Improving Chorro Creek Watershed – Reducing Nitrate and Dissolved Oxygen

REPORTING WATERSHED IMPROVEMENT

Based on Multiple Lines of Evidence (Option 2b)

Executive Summary

Water quality is improved in Chorro Creek, the largest tributary to the Morro Bay National Estuary in Central California. Chorro Creek has improved nitrate and dissolved oxygen levels as a result of the upgrade of a waste water treatment plant and implementation of several restoration and enhancement projects in the watershed. Improvements were achieved following a watershed approach, including many partners and stakeholders, addressing multiple parameters, targeting actions based on monitoring data and scientific evaluations, and by using a combination of regulatory and non-regulatory tools.

The Morro Bay watershed is an excellent case study of the sustained effort and resources necessary to protect and restore watersheds. Beginning more than 20 years ago with a local group of citizens determined to protect a unique and beautiful place, the Morro Bay National Estuary Program is now a well-established cooperative effort engaging partnership organizations and many local citizens. Preventing the kind of intense urbanization that is typical in coastal areas has certainly been part of protecting the estuary and its watershed. However, demonstrating direct water quality improvements is challenging, requiring consistent sustained effort, resources and adequate response time. This report provides a realistic consideration of the efforts needed to restore, preserve, and protect increasingly rare aquatic resources, and highlights the difficulties in achieving these goals even in a relatively undisturbed watershed. While acknowledging the challenges to eliminating all impairments , the Morro Bay National Estuary Program and its partners remain committed to fully restoring the bay and its watershed.

Watershed Identification

a	Organization	California Regional Water Quality Control Board, Central Coast Region
b	Point of Contact	Alison Jones, Staff Environmental Scientist 895 Aerovista Place, San Luis Obispo 805-542-4646 ajones@waterboards.ca.gov
c	Project Title	Reducing nutrients and increasing dissolved oxygen levels in Chorro Creek, the largest watershed draining to the Morro Bay National Estuary
d	Number of Watersheds Improved	One watershed showing improvement

Description of 2002 Baseline Condition

e	Watershed(s)	Chorro Creek, HUC-12 180600060505.
f	2002 Impairments	Chorro Creek was listed on the 2002 303(d) list as impaired by fecal coliform, nutrients (biostimulatory substances), and sediment. In 2006, it was listed for dissolved oxygen impairment. The Central Coast Water Board developed a nutrient and dissolved oxygen Total Maximum Daily Load (TMDL) for Chorro Creek that was approved by USEPA on July 19, 2007.

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g Maps	Attachment 1: Map of Morro Bay watershed, showing HUC-12 watersheds Attachment 2: Map of the Morro Bay watershed, including Chorro Creek and its tributaries Attachment 3: Map of implemented projects Attachment 4: Map showing monitoring locations on Chorro Creek

Evidence of Watershed Approach

h Area of Effort

Attachment 1 shows the Morro Bay watershed with HUC-12 watersheds delineated; Attachment 2 shows the Morro Bay watershed and its tributaries.

Chorro Creek is the main tributary to Morro Bay Estuary, one of California's largest estuaries and one of the last relatively unaltered coastal wetlands along the central and southern California coast. Morro Bay provides critical habitat for marine mammals, fish, shellfish, more than 200 species of birds, and other life, including 16 threatened and endangered species. Its sheltered waters, salt marshes and eelgrass beds (the estuary currently supports the third largest remaining eelgrass beds in Southern California) provide rare and important habitat. The bay, a working harbor and major tourist destination, supports commercial and sport fishing, recreational boating, and is also home to 25,000 people. The bay also supports commercial shellfish growing areas and the estuary and its tributaries provide habitat for threatened steelhead. The bay and its watershed encompass about 48,450 acres, approximately 75 square miles.

Since the 1980s, there has been a strong community effort to protect Morro Bay. In 1995, Morro Bay Estuary was designated a National Estuary by USEPA, one of 28 in the nation. In 2007, the estuary was incorporated into the California Department of Fish and Game's Marine Protected Areas, protecting the intertidal and subtidal habitats within Morro Bay.

One of the greatest threats to Morro Bay Estuary is believed to be human induced sediment loads from tributaries which appear to be filling up the Morro Bay Estuary at an unnatural rate. The NEP estimates that under "normal" circumstances, the Bay would naturally fill in with sediment in several thousand years, but at the present accelerated rate, the Bay could fill in within the next 300 years. Other concerns include high bacterial levels that impact recreation and shellfish beds within the bay, loss of eelgrass beds that provide critical habitat, emerging pollutants such as pharmaceuticals, and the impacts of climate change.

Chorro Creek drains about 65% of the Morro Bay watershed, encompassing an area of approximately 43 square miles. Tributaries to Chorro Creek include Dairy Creek, Pennington Creek, Walters Creek, San Luisito Creek and San Bernardo Creek. The Chorro Creek watershed is dominated by rangeland (62.8%) brushland (17.0%), and woodland (8.7%). Cropland accounts for 6.1% of the watershed, and urban development accounts for 5.4%.

The watershed has a Mediterranean climate, with warm, dry summers and cool wet winters. The San Luis Obispo County Operations Center, California Men's Colony state prison and Cuesta College are all located within close proximity to Chorro Creek. Publicly-owned property includes the California Army National Guard Camp San Luis Obispo, Chorro Creek Ecological Reserve, and rangeland owned by California Polytechnic State University. Numerous restoration and implementation projects have been implemented

		in Chorro Creek and its tributaries over the past several years, to reduce sediment, bacteria, nutrients and other pollutants, and to restore habitat for fish and wildlife.
i	Key Stake-holders Involved and Their Roles	Morro Bay National Estuary Program (MBNEP), The MBNEP is a multi-stakeholder effort with a mission to protect and restore the Morro Bay Estuary and its watershed. A committee of local stakeholders, resource managers and conservation practitioners provides guidance on implementation projects. As a member of the National Estuary program, the MBNEP receives an annual grant from USEPA, with 1:1 non-federal matching funds. The MBNEP has leveraged millions of dollars in grant and matching funds to implement a large number of restoration projects. Since 2006, MBNEP has leveraged more than $11.8 million dollars to support water quality improvements and implementation projects, many in Chorro Creek. MBNEP identifies at least 67 individual partner organizations that are involved in watershed protection activities. Below are some of the partners that have been directly involved in Chorro Creek restoration projects: Central Coast Regional Water Quality Control Board (CCWB) The CCWB regulates point (e.g, the California Men's Colony NPDES permit) and nonpoint source discharges within the watershed, develops and implements TMDLs, coordinates with the MBNEP on water quality monitoring efforts and provides additional monitoring data through its Central Coast Ambient Monitoring Program (CCAMP). CCAMP monitors sites at the lower ends of watersheds monthly, while MBNEP monitors sites further up the watershed. Data from both sources were used to provide a complete picture of water quality in the watershed. Staff also manages CWA Section 319(h) and other grants as well as settlement funds that are awarded to MBNEP and its partners. Coastal San Luis Resource Conservation District (CSLRCD) The CSLRCD works with farmers and ranchers on a variety of water quality protection practices. Projects include irrigation and nutrient management improvements, riparian fencing for cattle exclusion, providing off-stream water sources for cattle, road improvement practices, and creek and floodplain restoration. USDA Natural Resources Conservation Service (NRCS) The NRCS maintains a service center in Templeton, which is in the northern part of San Luis Obispo County. NRCS provides technical assistance and cost share funding for agricultural management practices through programs such as the Environmental Quality Incentives Program (EQIP), as well as several conservation programs such as the Conservation Innovation Grant (CIG) Program, the Conservation Stewardship Program (CSP) and the Wetlands Reserve Program (WRP). NRCS has partnered with University of California Cooperative Extension to provide water quality short courses for ranchers and farmers. San Luis Obispo County Farm Bureau The Farm Bureau provides education and outreach to farmers and ranchers on topics such as water quality management practices and regulatory compliance. California Polytechnic State University, San Luis Obispo (CalPoly),

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		CalPoly manages rangelands in the watershed and works with the MBNEP on implementing agricultural water quality management practices. CalPoly also hosts the San Luis Obispo Science and Ecosystem Alliance (SLOSEA), which formed in 2006 to provide an integrated, holistic approach to the management of marine resources on the Central Coast. SLOSEA brings together scientists, resource managers, county officials and community leaders to support healthy, resilient coastal ecosystems. California Department of Fish and Game (CDFG) CDFG consults on habitat restoration and owns and manages the Chorro Creek Ecological Reserve (CCER). IN 2004, CDFG acquired the 580-acre CCER, which lies along Chorro Creek at the base of Hollister Peak. The goal of the CCER project is to restore and enhance the floodplain and channel of Chorro Creek, while reducing sediment loading to Morro Bay Estuary. In 2005, the MBNEP and its partners completed a long-term plan for restoration and management of the reserve: http://knowledge.mbnep.org/morro/files/projects/Existing%20Conditions%20Report%20CCER.pdf Army National Guard Camp San Luis Obispo (Camp SLO) Camp SLO manages land in the watershed and works with the MBNEP to improve roads in its jurisdiction, which are eroding and contributing sediment to Chorro Creek. Camp SLO is partnering with MBNEP on a federally funded Clean Water Act (CWA) Section 319(h) project to implement road water quality protection practices. U.S. Forest Service Los Padres Region (USFS) USFS manages approximately 2,500 acres of national forest lands in the upper portions of the Chorro Creek watershed (approximately 8%) and works with the MBNEP to reduce erosion from roads in its jurisdiction. California Men's Colony (CMC) CMC operates the only NPDES permitted facility in the watershed. An upgrade to the wastewater treatment plant in 2007 has significantly improved water quality in the Chorro Creek watershed. United State Environmental Protection Agency (USEPA) USEPA is an active partner in the MBNEP, providing technical assistance and 319(h) funding for numerous projects. Farmers and ranchers and other citizens Farmers, ranchers and other citizens participate in MBNEP programs through implementation of water quality management practices on their lands, through conservation efforts and through other activities, such as participation on committees, bird counts, volunteer monitoring, and other actions to protect and enhance the bay and its watershed.
j	Watershed Plans	Morro Bay Comprehensive Conservation and Management Plan (CCMP) http://www.mbnep.org/Library/ccmp.html As a designated national estuary, the MBNEP is required to develop and implement a Comprehensive Conservation and Management Plan (CCMP) to address priority problems, with the intent of restoring and maintaining the chemical, physical and biological integrity of the estuary and its watershed. The CCMP is a comprehensive plan to address multiple issues. The seven priority problems identified in the current CCMP are: rapid sedimentation,

increased bacterial contamination, increased nutrient concentrations, freshwater flow reductions, increased heavy metal and toxic pollutant concentrations, habitat loss, and loss of steelhead. The Plan incorporates many of the nine key elements of effective watershed plans identified by US EPA as necessary to direct the restoration of impaired waters, including monitoring water quality and habitat, tracking implementation and assessing the effectiveness of its program. The MBNEP is currently updating the CCMP; they expect to adopt an updated plan by November 2012.

Chorro Creek nutrient and dissolved oxygen (DO) TMDL
http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/chorro_creek/index.shtml

The Central Coast Water Board adopted a nutrient and dissolved oxygen TMDL for Chorro Creek in 2006. Beneficial uses of Chorro Creek, as laid out in the Central Coast Water Board's Basin Plan, include municipal and domestic water supply, recreation, cold and warm fresh water habitat, fish migration and spawning, and habitat for rare, threatened or endangered species. Chorro Creek and its tributaries are important streams for populations of threatened south central California steelhead trout, whose spawning and rearing habitat continues to be impacted by sediment and other pollutants.

Data assessed by Water Board staff during development of the nutrient TMDL showed that Chorro Creek was not exceeding nitrate levels protective of drinking water, (10 mg/L nitrate-N); however, low dissolved oxygen and prevalence of large masses of benthic algae led staff to conclude that the narrative standard for biostimulatory substances was not being met. In order to achieve the COLD dissolved oxygen objective of 7mg/L, the following targets were established:

- A median nitrate-N concentration not to exceed 1.5 mg/L-N, within the half-mile reach of Chorro Creek upstream from the road crossing at South Bay Boulevard (310-TWB), measured as a rolling median from May through September.
- A median orthophosphate-P concentration not to exceed 0.4 mg/L, within the half-mile reach of Chorro Creek upstream from the road crossing at South Bay Boulevard (310-TWB), measured as a rolling median from May through September.
- Median stream shading along Chorro Creek downstream from Canet road should not be less than 70%.
- Median in-stream areal cover of benthic algae should not exceed 40%, expressed as a monthly median from May through September.

Morro Bay pathogen TMDL
http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/morro/pathogen/index.shtml

The Morro Bay pathogen TMDL, adopted in 2003, includes Chorro and Los Osos creeks and all of their tributaries. This TMDL is expressed as concentrations that are equal to the numeric targets. For tributaries such as Chorro Creek, the geometric mean for fecal coliform cannot exceed 200 MPN/100 mL (Most Probable Number per 100 milliliters) over a 30-day period, nor shall 10% of samples exceed 400 MPN/100 mL over any 30-day period. The wasteload allocations and load allocations, which include background levels, are also equal to the numeric targets.

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		Morro Bay sediment TMDL http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/morro/sediment/index.shtml The Morro Bay sediment TMDL, adopted in 2003, includes Chorro and Los Osos creeks and all of their tributaries. The annual sediment load allocated to the entire Morro Bay watershed by the TMDL is 34,885 tons per year; the Chorro Creek watershed's allocation is 30,020 tons per year..
k	Restoration Work	Attachment 3 shows the location of restoration and improvement projects in Chorro Creek. Chorro Flats Floodplain Restoration The Chorro Flats Enhancement Project, located in the lower watershed just upstream of the TWB monitoring site, was constructed in 1997 to reconnect Chorro Creek with its historical floodplain, thereby allowing sediment to be deposited there instead of in the bay. The project's other benefits include increasing the riparian corridor to provide shading to Chorro Creek and providing 83 acres of restored wetland and wildlife habitat. Land acquisition was funded through Proposition 111 and State Coastal Conservancy funds; project design, implementation, monitoring and maintenance have been funded with State Coastal Conservancy and USEPA 319(h) funds. The cost of the entire project was approximately $2.3 million. California Men's Colony (CMC) Waste Water Treatment Plant Upgrade As a condition of its NPDES permit to discharge to Chorro Creek, CMC upgraded its wastewater treatment plant in 2007 to reduce nitrate in its discharge. As a result, water downstream of the plant has shown measureable improvements in nitrate levels and dissolved oxygen. Grazing Management Projects, 1998 - 2010 Riparian fencing projects to limit or prevent cattle access to creeks have been completed on sections of several Chorro Creek tributaries (San Bernardo, San Luisito, Dairy, Pennington, Walters and Chumash creeks). The intent of the projects is to reduce fecal coliform and nutrient loading to creeks, to protect creek banks and riparian vegetation, and to improve habitat for fish and wildlife. Projects have been funded with a mixture of state and federal grants, settlement funds and cost-sharing by landowners. Walters Creek Restoration Walters Creek had been straightened and bermed during World War II. As a result, the channel was deeply incised and dominated by non-native vegetation. The restoration project, funded through a combination of state and private funds, removed the berms, re-established a creek meander, connected the channel to its floodplain, and planted native riparian vegetation. The project cost approximately $125,000 and was completed in 2008. MBNEP conducts bird surveys, macroinvertebrate bioassessments and monitors vegetation at the restoration site, in order to track changes in habitat diversity over time. Project Clearwater This Clean Water Act (CWA) Section 319(h) project, implemented by the Coastal San Luis Resource Conservation District, involved implementation of management practices on agricultural lands. The goals of the project were to reduce sediment, nutrient and pathogen loads into Morro Bay. The project

completed five water quality improvement projects in the Chorro Creek watershed, including installation of nearly nine miles of fencing along creeks and a road improvement project to reduce erosion. The project was completed in 2009. In addition to the $291,000 provided by USEPA with CWA Section 319(h) funds, mitigation and settlement funds, private donations, landowner cost-sharing, State Coastal Conservancy funds, and State Department of Conservation funds leveraged the CWA 319(h) grant to nearly $1.8 million for implementation.

Evidence of Watershed-wide Improvement

l Impairments Removed (If applicable)

Dissolved Oxygen (DO)

The Chorro Creek dissolved oxygen listing was removed from the 303(d) list in 2010 because data analysis showed that Chorro Creek was meeting the Basin Plan objective of 7.0 milligrams per liter (mg/L) and was therefore protective of the cold freshwater habitat beneficial use (COLD).

When the TMDL was established, dissolved oxygen concentrations in the lower reaches of Chorro Creek were not within the range protective of cold freshwater habitat as described in the Central Coast Water Board's Water Quality Control Plan (Basin Plan). The initial dissolved oxygen listing was based on five out of ten samples being below the water quality objective of 7.0 mg/L dissolved oxygen. Since the initial listing, more than one hundred additional samples have been collected and analyzed by the Water Board's Central Coast Ambient Monitoring Program (CCAMP). Out of 111 samples collected at the most downstream site (310-TWB), only nine had dissolved oxygen below 7.0 mg/L. Additional monitoring by MBNEP at the same site showed that only two of 67 samples were below 7.0 mg/L. Overall, these data meet the COLD beneficial use water quality objective and are sufficient justification to remove the dissolved oxygen Clean Water Act section 303(d) listing for Chorro Creek. Chorro Creek was "delisted" for dissolved oxygen in 2010. Because CWA Section 319(h) funds had been used in Chorro Creek, the delisting met USEPA requirements for a Section 319(h) Success Story. The story is posted on USEPA's website at http://water.epa.gov/polwaste/nps/success319/ca_chorro.cfm

Attachment 4 shows the monitoring stations on Chorro Creek. Sites are shown with three-letter site tags; however, full site names include the three digit hydrologic unit number, 310, followed by the three-letter site tag, e.g., 310-CHO, 310-TWB, etc. The text, graphs and figures of this report usually use the full site names.

Figure 1 – Dissolved Oxygen Concentration at 310-TWB, 2008 – 2011, Routine Monthly Sampling (CCAMP)

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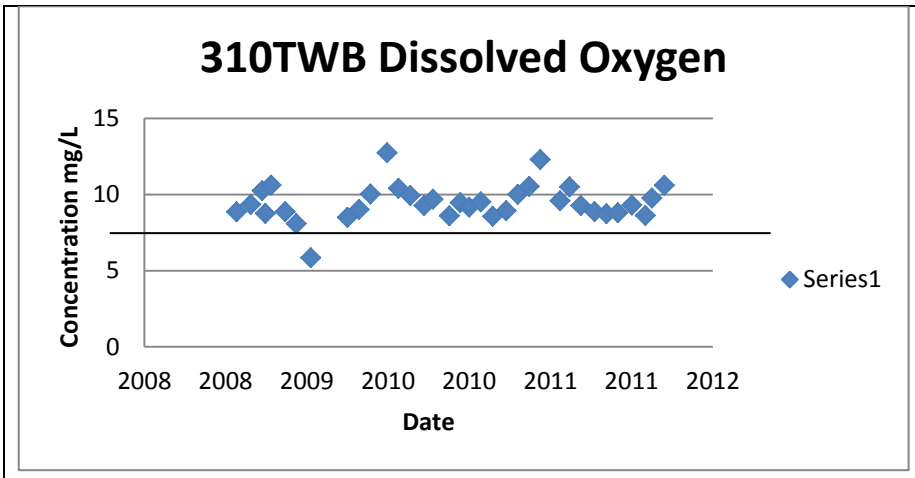

m Improving Trend in Water Quality

Nitrate

The 2007 Chorro Creek Nutrient and Dissolved Oxygen TMDL established an in-stream summer median nitrate-N concentration not to exceed 1.5 mg/L-N within the half-mile reach of Chorro Creek upstream of the bay. Table 1 shows that the summer median has declined from a 2007 high of 4.2 mg/L nitrate-N to 2.0 mg/L nitrate-N in 2011.

Table 1 – 310-TWB Nitrate as N

Year	Annual Average, Nitrate as N	Median* nitrate-N concentration	Number of Samples used to determine both Average and Median
2001	2.61	1.68	9
2002	1.96	1.4	14
2003	2.97	No Summer sample	2
2004	2.33	1.8	9
2005	2.73	2.6	13
2006	3.58	3.1	13
2007	4.08	4.2	11
2008	2.91	3.1	11
2009	1.82	2.2	11
2010	2.08	2.2	12
2011	1.81	2.0	12

*rolling median from May through September (CCAMP Data)

The graph below (Figure 2) is from the MBNEP's 2011 Data Summary Report, showing nitrate data collected by the MBNEP's monitoring program from 2002 through 2011 at four Chorro Creek sites, 310-CHO, 310-UCR, 310-CAN and 310-TWB. Site names include the hydrologic unit (310) and a three-letter tag indicating the location. Data was collected using screening level nitrate test kits. Sites 310-UCR, 310-CAN and 310-TWB are all downstream of the CMC waste water treatment plant. The two sites immediately downstream, 310-UCR and 310-CAN, show a reduction in mean nitrate levels following the treatment plant upgrade in

2007. Site 310-TWB does not show the same reduction, indicating other nitrate sources. All sites are well below the drinking water standard of 10 mg/L nitrate as N, but 310-TWB remains above the screening level of 2.25 mg/L and above the TMDL target.

Figure 2 – Chorro Creek Mean Nitrate Levels

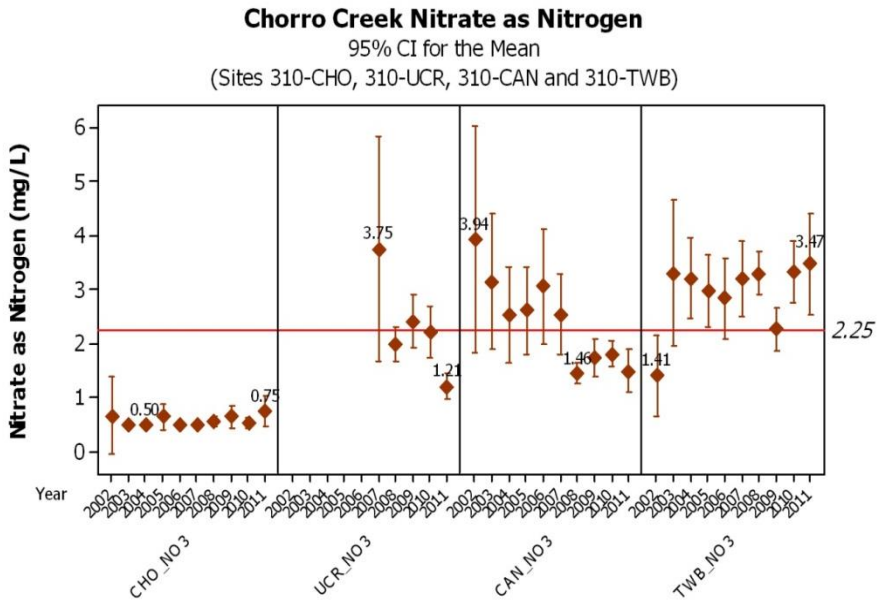

Table 2, excerpted from MBNEP 2011 Data Summary Report, shows median nitrate concentrations at all Chorro Creek monitoring sites on the raw scale, before and after the wastewater treatment plant upgrade. The table has been updated from the version contained in the report to include the sample size. All sites are located within the 310 hydrologic unit. The 310 prefix has been omitted from the names in the table.

Table 2

Site	Pre-upgrade concentrations, Nitrate as N (mg/L)	Pre-upgrade sample size	Post-upgrade concentrations, Nitrate as N (mg/L)	Post-upgrade sample size	Location with respect to CMC WWTP outfall
R-01	0.05	53	0.055	41	Upstream
CHO	0.05	8	0.097	41	Upstream
R-02	0.50	53	0.615	42	Upstream
R-03	4.05	52	2.100	42	Downstream
UCR	3.20	53	1.630	95	Downstream
CER	2.55	6	1.520	10	Downstream
CAN	2.90	13	1.200	50	Downstream
UCF	-	-	1.650	18	Downstream
TWB	3.35	24	2.200	67	Downstream

P. 4-6, 2011 Data Summary Report

The nitrate levels in Chorro Creek show improvement, but are not yet

attaining the TMDL target of 1.5 mg/L nitrate-N at 310-TWB, expressed as a rolling median from May through September.

Orthophosphate-P

The TMDL established an instream median orthophosphorus-P concentration (interpreted as orthophosphate as P) not to exceed 0.4 mg/L-P. Table 3 (data from Chorro Creek 2012 TMDL Three Year Review, draft) shows that the target has been met all but once in the past five years since the wastewater treatment plant upgrade.

Table 3 – 310-TWB Orthophosphate and Total Phosphate as P

Year	Annual Average, Orthophos-phate as P mg/L	Median* Orthophos-phate as P mg/L	Annual Average, Phos-phate, total as P in mg/L	Median* Phos-phate, total as P in mg/L	Number of Samples used to determine both Average and Median
2001	0.55	0.49	0.57	No summer sample	9
2002	0.59	0.62	0.58	0.61	14
2003	0.59	No summer sample	0.61	No summer sample	2
2004	0.41	0.37	0.43	0.37	9
2005	0.31	0.30	0.38	0.34	13
2006	0.35	0.32	0.39	0.34	13
2007	0.38	**0.32**	0.45	0.34	11
2008	0.42	**0.40**	0.44	0.42	11
2009	0.38	**0.36**	0.40	0.36	11
2010	0.39	**0.42**	0.41	0.39	12
2011	0.30	**0.35**	0.31	0.34	12

*rolling median from May through September (CCAMP Data)

n Supporting Trends (one or more)

Evidence of Widespread Significant Load Reductions

Through land acquisitions, conservation agreements and habitat restoration efforts, 3000 acres in the Chorro Creek watershed have been protected and 400 acres restored or enhanced. . A conservation agreement protects 1860 acres in the Chorro Valley, and a purchase of a 580 acre ranch forms the Chorro Creek Ecological Reserve, now owned by California Department of Fish and Game.

Chorro Flats Floodplain Restoration

According to the Coastal San Luis Resource Conservation District's 2000 Final Chorro Flats report, it is estimated that the Chorro Flats project has prevented over 225,000 tons of sediment from reaching the bay.

Project Clearwater

The Coastal San Luis Resource Conservation District estimates that Installation of the five rangeland and road improvement projects in the Chorro Creek watershed between 2006 and 2009 resulted in average annual

		load reductions of approximately five cubic yards of sediment, 757 pounds of nitrogen and 244 pounds of phosphorus. This does not include reduction in streambank erosion as a result of preventing cattle access to stream banks. *Walters Restoration* By restoring meanders to a straightened channel and removing berms, the Walters project is reducing erosion at the source and enhancing habitat. Improvements in Habitat MBNEP and CCAMP also monitor biologic parameters, such as macroinvertebrates, stream shading and in-stream benthic algae cover. Although there are not yet enough data to draw clear conclusions, none of these parameters are showing deteriorating trends, and some areas, such as Chorro Flats, have seen an increase in riparian vegetation. More data is needed to assess whether algae levels are decreasing and shading is increasing. The MBNEP has complete two annual assessments, in 2010 and 2011. As they collect more data, they will be able to evaluate the level of improvement in biotic parameters.
o	Evidence of implementation	The MBNEP maintains a website showcasing work that has been done in the watershed. Photo-documentation of completed projects is standard for most projects. Monitoring and tracking are part of the requirements of both TMDLs and the National Estuary Program. Water Board TMDL staff compile updates on the implementation of most TMDLs every three years. Links to both TMDLs and the MBNEP reports have been provided above. Other evidence includes final reports from grant projects, and monitoring reports required by CMC's NPDES permit.
p	No deteriorating trends	Although Chorro Creek is not yet meeting all numeric targets set by the TMDLs, there do not appear to be any significant deteriorating trends. In 2011, MBNEP completed an analysis of the effectiveness of its efforts to improve water quality and habitat in Morro Bay and its tributaries. The report looked at multiple parameters, including temperature, dissolved oxygen, turbidity, pH, percent in-stream benthic algae cover, bacterial levels and macroinvertebrates. As discussed above, there appears to be a significant downward trend in nitrates. Other parameters appear to be already meeting water quality objectives, moving in the right direction, or fluctuating such that a clear trend could not yet be determined. For some parameters, such as macroinvertebrates, benthic algae cover, and shading, there were not yet enough data to draw clear conclusions; however, none of the parameters showed significant deteriorating trends. The increase in dissolved oxygen levels and subsequent delisting is a positive indicator of improvement in the watershed and is closely related to a number of other parameters, such as temperature, shading, and nutrients. MBNEP and the Water Board expect to be able to measure positive trends in those parameters in the near future.

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q Photos/Graphics (optional)

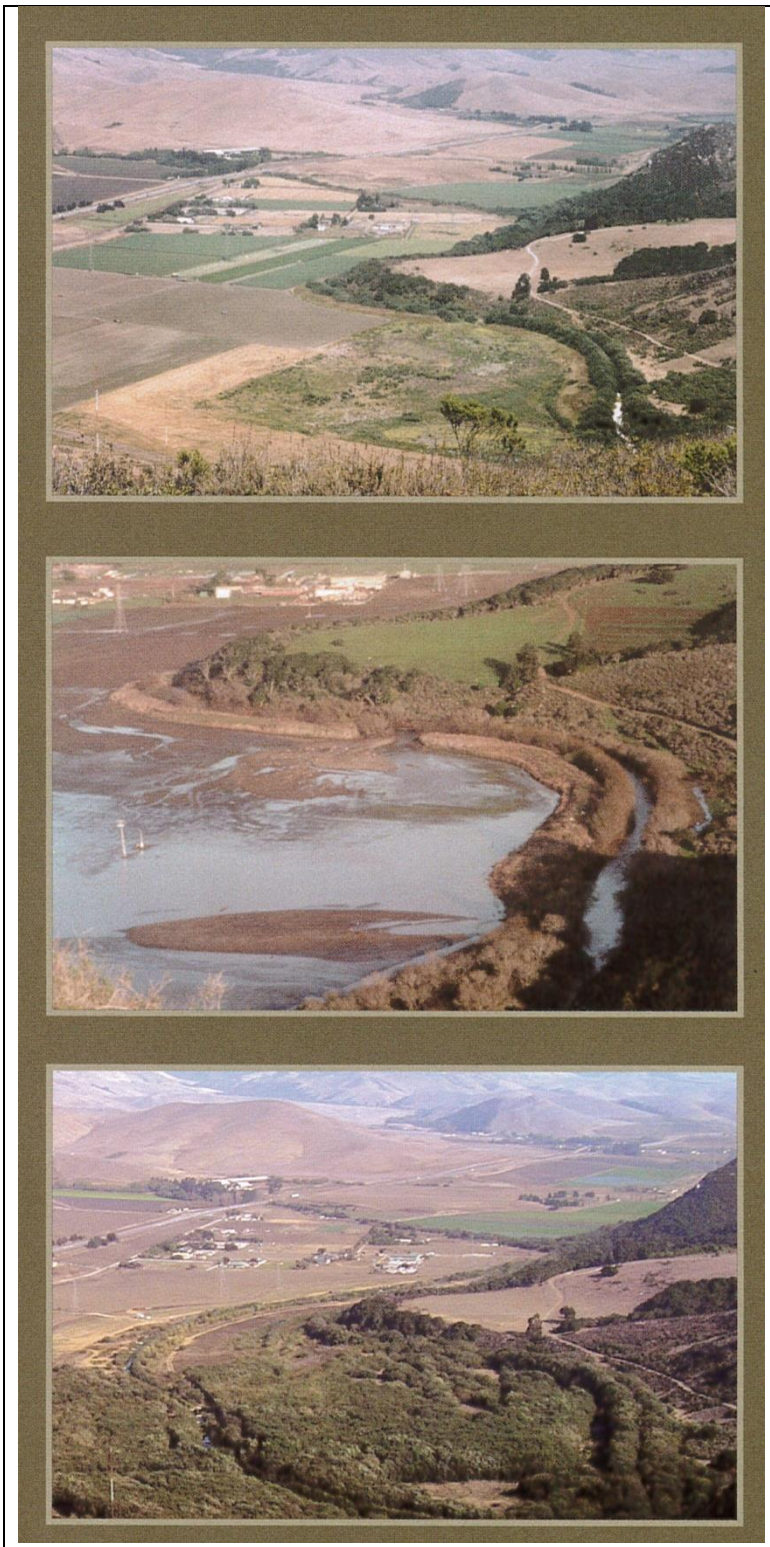

Figure 3: Chorro Flats Levee Breach, 1995 to 2002 (MBNEP)

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Figure 4: Chorro Flats, 2011 (MBNEP)

Figure 5: San Luisito Creek, Before and After (MBNEP)

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Figure 6: Walters Creek Restoration, 2011, After Three Years (MBNEP)

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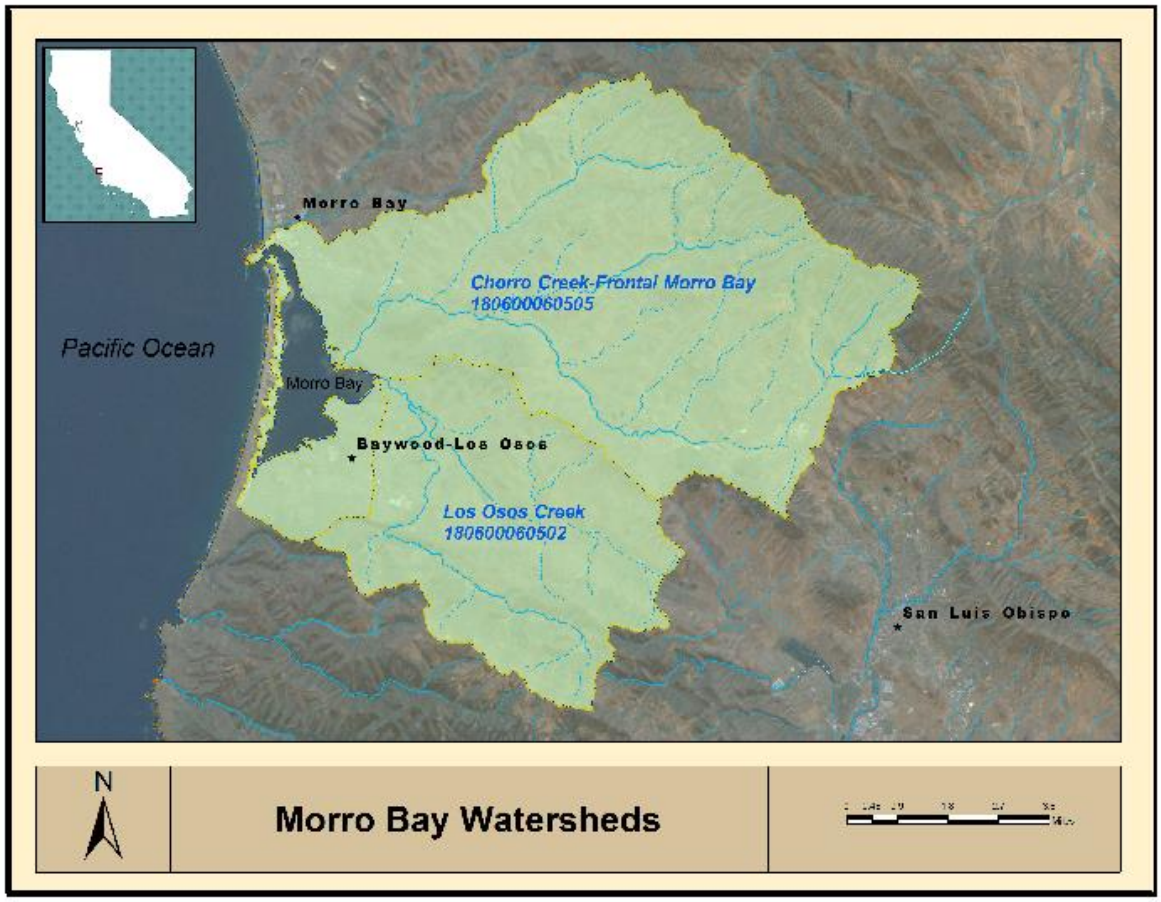
Attachment 1: Morro Bay HUC-12 Watersheds



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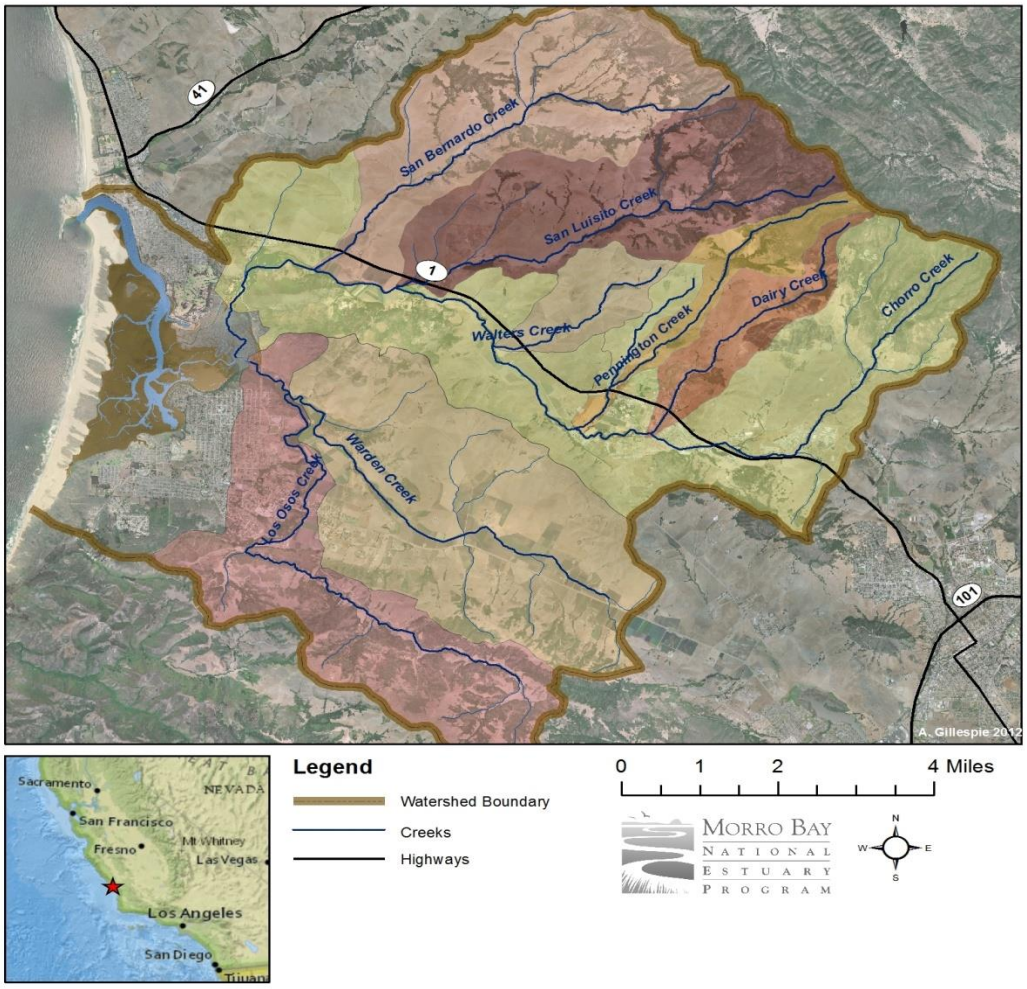
Attachment 2
Morro Bay Watershed (Los Osos and Chorro Creeks and Subwatersheds)



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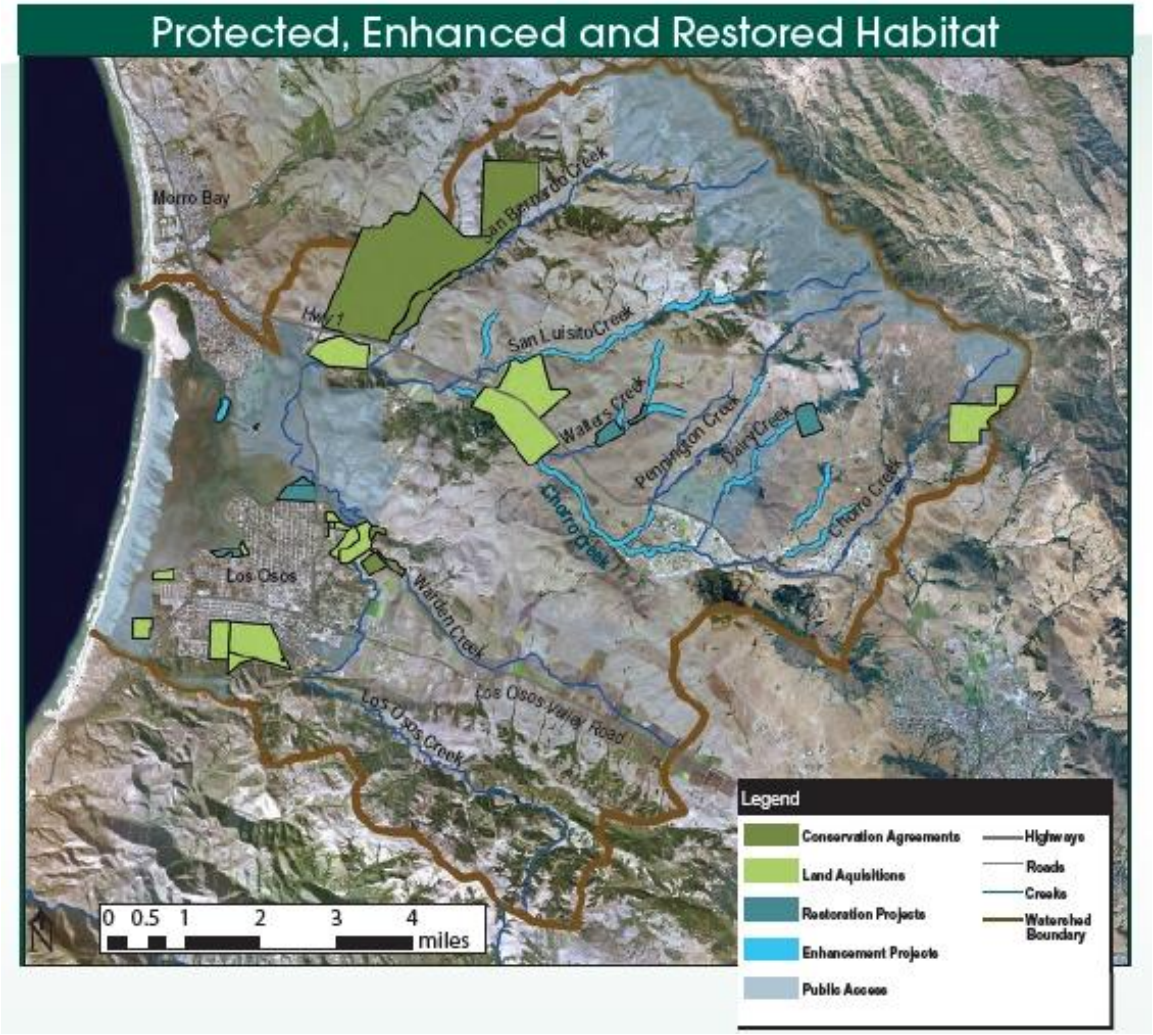
Attachment 3
Project Sites in Chorro Creek Watershed.



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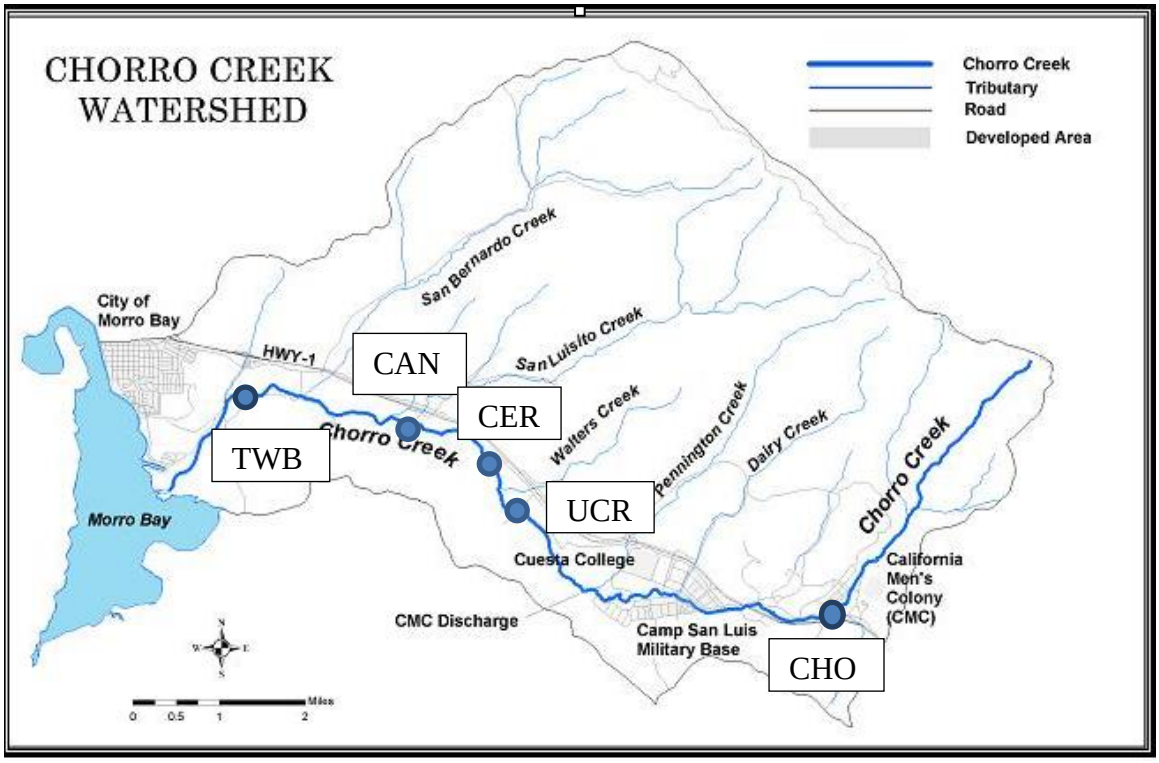
Attachment 4
Chorro Creek Watershed and Monitoring Site Locations

(Site names used in the text of this document often include the hydrologic unit number, 310, in front of the three-letter site tags, e.g., 310-TWB, 310-CAN, etc.)



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References:

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