

**STATE OF CALIFORNIA  
REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL COAST REGION**

**STAFF REPORT FOR REGULAR MEETING ON FEBRUARY 6, 2004  
Prepared on January 15, 2004**

**ITEM:** 32

**SUBJECT:** Chorro and Los Osos Creeks Nutrient and Dissolved Oxygen TMDL Status Report

**KEY INFORMATION:** Proposed State-wide TMDL Guidance, Proposed Region-wide Nutrient TMDL Approach and Status of Chorro Creek and Los Osos Creek Nutrient and Dissolved Oxygen Total Maximum Daily Loads

**SUMMARY**

This report includes a description and status of the proposed Total Maximum Daily Load (TMDL) Guidance and related proposed Water Quality Control Policy, a discussion of how staff is proposing to address current nutrient listings region-wide, and an explanation of the proposed strategies to address the nutrient and dissolved oxygen listings within Chorro and Los Osos Creeks.

As you recall, staff presented a Resolution to adopt a Basin Plan Amendment for the Chorro Creek and Los Osos Creek TMDL for Nutrients and Dissolved Oxygen to the Board in December 2002. The Board continued the item to a later date in order to provide more time for Board members to review the supporting documentation and to allow staff to clarify the basis for the numeric targets. Staff reevaluated the nature of the problem and numeric targets, and revised the implementation strategies and associated regulatory mechanisms to address the 303(d) listings.

Originally staff addressed six listings on the 303(d) list of impaired waterbodies. These included two nutrient and three dissolved oxygen listings within Chorro and Los Osos Creek watersheds. Figure 1 shows the location of these waterbodies and monitoring sites. Staff initially included these listings in one TMDL document because the impairments

were thought to be related, i.e., that a cause/effect relationship exists between nutrients and dissolved oxygen in these waterbodies. Staff reevaluated the information, and concluded that a clear relationship does not exist, or has not been established. Additionally, staff has determined that each listing requires a different implementation strategy and as a result, is addressing each listing separately. Table 1 contains a summary of that information.

**DISCUSSION**

**State-wide TMDL Guidance and Policy**

In 2002, the California Water Code was amended requiring the development of guidelines to be used by the State and Regional Boards in listing, delisting, as well as developing and implementing TMDLs. The State Board has prepared Draft TMDL Guidance (Guidance) and a proposed Water Quality Control Policy (Policy) to comply with the statutory requirement, and is requesting public comment by February 11, 2004. Regional Board staff is using the drafts as guidance in addressing impaired waterbodies. In order to reduce the chance that the Regional Board will adopt a TMDL that conflicts with the final policies, staff has decided to wait until the Policy is approved by the State Board prior to bringing action items before the Regional Board.

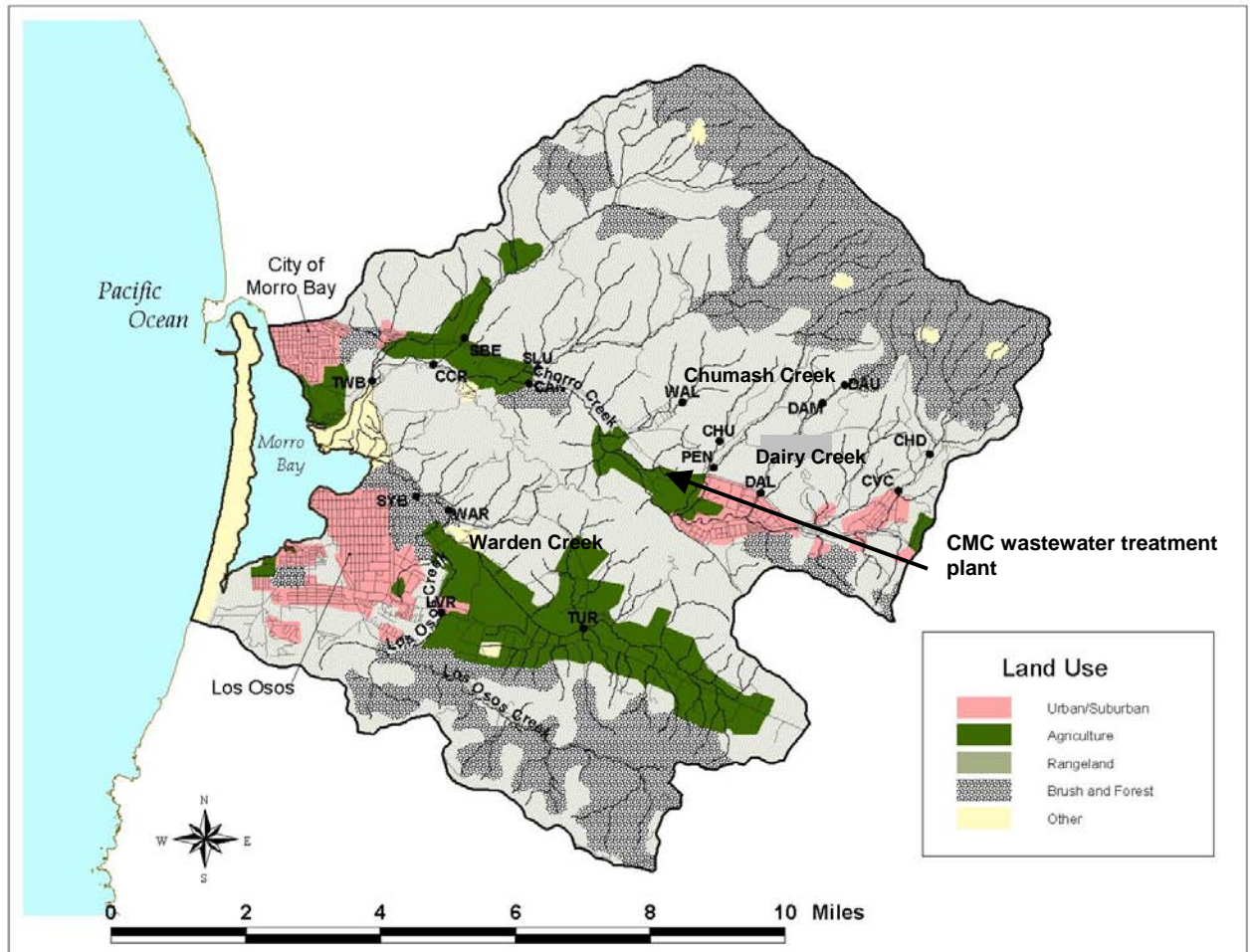


Figure 1. Listed waterbodies for dissolved oxygen and nutrients, and monitoring sites within the Morro Bay watershed.

Table 1. Proposed strategy for the Chorro Creek and Los Osos Creek nutrient and dissolved oxygen listings.

<b>Waterbody</b>	<b>Impairment</b>	<b>Proposed Approach</b>	<b>Anticipated Board Action and Schedule</b>
Los Osos Creek	Nutrients	Recommend approval of a Resolution amending the Basin Plan to include a Los Osos Creek Nutrient TMDL	Resolution Approval, September or December 2004 <sup>5</sup>
Chorro Creek	Nutrients	Recommend approval of modifications to existing NPDES permit <sup>1</sup> that will establish the TMDL and eliminate the impairment	Permit Renewal, February 2006
Chumash Creek	Dissolved Oxygen	Recommend approval of a Resolution certifying that existing implementation efforts <sup>2</sup> will implement the TMDL	Resolution Approval, in or after May 2004 <sup>6</sup>
Dairy Creek	Dissolved Oxygen	Recommend approval of a Resolution certifying that existing implementation efforts <sup>3</sup> will implement the TMDL	Resolution Approval, in or after May 2004 <sup>6</sup>
Los Osos Creek	Dissolved Oxygen	Listing will remain as a low priority <sup>4</sup>	Information Only, February 2004
Warden Creek	Dissolved Oxygen	Listing will remain as a low priority <sup>4</sup>	Information Only, February 2004

1. Revised NPDES permit will include the elements of the TMDL (i.e., waste load allocation and margin of safety) and will constitute the implementation plan.
2. BMPs implemented by Cal Poly State University as part of a Clean Water Act Section 319(h) grant.
3. BMPs implemented by the County of San Luis Obispo in partnership with the NRCS.
4. Depressed oxygen levels may be induced by low flow or other non-controllable factors. The listing will remain while efforts to monitor dissolved oxygen levels continue and the Los Osos Creek Nutrient TMDL is implemented. If nutrients are indeed playing a role in biostimulation, then implementing the Los Osos Creek Nutrient TMDL Implementation Plan will reduce nutrient loading and will act as a treatment to gauge whether biostimulation is indeed resulting from nutrient loading.
5. Depending on peer review timeframe.

The purpose of the Guidance is to assist the State and Regional Boards in addressing impaired waters through actions that are consistent with regional and national regulations, as well as technical, regulatory, and legislative requirements. The Guidance is also intended to serve as a handbook to TMDL practitioners as well as provide transparency on the process to the public. A portion of the Guidance relies on the proposed Policy, which outlines options available to the State and Regional Boards for adopting and implementing TMDLs. In addition to setting out guidelines for adopting TMDLs as part of Basin Plan Amendments, the Policy describes other regulatory tools and mechanisms for addressing impaired waterbodies, such as relying on an existing permit or enforcement action or programs of other agencies to achieve water quality objectives. After approval by the Office of Administrative Law, the Policy will have regulatory status.

### **Region-wide Nutrient TMDL Approach**

#### Translating Narrative Objectives into Nutrient Numeric Targets for TMDLs

Staff has had difficulty translating narrative objectives into numeric targets for TMDLs currently being developed. Consequently, staff has concluded that the numeric target for nutrient TMDLs be the Basin Plan numeric objective of 10 mg/L nitrate as nitrogen (45 mg/L nitrate as nitrate) for protection of the MUN beneficial use. Where applicable, the Basin Plan numeric objective of 0.025 mg/L for ammonia as nitrogen will also be used as a numeric target. No numeric target for phosphorus will be articulated in stream nutrient TMDLs at this time.

Nitrate, along with other nitrogen compounds and phosphorus numeric targets will be revisited after further investigation lead staff to recommend alternative targets that are achievable and scientifically defensible. Current efforts to develop nutrient targets and water quality objectives are discussed later in this section of the staff report.

#### The Biostimulatory General Objective

Many of the stream 303(d) listings for nutrients are based on visual, and often unquantified, observed algae. It is widely believed that the presence of dense, benthic (attached to stream bottom substrate) algae is the direct result of nutrient loading, particularly loading of nitrogen and phosphorus. The Basin Plan biostimulatory narrative objective reflects this view. The objective states:

“Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.”

The view that algal density is a direct result of nutrient loading is true to an extent. A review of literature, as well as analysis of data from the region, lead staff to conclude the following:

1. Benthic algae are true plants and therefore require nitrogen and phosphorus for growth. However, the levels of nitrogen and phosphorus required to generate high-density benthic algae may be as low as background levels if other environmental factors are not limiting.
2. Above a nutrient concentration threshold level, benthic algae density is not proportional to nitrogen and/or phosphorus concentration. The increase of nitrogen and/or phosphorus concentration does not necessarily correspond to a predictable increase in algal density. Conversely, the reduction of nitrogen and/or phosphorus does not necessarily correspond to a predictable reduction in algal density. Proportionality between nutrient availability and algal density occurs only between a nutrient concentration of zero and a very low threshold level. Proportionality is not consistent above a nutrient threshold level, which is unique for each system. In some waterbodies, the nutrient threshold

level may be lower than background levels. Therefore, setting numeric target levels above the threshold level will not necessarily correspond to a proportional or predictable reduction in algal density.

3. The reduction of existing nitrogen and phosphorus levels, in *some* listed waterbodies, to levels generating desired algal densities is not technologically and/or economically possible or perhaps reasonable at this time. This is particularly true in waterbodies that are effluent dominated from wastewater treatment discharge. This poses a problem for TMDL implementation, as proposed targets must be achievable.

Staff has had limited success attempting to establish a reliable relationship between nutrients and benthic algae. The limited success is driven by the complexities of stream systems, including the multiple environmental factors driving algal growth. Factors limiting algal growth include: 1) sunlight availability, 2) nutrient supply, 3) substrate for algal attachment, 4) pH, and 5) flow. Any one of these environmental factors may limit algal growth. Staff has observed exceedingly high benthic algae density in areas adjacent to no algal growth at all. This phenomenon is particularly frequent in areas where overhead canopy abruptly reduces sunlight availability to the stream. Staff has observed that sunlight availability, or the lack thereof, is a more predictable means of controlling benthic algal density, relative to nutrient control.

In addition, the regulatory means for requiring the installation of canopy or BMPs to allow canopy to reestablish is not always feasible and/or clear. For example, the riparian corridor may be developed and not suitable for the introduction of woody vegetation. A landowner who is discharging nutrients may not have access or ownership of the locations where canopy has been impacted. Access to the stream may be limited, thereby limiting the capacity of staff to confirm whether nuisance levels of algae are present. The Regional Board generally can only require the installation of canopy or BMPs as a mitigation

measure for discharges that contribute to the impairment in other ways (e.g., by adding nutrients).

The biostimulatory narrative objective makes reference to nuisance levels of aquatic growths. However, nuisance levels are neither generally defined nor articulated for any specific beneficial use. As such, it falls upon staff to:

1. Determine what constitutes a nuisance level of aquatic growth for various beneficial uses, and furthermore to
2. Predict and prescribe what implementation actions and numeric targets will result in a desired algal density level, i.e., a density less than nuisance level.

It is clear and defensible that there exists a level of aquatic growth, e.g. benthic algae, that will adversely affect beneficial uses, particularly uses for aquatic life. However, it is not yet clear, or defensible, how to quantifiably define nuisance levels of aquatic growth. Nor are staff at this time able to confidently predict what implementation actions will achieve aquatic growth levels protective of beneficial uses. It is, however, necessary to develop these definitions and predictions if staff is to establish TMDL numeric targets under the pretext that such numeric targets will result in meeting the biostimulatory objective.

#### The Toxicity General Objective

Observed algae and/or data suggesting exceedence of the nitrate water quality objective prompted most of the current TMDL listings for nutrients. However, staff has researched other potential adverse affects to beneficial uses caused by elevated nutrient levels.

The Basin Plan general objective for toxicity states:

“All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life.”

Research by staff has lead to documented toxicity studies concluding that nitrate present in water may be toxic to some aquatic organisms. Specifically, nitrate toxicity is a concern in some fish, macro invertebrate, frog, and toad species in early developmental stages. Adverse affects to these species occurred at nitrate levels ranging from one to hundreds of mg/L-N, depending on the species and growth stage.

Existing nitrate levels in some listed waterbodies are greater than levels shown to cause toxic affects. However, most of the species tested are not present in the waterbodies with nutrient listings. It is not clear whether the nitrate toxicity level determined for species-A can be applied to species-B, even if species A and B are similar, e.g., within the same genus. More studies need to be conducted before such an application can be made.

One nitrate toxicity study reviewed by staff investigated toxicity in species present in regional waterbodies. A 1979 study concluded that steelhead trout eggs suffer a statistically significant greater mortality when subjected to nitrate concentrations above 1.1 mg/L-N. The study has not been confirmed or refuted by a repeated experiment. In addition, staff requested an objective review of the study by a fisheries expert, who concluded that the results of the 1979 may be in question, and should be repeated before the results are applied in management decisions.

#### Current Efforts to Develop Nutrient Targets and Objectives

Current activities aimed at developing nutrient numeric targets or objectives include:

- Regional Technical Advisory Group (RTAG). The RTAG is an EPA Region IX effort to establish nutrient criteria or a protocol for developing nutrient criteria. Results of this effort will be applicable for the state of California. A report is due in 2004.
- Tetra-Tech is a consulting firm contracted by the SWRCB to develop and suggest means for applying the biostimulation objective with respect to nutrients. Tetra-Tech will research

and report definitions of nuisance algal levels as they pertain to stream systems and make recommendations regarding nutrient levels aimed at avoiding such nuisance levels.

- Staff will continue to compile information and work with resources, as available, to develop nutrient numeric targets protective of all beneficial uses.

#### Approach Proposed

In consideration of the information presented above, staff proposes to develop stream TMDLs for nutrient listings using an in-stream nitrate numeric target of 10 mg/L-N, and no target for phosphorus. Staff will utilize updated nutrient targets and/or methods for developing targets as they become available from existing or future efforts. Nutrient targets used in approved TMDLs will be revisited if the targets used to develop the TMDLs are later determined to be non-protective of beneficial uses.

For many of the waterbodies listed in Region 3 for nutrients or nutrient-related impairment, the levels of nitrates are much higher than the existing Basin Plan nitrate objective protecting the MUN beneficial use. Therefore, this approach will have the benefit of initiating implementation efforts to reduce current nitrate loading causing these high levels of nitrate, aiming to attain the drinking water objective, while efforts to establish numeric targets protective of other beneficial uses continue.

#### **Chorro Creek Nutrients**

Chorro Creek was listed as impaired for nutrients on the 1998-303(d) list. Following the December 2002 Regional Board hearing, staff conducted further field observations and collected additional data. Staff concludes that in the case of Chorro Creek, algal growth and corresponding low dissolved oxygen observed is not driven by nutrient loading but rather by other conditions (i.e., canopy), and a reduction in nutrient loading is not likely to generate a corresponding reduction in algal growth. This is evidenced by the fact that a cause/effect relationship between nutrient loading and dissolved oxygen conditions cannot be

established, and algal growth and dissolved oxygen conditions are similar upstream and downstream of the primary source of nitrates to Chorro Creek, the California Men's Colony (CMC) discharge. Therefore, the only water quality objective clearly exceeded and proposed to be attained for this TMDL is the municipal drinking water objective for nitrate, 10 mg/l-N.

Staff evaluated effluent and receiving water nitrate data collected by the CMC relative to the municipal drinking water objective of 10 mg/l-N. This data indicate that exceedances of this objective have occurred instream. However, this data was only collected during periods when there was natural flow in the creek. Since data is not available during drought years, staff thinks any persistent impairment is most likely to occur under effluent-dominated conditions when there is no dilution of the effluent from waters upstream of the CMC discharge.

According to the proposed TMDL Guidance and Policy, if the solution to the impairment being addressed by a TMDL can be implemented by a single action of the Regional Board, such as adoption of a permit or enforcement action, it may be implemented by that action. Staff proposes that implementation of this TMDL rely on future modifications to the requirements in the National Pollutant Discharge Elimination System (NPDES) permit. Included in CMC's existing NPDES permit is a receiving water limitation of 10 mg/l-N. The Regional Board adopted a Cleanup or Abatement Order on September 15, 1998 requiring the CMC to upgrade the treatment plant by December 1, 2001. Predicted effluent nitrate concentrations range between 2.1 mg/l-N and 3.9 mg/l-N, well below the MUN drinking water objective for nitrate of 10 mg/l-N. Completion of the upgrade is planned for January 2006. As such, Regional Board staff plans to modify CMC's NPDES permit in 2006 and set effluent limits, in addition to the receiving water limit, designed to achieve the goal of attaining 10 mg/l-N in the creek during all seasons.

Staff has developed supporting documentation indicating that existing and planned efforts

will implement the TMDL. Staff will recommend approval of the revised permit as the mechanism to implement the TMDL in 2006.

Reopening the permit will not result in attainment of water quality objectives any sooner as CMC cannot feasibly change the schedule for treatment plant improvements to reduce the nitrate load before the currently planned completion date. Furthermore, staff is not currently scheduled to spend time preparing revisions to the permit so reopening the permit would result in reprioritizing assigned permitting tasks. Similarly, adopting a Basin Plan Amendment to implement this TMDL would result in an additional and duplicative administrative burden since compliance with the TMDL will actually be achieved after the permit is revised and CMC's discharge is in compliance with the requirements in the revised permit. Adopting a Basin Plan Amendment would establish an enforceable implementation plan sooner, but would not advance the timing of achieving the TMDL.

### **Los Osos Creek Nutrients**

Los Osos Creek was listed as impaired for nutrients on the 1998-303(d) list. Staff evaluated nitrate levels related to exceedances of the municipal and domestic water supply (MUN) beneficial use. Exceedances of the MUN drinking water objective occurred periodically on the Warden Creek branch of Los Osos Creek, with levels reaching 42 mg/l-N and 22 mg/l-N in 1996 at the Warden Creek monitoring site. While concentrations are not consistently elevated above the drinking water objective of 10 mg/l-N for nitrate, staff considers the waterbody as impaired because it is likely that values less than 10 mg/l impact aquatic organisms.

Staff evaluated land use and loading information to determine sources and appropriate implementation actions. The results of this analysis indicate the primary source of nitrates to Los Osos Creek is croplands. However, rangeland is also a source. Therefore, implementation of this TMDL will rely on a variety of management

practices implemented by several responsible parties, to be approved by different actions of the Regional Board (e.g., conditional waivers for agricultural discharges).

According to the proposed TMDL Guidance and Policy, if the solution to the impairment being addressed by a TMDL will require multiple actions of the Regional Board, the solution must be implemented by a Basin Plan amendment or other regulation.

Staff plans to recommend adoption of a Resolution amending the Basin Plan to include a Los Osos Creek Nutrient TMDL and Implementation Plan in September or December 2004, following scientific peer review and formal public review.

#### **Chumash Creek and Dairy Creek Dissolved Oxygen**

Chumash Creek and Dairy Creek were listed as impaired for dissolved oxygen on the 2002 303(d) list. Both creeks are tributary to Chorro Creek. Staff evaluated dissolved oxygen levels related to exceedances of the COLD freshwater habitat numeric water quality objective of 7 mg/l.

Nonpoint source pollution control efforts have been implemented along Chumash and Dairy Creeks. In 1995, California Polytechnic State University implemented a suite of rangeland best management practices (BMPs) at Chumash Creek. The County of San Luis Obispo Parks Department also partnered with the Natural Resource Conservation District, USDA, to implement BMPs along a mile-long corridor along Dairy Creek in 1994.

Chumash Creek and Dairy Creek were included in the Morro Bay National Monitoring Program, a ten-year BMP implementation and monitoring project funded by a Clean Water Act Section 319(h) grant. According to the results of the project, dissolved oxygen levels on these creeks are improving as a result of implementing BMPs. Dissolved oxygen levels, however, do not yet achieve the numeric water quality objective of 7.0 mg/l. As such, the creeks cannot be removed from the 303(d) list.

According to the proposed TMDL Guidance and Policy, if the solution to the impairment being addressed by a TMDL is being implemented by a non-regulatory agency and the Regional Board finds that the solution will actually correct the impairment, the Regional Board may certify that the non-regulatory action will correct the impairment. Staff is confident that existing efforts will implement the TMDL and ultimately result in attainment of the water quality objective. Staff is developing implementation tracking mechanisms (e.g., reporting) that will verify TMDL achievement. Staff will recommend approval of Resolutions in or after May 2004 (depending upon the effective date of the Policy), certifying that existing implementation efforts will achieve the TMDLs.

#### **Los Osos Creek and Warden Creek Dissolved Oxygen**

In this case, staff has concluded that implementing actions will not likely generate a corresponding improvement in dissolved oxygen levels. Los Osos Creek and Warden Creek will remain on the list, and staff will pursue additional data collection. Staff does not believe that developing a TMDL or establishing an implementation plan is warranted at this time.

Los Osos Creek is identified in the Basin Plan as supporting both warm and cold freshwater habitat beneficial uses. Warden Creek is identified as supporting warm freshwater habitats.

Staff evaluated dissolved oxygen levels related to the COLD freshwater habitat water quality objective of 7 mg/l on Los Osos Creek and the WARM freshwater habitat water quality objective of 5 mg/l on Warden Creek. Staff did not find exceedances of associated water quality objectives at the monitoring site, LVR on Los Osos Creek nor at the monitoring site, TUR on Warden Creek. Staff does not consider the upper reaches of these waterbodies as impaired; however, the extent of impairment downstream of LVR and TUR (and upstream of the monitoring stations, SYB

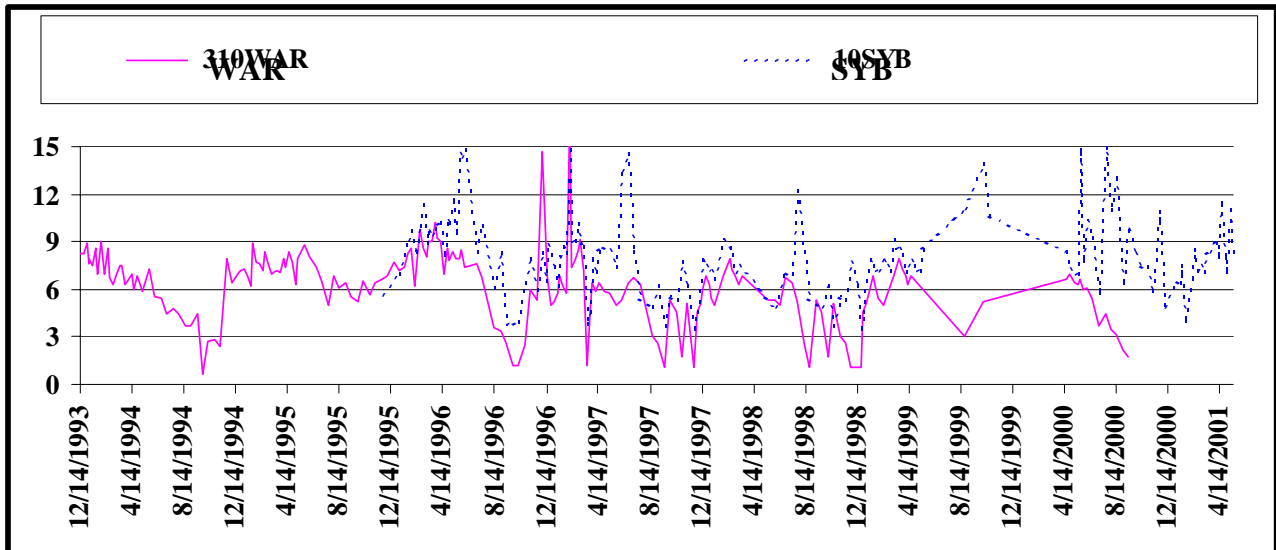


and WAR discussed below) is unknown. Staff is currently working with stakeholders to establish additional sites for improved assessment.

At the monitoring site SYB at the mouth of Los Osos Creek, downstream of the confluence with Warden Creek, 28% of dissolved oxygen measurements taken did not meet the COLD freshwater habitat water quality objective of 7 mg/l. Of dissolved

oxygen measurements taken at WAR, on Warden Creek, 22% of all data points did not meet the WARM water quality objective of 5 mg/l. The monitoring site nearest the estuary (SYB) is tidally influenced, and a backwater effect often results at the monitoring site (WAR) further upstream on the Warden Creek branch. Both of these sites have a low gradient, and measurements are often taken in slow flowing conditions. Figure 2 shows dissolved oxygen concentrations between

Figure 2. Dissolved oxygen concentrations (mg/L) at WAR, on Warden Creek, and SYB, on Los Osos Creek between 1993-2001.



1993 and 2001 at WAR and SYB.

Staff believes that the depressed oxygen levels are most likely induced by low gradient, slow flow, or other natural causes. Therefore, the depressed oxygen levels at these sites are not necessarily due to nutrient loading or other controllable factors, such as canopy.

Low dissolved oxygen can occur from elevated nutrients, instigating algal growth, which in turn affects dissolved oxygen. Low dissolved oxygen can also be driven by lack of canopy, which affects water temperature and the ability of water to dissolve and hold oxygen. Staff initially thought depressed oxygen levels were associated with biostimulation driven by nutrient loading. Staff reevaluated the information and concluded that asserting a causal relationship between nutrient loading, biostimulation, and dissolved oxygen in the listed creeks cannot scientifically be supported at this time.

Tracking and Monitoring of the Los Osos Creek Nutrient TMDL and Implementation Plan (as discussed in a previous section) may indicate that nutrients are indeed playing a role in biostimulation. If so, nonpoint source control efforts should also result in improvements in dissolved oxygen levels.

The Morro Bay Volunteer Monitoring Program (VMP) currently monitors TUR, LVR, and SYB on a monthly basis. Monitoring at WAR was discontinued, but Regional Board staff is pursuing reestablishing monitoring as part of the Los Osos Creek Nutrient TMDL. Staff also recommends another site between LVR and SYB on Los Osos Creek be added. If the data indicates that waterbody segments are not impaired, then staff will recommend that they be removed from the 303(d) list.

Staff also evaluated data collected by the County of San Luis Obispo for the Los Osos Landfill to determine potential impacts from chemical leachate. Quarterly chemical oxygen demand (COD) data collected between 1991 and 2002 from monitoring sites upstream, adjacent to, and downstream of the landfill are

similar. As a result, staff concludes that the landfill is not contributing to depressed oxygen levels in the creek.

Staff concludes that segments of Los Osos Creek and Warden Creek are impaired by depressed levels of dissolved oxygen. The impairment, however, is not simply a function of controllable factors, but may be a natural phenomenon. As such, implementing actions will not likely generate a corresponding improvement in dissolved oxygen levels.

Because dissolved oxygen concentrations do not achieve numeric water quality objectives, the 303(d) listings cannot be removed. Consequently, the listings will remain while efforts to monitor dissolved oxygen levels, along with algal growth and nutrient concentrations continue.

While Los Osos and Warden Creek must remain on the list, staff does not believe that developing a TMDL or establishing an implementation plan is warranted at this time. Once more data is available, staff may recommend a different course of action.

#### **Conclusion:**

Staff reevaluated the problem and numeric targets, and proposes a unique implementation strategy and associated regulatory mechanism to address each of the nutrient and dissolved oxygen listings within Chorro and Los Osos Creeks. Staff will propose appropriate recommendations and requests for approval of Resolutions or other actions to the Regional Board in the near future, consistent with the information in this staff report. This conclusion is based on the proposed State-wide TMDL Guidance, the proposed region-wide approach to nutrient TMDLs and the information pertinent to each listing.

#### **Recommendation:**

Information only.

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