows in Text Box 4-1.

Text Box 4-1. Antidegradation expectations for the TMDLs proposed in this report

**Summary of TMDL Antidegradation Expectations**

*Where the quality of water in a stream reach or waterbody is better than necessary (i.e., lower/better than the water quality objective/criteria/allocation) to support the designated beneficial uses, that existing water quality shall be maintained and protected, unless and until a lowering of water quality is warranted pursuant to provisions in federal and state antidegradation policies.*

During TMDL implementation, compliance with antidegradation requirements may be determined on the basis of trends in declining water quality in applicable waterbodies, consistent with the methodologies and criteria provided in Section 3.10 of the California 303(d) [Listing Policy](#)<sup>9</sup>. Section 3.10 of the California 303(d) Listing Policy explicitly addresses the antidegradation component of water quality standards as defined in 40 CFR section 130.2(j), and provides for identifying trends of declining water quality as a metric for assessing compliance with antidegradation requirements.

<sup>9</sup> Section 3.10 of the Water Quality Control Policy for Developing California's Clean Water Act §303(d) List (adopted, Sept. 20, 2004, State Water Board Resolution No. 2004-0063; amended February 3, 2015)



Section 3.10 of the California 303(d) Listing Policy states that pollutant-specific water quality objectives need not be exceeded to be considered non-compliance with antidegradation requirements *“if the water segment exhibits concentrations of pollutants or water body conditions for any listing factor that shows a trend of declining water quality standards attainment”*<sup>10</sup>.

Practically speaking, this means that, for example, if a stream reach has a concentration-based TMDL allocation of 10 mg/L nitrate as N and current water quality data or future water quality assessments in the stream reach indicate nitrate concentrations are in fact well under 10 mg/L nitrate as N, the allocation does not give license for controllable nitrogen sources to degrade the water resource all the way up to the maximum allocation of 10 mg/L nitrate as N. Data demonstrating trends of declining water quality in these reaches may constitute non-compliance with antidegradation requirements, where applicable.

#### **4.2.4 Point Sources (NPDES-permitted entities)**

The National Pollutant Discharge Elimination System (NPDES) permit is the mechanism for translating waste load allocations (WLAs) into enforceable requirements for point sources. Under Clean Water Act section 402, discharges of pollutants to waters of the United States are authorized by obtaining and complying with the terms of an NPDES permit. USEPA policy explicitly specifies NPDES-regulated stormwater discharges are point source discharges and, therefore, must be addressed by the WLA component of a TMDL.<sup>11</sup> The Central Coast Water Board is the permitting authority for NPDES permits in California’s central coast region.

USEPA regulations require that a TMDL include WLAs which identify the portion of the loading capacity allocated to existing and future point sources. Thus, the WLA is the maximum amount of a pollutant that may be contributed to a waterbody by point source discharges<sup>12</sup> of the pollutant in order to attain and maintain water quality objectives and restore beneficial uses. 40 CFR section 122.44(d)(1)(vii)(B) requires effluent limits to be consistent with the WLAs in an approved TMDL. The State Water Board Office of Chief Counsel has indicated that permit conditions are not necessarily required to contain a literal incorporation of the TMDL’s numeric allocations, and that the Regional Boards have discretion to implement the assumptions of a TMDL and its allocations through methodologies other than a direct, literal translation of the numeric WLA, as long as they are “consistent with the assumptions” of the TMDL<sup>13</sup>.

According to the USEPA and the State Water Board, all identified NPDES-permitted point sources identified in a TMDL must be given a waste load allocation, even if their current loading to receiving waters is zero<sup>14, 15</sup> otherwise their TMDL allocation is assumed to be zero and no

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<sup>10</sup> Ibid.

<sup>11</sup> See 40CFR 130.2(g) & (h) and USEPA Office of Water Memorandum (Nov. 2002) *“Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs”*

<sup>12</sup> See 40 CFR section 130.2(h). A wasteload allocation is the portion of the receiving water’s loading capacity that is allocated to its point sources of pollution.

<sup>13</sup> State Water Resources Control Board, Office of Chief Counsel Memo dated June 12, 2002. Subject: The Distinction Between a TMDL’s Numeric Target and Water Quality Standards.

<sup>14</sup> Personal communication, February 18, 2015, Janet Parrish, Central Coast Regional Liaison, U.S. Environmental Protection Agency, Region IX.

<sup>15</sup> Communication, August 2014, Phil Wyels, Assistant Chief Counsel, State Water Resources Control Board.

discharges of the identified pollutant(s) would be allowed<sup>16</sup>. Also, a waste load allocation for identified NPDES sources is needed for potential permit renewal issues<sup>17</sup>.

#### 4.2.5 Nonpoint Sources

Nonpoint sources (NPS) refer to pollution that is not released through pipes but rather originates from multiple sources over a relatively large area. Nonpoint sources are assigned the load allocation component of a TMDL. The load allocation is the portion of the receiving water's pollutant loading capacity attributed to (1) the existing or future nonpoint sources of pollution and (2) natural background sources. State programs, developed under state law, regulate nonpoint source pollution. California's Porter-Cologne Act applies to both point and nonpoint sources of pollution and serves as the principle legal authority in California for the application and enforcement of TMDL load allocations for nonpoint sources.

In July 2000, the State Water Board and the California Coastal Commission developed the *Plan for California's Nonpoint Source Pollution Control Program* (California NPS Program Plan) to reduce and prevent nonpoint source pollution in California, expanding the State's nonpoint source pollution control efforts. The NPS Program's long-term goal is to "improve water quality by implementing the management measures identified in the California Management Measures for Polluted Runoff Report (CAMMPR) by 2013." Under the California NPS Program Pollution Control Plan, TMDLs are considered one type of implementation planning tool that will enhance the state's ability to foster implementation of appropriate NPS management measures.

The Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program adopted in August 2004, explains how Water Board authorities granted by the Porter-Cologne Act will be used to implement the California NPS Program Plan, and the Nonpoint Source Implementation and Enforcement Policy requires the Regional Water Boards to regulate all nonpoint sources of pollution using the administrative permitting authorities provided by the Porter-Cologne Act. Nonpoint source dischargers must comply with Waste Discharge Requirements (WDRs), waivers of WDRs, or Basin Plan Prohibitions by participating in the development and implementation of Nonpoint Source Pollution Control Implementation Program. Nonpoint source dischargers can comply either individually or collectively as participants in third-party coalitions. The "third-party" Programs are restricted to entities that are not actual discharges under Regional Water Board permitting and enforcement jurisdiction. These may include Non-Governmental Organizations, citizen groups, industry groups, watershed coalitions, government agencies, or any mix of these. All Programs must meet the requirements of the following five key elements described in the NPS Implementation and Enforcement Policy. Each Program must be endorsed or approved by the Regional Water Board or the Executive Officer (if the Water Board has delegated authority to the Executive Officer).

Key Element 1: A Nonpoint Source Pollution Control Implementation Program's ultimate purpose must be explicitly stated and at a minimum address NPS pollution control in a manner that achieves and maintains water quality objectives.

Key Element 2: The Program shall include a description of the management practices (MPs)

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<sup>16</sup> Personal communication, February 25, 2015, Jamie Marincola, Water Division, U.S. Environmental Protection Agency, Region IX.

<sup>17</sup> Personal communication, February 26, 2015, Janet Parrish, Central Coast Regional Liaison, U.S. Environmental Protection Agency, Region IX.

and other program elements dischargers expect to implement, along with an evaluation program that ensures proper implementation and verification.

Key Element 3: The Program shall include a time schedule and quantifiable milestones, should the Regional Water Board require these.

Key Element 4: The Program shall include sufficient feedback mechanisms so that the Regional Water Board, dischargers, and the public can determine if the implementation program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required (See Section 12, Monitoring Program).

Key Element 5: Each Regional Water Board shall make clear, in advance, the potential consequences for failure to achieve a Program's objectives, emphasizing that it is the responsibility of individual dischargers to take all necessary implementation actions to meet water quality requirements.

### 4.3 Implementation for Discharges from Irrigated Lands

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Owners and operators of irrigated agricultural land must comply with the [Conditional Waiver of Waste Discharge Requirements for Irrigated Lands](#) (Order R3-2017-0002; the "Agricultural Order") and the Monitoring and Reporting Programs in accordance with Orders R3-2017-0002-01, R3-2017-0002-02, and R3-2017-0002-03, or future permits regulating discharges from irrigated lands, to meet load allocations and achieve the TMDLs. The requirements in these orders, and their renewals or replacements in the future, will implement the TMDLs and help rectify the impairments addressed in the TMDLs.

Current requirements in the Agricultural Order that will achieve the load allocations include:

- A. Implement, and update as necessary, management practices to reduce nutrient loading.
- B. Maintain existing, naturally occurring riparian vegetative cover in aquatic habitat areas.
- C. Develop/update and implement Farm Plans.
- D. Properly destroy abandoned groundwater wells.
- E. Develop and initiate implementation of an Irrigation and Nutrient Management Plan (INMP) or alternative certified by a Professional Soil Scientist, Professional Agronomist, or Crop Advisor certified by the American Society of Agronomy, or similarly qualified professional.

The 2017 Agricultural Order provides the requirements necessary to implement this TMDL. However, sediment control is crucial to reducing phosphorus loading to Pinto Lake. Future revisions to the Agricultural Order or other permit regulating the discharge of waste from irrigated agricultural land should incorporate sediment and erosion management plans with appropriate management practices and turbidity limits to maintain or restore applicable water quality standards in Pinto Lake. Future permits should also include monitoring and reporting requirements that will provide data to demonstrate attainment of water quality standards. Central Coast Water Board staff will pursue modification of the existing Agricultural Order conditions, or other regulatory means, if necessary, to address remaining impairments resulting from phosphorus discharges during the TMDL implementation phase.

Central Coast Water Board staff will conduct a review of implementation activities as monitoring and reporting data are submitted as required by the Agricultural Order, or when other monitoring data and/or reporting data are submitted outside the requirements of the Agricultural Order.

Central Coast Water Board staff will pursue modification of Agricultural Order conditions, or other regulatory means, if necessary, to address remaining impairments resulting from phosphorus discharges during the TMDL implementation phase.

### **4.3.1 Implementing Parties**

Table 4-1 presents the implementing parties responsible for implementation load allocations for discharges of nutrients from irrigated lands.

**Table 4-1. Implementing parties for discharges of nutrients from irrigated lands.**

<b>Source Category</b>	<b>Implementing Parties</b>
Irrigated lands	Owners/operators of irrigated lands

### **4.3.2 Priority Areas & Priority Nutrient Type**

The Agricultural Order should prioritize implementation and monitoring efforts in areas where:

- 1) Water quality data and land use data indicate the largest magnitude of nutrient loading and/or impairments;
- 2) Reductions in nutrient loading, reductions in-stream nutrient concentrations, and/or implementation of improved nutrient management practices that will have the greatest benefit to aquatic habitat and/or human health in receiving waters and also with consideration to mitigation of downstream impacts;
- 3) Crops that are grown that require high fertilizer inputs; and
- 4) Other information such as proximity to waterbody; soils/runoff potential; irrigation and drainage practices, or relevant information provided by stakeholders, resource professionals, and/or researchers indicate a higher risk of nutrient and/or biostimulatory impacts to receiving waters.

The priority areas to focus on are areas that are in close proximity to the lake. The Amesti Creek, CCC Creek, Pinto Creek Mainstem, Lakeside, and Todos Santos Creek subcatchments all contain irrigated agricultural lands and are high priorities in which to focus implementation efforts. The areas in the Pinto Creek East and West Branch subcatchments also have irrigated agriculture; however, as evidenced from the monitoring site on Pinto Creek, nutrient levels are relatively low. Therefore, these areas may not be as high a priority as the irrigated agriculture operations in closer proximity to the lake.

Control of phosphorus discharges will require management of sediment and erosion. The current Agricultural Order specifically requires owners and operators of irrigated lands to take planning and management actions that are anticipated to reduce erosion and sedimentation. For example, these include requirements for implementing practices which prevent erosion and hold fine particles in place, minimizes the presence of bare soil vulnerable to erosion, and maintains riparian areas for streambank stabilization and erosion control.

In addition to focusing on reducing nutrient loading, controlling erosion from agricultural sites is important in this catchment. Phosphorus binds to sediment and reducing sediment loading from the watershed will reduce phosphorus loading.



### ***4.3.3 Potential Management Measures for Agricultural Sources***

The SWRCB, California Coastal Commission and other State agencies have identified management measures (MMs) to address agricultural sources of nutrient pollution that affect State waters. The agricultural MMs include practices and plans installed under various NPS programs in California, including systems of practices commonly used and recommended by the U.S. Department of Agriculture as components of Resource Management Systems (RMS), Water Quality Management Plans and Agricultural Waste Management Systems. These RMSs are planned by individual farmers and ranchers using an objective-driven planning process outlined in the NRCS National Planning Procedures Handbook.

Further, the State Water Resources Control Board's (SWRCB) Nonpoint Source Management Program provides an on-line reference guide designed to facilitate a basic understanding of nonpoint source pollution control and to provide quick access to essential information from a variety of sources. The purpose of this on-line resource guide is to support the implementation and development of NPS total maximum daily loads and watershed (action) plans with a goal of protecting high-quality waters and restoring impaired waters. Relevant information from the SWRCB Nonpoint Source– Encyclopedia for nutrient management is available online at: [http://www.swrcb.ca.gov/water\\_issues/programs/nps/encyclopedia.shtml](http://www.swrcb.ca.gov/water_issues/programs/nps/encyclopedia.shtml)

The California Department of Food and Agricultural Fertilizer Research and Education Program (FREP) funds and coordinates research to advance the environmentally safe and agronomically sound use and handling of fertilizer materials. FREP serves growers, agricultural supply and service professionals, extension personnel, public agencies, consultants, and other interested parties. FREP is guided by the Technical Advisory Subcommittee (TASC) of the Fertilizer Inspection Advisory Board (FIAB). This subcommittee includes growers, fertilizer industry professionals, and state government and university scientists. The TASC directs FREP activities, and reviews, selects and (after peer review) recommends to the FIAB funding for FREP research and education projects. Information on FREP and nutrient management research and education can be found at: <http://www.cdfa.ca.gov/is/ffldrs/frep.html>

### ***4.3.4 Determining Progress Towards Attainment of Load Allocations***

Load allocations will be achieved through a combination of implementation of management practices and strategies to reduce phosphorus loading, and these reductions will be analyzed through water quality monitoring. For nonpoint source load allocations in Pinto Lake, USEPA guidance generally expects that the state's Clean Water Act section 319 nonpoint source management programs will be the basis for implementing load allocations<sup>18</sup>. California's Nonpoint Source Pollution Control Program was previously described in Section 4.2.5. In practical terms, this means load allocations are addressed through the implementation of management practices (e.g., land, irrigation, and nutrient management practices)<sup>19</sup>. It is important to note that although load allocations are typically addressed by adoption of specific management practices, it is not always easy to evaluate the effectiveness of management practices. As this TMDL is heavily dependent on nonpoint source loading reductions through load allocations, long-term watershed water quality monitoring is proposed to evaluate the effectiveness of implemented management practices and nonpoint source load reductions.

<sup>18</sup> See USEPA, "Establishing and Implementing TMDLs" at <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/TMDL-ch3.cfm>

<sup>19</sup> See USEPA, Protocol for Developing Nutrient TMDLs. EPA 841-B-99-007 (November, 1999)

Existing monitoring programs in conjunction with proposed monitoring requirements in this TMDL can be used synergistically to provide for long-term water quality monitoring.

Biostimulatory impairments result from nutrients acting in combination with other factors to contribute to dissolved oxygen fluctuations, algal biomass problems, toxin production, and degradation of aquatic habitat. The proposed phosphorus allocations to address biostimulation are the nutrient water quality level necessary to restore beneficial uses and reduce the frequency and severity of nuisance cyanobacteria blooms and attain the nutrient-response indicator targets for dissolved oxygen, chlorophyll *a*, and microcystin. It should be recognized that the main goal to address biostimulatory impairments is to restore dissolved oxygen and biomass to acceptable levels consistent with designated beneficial uses. As such, nutrient-response indicator targets (dissolved oxygen, chlorophyll *a*, and microcystin) proposed in this TMDL can be used to assess water quality standards attainment over the long term. Accordingly, to allow for flexibility, compliance with waste load allocations can be demonstrated and determined in several ways, as follows:

To allow for flexibility, attainment of load allocations can be demonstrated and determined in several ways, using one or a combination of the following:

[Text Box 4-2. Demonstrating progress towards and attainment of load allocations.](#)

**Water Board staff will assess progress towards and attainment of load allocations using one or a combination of the following:**

- a) Water quality data demonstrating the receiving water numeric target for total phosphorus has been attained;
- b) Water quality data demonstrating the receiving water numeric targets for nutrient-response indicators have been attained (i.e., dissolved oxygen water quality objectives, chlorophyll *a* targets, and microcystin targets);
- c) Ranch-level surface discharge monitoring data demonstrating that the total phosphorus mass-based load allocations have been reduced or attained at the ranch-level. Evidence of effective sediment and erosion control may constitute a proxy demonstration of phosphorus discharge control;
- d) Owners/operators may provide sufficient evidence of implementing management practices that are capable of achieving mass-based load allocations identified in this TMDL, combined with water quality monitoring data demonstrating progress toward attaining the mass-based waste load allocations at the ranch-level; and/or
- e) Owners/operators of irrigated lands may provide sufficient evidence to demonstrate that they are, and will continue to be, in compliance with the mass-based load allocations. Such evidence could include documentation submitted by the owner/operator to the Executive Officer that the owner/operator is not causing waste to be discharged to impaired waterbodies resulting in or contributing to violations of the load allocations.

#### **4.4 Implementation for Discharges from MS4 Stormwater Entities**

The NPDES MS4 stormwater General Permit will implement waste load allocations for this source category. Municipal separate storm sewer systems (MS4s) are considered relatively minor loads of phosphorus in the Pinto Lake catchment based on the source analysis presented

in the TMDL Report. However, because these sources can potentially have a significant localized effect on water quality, they are allocated waste load allocations. The Central Coast Water Board will address phosphorus discharged from municipal separate storm sewer systems (MS4s) by regulating the MS4 entities under the provisions of the State Water Board's General Permit for the discharges of storm water<sup>20</sup> from MS4's, or subsequent General Permits. To address the MS4 waste load allocations, the Central Coast Water Board will require Santa Cruz County and the City of Watsonville to address impairments by developing and implementing a Waste Load Allocation Attainment Program. The elements of a Waste Load Allocation Attainment Program are described in report section 4.4.2 and in Text Box 4-3.

Because antidegradation is an element of all water quality standards, these entities should continue to implement their stormwater programs and comply with the MS4 stormwater General Permit or any subsequent permits with the goal of maintaining existing nutrient water quality and helping to prevent any further water quality degradation.

The Central Coast Water Board will require MS4 entities to develop and submit for Executive Officer approval a Waste Load Allocation Attainment Program consistent with the requirements of the General Permit, or with any subsequent General Permits. The Waste Load Allocation Attainment Program shall include descriptions of the actions that will be taken by the MS4 entity to attain the TMDL waste load allocations. Specifics of the Waste Load Allocation Attainment Program are detailed in Section 4.4.2.

#### **4.4.1 Implementing Parties**

The MS4 entities responsible for control of discharges to Pinto Lake are the City of Watsonville and Santa Cruz County.

**Table 4-2. Implementing parties for discharges of nutrients from urban landscapes.**

<b>Source Category</b>	<b>Implementing Parties</b>
MS4 stormwater discharges	City of Watsonville County of Santa Cruz

#### **4.4.2 Implementation Actions**

The overall goal of developing a Waste Load Allocation Attainment Program is to implement management practices capable of achieving interim and final waste load allocations identified in this TMDL. The Central Coast Water Board will require the Waste Load Allocation Attainment Program to include descriptions of the actions that will be taken by the MS4 entity to attain the TMDL waste load allocations, and specifically address:

- A. Development of an assessment and implementation strategy;
- B. Source identification and prioritization;
- C. Best management practices (BMP) identification, prioritization, implementation schedule, analysis, and effectiveness assessment;
- D. Monitoring and reporting program development and implementation. Monitoring program goals shall address:
  - (1) assessment of stormwater discharge and/or receiving water quality;
  - (2) assessment of BMP effectiveness; and

<sup>20</sup> MS4 stormwater General Permit, Water Quality Order No. 2013-0001-DWQ, NPDES No. CAS000004

- (3) demonstration and progress towards achieving interim goals and waste load allocations;
- E. Coordination with stakeholders; and
- F. Other pertinent factors.

The Waste Load Allocation Attainment Program will be required by the Central Coast Water Board to address each of these TMDLs that occur within Santa Cruz County and the City of Watsonville's jurisdictions. Santa Cruz County and the City of Watsonville will submit Waste Load Allocation Attainment Program Plans consistent with current, or future conditions specified in the Small Municipal Separate Storm Sewer Systems (MS4) stormwater General Permit for Waste Discharge Requirements for Stormwater Discharges from MS4s (Water Quality (WQ) Order 2013-0001-DWQ NPDES NO. CAS000004, as amended by Order WQ 2015-0133-EXEC, Order WQ 2016-0069-EXEC, WQ Order 2017-XXXX-DWQ, Order WQ 2018-0001-EXEC, and Order WQ 2018-0007-EXEC) (hereafter Phase II Small MS4 Permit) or future National Pollutant Discharge Elimination System (NPDES) permits regulating the stormwater discharges.

The Waste Load Allocation Attainment Programs shall include the elements identified in Attachment G of the current Phase II Small MS4 Permit, as reproduced below in Text Box 4-3.

**Text Box 4-3. Required components of Waste Load Allocation Attainment Programs.**

1. A detailed description of the strategy the MS4 will use to guide BMP selection, assessment, and implementation, to ensure that BMPs implemented will be effective at abating pollutant sources, reducing pollutant discharges, and achieving waste load allocations according to the TMDL schedule.
2. Identification of sources of the impairment within the MS4's jurisdiction, including specific information on various source locations and their magnitude within the jurisdiction.
3. Prioritization of sources within the MS4's jurisdiction, based on suspected contribution to the impairment, ability to control the source, and other pertinent factors.
4. Identification of BMPs that will address the sources of impairing pollutants and reduce the discharge of impairing pollutants.
5. Prioritization of BMPs, based on suspected effectiveness at abating sources and reducing impairing pollutant discharges, as well as other pertinent factors.
6. Identification of BMPs the MS4 will implement, including a detailed implementation schedule. For each BMP, identify milestones the MS4 will use for tracking implementation, measurable goals the MS4 will use to assess implementation efforts, and measures and targets the MS4 will use to assess effectiveness. MS4s shall include expected BMP implementation for future implementation years, with the understanding that future BMP implementation plans may change as new information is obtained.
7. A quantifiable numeric analysis demonstrating the BMPs selected for implementation will likely achieve, based on modeling, published BMP pollutant removal performance estimates, best professional judgment, and/or other available tools, the MS4's waste load allocation according to the schedule identified in the TMDL. This analysis will most likely incorporate modeling efforts. The MS4 shall conduct repeat numeric analyses as the BMP implementation plans evolve and information on BMP effectiveness is generated. Once the MS4 has water quality data from its monitoring program, the MS4 shall incorporate water quality data into the numeric analyses to validate BMP implementation plans.



8. A detailed description, including a schedule, of a monitoring program the MS4 will implement to assess discharge and receiving water quality, BMP effectiveness, and progress towards any interim targets and ultimate attainment of the MS4s' waste load allocation. The monitoring program shall be designed to validate BMP implementation efforts and quantitatively demonstrate attainment of interim targets and waste load allocations.
9. If the approved TMDL does not explicitly include interim targets, the MS4 shall establish interim targets (and dates when stormwater discharge conditions will be evaluated) that are equally spaced in time over the TMDL compliance schedule and represent measurable, continually decreasing MS4 discharge concentrations or other appropriate interim measures of pollution reduction and progress towards the waste load allocation. At least one interim target and date must occur during the five-year term of this Order. The MS4 shall achieve its interim targets by the date it specifies in the Waste Load Allocation Attainment Program. If the MS4 does not achieve its interim target by the date specified, the MS4 shall develop and implement more effective BMPs that it can quantitatively demonstrate will achieve the next interim target.
10. A detailed description of how the MS4 will assess BMP and program effectiveness. The description shall incorporate the assessment methods described in the CASQA Municipal Storm water Program Effectiveness Assessment Guide.
11. A detailed description of how the MS4 will modify the program to improve upon BMPs determined to be ineffective during the effectiveness assessment.
12. A detailed description of information the MS4 will include in annual reports to demonstrate adequate progress towards attainment of waste load allocations according to the TMDL schedule.
13. A detailed description of how the MS4 will collaborate with other agencies, stakeholders, and the public to develop and implement the Waste Load Allocation Attainment Program.
14. Any other items identified by Integrated Report fact sheets, TMDL Project Reports, TMDL Resolutions, or that are currently being implemented by the MS4 to control its contribution to the impairment.

#### ***4.4.3 Potential Management Measures for Stormwater Sources***

The Water Board cannot specify or mandate the specific type or design of onsite actions (e.g., BMPs) necessary to reduce nutrient loading to waterbodies; however the State Water Resources Control Board's Nonpoint Source Management Program provides an on-line reference guide designed to facilitate a basic understanding of nonpoint source pollution control and to provide quick access to essential information from a variety of sources. The purpose of this on-line resource guide is to support the implementation and development of nonpoint source total maximum daily loads and watershed (action) plans with a goal of protecting high-quality waters and restoring impaired waters. Relevant information from the SWRCB Nonpoint Source– Encyclopedia for nutrient management is available online at:  
[http://www.swrcb.ca.gov/water\\_issues/programs/nps/encyclopedia/3\\_0\\_urb.shtml](http://www.swrcb.ca.gov/water_issues/programs/nps/encyclopedia/3_0_urb.shtml)

The International Stormwater BMP Database is a comprehensive source of BMP performance information. The BMP Database is comprised of carefully examined data from a peer reviewed collection of studies that have monitored the effectiveness of a variety of BMPs in treating water

quality pollutants for a variety of land use types. The Stormwater BMP Database is available online at:

<http://www.bmpdatabase.org/>

#### ***4.4.4 Determining Progress Towards Attainment of Waste Load Allocations***

USEPA guidance states that if the State or USEPA establishes a TMDL for impaired waters that include waste load allocations for stormwater discharges, permits for MS4 discharges must contain effluent limits and conditions consistent with the requirement and assumptions of the WLAs in the TMDL. Compliance with waste load allocations can be demonstrated in several ways; 1) the permitting authority (Water Board) has the discretion to express the effluent limitations in the applicable stormwater permits as numeric water quality-based limits consistent with the waste load allocations (if and where feasible), or 2) the effluent limitations may be expressed as measurable, objective Best Management Practices (BMPs) that are anticipated to be capable of achieving the waste load allocation. USEPA states that where a BMP-based approach to permit limitations is selected, the BMPs required by the permit will be sufficient to implement applicable waste load allocations, including adequate monitoring, numeric benchmarks, or specific protocols to determine if the BMPs are performing as necessary.

Biostimulatory impairments result from nutrients acting in combination with other factors to contribute to dissolved oxygen fluctuations, algal biomass problems, toxin production, and degradation of aquatic habitat. The proposed phosphorus allocations to address biostimulation are predictors of the nutrient water quality level necessary to restore beneficial uses. However, it should be recognized that the main concern with biostimulatory impairments is to restore dissolved oxygen and reduce the frequency of cyanobacteria blooms to acceptable levels consistent with designated beneficial uses, and to mitigate downstream biostimulatory nutrient impacts to receiving waterbodies. As such, nutrient-response indicator targets (dissolved oxygen, chlorophyll *a*, and microcystin) proposed in this TMDL can be used to assess water quality standards attainment over the long term. Accordingly, to allow for flexibility, compliance with waste load allocations can be demonstrated and determined in several ways, as follows:

Text Box 4-4. Demonstrating progress towards attainment of waste load allocations.

**Water Board staff will assess progress towards and attainment of waste load allocations using one or a combination of the following:**

- a) Water quality data demonstrating the receiving water numeric target for total phosphorus has been attained;
- b) Water quality data demonstrating the receiving water numeric targets for nutrient-response indicators have been attained (i.e., dissolved oxygen water quality objectives, chlorophyll *a* targets, and microcystin targets);
- c) Storm drain outfall monitoring data demonstrating that the total phosphorus mass-based load allocations have been reduced or attained at storm drain outfalls;
- d) MS4 entities may provide sufficient evidence of implementation and assessment of pollutant load reduction projects and BMPs capable of achieving the total phosphorus waste load allocations, combined with water quality monitoring data demonstrating progress toward attaining the mass-based waste load allocations; and
- e) Any other effluent limitations and conditions which are consistent with the assumptions and requirements of the waste load allocations.

#### 4.5 Implementation for Industrial & Construction Stormwater Discharges

There is one registered industrial facility in the Pinto Lake catchment; Sun-Land Garden Products. This facility is operating under the 2014 Industrial General Permit. This facility is operating under the Statewide General Permit for Stormwater Dischargers Associated with Industrial Activities, State Board Order 2014-0057-DWQ, NPDES No. CAS000001 (Industrial General Permit) or any future permit regulating the discharge of waste associated with industrial activities. The Industrial General Permit requires enrollment of industrial facilities that meet certain criteria based on their risk to impact water quality. There are no other industrial or construction stormwater permits in the Pinto Lake catchment<sup>21</sup>.

There has been some concern in the past regarding garden amendments moving offsite and ending up in Pinto Lake or Todos Santos Creek. The Industrial General Permit Prohibits Sun-Land Garden Products from discharging any liquids or materials (III, B, page 19). Additionally, Sun-Land Garden Products shall ensure that any of their industrial storm water discharges do not cause or contribute to an exceedance of any applicable water quality standards in any affected receiving water (VI, A, page 21).

Because the regulation of any discharges from this facility is covered under the Industrial General Permit, additional regulatory measures for this source category are not warranted at this time.

Section 4.4.3 outlines sources of information for potential management measures to control sediment and nutrient discharges from stormwater sources.

<sup>21</sup> According to the [SMARTS website](#); data pulled on 8/2/2017.

## 4.6 Implementation for Onsite Wastewater Treatment Systems

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Owners of OWTS and local agencies must comply with the Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems (OWTS Policy) adopted by the State Water Board on June 19, 2012 (by Resolution No. 2012-0032) and amended on April 17, 2018 (by Resolution No. 2018-0019). This Policy establishes a statewide, risk-based, tiered approach for the regulation and management of OWTS installations and replacements and sets the level of performance and protection expected from OWTS.

The OWTS Policy stipulates that existing, new, and replacement OWTS, that are located near a waterbody that has been listed as impaired on the Clean Water Act section 303(d) List, may be addressed by one or more of the following:

- Special provisions contained in a Local Agency Management Plan (LAMP);
- Compliance with specific requirements of Tier 3; and/or
- Special provisions in the Advanced Protection Management Program (APMP) to address the Load Allocation for OWTS established in this TMDL for phosphorus loading to Pinto Lake.

The LAMP and APMP shall include descriptions of the actions that will be taken by the local entity to attain the TMDL load allocation, and could include the following for OWTS within 900 feet<sup>22</sup> of the lake:

- Encourage or require phosphorus free soaps (e.g., laundry detergent).
- Encourage voluntary implementation of enhanced septic system treatment to sequester phosphorus (such as alum applications).
- New and proposed OWTS within 600 feet<sup>23</sup> of a surface waterbody in the Pinto Lake catchment implement enhanced septic system treatment to sequester phosphorus.
- Upon repair or expansion of OWTS, implement enhanced septic system treatment (such as alum application to sequester phosphorus).

### 4.6.1 Potential Management Measures for Onsite Wastewater Treatment Systems

The Water Board cannot specify or mandate the specific type or design of onsite actions (e.g., BMPs) necessary to reduce nutrient loading to waterbodies; however the California Nonpoint Source Pollution Control Program contains information on the general expectations and types of management measures that will reduce nutrient loading from onsite wastewater treatment systems; this information may be reviewed at the following link:

[https://www.waterboards.ca.gov/water\\_issues/programs/nps/encyclopedia/3\\_2c\\_const\\_owts.html](https://www.waterboards.ca.gov/water_issues/programs/nps/encyclopedia/3_2c_const_owts.html)

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<sup>22</sup> Technical citations (see references section): Robertson (2008) and Lusk, Toor, and Obreza (2011)

<sup>23</sup> Technical citation: Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems (OWTS Policy). Adopted by State Water Resources Control Board June 2012.

## 4.7 Implementation for Livestock & Domestic Animals

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Owners and operators of lands with livestock and/or farm animals must control discharges of soil and sediment into water courses nearby pursuant to plans and policies adopted by the Central Coast Water Board. These plans and policies require residents who have livestock and farm animals to manage their property to protect water quality. Section 4.8.5.1 of the Central Coast Basin Plan establishes a land disturbance prohibition for the Pajaro River watershed. The Pajaro watershed includes Pinto Lake and its associated catchment. The Basin Plan prohibition requires residents who have livestock and farm animals to manage their property to protect water quality.

Practically speaking, this means residents who have livestock and farm animals on their property must begin, or continue, to self-assess and self-monitor their property to determine if erosion control or other practices must be used to reduce excessive erosion and waste discharges. If erosion and waste discharges are observed, prevention and control practices must be implemented. Good land and animal management practices can not only improve water quality and the environment, but can also improve animal health, enhance land aesthetics, and can even increase property values<sup>24</sup>.

### *4.7.1 Potential Management Measures for Animals and Manure Management*

The Water Board cannot specify or mandate the specific type or design of onsite actions (e.g., BMPs) necessary to reduce nutrient loading to waterbodies; however the California Nonpoint Source Pollution Control Program contains information on the general expectations and types of MMs that will reduce nutrient loading associated with domestic animals and manure located on pasture and rural residential lands; this information may be viewed at the following link:

[https://www.waterboards.ca.gov/water\\_issues/programs/nps/encyclopedia/1b\\_animalwste.html](https://www.waterboards.ca.gov/water_issues/programs/nps/encyclopedia/1b_animalwste.html)

## 4.8 Need for Future Alum Treatments

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In 2017, The City of Watsonville's alum application contractor (HAB Aquatic Solutions) reported that it is difficult to predict how long the 2017 grant-funded alum treatment will effectively sequester phosphorus in lake bottom sediments in Pinto Lake. As of 2017, the best professional guess of the contractors was six to seven years.

In 2017, grant funds were insufficient to completely cover the entire lakebed with a full dose (10 cm of alum on top of lake bottom sediments). It was estimated at that time that at least \$250,000 more was necessary to fund a full alum dose. While the 2017 alum application appears to have had significant water quality benefits to date, consultants indicated that future alum applications would likely be needed.

The City of Watsonville's alum application contractor has discussed strategies with City staff about future alum application. As a matter of cost-efficiency, alum contractors suggested that City of Watsonville staff could do light, springtime applications of alum as a long-term lake management goal. The light applications be done by the City if staff is trained. HAB Aquatic Solutions contractors stated that their expertise is not necessarily needed to do these light applications.

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<sup>24</sup> See Land and Livestock Program brochure at [www.livestockandland.org/PDF/BMP%20Brochure.pdf](http://www.livestockandland.org/PDF/BMP%20Brochure.pdf)



## 4.9 Recommended Water Quality Monitoring

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There is a relatively large quantity of surface water quality samples being collected by multiple entities in Pinto Lake, with reasonably good spatial and temporal variation. The City of Watsonville stormwater program is required conduct microcystin sampling in the lake pursuant to the Phase II MS4 General Permit. Additionally, weekly samples are being collected at the boat dock at the south end of Pinto Lake. City and County staff are sharing these results with Central Coast Water Board staff as they become available. Thus, at this time Central Coast Water Board staff are not recommending additional receiving water quality monitoring above and beyond what is currently being collected. However, maintaining this ongoing monitoring is necessary to inform public health notifications for persons recreating at and around Pinto Lake. Future reviews of TMDL implementation progress may recommend the need for more details regarding the county's sampling program, potentially including maps with sites, frequency of sampling, and constituents monitored at each site to assure that coverage will be adequate to allow evaluation of the criteria previously.

The County of Santa Cruz, through their Monitoring Plan for Pinto Lake<sup>25</sup> and in coordination with the City of Watsonville, the Monterey Bay Analytical Services, and UC Santa Cruz's Raphe Kudela, have been, and will be collecting various water quality samples for nutrients and cyanobacteria in the Pinto Lake catchment. The County has identified various sampling site locations and sampling frequencies. These data will help inform the progress of management measures in the catchment.

## 4.10 TMDL Attainment Schedule

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Discharges of phosphorus are occurring at levels which are impairing a wide spectrum of beneficial uses and, therefore, constitute a serious water quality problem. As such, implementation should occur at a pace to achieve the allocations and the total phosphorus TMDL in the shortest time-frame feasible. Central Coast Water Board staff recognizes that immediate compliance with water quality standards is not feasible and establish TMDL attainment milestones as follows.

- Interim Water Quality Milestone: Achieve and maintain the toxicity water quality objectives for contact recreation in receiving waters that are designated REC, based on microcystin numeric target (0.8 ug/L) within 5 years of the effective date of the TMDL (which is upon approval by the [Office of Administrative Law](#));
- Final TMDL Attainment Date: Within 10 years after the OAL approval date, achieve the phosphorus waste load allocations and load allocations; or meet all regulatory and policy requirements necessary for removing the impaired waters from the Clean Water Act section 303(d) List of impaired waters; or attain the numeric targets for nutrient-response indicators (i.e., dissolved oxygen water quality objectives, chlorophyll *a* numeric targets, and microcystin numeric targets).

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<sup>25</sup> The County of Santa Cruz has a Monitoring Plan and Quality Assurance Program Plan for Pinto Lake to meet Section E.13.C of Order No. 2013-0001-DWQ General Permit for Waste Discharge Requirements for stormwater discharges from small municipal separate storm sewer systems.

These attainment dates are based on the expectation that microcystin water quality criteria could be achieved relatively quickly, assuming ongoing alum or other lake bottom treatment applications when, and as necessary. It is difficult to predict how long the 2017 alum treatment will sequester enough phosphorus to keep cyanobacteria levels down, and consultants have indicated that future treatments will likely be needed. Consultants provided a fairly speculative estimate of 6-7 years of effectiveness for the 2017 alum treatment. The ten year attainment date for phosphorus waste load and load allocations are based on the expectation that control of phosphorus loads originating from the watershed have been initiated (such as sediment basin and road projects to reduce the discharge of sediment, and the phosphorus that is bound to it, into creeks and the lake). Staff also acknowledge that phosphorus load reductions will require longer-term and sustained watershed management strategies.

#### 4.11 Climate Change Considerations

*“Mitigating the global expansion of cyanobacterial harmful blooms (CyanoHABs) is a major challenge facing researchers and resource managers. A variety of traditional (e.g., nutrient load reduction) and experimental (e.g., artificial mixing and flushing, omnivorous fish removal) approaches have been used to reduce bloom occurrences. Managers now face the additional effects of climate change on watershed hydrologic and nutrient loading dynamics, lake and estuary temperature, mixing regime, internal nutrient dynamics, and other factors. Those changes favor CyanoHABs over other phytoplankton and could influence the efficacy of control measures.”*

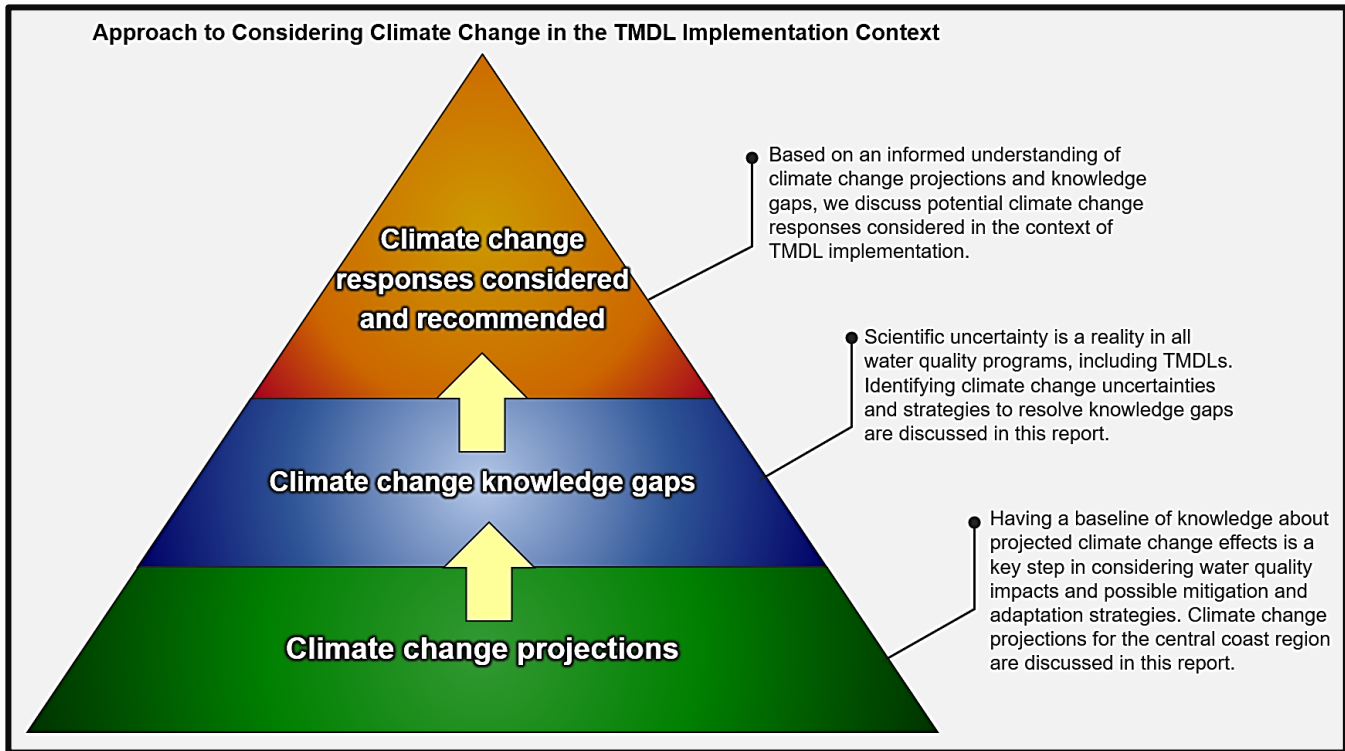
→ Paerl et al. (2016) *“Mitigating cyanobacterial harmful algal blooms in aquatic ecosystems impacted by climate change and anthropogenic nutrients”*. In *Harmful Algae Volume 54*.

The purpose of this section is to discuss climate change considerations that may be relevant to TMDL implementation and watershed improvement activities at Pinto Lake.

At this time, there is no regulatory requirement to include climate change in a TMDL, but, a few TMDLs have begun to include climate change considerations. A TMDL is a regulatory requirement for addressing specific water quality impairments, the State Water Board’s Resolution No. 2017-0012 states that the regional water boards are encouraged to refer to projections of sea level rise as directed in the most recent Ocean Protection Council Sea-level Rise Guidance Document when making recommendations on permits and other decisions to protect wetlands. In addition, it is warranted to consider climate change in this TMDL Implementation Plan because climate change impacts have the potential to impact freshwater ecosystems and may make attainment of water quality standards more difficult.

Figure 2-1 illustrates the approach we used in considering climate change in the framework of TMDL implementation and watershed improvement for Pinto Lake. This approach requires us to reach an informed understanding of climate change projections, and climate change uncertainties, prior to identifying appropriate potential strategies, and actions the Central Coast Water Board may take in responding to climate change in the Pinto Lake TMDL context.

Figure 4-1. Approach for considering climate change in the Pinto Lake TMDL implementation framework.



#### 4.11.1 Climate Change Projections

The Earth's climate has changed throughout history. According to National Aeronautics and Space Administration (NASA) and the Intergovernmental Panel on Climate Change<sup>26</sup>, most of these climate changes are attributed to very small variations in Earth's orbit that change the amount of solar energy our planet receives. The current warming trend is widely attributed by climate scientists to be the result of human activity since the mid-20th century (greater than 95 percent probability) and proceeding at a rate that is unprecedented over decades to millennia.

[California's Climate Change Assessments](#) reports provide a peer-reviewed scientific foundation for understanding climate related vulnerability at the local scale. The most recent report, published in September 2018, is California's Fourth Climate Change Assessment (Fourth Assessment) which advances actionable science that serves the growing needs of state and local-level decision-makers from a variety of sectors.

Table 4-3 presents a summary of climate change projections reported in [California's Fourth Climate Change Assessment, Central Coast Region Report](#). In this table we present a selected subset of anticipated climate change projections and considerations which conceivably may be relevant to the Pinto Lake catchment. Perhaps most noteworthy are the projections that ongoing climate change will lead to an increase in harmful algal blooms which need to be managed by controlling nutrient runoff from agriculture and other human activities.

<sup>26</sup> [NASA webpage](#) accessed July 2019

Table 4-3. Summary of take home messages from California's Fourth Climate Change Assessment, Central Coast Region report.

Climate change projections	Take home messages
Temperature and precipitation	<p>Maximum and minimum temperatures will continue to increase through the next century, with greater increases in the inland region.</p> <p>Average precipitation is expected to increase by a relatively small amount, but the annual variability increases substantially by the end of the century.</p>
Fog	<p>Coastal fog reduces summertime temperatures, adds water, and reduces plant water demand. The future of fog is uncertain because system feedbacks and their response to climate change are not well characterized.</p>
Extreme storm events	<p>Periodic El Niño events dominate coastal hazards across the central coast and will be a key driver of coastal vulnerability in the coming decades.</p>
Extreme Drought Events	<p>Climate projections show an increase in extreme dry events. While only modest changes in mean precipitation are projected, when combined with increasing temperatures, the management of the central coast's already stressed water supplies will be challenging.</p>
Sea level rise	<p>Historical sea level rise observations from tide gauges in the region have lagged behind the global average, but recently observed and projected acceleration poses a significant threat to coastal communities.</p> <p>Accelerating sea level rise combined with a lack of ample sediment in the system will continue to drive the landward erosion of beaches, effectively drowning them between the rising ocean and the backing cliffs and/or urban hardscape.</p>
Public health	<p>An increase in harmful algal blooms will have detrimental effects on animals and people exposed to toxins released from the algae. Mitigation requires control of nutrients from agricultural runoff.</p> <p>Extreme heat events could increase heat-related illnesses for agricultural workers; spark wildfires in arid areas with high vegetation releasing harmful particulate matter affecting residents' respiratory health</p>
Sediment transport and deposition	<p>Sedimentation varies widely in individual watersheds and rivers due to inter-annual hydro-climatological variability. It is exacerbated by landscape disturbances (e.g. wildfires or landsliding) and can remain elevated for years.</p>

Climate change projections	Take home messages
Wildlife	<p>The region harbors diverse reptile and amphibian taxa because many northern and southern species have overlapping ranges.</p> <p>For northern taxa, this poses a risk of extinction and several species have already registered local extinctions. Species may have robust climate refugia in the Santa Cruz Mountains and Santa Lucia Mountains that protect from the risk of extirpation owing to cooler temperatures and higher levels of precipitation.</p>
Rivers, streams, riparian areas	<p>Aquatic life of streams and rivers are threatened by extreme swings from drought to floods and exacerbated by fire and erosion that buries habitat in sediments. This restricts survival conditions for already endangered migratory Steelhead and Coho salmon, and could further reduce the diversity and abundance of sensitive aquatic insects.</p>
Freshwater resources	<p>Water supply shortages, already common during drought, will be exacerbated.</p> <p>Higher temperatures and more extreme droughts will likely result in increases in water demand for agriculture and landscaping.</p> <p>Reduced surface water will likely lead to increased groundwater extractions, potentially leading to increases in saltwater intrusion and higher pollutant concentrations.</p> <p>Climate change will affect reservoir storage and SWP water reliability.</p>
Agriculture	<p>Agricultural production is highly sensitive to climate change including amounts, forms, and distribution of precipitation, changes in temperatures and increased frequency and intensity of climate extremes. The Salinas Valley is identified as one of the most vulnerable agricultural regions under climate change.</p> <p>Changes in climate influence crop selection, crop acreage, technology adoption, and the demand for water. Such changes can affect the diversity of crops planted, potentially impacting agricultural biodiversity</p>
Adaptations: regional, municipal, natural lands	<p>Significant efforts to assess and adapt to climate change are occurring.</p> <p>Community efforts include for example, the Central Coast Climate Collaborative involving cities, counties and community groups, and the Central Coast Action Lab focusing on youth in farmworker communities.</p> <p>Many cities counties, non-governmental organizations and colleges have completed assessments of local vulnerabilities and engaged in climate adaptation planning.</p> <p>Some undeveloped lands are undergoing vulnerability assessments and there are on-the-ground adaptation projects being implemented.</p>



### 4.11.2 Climate Change Knowledge Gaps

*“While significant research is continuing on the scientific impacts of climate change and the Central Coast is actively involved in mitigation and adaptation projects, there is more to be done.”*

*→ Langridge (2018) - California’s Fourth Climate Change Assessment, Central Coast Region Report.*

Scientific uncertainty is a reality in all water quality programs, including TMDLs and climate change considerations. Clarifying uncertainties and resolving knowledge gaps include:

- better understanding of orographic climate effects,
- interplay between present and future drought,
- wildfire,
- precipitation conditions,
- sediment dynamics in response to climate-driven hydrologic variability,
- species and ecosystem responses to climate change,
- how higher temperatures and changes to precipitation patterns will affect the growing season, and
- use of newer climate projection models that have increased spatial resolution.

Text Box 4-5 outlines a strategy the Central Coast Water Board may implement to address climate change knowledge gaps<sup>27</sup>, when relevant to TMDL implementation.

Text Box 4-5. Actions the Central Coast Water Board may take to address climate change knowledge gaps during TMDL implementation.

- 1) **Improve understanding of the effects of climate change, and the effectiveness of mitigation and adaptation strategies** in the central coast region:
  - a) **Use best available science** to fill gaps in understanding as to how climate change will affect ecosystems, watershed processes, and beneficial uses. Improve capacity to evaluate groundwater-surface water connections including effects on base flows for aquatic life and the effects of pumping on groundwater-dependent ecosystems.
  - b) **Track research in key areas**, including: University of California, Santa Cruz research and related Salinas case study on impacts to disadvantaged communities that will identify current data gaps and develop critical data, models, vulnerability analyses, and scenarios that managers need to adapt to climate change and alleviate community vulnerability.
- 2) **Rely on sound modeling and analyses**: Seek guidance from State Water Board’s Office of Information Management and Analysis in the selection and the use of relevant climate change data, model outputs and data evaluation service.

<sup>27</sup> The recommended actions highlighted in the text box are based on guidance from State Water Resources Control Board Resolution No. 2017-0012 and the Central Coast Water Board Staff report entitled “Central Coast Region Response to Climate Change”, Agenda Item 6 for the Regular Meeting of December 6-7, 2018.

### 4.11.3 Climate Change Responses Considered

In this section, we discuss potential climate change responses considered for TMDL Implementation. Climate change responses are recommended actions the Central Coast Water Board or other agencies may consider in adaptation and mitigation strategies.

The State Water Resources Control Board (hereafter, State Water Board or SWRCB) has approved a climate change response framework (SWRCB Resolution No. 2017-0012). This framework lays the groundwork for actions the Regional Water Quality Control Boards (Regional Water Boards) and associated state agencies need to implement to support California's ongoing climate leadership.

Here, we rely on the State Water Board's climate change response framework in considering a range of actions the Central Coast Water Board may implement to support TMDL implementation and watershed improvement activities at Pinto Lake. Table 4-4 tabulates relevant climate responses the State Water Board recommends and highlights those actions which may be most applicable to Pinto Lake TMDL implementation.

Table 4-4. Summary of climate change responses required or recommended by SWRCB Resolution No. 2017-0012. Responses expected of Regional Water Boards, and applicability of these actions to the Pinto Lake TMDL Implementation Strategy are highlighted in this table.

Climate Change Responses	SWRCB Resolution No. 2017-0012 Actions Responding to Climate Change Required or Recommended to be Implemented by Regional Water Quality Control Boards (Regional Water Boards) and other Entities	Applicability to the Pinto Lake TMDL Implementation Strategy?
Reduce Greenhouse Gas Emissions	<b>Regional Water Boards</b> are encouraged assess opportunities for reducing methane emissions from landfills through organic waste diversion, and co-digestion at existing or new anaerobic digesters, or through composting, while achieving water quality objectives. Regional Water Boards are also encouraged to identify opportunities to reduce methane emissions from dairies and concentrated animal feeding operations while achieving water quality objectives.	Not applicable – this directive applies to methane emissions from landfills, composting, confined animal facilities.
Water Conservation and Efficiency	<b>No specific action recommended to be implemented by Regional Water Boards.</b> Actions assigned to Office of Research, Planning, and Performance.	Not applicable
Recycled Water	State Water Board (Division of Water Quality) shall coordinate with the <b>Regional Water Boards</b> to make annual reporting of recycled water data a requirement of waste discharge permits and water reclamation requirements.	Not applicable
Storm Water	<b>No specific action recommended to be implemented by Regional Water Boards.</b> Actions are assigned to State Water Board (Division of Water Quality).	Not applicable

Climate Change Responses	<p align="center"><b>SWRCB Resolution No. 2017-0012</b></p> <p align="center"><b>Actions Responding to Climate Change Required or Recommended to be Implemented by Regional Water Quality Control Boards (Regional Water Boards) and other Entities</b></p>	<p align="center"><b>Applicability to the Pinto Lake TMDL Implementation Strategy?</b></p>
Energy Efficiency and Renewable Energy	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Actions assigned to State Water Board Division of Financial Assistance, and Division of Drinking Water.</p>	Not applicable
Improve Ecosystem Resilience	<p><b>Regional Water Boards</b> are encouraged to, update plans, permits, and policies, and coordinate with other agencies to enhance ecosystem resilience to the impacts of climate change, including but not limited to actions that protect headwaters, facilitate restoration, enhance carbon sequestration, build and enhance healthy soils, and reduce vulnerability to and impacts from fires. Staff shall also collaborate with the California Department of Food and Agriculture, CalRecycle, and other agencies to advance carbon sequestration. Regional Water Boards are encouraged to, document climate resilience benefits of ecosystem protection and restoration actions.</p>	<p align="center">Yes – Potentially applicable.</p> <p>Central Coast Water Board will coordinate with relevant agencies to enhance ecosystem resilience in the Pinto Lake catchment.</p>
Improve Ecosystem Resilience	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Actions assigned to State Water Board’s Executive Director.</p>	Not applicable
Improve Ecosystem Resilience	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Actions assigned to State Water Board Office of Information Management and Analysis (OIMA).</p>	Not applicable
Respond to Climate Change Impacts	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Actions assigned to State Water Board Division of Drinking Water (DDW) shall, in consultation with Office of Information Management and Analysis (OIMA).</p>	Not applicable
Respond to Climate Change Impacts	<p>State Water Board staff shall coordinate with the <b>Regional Water Boards</b> and relevant agencies to identify and recommend actions the Water Boards could take for effective permitting of projects to develop new and underutilized water resources, expand surface water and groundwater storage where appropriate, and add operational flexibility to build and enhance resilience to impacts of climate change.</p>	Not applicable at this time
Respond to Climate Change Impacts	<p><b>Regional Water Boards</b> are encouraged to, work with California Department of Forestry and Fire Protection, federal land management, and other relevant agencies to restore and maintain healthy watersheds, reduce vulnerability to catastrophic fires, and support resilience in recovery efforts.</p>	<p align="center">Yes – Applicable.</p> <p>Central Coast Water Board will work with relevant agencies to promote and restore watershed health at Pinto Lake.</p>

Climate Change Responses	<p align="center"><b>SWRCB Resolution No. 2017-0012</b></p> <p align="center"><b>Actions Responding to Climate Change Required or Recommended to be Implemented by Regional Water Quality Control Boards (Regional Water Boards) and other Entities</b></p>	<p align="center"><b>Applicability to the Pinto Lake TMDL Implementation Strategy?</b></p>
Respond to Climate Change Impacts	Division of Water Quality shall work with <b>the Regional Water Boards</b> to evaluate and by July 1, 2018 make recommendations to the State Water Board on the need to modify permits and other regulatory requirements to reduce vulnerability of water and wastewater infrastructure to flooding, storm surge, and sea level rise.	Not applicable
Respond to Climate Change Impacts	When making recommendations on permits and other decisions to protect coastal infrastructure, <u>wetlands</u> , and other near-shore ecosystems, all State Water Board staff shall, and all <b>Regional Water Boards</b> are encouraged to, refer to projections of sea level rise as directed in the most recent Ocean Protection Council Sea-level Rise Guidance Document (emphasis added to wetlands).	Not applicable
Rely on Sound Modeling and Analyses	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Obtain access to relevant climate change data, model outputs and data evaluation services.</p> <p>Actions assigned to State Water Board Office of Information Management and Analysis (OIMA)..</p>	Not applicable
Rely on Sound Modeling and Analyses	OIMA shall assist <b>Regional Water Boards</b> in the selection and the use of relevant climate change data, model outputs and data evaluation services described above.	<p>Yes – Potentially applicable.</p> <p>Central Coast Water Board will coordinate with OIMA in the selection and use of appropriate climate change data and models.</p>
Rely on Sound Modeling and Analyses	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Actions assigned to State Water Board. Division of Water Rights shall identify data needs, and evaluate and make recommendations on regulatory and policy changes regarding the use of models to account for projected impacts of climate change when conducting water availability analyses and shortage analyses.</p>	Not applicable

Climate Change Responses	<p align="center"><b>SWRCB Resolution No. 2017-0012</b></p> <p align="center"><b>Actions Responding to Climate Change Required or Recommended to be Implemented by Regional Water Quality Control Boards (Regional Water Boards) and other Entities</b></p>	<p align="center"><b>Applicability to the Pinto Lake TMDL Implementation Strategy?</b></p>
Funding	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Actions assigned to State Water Board. Office of Public Affairs shall include how Water Boards' actions support climate change mitigation and adaptation policy goals in media material, including press releases and fact sheets, and through media interviews.</p>	Not applicable
Funding	<p>Office of Public Participation (OPP) shall work with <b>Regional Water Boards</b> on the development of multi-lingual educational material for climate change-related actions and initiatives, and shall assist in providing, and support local agencies to provide, information and public outreach on potential climate change impacts to water quality, and options and funding opportunities for adapting to those impacts, including protecting source watersheds, drinking water and wastewater treatment infrastructure.</p>	<p>Yes – Potentially applicable.</p> <p>Lead responsibility is assigned to State Water Board (OPP). Central Coast Water Board will coordinate with OPP as needed on public outreach concerning funding opportunities.</p>
Outreach	<p>OPP shall work with State Water Board divisions and offices, <b>Regional Water Boards</b>, and the USEPA to offer consultation to Tribes and solicit feedback on Tribal needs for addressing climate change and related impacts pertaining to the Water Boards' core functions.</p>	<p>Yes – Potentially applicable.</p> <p>Lead responsibility is assigned to State Water Board (OPP). Central Coast Water Board will coordinate with OPP as needed on soliciting feedback on Tribal needs for addressing climate change.</p>



Climate Change Responses	<b>SWRCB Resolution No. 2017-0012</b> <b>Actions Responding to Climate Change Required or Recommended to be Implemented by Regional Water Quality Control Boards (Regional Water Boards) and other Entities</b>	<b>Applicability to the Pinto Lake TMDL Implementation Strategy?</b>
Outreach	<p>Office of Public Participation (OPP) shall work with State Water Board divisions and offices, and with <b>Regional Water Boards</b> on the development of multi-lingual educational material for climate change-related actions, and shall assist local agencies to provide, information and public outreach on potential climate change impacts to water quality, and options and funding opportunities for adapting to those impacts. Assessment to identify communities most vulnerable to climate change impacts to ensure that those communities have access to information and technical assistance.</p> <p>OPP shall work with State Water Board divisions and offices, <b>Regional Water Boards</b>, and the USEPA to offer consultation to Tribes and solicit feedback on Tribal needs for addressing climate change and related impacts pertaining to the Water Boards' core functions. OPP shall report on its progress annually starting with the 2017-18 Performance Report.</p>	<p>Yes – Potentially applicable.</p> <p>Lead responsibility is assigned to State Water Board (OPP). Central Coast Water Board will coordinate with OPP as needed on public outreach efforts.</p>
Administration	<p><b>No specific action recommended to be implemented by Regional Water Boards.</b></p> <p>Actions assigned to State Water Board and Office of Research, Planning, and Performance, Office of Legislative Affairs.</p> <p>Tracking, reporting, develop performance measures, identify training that support adaptation to climate change.</p>	Not applicable

Text Box 4-6 presents a climate change response framework that is potentially relevant to watershed improvement activities and TMDL implementation for Pinto Lake. This framework is based directly on policy guidance and recommendations from State Water Resources Control Board Resolution No. 2017-0012 and the Central Coast Water Board Staff report entitled “Central Coast Region Response to Climate Change”, Agenda Item 6 for the Regular Meeting of December 6-7, 2018.

[Text Box 4-6. Recommended climate change response framework in the context of TMDL implementation and watershed improvement activities for Pinto Lake.](#)

#### **Climate Change Response Framework**

- 1) **Improve ecosystem resilience:** As appropriate, the Central Coast Water Board should update plans, permits, and policies, and coordinate with other agencies to enhance ecosystem resilience to the impacts of climate change. These include but not limited to actions that protect headwaters, facilitate restoration, enhance carbon sequestration, build and enhance healthy soils, and reduce vulnerability to and impacts from fires. Central Coast Water Board staff shall also collaborate with the California Department of Food and Agriculture, CalRecycle, and other agencies to advance carbon sequestration. The Central Coast Water Board should document climate resilience benefits of ecosystem protection

and restoration actions. The State Water Board also participates in a [multi-agency collaborative effort on Healthy Soils](#) a strategy with both mitigative and adaptive components towards climate change.

- 2) **Responding to climate change impacts, and improve our understanding of the effectiveness of mitigation and adaptation strategies:** Central Coast Water Board will work with relevant public agencies to restore and maintain healthy watersheds, reduce vulnerability to catastrophic fires, and support resilience in recovery efforts. The Central Coast Water Board is considering implementation of new or improved water quality and land use management practices, irrigation efficiency and management, nutrient management, and modernization in irrigated agriculture which may have benefits pertaining to climate response and resiliency.
- 3) **Rely on sound modeling and analyses, track research in key areas, improve our understanding of the effects of climate change:** To inform subsequent decisions which need to take into account climate change, the Central Coast Water Board will coordinate with the Office of Information Management and Analysis in the selection and use of appropriate climate change data and models. We will use best available science to fill gaps in understanding as to how climate change will affect ecosystems, watershed processes, and beneficial uses. We will improve capacity to evaluate groundwater-surface water connections including effects on base flows for aquatic life and the effects of pumping on groundwater-dependent ecosystems.
- 4) **Funding:** The Central Coast Water Board shall work with Office of Public Participation on the development of multi-lingual educational material for climate change-related actions and initiatives, and shall assist in providing, and support local agencies to provide, information and public outreach on potential climate change impacts to water quality, and options and funding opportunities for adapting to those impacts, including protecting source watersheds, drinking water and wastewater treatment infrastructure.
- 5) **Outreach:** Central Coast Water Board staff shall facilitate or participate in engagement with climate change stakeholders through IRWM meetings, Stormwater Resource Plan technical advisory committees, and regional climate collaboratives. Strategically engage with stakeholders to identify additional opportunities and further evolve the Water Board role in implementing adaptation and mitigation strategies such as advancing climate-safe infrastructure, identifying and helping implement regional resilience needs and priorities, and developing contingencies for agency response to large wildfires and floods.
- 6) **Outreach:** As appropriate, the Central Coast Water Board shall work with Office of Public Participation and the USEPA to offer consultation to Tribes and solicit feedback on Tribal needs for addressing climate change and related impacts pertaining to the Water Boards' core functions.
- 7) **Outreach:** As appropriate, the Central Coast Water Board shall work with Office of Public Participation on the development of multi-lingual educational material for climate change-related actions, and shall assist local agencies to provide, information and public outreach on potential climate change impacts to water quality, and options and funding opportunities for adapting to those impacts. Assessment to identify communities most vulnerable to climate change impacts to ensure that those communities have access to information and technical assistance.

## 4.12 Environmental Justice Considerations

In any given TMDL report, there can be both practical and policy-related reasons to consider the human demographics of a watershed. Thus, this section of the report presents information on population, demographics, and socioeconomic factors in and around the Pinto Lake catchment.

It is worth noting that Pinto Lake is an important recreational and aesthetic resource for the socio-economically disadvantaged nearby community of Watsonville.

### Text Box 4-7. Pinto Lake is a resource for economically disadvantaged Watsonville families.

*“The Pinto Lake watershed has two parks located on the lake which serve over 100,000 visitors per year. Many of the visitors are young families from Watsonville’s disadvantaged community.”*

*→ City of Watsonville, Public Works and Utilities Department, Memorandum dated Dec. 10, 2013 and entitled “Application for \$750,000 in Clean Water Act 319H Grant Funds for Pinto Lake”*

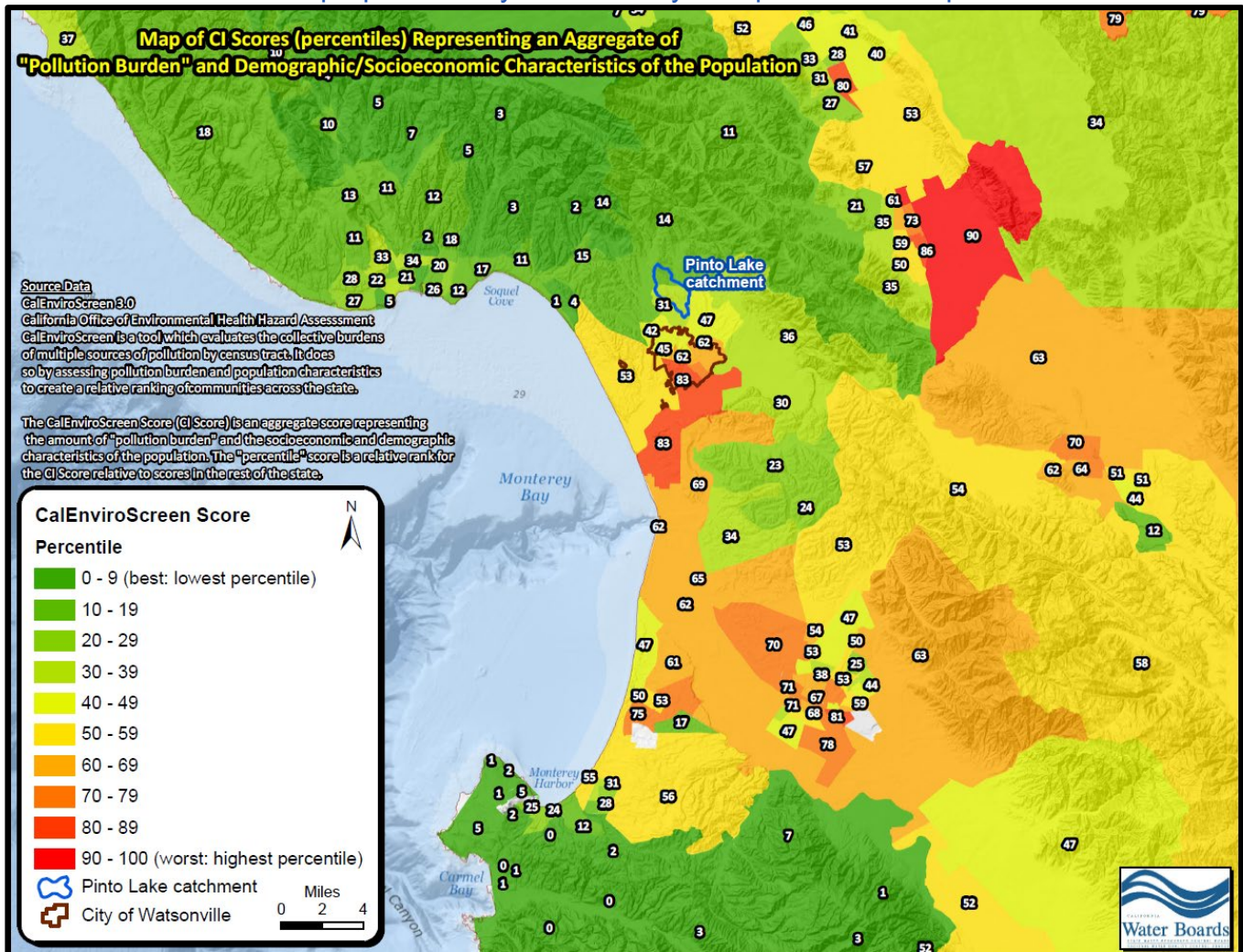
The City of Watsonville is a designated Disadvantaged Community<sup>28</sup> pursuant to [Senate Bill 535](#). Practically speaking, this means the community is characterized by higher levels of poverty, lower household incomes, higher unemployment and other adverse economic indicators relative to other parts of the state.

Further, the City of Watsonville is disproportionately impacted by multiple sources of pollution relative to other areas of the state, according to information from the California Environmental Protection Agency. Watsonville is in the bottom fifth (83<sup>rd</sup> percentile) of the state’s population for communities that are most impacted by economic disadvantage, coupled with disproportionate environmental burden of multiple pollution sources (refer to Figure 4-2).

Therefore, TMDL development with the goal of reducing environmental pollution at Pinto Lake is consistent with the Central Coast Water Board’s objective of integrating environmental justice considerations into our activities and decisions.

<sup>28</sup> A disadvantaged community is defined by the California Environmental Protection Agency for the purpose of SB 535. They are communities with annual household median household incomes that are less than 80 percent of the statewide annual median household income. However, this definition is subject to modification and review, as the state develops ways to better identify disadvantage communities pursuant to SB 535.

Figure 4-2. Map showing CalEnviroScreen scores (percentiles) for the human population of the Monterey Bay area. CalEnviroScreen scores are a screening methodology to help identify communities that are disproportionately burdened by multiple sources of pollution.



In the central coast region, small water systems and domestic wells are especially vulnerable to drought due to shallow water sources, local hydrogeologic conditions, and surrounding land uses. Central Coast Water Board program staff address drinking water vulnerabilities by coordinating with the Division of Drinking Water, county environmental health agencies and non-governmental organizations to implement replacement water and domestic well testing programs.

On January 26, 2017, the Central Coast Water Board adopted Resolution No. R3-2017-0004 directing Water Board staff to implement the Human Right to Water law and protect human health as the top priority. Furthermore, the Central Coast Water Board directed staff to prioritize regulatory programs and activities to prevent and/or address discharges that could threaten human health by causing or contributing to pollution or contamination of drinking water sources of waters of the state.

It is worth noting that the Central Coast Water Board has already taken steps to prioritize environmental justice in the framework of TMDLs and grant funding for the City of Watsonville.



*“As part of a competitive ranking and selection process, the Pinto Lake Planning Grant (#10-443-553 for \$125,000) and the Pinto Lake Restoration Project (Grant #14-424-253 for \$750,000) received scoring criteria points specific to the project benefitting a disadvantaged community. In addition, the grantees were not required to provide the 25% minimum matching funds for the 319(h) grant award. Pinto Lake is a priority given the severity of water quality impairments and impacts to associated beneficial uses by a community which is disadvantaged.”*

*→ Katie McNeill, Central Coast Water Board staff, grants coordinator, personal communication July 29, 2019.*

Text Box 4-8 presents a framework for implementing the Human Right to Water law in the central coast region. This framework provides guidance and actions Central Coast Water Board staff must take in the drafting and execution of any regulatory actions, permits, and grant approvals that may occur in the Pinto Lake watershed. The proposed Pinto Lake TMDL addresses the Human Right to Water by taking into consideration human health in the protection and restoration of water resources at Pinto Lake.

[Text Box 4-8. Framework to implement the Human Right to Water law in the context of Pinto Lake TMDL implementation.](#)

#### **Framework for Implementing the Human Right to Water law**

On January 26, 2017, the Central Coast Water Board adopted Resolution No. R3-2017-0004 directing Water Board staff to implement the Human Right to Water law and protect human health as the top priority. Furthermore, the Central Coast Water Board directed staff to prioritize regulatory programs and activities to prevent and/or address discharges that could threaten human health by causing or contributing to pollution or contamination of drinking water sources of waters of the state. The questions presented below are intended to assist regulatory program managers and technical staff to evaluate if they have sufficiently addressed the human right to water, consistent with R3-2017-0004. In addition, draft findings are provided to assist staff in documenting how they have implemented the human right to water in their permit, order, TMDL, or grant project.

1. Does permit, order, or regulatory activity address discharges of waste that cause or contribute to pollution that affects the drinking water of individuals or communities?
2. Does permit, order, or regulatory activity address discharges of waste that cause or contribute to pollution that affects the drinking water of individuals or communities?
3. Do discharges of waste result in individuals or communities having to treat their drinking water or use replacement water to reduce risk to public health?
4. Does permit, order, or regulatory activity require the discharger to remove or remediate source of pollution?
5. Does permit, order, or regulatory activity regulate discharges of waste to limit waste loading to drinking water sources?
6. Does permit, order, or regulatory activity include a time schedule for drinking water to achieve relevant water quality standards?
7. Does permit, order or regulatory activity require monitoring of drinking water wells?
8. Does permit, order or regulatory activity require direct notification to drinking water users in cases where drinking water wells are impacted by pollution?
9. Does permit, order, or regulatory activity minimize impediments to data access, and



maximize the public accessibility of data and information regarding drinking water quality and sources of pollution?

10. Does permit, order, or regulatory activity provide any assistance to individuals or communities whose drinking water is affected by discharges of waste (e.g. provision of replacement water or funding assistance for testing or treatment)?
11. Does permit, order, or regulatory activity include any actions to monitor or address adverse water quality impacts from homeless encampments (e.g. minimizing trash and human waste from discharging to waters of the State)?
12. Does permit, order, or regulatory activity include any actions that improve access to drinking water or sanitation for homeless individuals or encampments?
13. Did staff identify disadvantaged communities (DACs) or homeless encampments that may be affected by this permit, order, or regulatory activity?
14. Did staff conduct outreach to DACs and other stakeholders and provide meaningful opportunity for individuals and communities that lack adequate, affordable, or safe drinking water, to provide meaningful input and participate in the decision-making process related to this permit, order, or regulatory action?

#### 4.13 How We Will Evaluate TMDL Implementation Progress

Measures of TMDL implementation progress may not necessarily be limited to receiving water column concentration-based metrics and/or time-weighted average concentrations of water column pollutants.

Therefore, the approach proposed in this TMDL project is to strive for pollutant load reduction strategies while continuing to collect additional data on receiving water concentrations, and recognizing that there may not always be a direct linkage between mass-based load reductions and in-lake or in-stream concentrations of pollutants in grab samples. Regardless of the short or intermediate-term effects on in-lake and instream pollutant concentrations, pollution control efforts, such as improved nutrient and irrigation management, will ultimately have environmental and water quality benefits.

In recognition of the uncertainties highlighted above, other metrics that can provide insight on interim progress to reduce nutrient pollution may be utilized, for example:

- assessments of phosphorus mass-based load reductions (e.g., tons of pollutant load reduced per year);
- improvements in flow-weighted concentrations;
- estimates of the scope and extent of implementation of improved management practices capable of ultimately achieving load allocations;
- improvements in receiving water nutrient-response indicators (i.e., dissolved oxygen, chlorophyll *a*, microcystins), independent of nutrient concentrations.

Water Board staff may conclude in future reviews that ongoing implementation efforts may be insufficient to ultimately achieve the allocations and numeric targets. If this occurs, Water Board staff will recommend revisions to the implementation plan. Water Board staff may conclude and articulate in the reviews that implementation efforts and results are likely to result in achieving the allocations and numeric target, in which case existing and anticipated implementation efforts should continue. If allocations and numeric targets are being met, Water Board staff will recommend the waterbody be removed from the 303(d) List.

## 4.14 TMDL Achievement & Future Delisting Decisions

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Achieving phosphorus reductions and toxicity water quality objectives of the scale identified in this TMDL and in a residential and agricultural watershed is necessarily subject to uncertainties.

Staff maintains it is prudent to allow for flexibility, adaptation, and re-assessment as appropriate. It also should be noted that immediate compliance with water quality objectives are not contemplated or required by TMDLs. Staff are proposing interim waste load and load allocations and benchmarks, and periodic re-consideration of the TMDL and appropriateness of the biostimulatory numeric water quality targets based on new research and information.

In terms of ultimately assessing TMDL achievement in waterbodies, evaluating exceedances of TMDL numeric targets identified herein and assessing future de-listing decisions to remove waterbodies from the CWA section 303(d) List, staff will use the de-listing criteria and methodologies identified in Section 4 (California Delisting Factors) of the State Water Resources Control Board's *Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List* (i.e., "Listing Policy", State Water Board, 2004), or as consistent with any relevant revisions of the Listing Policy promulgated in the future pursuant to Government Code section 11353.

## 4.15 Success Stories, Case Studies, & Existing Implementation Efforts

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Protecting California's water resources depends on the proactive engagement of citizens, land owners, public agencies, researchers, and businesses. Proactive efforts by citizens in the Pinto Lake catchment that may result in improved water quality protection are commendable and should be recognized. In addition, the Central Coast Water Board is not simply limiting its activities to administrative functions associated with developing a TMDL Report and Basin Plan amendment. This section also reports on our recent regulatory and enforcement activities in the lake catchment.

### 4.15.1 Pinto Lake 319(h) grants

Beginning in 2010, Planning and Assessment Grant #10-443-553 funded efforts of the City of Watsonville and the Santa Cruz RCD to identify the main source of nutrients, create a consistent dataset of cyanobacteria bloom development and toxicity in relation to lake nutrient and temperature dynamics, and prioritize necessary management measures and outreach activities. Within the Pinto Lake sub-watershed, the assessment showed that in-lake sediments account for approximately 85% of nutrient loads to Pinto Lake. Seasonal runoff from the watershed contributes approximately 15% of nutrient loads from a combination of agricultural operations, residential septic systems, and erosion of phosphorus-rich sediment.

The City of Watsonville (grantee) received a 319(h) implementation grant<sup>29</sup> for \$750,000 to reduce pollutant loads and restore Pinto Lake. The primary goal of the grant is to apply aluminum sulfate (alum) to Pinto Lake. The alum settles to the bottom of the lake and binds to the phosphorus in the lake sediment reducing the amount of phosphorus available to fuel cyanobacteria blooms. The other goal is to implement two sediment reduction practices in the watershed.

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<sup>29</sup> The title of the 319(h) grant is "Pinto Lake Restoration Project" and the agreement no. is 14-424-253.

[HAB Aquatics Solutions](#) (subcontractor to the City of Watsonville) applied alum to Pinto Lake the first week of April 2017. Alum was applied to the lake in order to bind with phosphorus at the lake's bottom. Harmful algal blooms in lakes nationwide are often due to excess phosphorus concentrations. In Pinto Lake, data indicates as much as 80% of the phosphorus in lake originates from lake sediments (Ketley, et al., 2013). With much of the phosphorus bound to the alum applied in April 2017, cyanobacteria blooms and associated toxicity have been reduced since the alum application. See Figure 4-3 for a photo of the barge applying alum to the lake. Central Coast Water Board staff developed a [Report Card](#) summarizing the lake's phosphorus data since the alum treatment.

Figure 4-3. Photo: HAB Aquatics applies alum to Pinto Lake, April 6, 2017 (photo credit Catherine Bosley, HAB Aquatics).



Robert Ketley (director Resource Conservation District of Santa Cruz County) reported in a personal communication of August 2019 that after the alum treatment and improved water clarity at Pinto Lake, aquatic macrophytes are returning to some areas which had been inhospitable to them (see Figure 4-4).

*“Pinto now has some decent aquatic macrophytes. I spotted some small patches of elodea by the City Park, and talked to one of the regular bass anglers who said there were loads of them on the East side of the lake. Turns out they were Eurasian millfoil, an invasive species, but macrophytes nonetheless. They are visible from the surface, but I think the attached photo of my depth finder gives a better idea of just how large they are. The top of this specimen was visible on the surface, but it's rooted in 7 feet of water! It seems the alum treatment provided enough water clarity to allow them to establish in areas where the bottom had hitherto been nothing but mud. Not enough to out compete the cyanos for nutrients, but an encouraging sign.”*

→ Robert Ketley, director Resource Conservation District of Santa Cruz County, in an email communication to Central Coast Water Board staff dated August 2, 2019.

Figure 4-4. Depth finder image of aquatic macrophytes establishing on the lake bed in areas previously inhospitable to them due to poor water clarity, and cyanobacteria blooms (photo credit: Robert Ketley).



Since historic loading from the watershed is responsible for the present day in-lake phosphorus load the grant also focused on implementing sediment other reduction practices in the catchment. Since phosphorus binds to sediment, reducing sediment input into Pinto Lake should reduce phosphorus loading. These sediment control practices focused on reducing sediment runoff from roads. Contractors installed 5 rolling dips, and 40 linear feet of drainage swale, and repaired exiting ruts on the road prior to grading and installing 950 ft<sup>2</sup> of Class II aggregate road base. This project is located adjacent to Amesti Creek at the northeast boundary of Pinto Lake Park. According the Santa Cruz RCD, the road improvements prevented 13.54 tons of sediment from entering Pinto Lake in rainy season 2016-2017 (email Santa Cruz RCD, May 31, 2017). See Figure 4-5 for photos.



Figure 4-5. Photos adjacent to Amesti Creek, before and after implementation.



Before: Note the downcutting observed prior to implementation. Photo credit, Lisa Lurie, Santa Cruz RCD as submitted in item A.B.4.2, 1/19/2017.



After: Post implementation. Rolling dips in action: moving water off road to inhibit downcutting. Photo credit, Emma Pickering, City of Watsonville as submitted in item A.B.4.2, 1/19/2017.

The second road sediment control practice involves installing three reverse-grade dips and 72 linear feet of drainage swale at a location locally known as the “Virgin Mary Shrine” within the Pinto Lake park. The project also includes the installation of road surfacing of approximately 2,500 square feet of Class II aggregate road base. Stabilizing this roadway that erodes during the rainy season will reduce sediment runoff from entering Pinto Lake. This project was completed by the end of 2017. According to the City of Watsonville, the road dips eliminated runoff from the Pinto Lake County Park into Amesti Creek (City of Watsonville, 2018). Reportedly, total phosphorus concentrations in Amesti Creek were reduced by 66% as a result of sediment control practices (City of Watsonville, 2018).

The City of Watsonville, along with the Resources Conservation District of Santa Cruz, put together a brochure that describes the toxic algal blooms that occur in Pinto Lake and what individuals can do to help address this problem. Management measures for farmers, ranchers, and homeowners were included in this brochure. Brochures will be distributed at four watershed stakeholder meetings that highlight erosion control, nutrient management, and septic tank maintenance. These meetings were held in 2017. The brochures are in English and Spanish.

#### **4.15.2 Proposition 84 Water Quality Grant**

This Agricultural Water Quality Grant (#13-515-553) funded practices throughout the Pajaro watershed, including the construction of a sediment retention basin in the watershed draining to Pinto Lake in Fall 2016. The constructed sediment basin captures agriculturally derived stormwater and return flows from multiple farms, allowing sediment and sediment-bound phosphorus to settle out of suspension prior to the water being discharged downstream (see Figure 4-6). The goal of the sedimentation basin was to reduce sediment and nutrient loads by 25%. Monitoring results after installation of the sedimentation basin showed reductions of 8% of the total suspended solids (TSS), 4% of the phosphorus (as P), and 22% of the total kjeldahl



nitrogen (TKN). The sedimentation basin treats 21 acres in the watershed, with 18 of those acres from irrigated agriculture.

Figure 4-6. Constructed sediment basin captures agriculturally derived stormwater and return flows from multiple farms near Pinto Lake (photo credit: City of Watsonville and the RCDSCC).



As their discussion notes (page 18) the low percent removal may be because the sedimentation basin was installed in November 2016 and there was not a chance for the vegetation to become established. It is possible that the Resources Conservation District will see more effective removal rates next rainy season. The District will continue to work with Santa Cruz County Parks to adaptively manage and evaluate the effectiveness of the CCC Sediment Basin. Additionally, the Resources Conservation District will work with Santa Cruz County Parks to track sediment removal from the system over time. Current estimations state that the sedimentation basin should prevent 63.45 tons of sediment from loading to the lake each year (email Santa Cruz RCD, May 2017).

#### ***4.15.3 Irrigated Lands Agricultural Order***

Central Coast Water Board staff prioritized the Pinto Lake catchment as a high priority for verifying enrollment in the Agricultural Order in part, because the Pinto Lake area received 319(h) grant funds. Staff visited the area in order to identify any potential operations that were not enrolled in the Agricultural Order that should be. On June 8, 2017 and on July 21, 2017, staff issued letters to ten operations that were not enrolled in the Agricultural Order (one letter on June 8 and nine letters on July 21<sup>st</sup>). As a result of these actions, several growers in the watershed were enrolled in the Agricultural Order and received regulatory coverage.

#### ***4.15.4 Stormwater***

Central Coast Water Board staff issued a Notice of Violation to Sun-Land Garden Products in March of 2017. Sun-Land Garden Products responded to the notice and submitted a technical report in May 2017. Their technical report addressed the deficiencies identified.

## 4.16 Cost Estimates

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### 4.16.1 Preface

Note that in the case of this TMDL, impairments due to exceedances of *existing* State water quality objectives are being addressed. Although the State must consider a variety of factors in establishing the different elements of a TMDL, considering the economic impact of the required level of water quality is not among them. The State Water Board Office of Chief Counsel notes that the economic impact was already previously determined when the water quality standard was adopted<sup>30</sup> consistent with Porter-Cologne Act section 13241 and pursuant to the basin planning process. The statutory directive under the federal Clean Water Act to adopt TMDLs to “implement the applicable water quality standards” is not qualified by the predicate “so long as it is economically desirable to do so.” This conclusion is not altered when a TMDL is established to implement a narrative water quality objective (State Water Board, Office of Chief Counsel, 2002). Therefore, not only would an in-depth economic analysis be redundant, it would be inconsistent with federal law (State Water Board, Office of Chief Counsel, 2002). Further, the State Water Board Office of Chief Counsel states that under the Porter-Cologne Act section 13141 (i.e., implementation of agricultural water quality control programs), the Regional Boards “are not required to do a formal cost-benefit analysis” under the statute. This statute focuses only on costs and financing sources (State Water Board, Office of Chief Counsel, 1999).

### 4.16.2 Cost Estimates for Irrigated Agriculture

In accordance with section 13141 of the Porter-Cologne Act, prior to implementation of any agricultural water quality control program the Water Boards are required to estimate the *total* cost of such a program and potential sources of funding (see 0 for an outline of potential funding sources). It should be noted that the statute does not require the Water Boards to do, for example, a cost-benefit analysis or an economic analysis (refer back to Section 4.16.1).

Load allocations for irrigated cropland are proposed to be implemented using an existing regulatory tool – the Agricultural Order or future permits regulating discharges from irrigated agriculture. As such, the extent this TMDL would incur incremental costs – if any – above and beyond what is already required in the Agricultural Order is necessarily subject to significant uncertainty.

Further, it should be recognized that implementation measures to reduce nutrient pollution from irrigated agriculture are already required in the Pinto Lake catchment by compliance with an existing regulatory program [Agricultural Order No. R3-2017-0002 or future permits regulating discharges from irrigated agriculture. Compliance with these implementation measures is required *with or without* the TMDL and is therefore not dependent on TMDL approval. As outlined in Section 4.3, this TMDL is relying on the Agricultural Order (the existing order and any replacements) for TMDL implementation, and this TMDL is not proposing the adoption of additional regulatory requirements for irrigated cropland. To a significant extent, the proposed TMDL can be considered an informational tool to focus and facilitate implementation and assist the Central Coast Water Board in making its plan to implement State water quality standards.

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<sup>30</sup> State Water Resources Control Board, Office of Chief Counsel, memo June 12, 2002: “*The Distinction Between a TMDL’s Numeric Targets and Water Quality Standards*”

Also noteworthy, the cost estimates in TMDLs do not require economic cost-benefit analysis (see section 13141 of the Porter-Cologne Act; and State Water Board, Office of Chief Counsel, 1997). These estimates thus constitute gross expenses which do not contemplate potential net cost-savings associated with TMDL implementation measures (for example long-term savings associated with improved irrigation and nutrient efficiency).

In addition, some of the implementation costs likely will not constitute direct out-of-pocket expenses to growers, as the state and federal government have made funding sources, incentive payments, and grants available to address nonpoint sources of pollution and to implement TMDL. For example, recently just one grant funding source (i.e., the Proposition 50 Agricultural Water Quality Grant Program) made \$1,250,000 available to assist growers with irrigation and nutrient management in the Pinto Lake catchment.

Indeed, the State Water Board issued a Water Quality Order explicitly concluding that generally, TMDL implementation does not incur additional costs above and beyond what is already in the Agricultural Order:

*“[A] discharger’s implementation of the Agricultural Order will constitute compliance with certain applicable TMDLs. In other words, the TMDL provision does not lead to any costs above and beyond what is already required by the Agricultural Order. In addition, the Agricultural Order is simply the implementation vehicle for TMDL compliance\* – it does not require dischargers to do anything more than would be required of them under the applicable TMDLs”*

*\* emphasis added*

*From: California State Water Resources Control Board, Draft Water Quality Order, Change Sheet #1 (Circulated 09/19/12) In the Matter of the Petitions Of Ocean Mist Farms And Rc Farms; Grower-Shipper Association Of Central California, Grower-Shipper Association Of Santa Barbara And San Luis Obispo Counties, And Western Growers For Review of Conditional Waiver of Waste Discharge Requirements Order No. R3-2012-0011 Discharges from Irrigated Lands*

Cost estimates to comply with the existing Agricultural Order have previously been developed (Central Coast Regional Water Quality Control Board, 2011). It should be noted that these were scoping level assessments because it is difficult to estimate precise costs in the absence of information about the current extent of management practices implementation, and how the costs of the Agricultural Order would represent incremental increases above current costs. Water Board Agricultural Program staff therefore applied best professional judgment and conservative assumptions in constructing an estimate of total cost for management practice implementation for the Agricultural Order. The assumptions and information that went into developing the Agricultural Order cost estimates can be found in: *Central Coast Regional Water Quality Control Board. 2011. Technical Memorandum: Cost Considerations Concerning Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands; in: Appendix F – Staff Recommendations for Agricultural Order (March, 2011)*. Table 4-5 presents the cost estimates to implement the Agricultural Order throughout the entire Central Coast Region.

Table 4-5. Cost estimates to implement Agricultural Order for central coast region (2011).

Management Practice Category	Area Basis (Acres)	Acres/ Operation	Acres	Correction Factor	Acres Practice Applied to:	Cost/Acre <sup>d</sup>	Cost Year 1	% Year 1 Cost in Yrs 2-4	Cost Years 2-4	Cost 5 Years
<b>Sediment / Erosion Control &amp; Stormwater Management</b>	Total irrigated farm acreage <sup>a</sup>	NA	539,284	5%	26,964	\$992	\$26,748,486	25%	\$26,748,486	\$53,496,973
<b>Irrigation Management</b>	Operations with tailwater <sup>b</sup>	NA	74,121	50%	37,061	\$903	\$33,465,632	10%	\$13,386,253	\$46,851,884
<b>Nutrient &amp; Salt Management</b>	Total Vegetable Crop acreage <sup>c</sup>	NA	444,443	20%	88,889	\$56	\$4,977,762	25%	\$4,977,762	\$9,955,523
<b>Pesticide Runoff / Toxicity Elimination</b>	102 Operations on toxicity impaired streams	20	2,040	50%	1,020	\$72	\$73,440	50%	\$146,880	\$220,320
<b>Aquatic Habitat Protection</b>	10 Large Operations on temp. & turbidity impaired streams	1,000	10,000	50%	5,000	\$1,184	\$5,920,000	10%	\$2,368,000	\$8,288,000
							<b>One Year</b>	<b>\$71,185,320</b>	<b>Five Years</b>	<b>\$118,812,700</b>
							<b>Per Operation</b>	<b>\$23,728</b>	<b>Per Operation</b>	<b>\$39,604</b>

<sup>a</sup> State Farmland Mapping Program (FMMP) data consists of farmland classifications that include Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance.

<sup>c</sup> Total Vegetable Crop acreage from County Crop Reports, Table 12. Staff assumed these crops have high potential to discharge nitrogen to groundwater.

<sup>b</sup> Amount of irrigated acreage that has tailwater and is enrolled and active. Source: Central Coast Regional Water Quality Control Board Agricultural Regulatory Program Database, December 2009. While the number of operations is dynamic, staff has not made a broad effort to verify the accuracy of reported irrigated acreage and tailwater acreage. Growers can continually update their irrigated acreage and tailwater acreage to reflect seasonal growing changes. The Water Board officially requested acreage updates in 2007 and 2008.

<sup>d</sup> Median of high end of cost range/acre, or, unit cost/acre, whichever is higher from Table 5.

Staff endeavored to estimate incremental costs associated with implementing the proposed TMDLs, by using the cost estimate information in Table 4-5. Accordingly staff scaled acreage in Table 4-5 requiring implementation down to the scale of the Pinto Lake catchment. These scalar modifications are presented in Table 4-6.

Table 4-6. Farmland acreage and correction factors for Central Coast Region and Pinto Lake catchment.

	Amount of farmland <sup>A</sup> (acres)
Central Coast Region (Region 3)	738,429
Pinto Lake catchment	1,467
Farmland Acreage Ratio: Farmland in Pinto Lake catchment compared to all of Region 3	0.2% Ratio of the area of Pinto Lake catchment compared to all of Region 3

<sup>A</sup> source: DWR Farmland Mapping and Monitoring Program, 2014

Based on geographically scaling the 2011 Agricultural Order's regional compliance costs estimates to the scale of the Pinto Lake catchment, as outlined above, Table 4-7 presents the estimated compliance costs associated with the Agricultural Order that may be incurred for farmland within the Pinto Lake catchment

Table 4-7 illustrates estimated summed costs are that are associated with compliance with the Agricultural Order, plus incremental costs potentially attributable to TMDL implementation.

**Table 4-7. Cost estimates associated with Agricultural Order compliance and nutrient TMDL implementation in the Pinto Lake catchment (2011 dollars).**

Management Practice Category	Area Basis (Acres) <sup>A</sup>	Acres	Correction Factor <sup>B</sup>	Acres Practice Applied to:	Cost per Acre	Cost - Year 1 of TMDL Implementation	% Year 1 Cost in Yrs 2-5	Cost Years 2-5	Compliance Cost 5 Years
<b>Irrigation Management</b>	0.2% of corresponding acreage from Table 4-5	147	50%	74	\$903	\$66,822	10%	\$26,729	\$93,551
<b>Nutrient Management</b>	0.2% of corresponding acreage from Table 4-5	883	20%	176	\$56	\$9,856	25%	\$9,856	\$19,712
<b>Aquatic Habitat Protection</b>	0.2% of corresponding acreage from Table 4-5	20	50%	10	\$1,184	\$11,840	10%	\$615,680	\$4,736

<sup>A</sup> The 0.2% fraction in this column is the ratio (%) of farm acres in the Pinto Lake catchment to farm acres in all of the central coast region.

<sup>B</sup> Correction factors are an estimate of the ratio of irrigated acres that might be subject to actual management to reduce pollutant discharges

Based on the information presented in Table 4-7, the total costs associated with Agricultural Order compliance and TMDL implementation for a period of five years is approximately 12 million dollars. As discussed previously, this estimate is subject to significant uncertainty, however staff endeavored to use available information to develop these estimates in an effort to inform the interested public and decisions makers.

Based on information in the 2011 technical documentation for the Agricultural Order and information developed in this section, an estimated cost attributable to compliance with the Agricultural Order and TMDL implementation in the Pinto Lake catchment over 5 years is approximately **\$118,000**. This represents an estimated average unit-area gross cost of **\$74 per acre of farmland\* per year** (2011 dollars) in the Pinto Lake catchment over a period of five years of TMDL implementation.

\* as represented by the Calif. Dept. of Water Resource's 2010 farmland mapping and monitoring spatial dataset

#### **4.16.3 Cost Estimates of BMPs for MS4 Entities**

Anticipating incremental costs attributable specifically to TMDL implementation with any accuracy is challenging for several reasons. Many of the actions, such as review and revision of policies and ordinances by a governmental agency, could incur no significant costs beyond the



program budgets of those agencies. However, other actions, such as establishing nonpoint source implementation programs and establishing assessment workplans carry discrete costs.

Cost estimates are further complicated by the fact that some implementation actions are necessitated by other regulatory requirements (e.g., Phase II Stormwater) or are actions anticipated regardless of whether or not the TMDL is adopted. Therefore assigning all of these costs to TMDL implementation would be inaccurate. It also is important to note that reported MS4 program costs are not all attributable to compliance with MS4 permits. Many program components, and their associated costs, existed before any MS4 permits were issued. For example, street sweeping and trash collection costs cannot be solely or even principally attributable to MS4 permit compliance, since these practices have long been implemented by municipalities. Therefore, true program cost resulting from MS4 permit requirements is some fraction of reported costs,

Guidance and information on preparing scoping-level cost estimations were provided to staff by Brandon Steets, P.E. of Geosyntec Consultants. Geosyntec Consultants is an engineering firm with substantial experience assisting MS4 entities in California with TMDL implementation. Estimated BMP capital and O&M costs are available in Technical Appendix C of the Strategic BMP Planning and Analysis Tool (SBPAT)<sup>31</sup>. SBPAT is a public domain, water quality analysis tool intended to facilitate the selection of BMP project opportunities and technologies in urban watersheds. These estimated unit BMP capital costs and annual maintenance costs are presented in Figure 4-7 and Figure 4-8, respectively. These tables are from the SBPAT technical Appendix C.

Unit-area costs are based on cost per treated acre for a specific management practice. It would be highly speculative for staff to identify what percentage of the area of the MS4 footprint would require implementation, and what percentage of this area will receive implementation with or without a TMDL, due to permits which exist independent of the TMDL and/or other ongoing environmental projects. Implementation over 100% of the MS4 footprint is clearly impractical and cost-prohibitive. Implementation will undoubtedly be focused on areas or land uses that are identified as water quality risks and require implementation. Therefore, it is presumed that implementation, on a unit-area basis, will occur over catchment areas that are substantially smaller than the footprint of the MS4.

Geosyntec consultants suggested that for urban nutrient pollution control, Water Board staff should primarily focus on unit-area costs associated with bioretention and wetland treatment strategies (refer again to Figure 4-7 and Figure 4-8). Some these management strategies could represent entirely new practices associated with TMDL implementation that might not occur under existing permit requirements or as associated with other non-regulatory watershed improvement projects. Therefore, some unit-area costs potentially associated with strategies to implement the TMDL can be estimated. This approach is consistent with legal guidance from the State Water Resources Control Board's Office of Chief Counsel, whom have stated that economic considerations in a TMDL should determine: 1) what methods of compliance are reasonably foreseeable to attain the allocations; and 2) what are the costs of these methods (State Water Board, 1999b).

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<sup>31</sup> Online linkage: <http://www.sbp.at.net/>

Figure 4-7. Estimated unit BMP capital costs by design volume, flow rate, and footprint area (2008 dollars).

	Best Management Practice	Reference Catchment Size (acres)	Normalized Capital Cost \$ / ac-ft	Normalized Capital Cost \$ / cfs	Normalized Capital Cost \$ / ft <sup>2</sup>
<b>Distributed</b>	Cisterns	1	\$122,000 - \$203,000	NA	NA
	Bioretention	1	\$361,000 - \$602,000	NA	\$3.80 - \$6.30
	Vegetated Swales	10	NA	\$12,600 - \$21,000	\$5.30 - \$8.90
	Green Roofs	1	\$3,490,000 - \$5,800,000	NA	\$20 - \$35
	Permeable Pavement	1	NA	\$153,000 - \$255,000	\$3.00 - \$5.00
	Gross Solids Separators	10	NA	\$50,000 - \$84,000	NA
	Catch Basin Inserts	10	NA	\$5,400 - \$9,000	NA
	Media Filters	10	NA	\$47,000 - \$78,000	NA
<b>Regional</b>	Infiltration Basins	100	\$58,000 - \$97,000	NA	\$3.30 - \$5.50
	Dry Detention Basins	100	\$32,000 - \$54,000	NA	\$1.80 - \$3.00
	SSF Wetlands	100	NA	\$140,000 - \$233,000	NA
	Constructed SF Wetlands	100	\$36,000 - \$48,000	NA	\$1.80 - \$3.00
	Treatment Plants	100	NA	\$400,000 - \$670,000	NA
	Hydrodynamic Devices	100	NA	\$50,000 - \$84,000	NA
	Channel	100	NA	NA	\$1.80 - \$3.00
	Naturalization	100	NA	NA	\$1.80 - \$3.00

Figure 4-8. Estimated unit BMP annual maintenance costs by design volume, flow rate, and footprint area (2008 dollars).

	Best Management Practice	Reference Catchment Size (acres)	Normalized Annual Maintenance Cost \$ / ac-ft	Normalized Annual Maintenance Cost \$ / cfs	Normalized Maintenance Cost \$ / ft <sup>2</sup>
Distributed	Cisterns	1	\$1,400 - \$2,300	NA	NA
	Bioretention	1	\$7,300 - \$12,200	NA	\$0.08-\$0.13
	Vegetated Swales	10	NA	\$200 - \$300	\$0.85-\$1.40
	Green Roofs	1	\$6,500 - \$10,900	NA	\$0.04-\$0.06
	Permeable Pavement	1	NA	\$300 - \$400	\$0.01-\$0.02
	Gross Solids Separators	10	NA	\$20 - \$40	NA
	Catch Basin Inserts	10	NA	\$1,300 - \$2,200	NA
	Media Filters	10	NA	\$6,500 - \$10,900	NA
Regional	Infiltration Basins	100	\$1,200 - \$1,900	NA	\$0.07 - \$0.11
	Dry Detention Basins	100	\$300 - \$500	NA	\$0.02 - \$0.03
	SSF Wetlands	100	NA	\$1,600 - \$2,700	NA
	Constructed SF Wetlands	100	\$1,100 - \$1,800	NA	\$0.05 - \$0.09
	Treatment Plants	100	NA	\$500 - \$800	NA
	Hydrodynamic Devices	100	NA	\$20 - \$40	NA
	Channel Naturalization	100	NA	NA	\$0.02 - \$0.03

Therefore, for implementation of these TMDLs by MS4 entities, a range of unit costs to implement bioretention and vegetated and wetland treatments strategies are estimated to range as shown in Table 4-8.

Table 4-8. Unit costs for MS4 TMDL implementation (2008 dollars)

Implementation Strategy Methods	Costs of Method
SSF wetlands (subsurface flow wetlands)	<ul style="list-style-type: none"> <li>➤ Estimated Normalized Capital Costs (\$/cfs): \$140,000 - \$233,000 (\$/cfs) to treat 100 acres of catchment size.</li> <li>➤ Estimated Annual Maintenance Cost (\$/cfs): \$1,600 - \$2,700 (\$/cfs) to treat 100 acres of catchment size.</li> </ul>
Constructed SF wetlands (surface flow wetlands)	<ul style="list-style-type: none"> <li>➤ Estimated Normalized Capital Costs (\$/ft<sup>2</sup>): \$1.80 - \$3.00 (\$/ft<sup>2</sup>) to treat 100 acres of catchment size.</li> <li>➤ Estimated Annual Maintenance Cost (\$/ft<sup>2</sup>): \$0.05 to \$0.09 (\$/ft<sup>2</sup>) to treat 100 acres of catchment size.</li> </ul>
Channel Naturalization	<ul style="list-style-type: none"> <li>➤ Estimated Normalized Capital Costs (\$/ft<sup>2</sup>): \$1.80 - \$3.00 (\$/ft<sup>2</sup>) to treat 100 acres of catchment size.</li> <li>➤ Estimated Annual Maintenance Cost (\$/ft<sup>2</sup>): \$0.02 to \$0.03 (\$/ft<sup>2</sup>) to treat 100 acres of catchment size</li> </ul>

## 4.17 Stakeholder-Suggested Management Measures

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The purpose of this section is to present watershed management measures stakeholders have provided as suggestions to improve environmental conditions at Pinto Lake. If warranted, these management measures could be taken into consideration by implementing parties.

Much of the watershed is covered by clay soils with high erodibility. This combination of factors significantly limits the effectiveness of most sediment capture practices and can make erosion control practices much more challenging. Controlling phosphorous will likely be easier and more cost-effective at some locations, such as those where the land is flat and soils are protected by structures such as hoop houses. For exposed row crops, especially for those grown on sloped sites, it seems unlikely that an 85% reduction is possible. This would seem to suggest that a phosphorous trading system within the watershed may be advantageous.

The 2017 alum application was very effective, but may not be enough to achieve and maintain the microcystin numeric target for the next 5 years or beyond. As HAB Aquatics have indicated, additional alum application(s) may be necessary. The recommended light springtime applications of alum seems like a potentially cost effective option.

There is a potential for disturbance of the alum layer by carp feeding on the lake bed, potentially impacting the benefits of any future applications. A biennial assessment of carp populations and, if necessary some form of carp population control, would help maximize the effectiveness of additional alum applications.

It should be noted that other cyanotoxins (such as Anatoxin A) have been detected in Pinto Lake and these can also be a significant health hazard. It is possible controlling for microcystin will also control for other cyanotoxins, but this is not certain. Some monitoring for other cyanotoxins should be considered.

High internal phosphorous loadings suggest that cyanobacteria blooms will continue to be a problem at Pinto Lake. As such, additional in-lake measures will be required. While periodic alum applications are an obvious way to achieve this goal, other measures could be explored.

There have been a number (positive) shifts in the lake biota following the 2017 alum application. Increased light penetration has resulted in significant increases in benthic filamentous algae and large stands of macrophytes such as Coontail (*Cerostophyllum demersum*) and Canadian pond weed (*Elodea Canadensis*). In addition, the springtime cyanobacteria blooms have been largely replaced by prolific diatom and zooplankton blooms. These blooms have, in turn, resulted in noticeably larger schools of black crappie (*Pomoxis nigromaculatus*) and golden shiners (*Notemigonus crysoleucas*), which are heavily predated by herons, cormorants, grebes and gulls.

This means that a significant percentage of the remaining soluble phosphorous is being quickly shifted to higher phyla. This limits the amount of phosphorous available to cyanobacteria, further reducing the size and duration of any blooms. This suggests that measures aimed at promoting native aquatic macrophytes across the lake could improve the effectiveness and duration of any future alum applications and may, at some future date, eliminate the need for further treatments.

The County of Santa Cruz anticipates using source tracking and chemical fingerprinting to better quantify wastewater inputs from septic systems. County of Santa Cruz monitoring plan. The County's monitoring plan is reportedly undergoing revision to better align with TMDL goals and resource constraints.

#### 4.18 Optional Special Studies

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Additional monitoring and voluntary optional special studies would be useful to evaluate the uncertainties and assumptions made in the development of this TMDL. The results of special studies may be used to reevaluate waste load allocations and load allocations in this TMDL. Additionally, harmful cyanobacteria blooms is an active area of research. Consequently, ongoing scientific research on cyanobacteria may further inform the Water Board regarding appropriate waste load or load allocations which would reduce the frequency and severity of cyanobacteria blooms.

At this time, staff maintains there is sufficient information to begin to implement this TMDL and make progress towards attainment of water quality standards and the proposed allocations. However, in recognition of the uncertainties regarding nutrient pollution and cyanobacteria blooms, staff proposes that the Water Board reconsider the waste load and load allocations, if merited by future optional special studies and new research.

Specific suggestions for optional special studies listed below are based on feedback received from scientific peer review commenters and consultants.

**Optional study focusing on rebalance of the nitrogen:phosphorus (N:P) ratio:** There are two ways to rebalance the N:P ratio; one is the approach taken conventionally, which is to focus on reducing phosphorus; the other method to rebalance the N:P ratio is to add N. The logic is as follows: by adding N and rebalancing the N:P ratio, the competitive advantage of diazotrophic phytoplankton (nitrogen fixers) is removed, allowing green algae to outcompete cyanobacteria given the N:P ratios are replete. Green algae and picoplankton are highly grazable by zooplankton and thus allow carbon to flow through the food web instead of being bottlenecked by accumulating in inedible cyanobacteria.

**Optional study focusing on alum effectiveness:** HAB Aquatic Solutions contractors suggested that a monitoring program be implemented to evaluate long term alum efficacy and to construct a nutrient mass balance budget. This monitoring would also inform the need for and timing of future alum (or other) treatments to sequester phosphorus in lake bottom sediments.

**Optional study focusing on flow in tributary creeks:** Some effort could be made to obtain stage-discharge curves and deploy level loggers to obtain continuous flow data and develop hydrographs. These efforts can be achieved through undergraduate student projects or graduate student theses for relatively little cost.

#### 4.19 Potential Sources of Funding

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Prior to implementation of any agricultural water quality control program, the Water Board is required to identify potential sources of funding (section 13141 of the Porter Cologne Act).



Accordingly, in this section, staff provides some examples of funding sources. Potential sources of financing to TMDL implementing parties include the following:

#### ***4.19.1 State Water Resources Control Board - 319(h) Grant Program***

The Division of Financial Assistance administers water quality improvement programs for the State Water Board. The programs provide grant and loan funding to reduce nonpoint source pollution discharge to surface waters. More information about the 319(h) Grant Program is available from the [California State Water Resources Control Board's website](#). Contact Jeanie Mascia ([Jeanie.Mascia@waterboards.ca.gov](mailto:Jeanie.Mascia@waterboards.ca.gov)) for more information.

#### ***4.19.2 Regional Conservation Partnership Program (2014 Federal Farm Bill)***

The Regional Conservation Partnership Program (RCPP) offers new opportunities for the Natural Resources Conservation Service (NRCS), conservation partners and agricultural producers to work together to harness innovation, expand the conservation mission and demonstrate the value and efficacy of voluntary, private lands conservation. See their [website](#)<sup>32</sup> for more details.

#### ***4.19.3 California Coastal Conservancy Grants***

The [California Coastal Conservancy](#)<sup>33</sup> states on their website, that they fund projects that help achieve the goals and objectives of their Strategic Plan (2013-2018). Projects that help achieve multiple objectives in the strategic plan will receive higher priority for funding. The Conservancy will fund most stages of a project including: pre-project feasibility studies, property acquisition, planning (for large areas or specific sites) and design, environmental review, construction, monitoring, and, in limited circumstances, maintenance. Proposition 1 (2014 Water Bond) funding is also available through the Conservancy.

#### ***4.19.4 Other Sources of Funding for Growers and Landowners***

The local Resource Conservation District offices can provide access to and/or facilitate a land owners application for federal cost-share assistance through various local, state and federal funding programs. For certain projects the RCD may also be able to apply for other grant funds on behalf of a cooperating landowner, grower or rancher. More information is available from the [Santa Cruz County Resource Conservation District](#)<sup>34</sup>.

#### ***4.19.5 Natural Resources Conservation Service (NRCS) - Conservation Innovation Grant (CIG)***

The [Conservation Innovation Grant \(CIG\)](#)<sup>35</sup> is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging Federal investment in environmental enhancement and protection, in conjunction with agricultural production.

#### ***4.19.6 California Department of Food and Agriculture (CDFA)***

The Fertilizer Research and Education Program (FREP) within the California Department of Food and Agriculture's (CDFA) Division of Inspection Services is currently accepting full

<sup>32</sup> <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/rcpp/>

<sup>33</sup> <http://scc.ca.gov/grants/>

<sup>34</sup> <http://www.rcdsantacruz.org/>

<sup>35</sup> [https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/programs/financial/cig/?cid=nrcs144p2\\_063937](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/programs/financial/cig/?cid=nrcs144p2_063937)

Also <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/> for national information.

proposals to address the issue of nitrates in groundwater in environmentally sensitive areas of California. Full proposals should include experimental field research focusing on the “pump and fertilize” method in concert with nitrogen budget worksheets to show proof-of-concept for selected key crops, irrigation systems, and soils. Contact FREP staff at [FREP@cdfa.ca.gov](mailto:FREP@cdfa.ca.gov) for more information.

#### ***4.19.7 Department of Conservation***

The [Department of Conservation](#)<sup>36</sup> (DOC) offers grants and other funding programs to further California's goals toward agricultural land conservation and watershed restoration and management.

#### ***4.19.8 Central Coast Water Board***

In addition to the specific funding sources listed in this section, we encourage the stakeholders to subscribe to our “[Grant Funding Opportunities](#)<sup>37</sup>” email list. Subscribing to this list will keep you informed of the latest grant funding opportunities. The Central Coast Water Board also maintains a [website](#)<sup>38</sup> with the latest funding opportunities.

#### ***4.19.9 Department of Financial Assistance – Funding Assistance Options website***

The Department of Financial Assistance (DFA) has a [website](#)<sup>39</sup> that helps identify the funding opportunities available for potential projects.

#### ***4.19.10 United States Environmental Protection Agency***

The USEPA offers several grant opportunities including [research grants](#)<sup>40</sup> from EPA's national center for environmental research and grants under the [Clean Water State Revolving Fund \(CWSRF\)](#)<sup>41</sup>.

#### ***4.19.11 National Institute of Environmental Health Sciences***

The [NIEHS](#)<sup>42</sup> (National Institute of Environmental Health Sciences) provides federal research funding in the form of grants to support a wide array of research projects from single investigator initiated grants to multi-project, multi-investigator consortia grants.

#### ***4.19.12 USDA and the National Institute of Food and Agriculture***

The USDA (United States Department of Agriculture) and the National Institute of Food and Agriculture<sup>43</sup> offer different types of funding opportunities. See their [website](#) on how to search for funding opportunities.

<sup>36</sup> [http://www.conservation.ca.gov/index/Pages/gh\\_grants.aspx](http://www.conservation.ca.gov/index/Pages/gh_grants.aspx)

<sup>37</sup> [http://www.waterboards.ca.gov/resources/email\\_subscriptions/reg3\\_subscribe.shtml](http://www.waterboards.ca.gov/resources/email_subscriptions/reg3_subscribe.shtml)

<sup>38</sup> [http://www.waterboards.ca.gov/centralcoast/water\\_issues/programs/grants/index.shtml](http://www.waterboards.ca.gov/centralcoast/water_issues/programs/grants/index.shtml)

<sup>39</sup> [http://www.waterboards.ca.gov/water\\_issues/programs/grants\\_loans/applications/index.shtml](http://www.waterboards.ca.gov/water_issues/programs/grants_loans/applications/index.shtml)

<sup>40</sup> <https://www.epa.gov/research-grants>

<sup>41</sup> <https://www.epa.gov/fedfunds/state-revolving-funds-drinking-water-and-clean-water>

<sup>42</sup> <https://www.niehs.nih.gov/funding/grants/index.cfm>

<sup>43</sup> <https://nifa.usda.gov/apply-grant>

#### 4.19.13 National Science Foundation

The [National Science Foundation](#)<sup>44</sup> through offer grants that specifically focus on advancing knowledge of the nitrogen and phosphorus cycles; the production and use of fertilizers for food production; and the detection, separation, and reclamation/recycling of nitrogen- and phosphorus-containing species in and from complex aqueous environments.

#### 4.19.14 National Centers for Coastal Ocean Science

The National Centers for Coastal Ocean Science (NCCOS) offers funding for their [monitoring and event response for harmful algal blooms](#) (MERHAB)<sup>45</sup> research program. They also have a general [website](#)<sup>46</sup> that provides announcements on funding opportunities. There are also funding opportunities through the [Office for Coastal Management](#)<sup>47</sup>, which is a division of the National Oceanic and Atmospheric Administration (NOAA).

## 5 PUBLIC PARTICIPATION

Public outreach and public involvement are a part of TMDL development and the state's [basin planning process](#). Moreover, the U.S. Environmental Protection Agency encourages and expects the states to engage the public in the development of TMDL projects.

*“EPA supports public engagement in the state’s listing of impaired water bodies and TMDL process....EPA policy is to afford the public a chance to provide input and to ensure all viewpoints and suggestions are considered. Entities such as landowners, watershed or environmental organizations, homeowners associations, local businesses, citizen advocates and others all have unique perspectives. Local citizens sometimes know more about what is happening in their watersheds than state agencies, and this knowledge can be a valuable aspect in listing decisions and TMDL development.”*

→ USEPA “Impaired Waters and TMDLs: Public Participation” ([webpage](#) accessed August 2017)

Published U.S. Environmental Protection Agency guidance (USEPA, 2000) states that, among other things, the public’s role in the TMDL development process can be to:

- Provide data and information and work with the state in the TMDL development process.
- Review and comment on a proposed TMDL.
- Provide independent analysis to the state. Stakeholders are not simply limited to review and comment on state work.
- Attend public TMDL meetings to become informed and to provide oral feedback.
- Contact state staff by correspondence or phone communication at any time during the TMDL development process with questions, comments, and feedback.

Our public engagement process included regular TMDL updates, scheduled public meetings, and solicitation of public feedback via our stakeholder email subscription list consisting of over 175 stakeholders. These stakeholders represented a wide range of interests, including agricultural interests, local residents, public agencies, environmental groups, local businesses,

<sup>44</sup> <https://www.nsf.gov/pubs/2017/nsf17013/nsf17013.jsp>

<sup>45</sup> <https://coastalscience.noaa.gov/research/habs/merhab>

<sup>46</sup> <https://nccos.noaa.gov/funding/>

<sup>47</sup> <https://coast.noaa.gov/funding/>

researchers, local resource professionals, tribal representatives, and environmental justice advocates. Sections 5.1 through 5.4 below outline additional details concerning our public engagement process.

## 5.1 Public Meetings and CEQA Scoping Workshop

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Central Coast Water Board staff engaged with stakeholders during the development of the TMDL through email correspondence and telephone contact. Central Coast Water Board staff engaged with the following individuals and entities during public workshops or during TMDL development:

- Agricultural consultants, including Grower Shipper Association
- California Department of Fish and Wildlife
- Community Water Center
- Central Coast Water Quality Preservation, Inc.
- City of Watsonville staff
- County of Santa Cruz staff
- Driscoll's berry farms
- Friends of Pinto Lake
- Other individuals and local residents interested in Pinto Lake water quality
- Pajaro Valley Water Management Agency staff
- Pinto Lake 319(h) grant Technical Advisory Committee
  - City of Watsonville staff
  - HAB Aquatics
  - Robert Ketley
  - Santa Cruz County staff
  - UC Santa Cruz
- Representatives of commercial farms, nurseries, and ranches
- Researchers affiliated with California State University, Monterey Bay
  - Scott Blanco
  - Dr. Marc Los Huertos
  - Erin Stanfield
- Santa Cruz Resource Conservation District staff
- Sun-Land Garden Products
- U.S. Department of Agriculture, Natural Resources Conservation Service staff
- U.S. Environmental Protection Agency staff
- UC Davis

Central Coast Water Board staff conducted a public workshop in the City of Watsonville on July 22, 2014. The goal of this workshop was to present some background information on TMDLs and water quality in Pinto Lake, engage and inform stakeholder, and solicit input, questions, and comments.

The California Environmental Quality Act (CEQA) requires staff to conduct a scoping meeting<sup>48</sup> when drafting any water quality control plan. The purpose of a scoping meeting is to seek input from public agencies and members of the public on the range of project actions, alternatives,

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<sup>48</sup> California Code Regulations, Title 23, Division 3, Chapter 27, Article 1 § 3775.5; Public Resources Code 21083.9.

reasonably foreseeable means of compliance, significant impacts to be analyzed, cumulative impacts if any, and mitigation measures. On May 5, 2015, staff emailed a notice that we would be holding a CEQA scoping meeting on June 2, 2015. Attached to that notice, we distributed a *Scoping Document* and *Fact Sheet* to provide stakeholders with some information about the project in advance of the meeting. Additionally, stakeholders were also invited to provide written comments if they were unable to attend the meeting in person. Staff conducted a stakeholder scoping meeting on June 2, 2015. During the meeting, staff addressed questions and comments from attendees.

## 5.2 Stakeholder Data Solicitation

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The USEPA encourages that we solicit data and information from local agencies and other stakeholders. Consequently, we sent a data solicitation request to all stakeholders via email on August 2, 2015. In the data solicitation email we informed stakeholders they could voluntarily submit data to us to support TMDL development for Pinto Lake. We appreciate City of Watsonville staff, Dr. Raphe Kudela (UC Santa Cruz), Scott Blanco and Erin Stanfield (CSUMB) and the County of Santa Cruz staff for providing data we used during TMDL development.

## 5.3 Progress Reports and Information Sharing

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One of our objectives for this TMDL project was to keep stakeholders abreast of our progress throughout the development of the project. We periodically posted interim TMDL progress reports on the Central Coast Water Board's website with the intent of sharing our progress with stakeholders as we moved forward with TMDL development. We posted these interim progress reports on our website in April 2015, November 2015, and April 2017.

In addition, we periodically posted supplementary information on the [Pinto Lake TMDL project page](#) and sent out via emails and information regarding funding opportunities, information on health and scientific topics concerning cyanobacteria, information on potential lake management measures aimed at reducing nutrient pollution, and information concerning opportunities for technical assistance.

## 5.4 Public Review and Comment Period

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Public outreach and public involvement are an important part of TMDL development and the basin planning process. Over the past several years, staff of the Central Coast Regional Water Quality Control Board (Central Coast Water Board) implemented a process to inform and engage interested persons about this proposed total maximum daily load (TMDL) project.

Central Coast Water Board staff's efforts to inform and involve the public included a public comment period. Staff solicited public comments from a wide range of stakeholders including owners/operators of agricultural operations, representatives of the agricultural industry, representatives of environmental groups, academic researchers and resource professionals, representatives of local, state, and federal agencies, representatives of city and county stormwater programs, representatives of a NPDES –permitted industrial facility, local residents, representatives of Native American tribal groups, representatives of environmental justice groups, and other individuals and groups interested in the water quality of Pinto Lake.

In March 2020, Central Coast Water Board staff distributed notice of an opportunity to provide public comment on the proposed basin plan amendment. This provided interested parties an



opportunity to provide comment prior to any Central Coast Water Board hearing regarding these TMDLs. The public comment period for this TMDL project commenced on March 13, 2015 and extended through May 1, 2020.

Central Coast Water Board staff received three comment letters from the following interested parties:

1. Mr. Robert Ketley, former Senior Utilities Engineer for the City of Watsonville (retired), in an email attachment received April 30, 2020.
2. Mr. Steve Palmisano, Director of Public Works and Utilities, City of Watsonville, in an email attachment received May 1, 2020.
3. Mr. John A. Ricker, Water Resources Division Director, County of Santa Cruz, in an email attachment received May 1, 2020.

Central Coast Water Board staff appreciates the comments provided by these interested parties. Some of the comments prompted us to clarify and improve information and narrative in the TMDL project documents.

## REFERENCES

- Blanco, S. and M.W. Los Huertos. 2014. Thermocline-induced nutrient limitation of toxic cyanobacterial bloom in a shallow, hypereutrophic Mediterranean climate reservoir monitored weekly over two years. Conference Paper: 99<sup>th</sup> Ecological Society of America, Annual Convention 2014.
- Boyle, J.F., A.J. Plater, C. Mayers, S.D. Turner, R.W. Stroud, and J.E. Weber. 2011. Land use, soil erosion, and sediment yield at Pinto Lake, California: comparison of a simplified USLE model with the lake sediment record. *Journal of Paleolimnology*(2011) 45:199-212.
- Cahn, Michael, UC Cooperative Extension. Personal Communication regarding hoop houses in the Pinto Lake Catchment. April 28, 2017.
- California Office of Environmental Health Hazard Assessment. 2012. Toxicological Summary and Suggested Action Levels to Reduce Potential Adverse Health Effects of Six Cyanotoxins (May 2012).
- Central Coast Regional Water Quality Control Board. 2016. Water Quality Control Plan for the Central Coastal Basin (Basin Plan). March 17, 2016 Edition.
- City of Watsonville Public Works and Utilities Department (2015). Memorandum from Steve Palmisano, Robert Ketley, and Jackie McCloud to the City Manager Pro Tempore, dated March 12, 2015.
- City of Watsonville. 2018. Pinto Lake Restoration Project Final Report.
- CSUMB (California State University, Monterey Bay) and Resource Conservation District of Santa Cruz County, 2013. Pinto Lake Watershed: Implementation Strategies for Restoring Water Quality in Pinto Lake. Prepared March 2013.
- Domagalski, J.L. 2013. Identification of Geologic and Anthropogenic Sources of Phosphorus to Streams in California and Portions of Adjacent States, U.S.A., Using SPARROW Modeling. American Geophysical Union, Fall Meeting 2013, abstract #H43J-06. Published December, 2013.
- Fetscher, A.E., Howard, M.D.A, Stancheva, R., Kudela, R.M., Stein, E.D., Sutula, M.A., Busse, L.B., and Sheath, R.G. 2015. Wadeable streams as widespread sources of benthic cyanotoxins in California, USA. *Harmful Algae*. 49:105-116.
- Fish Sniffer magazine. 2013. Pinto: A Natural Lake Steeped in California History. April 2013, Volume 32, Issue 9.
- Gibble, C.M., and Kudela, R.M. 2014. Detection of persistent microcystin toxins at the land-sea interface in Monterey Bay, California. *Harmful Algae*. 39: 146-153.

Gibble, C.M., Peacock, M.P., and Kudela, R.M. 2016. Evidence of freshwater algal toxins in marine shellfish: implications for human and aquatic health. *Harmful Algae* 59:59-66.

Helsel D.R. and R.M. Hirsch. 2002. *Statistical Methods in Water Resources*. Chapter A3, *Techniques of Water-Resources Investigations of the United States Geological Survey*.

Ketley, R., A. Rettinger, and M. Los Huertos. 2013. [Pinto Lake Total Maximum Daily Load \(TMDL\) Planning and Assessment](#). Grant report prepared for State Water Resources Control Board, April 2013. Grant agreement number 10-443-553-02.

Langridge, Ruth. (University of California, Santa Cruz). 2018. Central Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-006.

Lusk, M., G.S. Toor, and T. Obreza. 2011. Onsite Sewage Treatment and Disposal Systems: Phosphorus. University of Florida Extension, technical publication SL349.

LVMWD (Las Virgenes Municipal Water District). 2012. Water Quality in the Malibu Creek Watershed, 1971–2010. Revised 06/13/2012. Report submitted by the Joint Powers Authority of the Las Virgenes Municipal Water District and the Triunfo Sanitation District to the Los Angeles Regional Water Quality Control Board in compliance with Order No. R4-2010-0165.

Miller, M.A., R.M. Kudela, A. Mekebri A, D. Crane, S.C. Oates, et al. 2010. Evidence for a Novel Marine Harmful Algal Bloom: Cyanotoxin (Microcystin) Transfer from Land to Sea Otters. *PLoS ONE* 5(9): e12576. doi:10.1371/journal.pone.0012576.

Moyle, Peter B. 2002. *Inland Fishes of California*, Revised and expanded. Regents of the University of California, University of California Press.

Paerl, H.W., W.S Gardner, K.E. Havens, A.R. Joyner, M.J. McCarthy, S.E. Newell, B. Qin, J.T. Scott. 2015. 2016. Mitigating cyanobacterial harmful algal blooms in aquatic ecosystems impacted by climate change and anthropogenic nutrients. *Harmful Algae* 54 (2016) 213-222.

Plater, A.J., Boyle, J.F., Mayers, C., Turner, S.D. 2006. [Climate and human impact on lowland lake sedimentation in Central Coastal California; the record from c. 650 AD to the present](#). *Reg Environ Change* (2006) 6:71-85.

Resources Conservation District of Santa Cruz County. *Implementation of Irrigation & Nutrient Management Projects in the Pajaro Watershed. Final Report*. Prop. 84 Agricultural Water Quality Grant Program. Agreement No. 13-515-553-0. February 28, 2017.

Resources Conservation District of Santa Cruz County. Email dated 5/31/2017. Subject: Sediment Load reduction correction.

Robertson, W.D. 2008. Irreversible Phosphorus Sorption in Septic System Plumes? *Groundwater* 46(1), pp. 51-60.

Rosales, K.A. 2011. Ecological changes of lakes: a focus on Watsonville's College Lake, Kelley Lake, and Pinto Lake. *Environmental Studies* 117: Human Ecology March 27, 2011.

Schindler, D.W., S.R. Carpenter, S.C. Chapra, R.E. Hecky, and D.M. Orihel. 2016. Reducing Phosphorus to Curb Lake Eutrophication is a Success. *Environmental Science & Technology*, September 2016 7; 50(17), pp. 8923-29.

Stanfield, E. R. 2013. Environmental Factors Associated with Toxic Cyanobacteria in Pinto Lake, a Coastal Lake in the Monterey Bay Area. Master's Thesis presented to the faculty of the Division of Science and Environmental Policy, California State University Monterey Bay.

Tetra Tech. 2010. STEPL Alternatives. Updated 9/24/2010. Accessed at Tetra Tech [STEPL website, May 2017](#).

Tetra Tech. 2016. Memo – Alum treatment description and dosing for Pinto Lake. Harry Gibbons, Gene Welch, Shannon Brattebo, and Robert Plotnikoff. Revised November 28, 2016.

USEPA (U.S. Environmental Protection Agency) 2000. Nutrient Criteria Technical Guidance Manual, Lakes and Reservoirs, First Edition, EPA-822-B00-001, April 2000. *Note: figure out correct chronology for all these USEPA 2000 publications*

USEPA (U.S. Environmental Protection Agency), 2000b. Guidance for Developing TMDLs in California. EPA Region 9. January 7, 2000. <http://www.epa.gov/region9/water/tmdl/303d-pdf/caguidefinal.pdf>

USEPA (U.S. Environmental Protection Agency). 2001. Ambient Water Quality Criteria, Recommendations, Lakes and Reservoirs in Nutrient Ecoregion III. EPA-822-B-01-008.

U.S. Environmental Protection Agency (2012), Water Quality Standards Handbook, Chapter 4: Antidegradation. EPA-823-B-12-002.

USEPA (U.S. Environmental Protection Agency), 2015a. Drinking Water Health Advisory for the Cyanobacterial Microcystin Toxins. EPA-820R15100.

U.S. Geological Survey, 1998. Circular 1139: "Groundwater and Surface Water – A Single Resource."

U.S. Geological Survey. 2014. Olson, J.R. and Hawkins, C.P., 2014, Geochemical Characteristics of the Conterminous United States: U.S. Geological Survey data release, <http://dx.doi.org/10.5066/F7X0653P>.

Watsonville, City of. Pinto Lake Total Maximum Daily Load (TMDL) Planning and Assessment. Grant no. 10-443-553-02. Grant completed on April 8, 2013.