



CITY OF SAN MARCOS

FINAL December 15, 2011

San Marcos Creek Specific Plan

Master Water Quality and Hydromodification Management Plan





FINAL San Marcos Creek Specific Plan Master Water Quality and Hydromodification Management Plan

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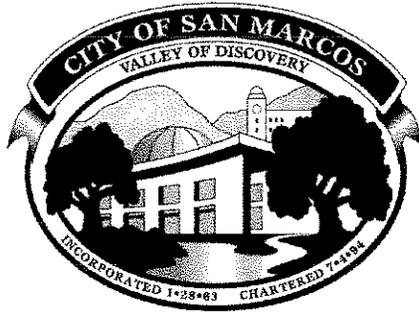
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December 15, 2011

Mike Porter

San Diego Regional Water Quality Control Board

9174 Sky Park Court, Suite 100
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Re: WQTR 401 Permit Condition for City of San Marcos – San Marcos Creek Specific Plan - City of San Marcos Stormwater Program Manager Letter Confirmation of Final Master Water Quality and Hydromodification Management Plan (Final Master WQTR Dated December 15, 2011) Meets Local SUSMP Requirements

Dear Mr. Porter:

This letter serves to confirm to the San Diego Regional Water Quality Control Board in the determination that the subject project will comply with certain 401 Certification conditions requiring priority development projects to confirm that their project design meets local SUSMP requirements.

The adopted San Marcos Creek Specific Plan and the Final Master WQTR dated December 15, 2011 are framework plans for guiding development in a 135-acre specific plan area. A Final Master Water Quality and Hydromodification Management Plan (Master WQTR) has been completed to guide development and ensure that hydromodification (HMP) effects and Water Quality Requirements can be met under Order R9 2007-0001 at a master plan level and project specific level.

The Final Master WQTR has provided a technical assessment of permit compliance for meeting water quality and HMP requirements for 100 percent of the public facilities and a minimum percentage of private development in shared bioretention facilities in the Promenade. Private development will be required to implement LID and other water quality/HMP facilities for any remainder treatment required onsite.

In addition, the Final Master WQTR includes recommendations for monitoring the efficacy of the BMP effectiveness as part of a 401 permit conditions as requested.

The City is attaching the Final Master Water Quality Technical Report (WQTR) to this letter. By way of my signature below and my signature on each individual development project Water Quality Improvement Plans (WQIPs) in the Specific Plan Area, I certify that the both the attached Final Master WQTR and each individual development project in the Specific Plan Area meets the following Local SUSMP Requirements of the City of San Marcos and that the measures being taken are protective of water quality:

- 85th percentile capture of the 24 hour storm;
- LID Requirements;
- Site Design Requirements;
- Source Control Requirements; and
- Hydromodification Requirements

Any revisions made hereafter will continue to comply with the local SUSMP requirements and will not result in any decreases in water quality treatment or capacity. This Final Master WQTR is signed by way of this letter by the City of San Marcos Stormwater Program Manager and provided to the San Diego Water Board to fulfill the condition of the 401 Certification for this project.



Erica Ryan

Stormwater Program Manager

City of San Marcos



FINAL San Marcos Creek Specific Plan

Master Water Quality and Hydromodification Management Plan

Objectives of Master Water Quality and Hydromodification Management Plan (Master WQ/HMP Management Plan)

This Master WQ/HMP Management Plan for the San Marcos Creek Specific Plan is intended to:

1. Provide a master management plan for water quality and hydromodification facilities within the specific plan development area;
2. Meet the Municipal Stormwater Permit Requirements for development in the San Diego Regional Water Quality Control Board (SDRWQCB) Order R9 2007-0001 (Permit) for water quality and hydromodification (HMP) development requirements as of January 14, 2011;
3. Implement shared and managed water quality and HMP facilities for each of the eight designated drainage management areas (DMAs);
4. Identify the required surface storage bioretention capacity in each of the eight DMA WQ/HMP facilities to adequately treat urban runoff and retain and release the natural rainfall rate for all public facilities and a designated portion of private development;
5. Identify a framework to be implemented and submitted annually with the 401 permit Mitigation and Monitoring Reporting Program (MMRP) to:
 - a. Ensure achievement of anticipated pollutant removal rates by treatment controls to implement a net reduction of current urban runoff load to water bodies downstream (San Marcos Creek, Lake San Marcos, Batiquitos Lagoon, and the Pacific Ocean);
 - b. Ensure HMP capacity is adequate for each DMA;
 - c. Ensure improving IBI/BMI scores over time; and
 - d. Ensure water quality improvement over time in San Marcos Creek.
 - e. Coordinate with required annual biological MMRP reporting requirements.
 - f. Provide baseline framework for 401 certification compliance.
6. Identify a consistent application of water quality treatment design, review and construction implementation for private development projects;

In addition to ensuring consistency in the application of WQ/HMP within a private development project located in the San Marcos Creek Specific Plan area, the Master WQ/HMP Management Plan also ensures that the Specific Plan area functions within ongoing watershed planning so that each project takes into consideration its



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role within the Specific Plan area as well as within the SAN MARCOS Creek watershed.



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Master Water Quality and Hydromodification Management Plan

1.0 PROJECT DESCRIPTION AND PHASING

1.1 SAN MARCOS CREEK SPECIFIC PLAN

Figure 1-1 shows the project location in the City of San Marcos. The San Marcos Creek adopted Specific Plan represents an effort to create a managed planning framework for future growth and redevelopment of the approximately 214-acre area along San Marcos Creek in central San Marcos between Discovery Street and SR 78. Approximately 124 acres are proposed for development.

The overall goals of the Specific Plan are to:

1. Create a smart growth downtown area which is currently absent in San Marcos; and
2. Restore San Marcos Creek/Las Posas Creek in the Specific Plan Area.

The Specific Plan provides a comprehensive vision for a creekside district along with goals, policies and development standards to guide future public and private actions relating to the area's development and conservation of open space and natural resources. The Specific Plan also serves as the mechanism for insuring that future development will be coordinated and occur in an orderly and well-planned manner. The vision for the Specific Plan area is a generally more urbanized feel.

The proposed land-use is a smart growth based mixed-use commercial core and "downtown" for San Marcos. The proposed Specific Plan land-uses will balance retail and entertainment uses with a mix of residential, office, and service uses to neighborhoods with both active and passive elements. The proposed land-use within the Specific Plan consists of the following:

- Streets: 42.6 acres
 - Mixed-Use: 75.6 acres
 - Improved Parks: 17.3 acres
- Subtotal Development Area: 135.54 acres**
- Natural Open-Space: 78.5 acres
- Total Area: 214.00 acres**



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Figure 1-1 Vicinity Map

San Marcos Creek Project Vicinity

-  San Marcos Creek
-  Lakes
-  San Marcos Creek Specific Plan Area
-  Discovery Street ROW
(Included in master WQTR analysis)
-  San Marcos City Limits

Source of Data: SanGIS, 0710 and City of San Marcos, 2/11
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1.2 ALTERNATIVE ASSESSMENT FOR ORDER R9 2007-0001 COMPLIANCE

The proposed project used as the basis for the assessment and development of the Master WQ/HMP Management Plan is the City's preferred Alternative 7 to be consistent with the Army Corps of Engineers 404(b) analysis and the selected LEDPA for the project. Alternative 7 was evaluated for compliance with the January 14, 2011 Order R9 2007-0001 requirements.

Figure 1-2 shows the current Alternative 7 concept plan developed by WRT in September 2011. Figure 1 was used as the basis by Mikhail Ogawa Engineering (MOE) and Wayne Chang Consultants for the Water Quality and HMP Order R9 2007-0001 compliance assessments

Other alternatives developed by the City, including Alternatives 1-6, 8, 8a, and 9, were also assessed for Order R9 2007-0001 water quality and hydromodification compliance. All other alternatives were found to be permit compliant or the development footprints were adjusted to accommodate required bioretention acreages for water quality and hydromodification.

1.3 PROJECT PHASING

The project will be constructed in two primary phases:

- **Phase I - Near Term (by 2014):** By 2014, the City plans to have constructed and placed into operation the promenade, the shared bioretention water quality and hydromodification facilities located in the promenade, restoration of San Marcos Creek and Las Posas Creek, floodwall improvements, primary utility infrastructure, and critical circulation element improvements in the Specific Plan Area.

It is important to note that by 2014 immediate water quality and hydromodification benefits to San Marcos Creek and Lake San Marcos would occur due to:

- The restoration of San Marcos Creek and Las Posas Creek into balanced creek systems within a key location within the subwatershed; and
- The immediate implementation and operation of the shared bioretention facilities in the promenade in advance of any



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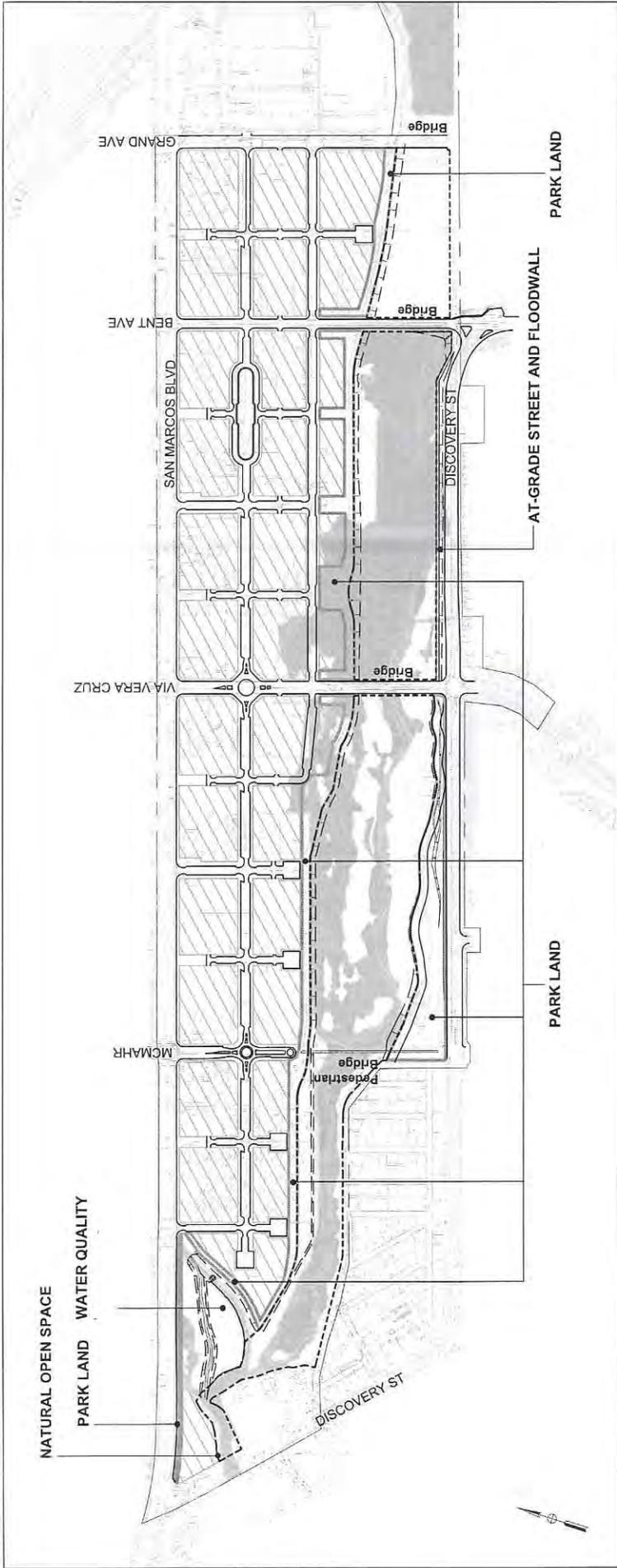
development anticipated over the estimated long term buildout of the specific plan area.

- **Phase II – Long Term (20 Year Estimated Buildout):** Private development of the specific plan area (predominately mixed use areas) is required by the specific plan to be developed in model blocks to ensure development consistency. It is anticipated that buildout of the remainder of the Specific Plan Area would occur based primarily on economic factors over a 20 year time frame.



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Figure 1-2 September 2011 Alternative 7, WRT



SCALE: 1"=800'

SAN MARCOS CREEK IMPROVEMENTS
ALTERNATIVE 7: REALIGNMENT OF LAS POSAS CREEK, DEVELOPMENT REDUCTION
BETWEEN MCMAHR AND VIA VERA CRUZ ,AT-GRADE DISCOVERY STREET WITH FLOODWALL,
ELIMINATION OF CHANNEL EXCAVATION WEST OF VIA VERA CRUZ, BRIDGE CROSSING AT BENT AVENUE

LEGEND

- PADS
- ROADWAYS
- PARK LAND
- ARMY CORPS JURISDICTIONAL AREA

	LAND USE COMPARISON				
	NEW DEVELOPMENT AREA (AC)	RETAIL (SF)	OFFICE (SF)	RESIDENTIAL (UNIT)	PARK (AC)
ADOPTED PLAN	81.30	1,284,703	598,205	2,341	20.64
ALT. 7 PLAN	75.55	1,193,841	555,897	2,175	16.45
DIFFERENCE	-5.75	-90,862	-42,308	-166	-4.19

	AREA (AC)
ROAD	14.76
PARK LAND	16.45
NATURAL OPEN SPACE	60.66
COMMERCIAL/RESIDENTIAL	75.55
TOTAL	167.42

San Marcos Creek Project Vicinity Future Land Use

-  San Marcos Creek
-  Lakes
-  Parcels
-  San Marcos Creek Specific Plan Area
-  Discovery Street ROW
(Included in master WQTR analysis)
-  San Marcos City Limits

Source of Data: WRT, 07/07, SanGIS, 07/11,
and City of San Marcos, 2/11
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2.0 EXISTING CONDITIONS

2.1 WATERSHED

Figure 2-1 shows that the San Marcos Creek Specific Plan area is located in the Upper San Marcos Creek (USMC) Watershed of the Carlsbad Hydrographic Unit (HU 904). The USMC Watershed is approximately 29 square miles and is comprised of two sub-watersheds. The primary water bodies in the USMC watershed are Upper San Marcos Creek and Lake San Marcos. The Specific Plan Area discharges into both the San Marcos Creek above Lake San Marcos, Lake San Marcos, and ultimately to the Batiquitos Lagoon and Pacific Ocean.

The Specific Plan Area is located in the Richland HSA (HSA 904.52) which comprises the lower portion of the USMC Watershed, and comprises 69% of the total land area of the USMC Watershed or 12, 863 acres. The proposed development area of the Specific Plan area is approximately 1.0% (135 developed acres) of the total area of the Richland HSA.

2.2 303(D) LISTINGS AND TMDLS

Table 2-1 summarizes current water quality impairments in San Marcos Creek and Lake San Marcos as identified on the current State of California's 303(d) List of Impaired Water Body Segments. **Table 2-2** lists the beneficial uses of San Marcos Creek, Lake San Marcos, and unnamed intermittent streams that are established in the Water Quality Control Plan for the San Diego Basin (Basin Plan).

Table 2-1

2010 303(d) Listings for San Marcos Creek/Lake San Marcos

303(d) Listed Water Body	2010
San Marcos Creek	DDE, phosphorous, selenium, sediment toxicity
Lake San Marcos	Ammonia as N, Nutrients,



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**Table 2-2
Basin Plan Inland Surface Waters
Beneficial Uses for San Marcos Creek/Lake San Marcos**

Water Body	Beneficial Uses
San Marcos Creek/Lake San Marcos (904.52 - Richland)	MUN (excepted), AGR, REC1, REC2, WARM, WILD

There are two TMDLs in place or underway in the Specific Plan Area. Currently the San Marcos HA is under the Bacteria I TMDL (adopted 2010) with designated load allocations. This TMDL is applicable to the entire San Marcos HA including the Specific Plan area. The City of San Marcos is participating in the Bacteria I TMDL. The Lead Agency for this effort is the City of Encinitas.

The Upper San Marcos Creek is also under a Voluntary Nutrient TMDL which commenced in June 2011. Load allocations have not yet been identified. The City of San Marcos is the lead agency for the Upper San Marcos Voluntary Nutrient TMDL (See **Figure 2-2**). The City of San Marcos is also the designated lead in the USMC Watershed Nutrient Management Plan effort.

The Specific Plan Area is just upstream of Lake San Marcos and must consider as the primary pollutants of concern the reduction of bacteria, phosphorous, nitrogen, selenium and other metals, and sediments into the Creek and Lake. DDE has been in use for decades and is attached to soil particulates. Regulatory bans and phase outs on the use of DDE pesticides over the last several years will take into effect along with increased soil stabilization practices. DDE derivatives are no longer commercially available and the concentrations are anticipated to reduce over time coupled with appropriate best management practices from existing development, proposed development and soil stabilization practices required during construction.

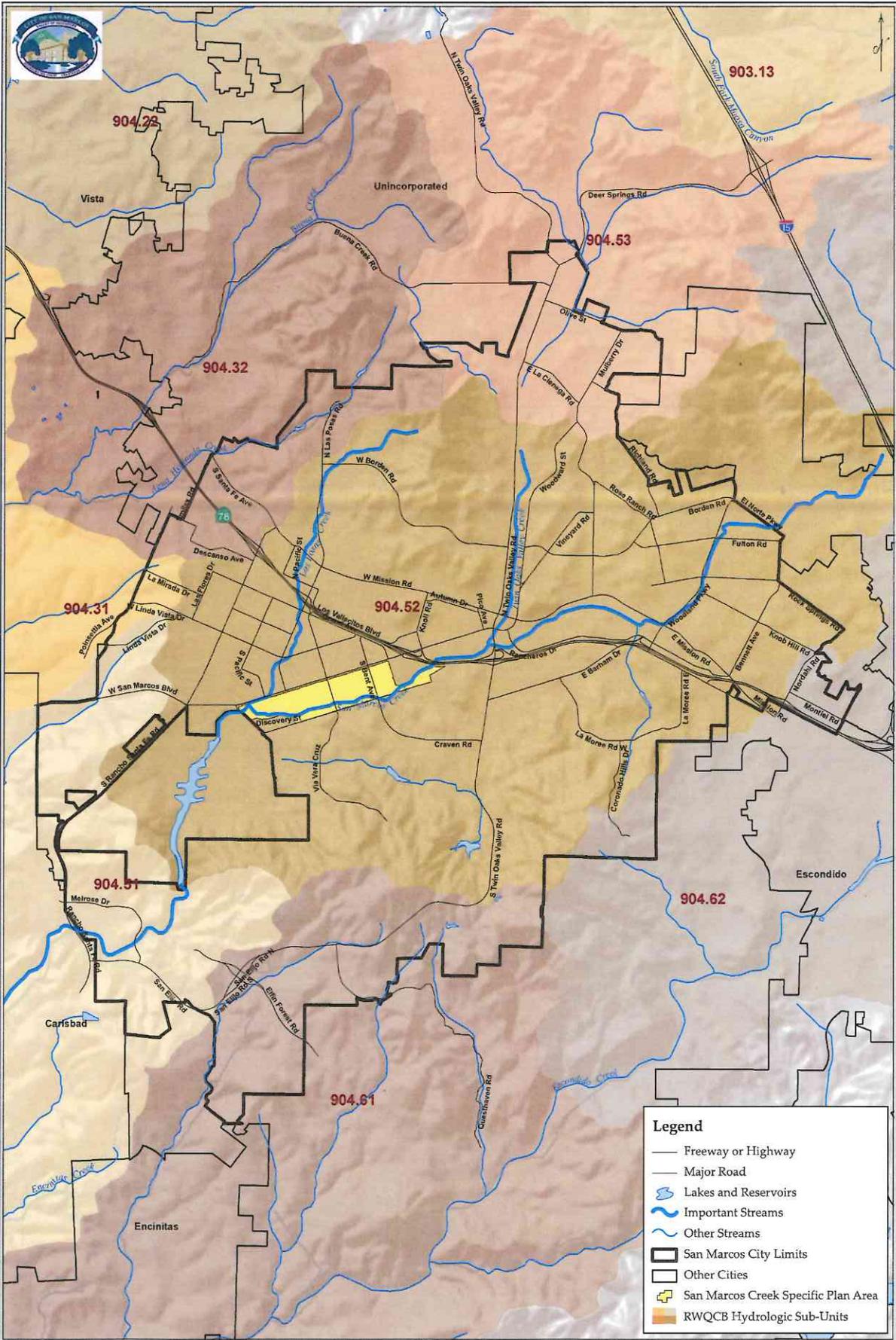
The Specific Plan Area is located in a key point in the USMC watershed. Because the Specific Plan Area is located at the western most part of the USMC where drainage areas from the Richland and Twin Oaks Valley HSA converge, it is poised to provide a significant net positive change to water quality through two primary objectives of the Specific Plan and the this Master WQ/HMP Management Plan:

1. Restoration and Enhancement to a balanced creek system of Las Posas Creek and San Marcos Creek; and
2. Implementation by approximately 2014 of shared hydromodification and water quality bioretention facilities in the promenade.



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Figure 2-1 Watershed Map



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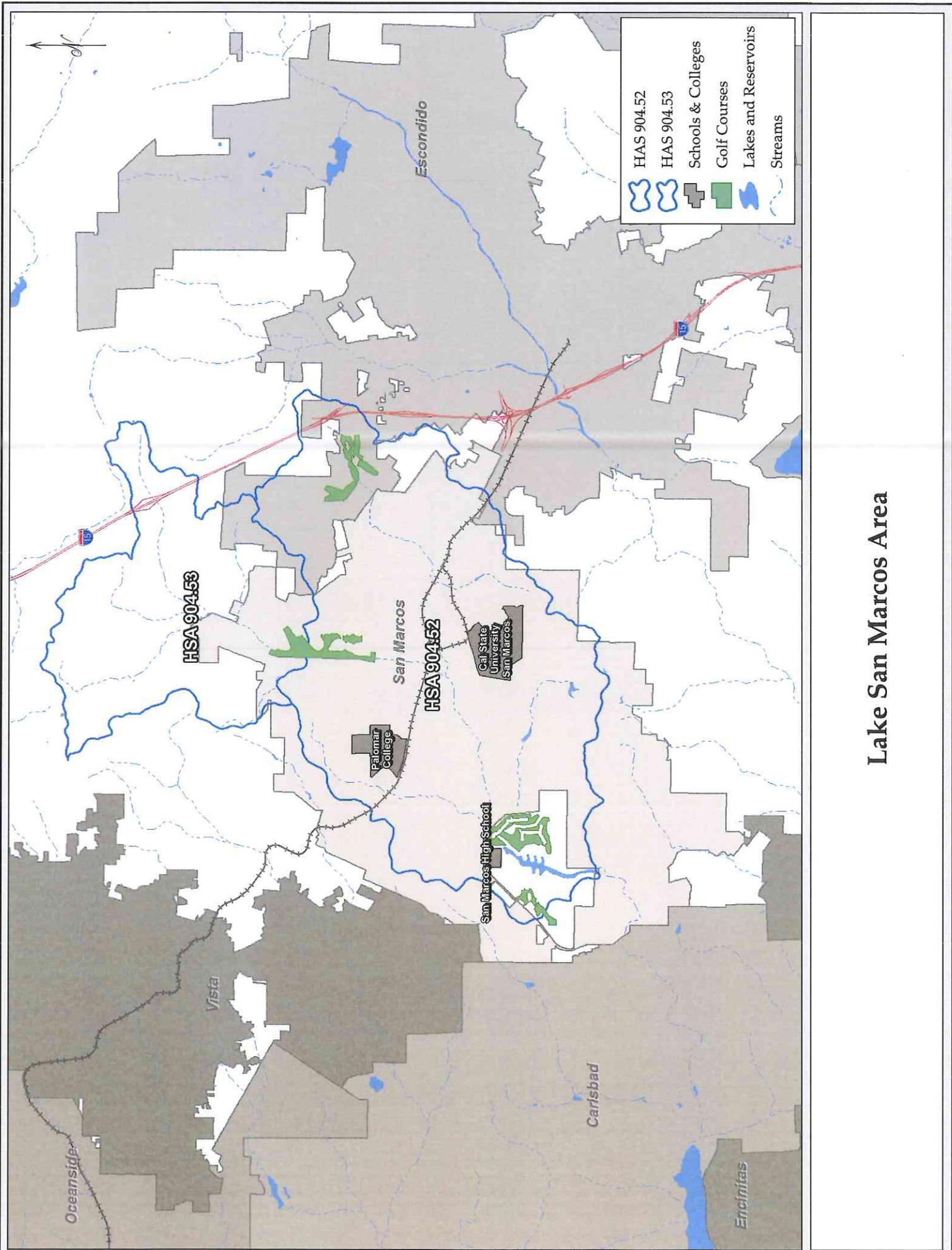
San Marcos Creek Specific Plan HSA MAP

0 1,000 2,000 4,000
Fees
1 inch = 4,000 feet
CREATED BY: City of San Marcos GIS
SOURCES OF DATA: SanGIS, 10/09;
City of San Marcos, 2011



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Figure 2-2 USMC Management Plan and Voluntary Nutrient TMDL Area



Lake San Marcos Area



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2.3 EXISTING TREATMENT CONTROLS IN SPECIFIC PLAN AREA



The Study Area consists of 135.5 acres on the north and south side of San Marcos Creek between Grand Avenue and Discovery Street in the City of San Marcos (See **Figure 1-1**). Existing development is generally located closer to San Marcos Boulevard.

Existing development in the area between Grand Avenue and McMahr Road consists primarily of commercial and legal nonconforming industrial uses, including neighborhood “strip” retail centers, two gas stations, a lumberyard, three storage facilities, a construction material storage yard, auto services, a bowling alley, office uses, and a fast food restaurant (San Marcos Creek Specific Plan, 2007). Additionally, there are several residential uses in the study area.

The existing land-use acreages within the Study Area consist of the following:

- Streets 12.65 ac
- Commercial Acreage: 28.02 ac
- Industrial Acreage: 17.57 ac
- Residential Acreage: 12.66 ac
- Vacant Acreage: 64.4 ac

Figure 2-3 shows that there are **no treatment controls or hydromodification facilities in the specific plan area**. All treatment controls implemented since 2001 are located outside of the Specific Plan Area and consist predominately of filters installed during the 2001 Municipal Stormwater Permit cycle which have since been established as a last resort treatment control and not as effective as infiltration and/ or bioretention facilities.

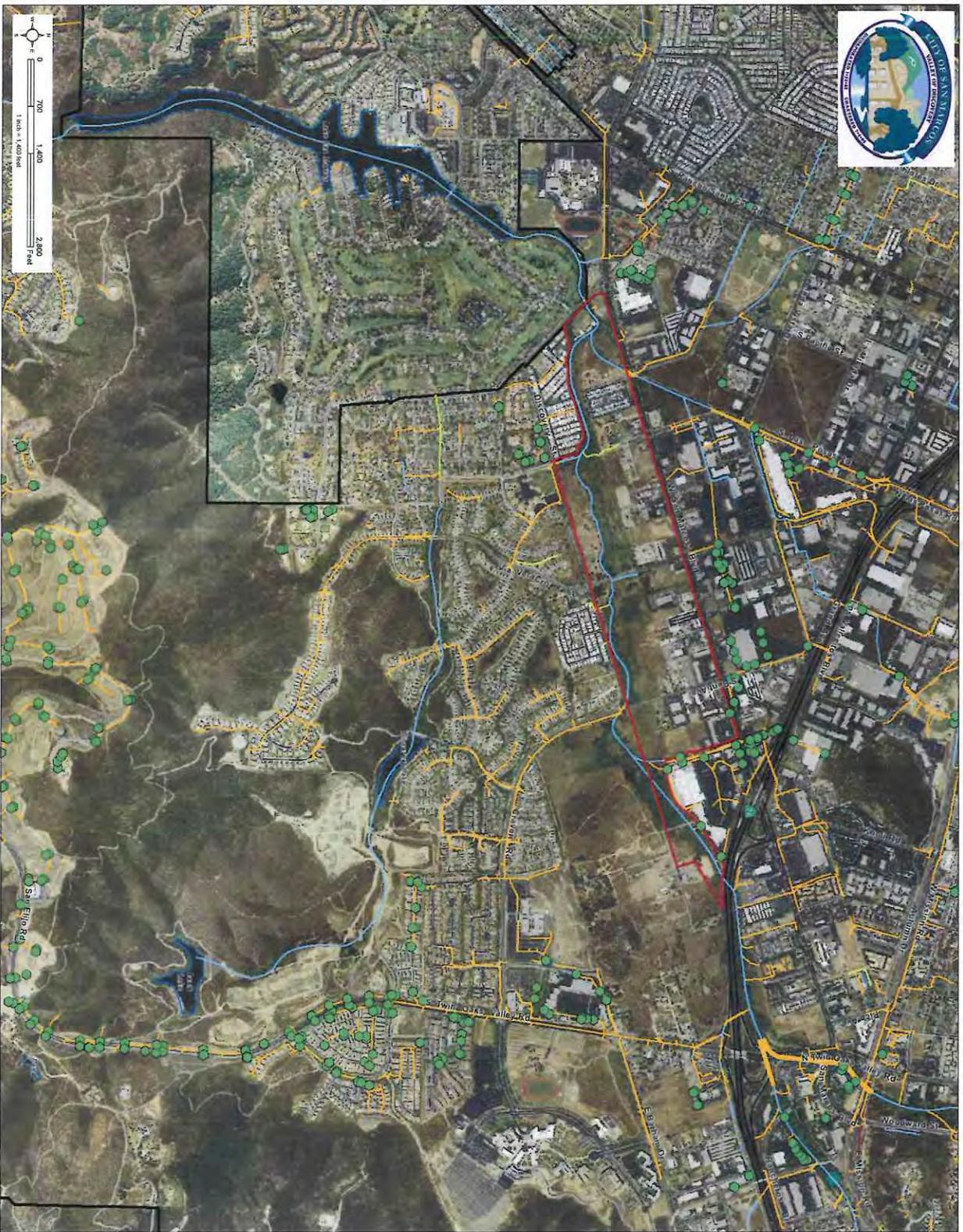


Table 2-3 represents existing water quality conditions within the Specific Plan area under existing land use conditions (See **Appendix A**, MOE 2011). Without water quality treatment in the proposed Specific Plan Area, the pollutant concentrations estimated in **Table 2-3** would continue for 1 - bacteria (fecal coliform), 2-oil and grease, 3-sediment (TSS), 4- nutrients (NH₃, No₂+NO₃, Nitrogen Total Kjeldahl, phosphorous (Total), and 5 – metals (Cd, Cu, Pb, Ni, Zn).



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Figure 2-3 Existing Treatment Controls in SP Area



San Marcos Creek Vicinity Existing MS4 System / Water Quality BMPs

- BMP
- Storm Ditch
- Channel wider than 5 ft
- Ditch less than 5 ft wide
- Storm Mains
- Detention Basins
- Lakes
- San Marcos Creek Specific Plan Area
- San Marcos City Limits

Source of Data: ArcGIS, 07/10 and City of San Marcos, 2/11
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**Table 2-3
Estimated Existing Land Use Pollutant Concentrations**



Constituent	Units	Estimated Existing Concentrations of Pollutants in Specific Plan Area
TSS	(mg/L)	90.07
COD	(mg/L)	109.59
Fecal Coliform	(mpn/100 mL)	4,962.7
NH3	(mg/L)	0.73
NO2+NO3	(mg/L)	0.74
Nitrogen, Total Kjeldahl	(mg/L)	1.71
Phosphorous, Total	(mg/L)	0.45
Cd, Total	(ug/L)	0.84
Cu, Total	(ug/L)	21.77
Pb, Total	(ug/L)	29.66
Ni, Total	(ug/L)	7.63
Zn, Total	(ug/L)	190.74
Oil and Grease	(mg/L)	2.57

The estimated existing pollutant concentrations were calculated using land use types from the National Stormwater Quality Database EPA rainfall Zone 6 (see **Appendix A**, MOE Preliminary Water Quality Treatment Analysis, July 2011) .



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2.4 2002/2007 SWAMP ASSESSMENTS IN SAN MARCOS CREEK

In 2002 and 2007, the Stormwater Ambient Monitoring Program (SWAMP) conducted a physical habitat assessment in the San Marcos Creek in just south of McMahr (see results for 2002/2007 SWAMP 904CBSAM3). The SWAMP assessment compared physical habitat component ranges for 10 physical habitat components. Numeric ratings from 0 (poor rating - heavily impacted habitat) to 20 (best rating - unimpacted habitat) were given to each component. The ability of a creek to perform natural water quality functions and its susceptibility to hydromodification are inherent in the physical habitat components. In general, the concept is that a balanced physical stream system provides the maximum water quality benefit and resistance to hydromodification. **Table 2-4** summarizes the individual physical habitat ratings for San Marcos Creek in the Specific Plan area and provides a generalized assessment of those features that relate most to water quality and those physical habitat features that relate most to hydromodification. The 2002 SWAMP mean rating for San Marcos Creek was 11.5 based on all components and was rated a moderately altered habitat (greater than 10). Good bank stability is achieved for scores over 15.

Table 2-4

Summary of SWAMP 2002/2007 Physical Habitat Assessment for San Marcos Creek in Specific Plan Area

Physical Habitat Component Description	Score	Generalized WQ or HMP Component of Natural Creek System
Epifaunal Cover	11	WQ
Embeddedness	2	WQ
Velocity Depth Regime	11	HMP/WQ
Sediment Deposition	20	HMP/WQ
Channel Flow	19	HMP/WQ
Channel Alteration	2	WQ
Riffle Frequency	6	WQ
Bank Stability	20	HMP
Vegetation Protection	18	HMP/WQ
Riparian Zone	6	WQ

Source: 2002 and 2007 SWAMP Reports on the Carlsbad Hydrologic Unit

The overall summary rating for San Marcos Creek in the Specific Plan Area was rated poor based on three ecological health indicators. Water Chemistry (High severity of impact; 6+ exceedences of aquatic life), Toxicity (Low severity of Impact; Frequency of toxicity between 0.0 and 0.1) and Bioassessment (High



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Severity of impact, IBI score between 0 and 40). This result was also identified for two locations assessed from 1998 through 2002 and included in the SDRWQCB 2002 Biological Assessment Report where site IDs 44 and 46 (one near McMahr and one near Rancho Santa Fe Road) also had poor IBI scores (both between 10 and 45) and BMI (bio assessment metrics and benthic macroinvertebrate) assessments which supported the poor rating.

The San Marcos Creek in the Specific Plan Area, while it has relatively stable banks, is in effect not a balanced stream system and is currently functioning at a substantially diminished capacity to naturally uptake water quality constituents.

DUDEK and associates confirmed during focused biological resource assessments for the Specific Plan proposed corridor of restoration for Las Posas Creek and San Marcos Creek that of the estimated 43.54 acres of existing wetlands, that roughly 35 acres (90%) were disturbed wetlands with inclusions of between 20% to 100% weeds. Undisturbed wetlands (wetlands with less than 20% weeds) comprised only 8.61 acres (10%) of the natural creek systems in the specific plan area.

2.5 EXISTING WATER QUALITY IN SPECIFIC PLAN AREA

Figure 2-4 shows ongoing water quality monitoring stations that are conducted annually in the specific plan area for two purposes:

- MS4 dry weather monitoring; and
- Upper San Marcos Creek Nutrient Management Plan and Voluntary Nutrient TMDL data gathering efforts.

There are currently five monitoring stations in the Specific Plan Area. Like the rest of the Calrsbad Watershed and County-wide, urban runoff for nutrients and bacteria are above the Basin Plan Water Quality Objectives and generally below the Order R9 2007-0001 actionable levels.

Data gathered from these monitoring stations will be used to identify existing baseline water quality for the specific plan area.



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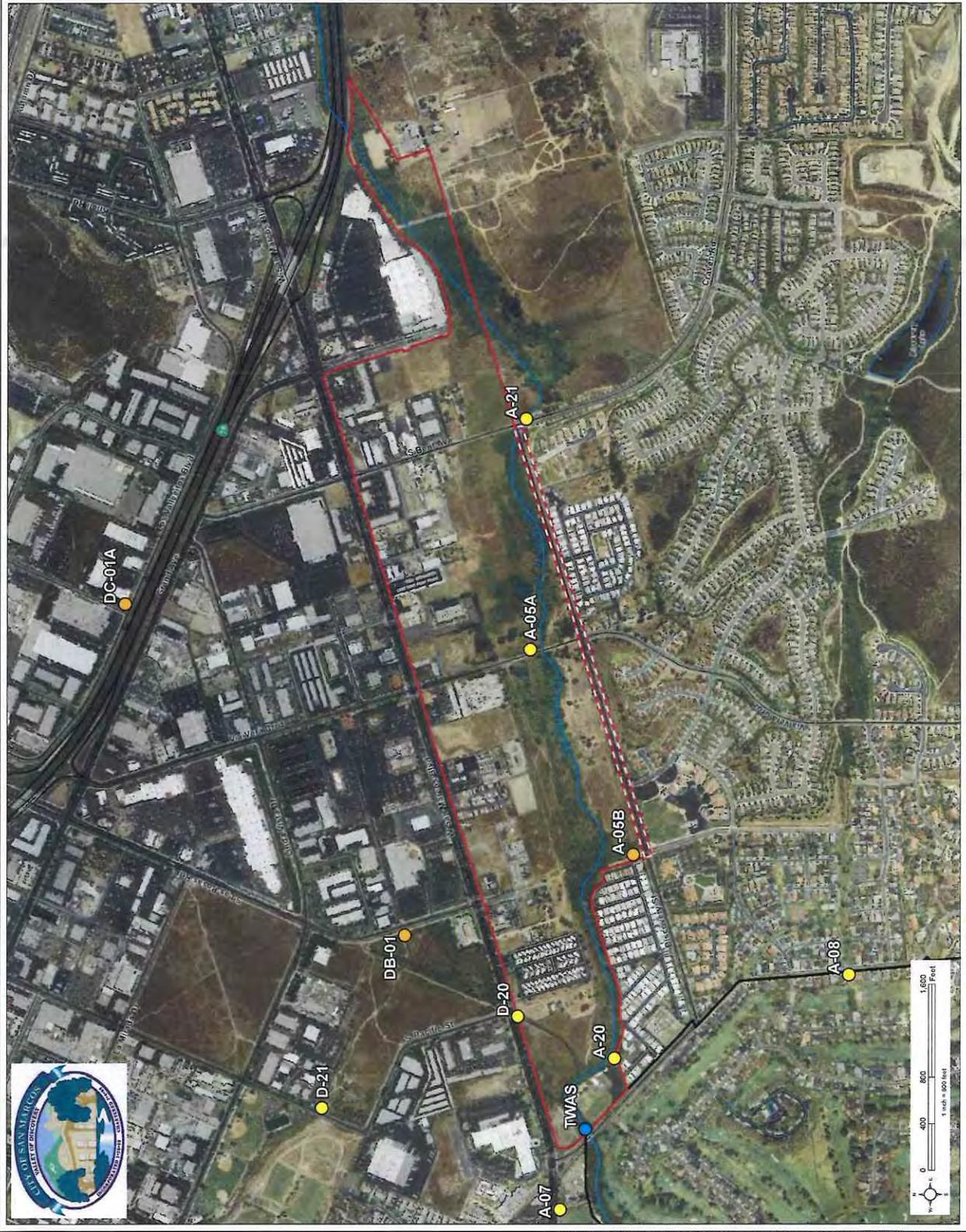
Figure 2-4 Existing Water Quality Monitoring Stations in Specific Plan Area

San Marcos Creek Monitoring Stations

- Mass Loading (TWAS) Site
- Dry Weather Sites
- Lake San Marcos Quarterly Monitoring Sites
-  San Marcos Creek
-  Lakes
-  San Marcos Creek Specific Plan Area
-  Discovery Street ROW (Included in master WQTR analysis)
-  San Marcos City Limits

Source of Data: SanGIS, 0710 and City of San Marcos, 7111
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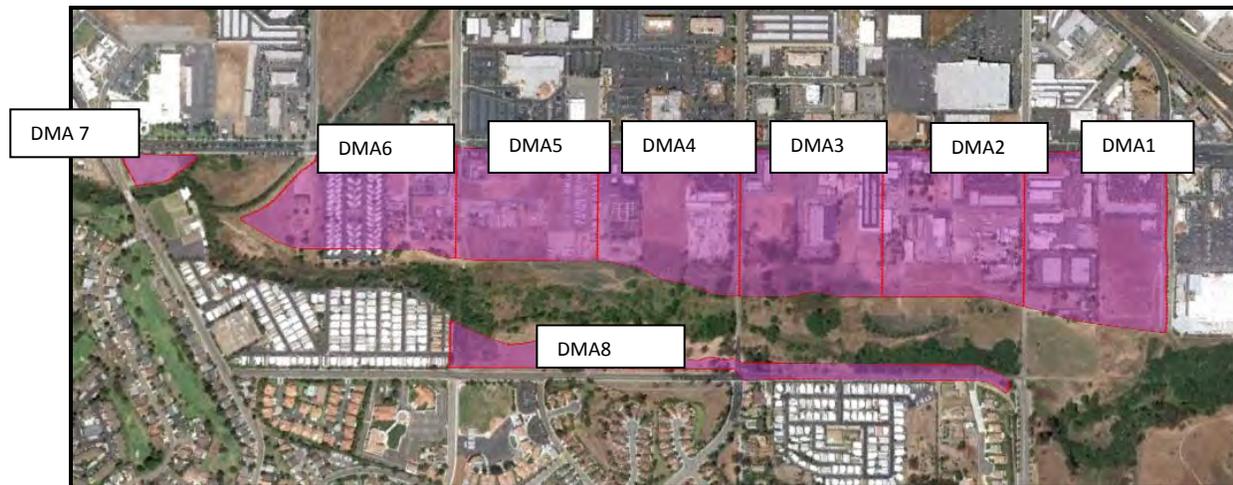




FINAL San Marcos Creek Specific Plan Master Water Quality and Hydromodification Management Plan

3.0 WATER QUALITY/HYDROMODIFICATION COMPLIANCE REQUIREMENTS

3.1 DRAINAGE MANAGEMENT AREAS



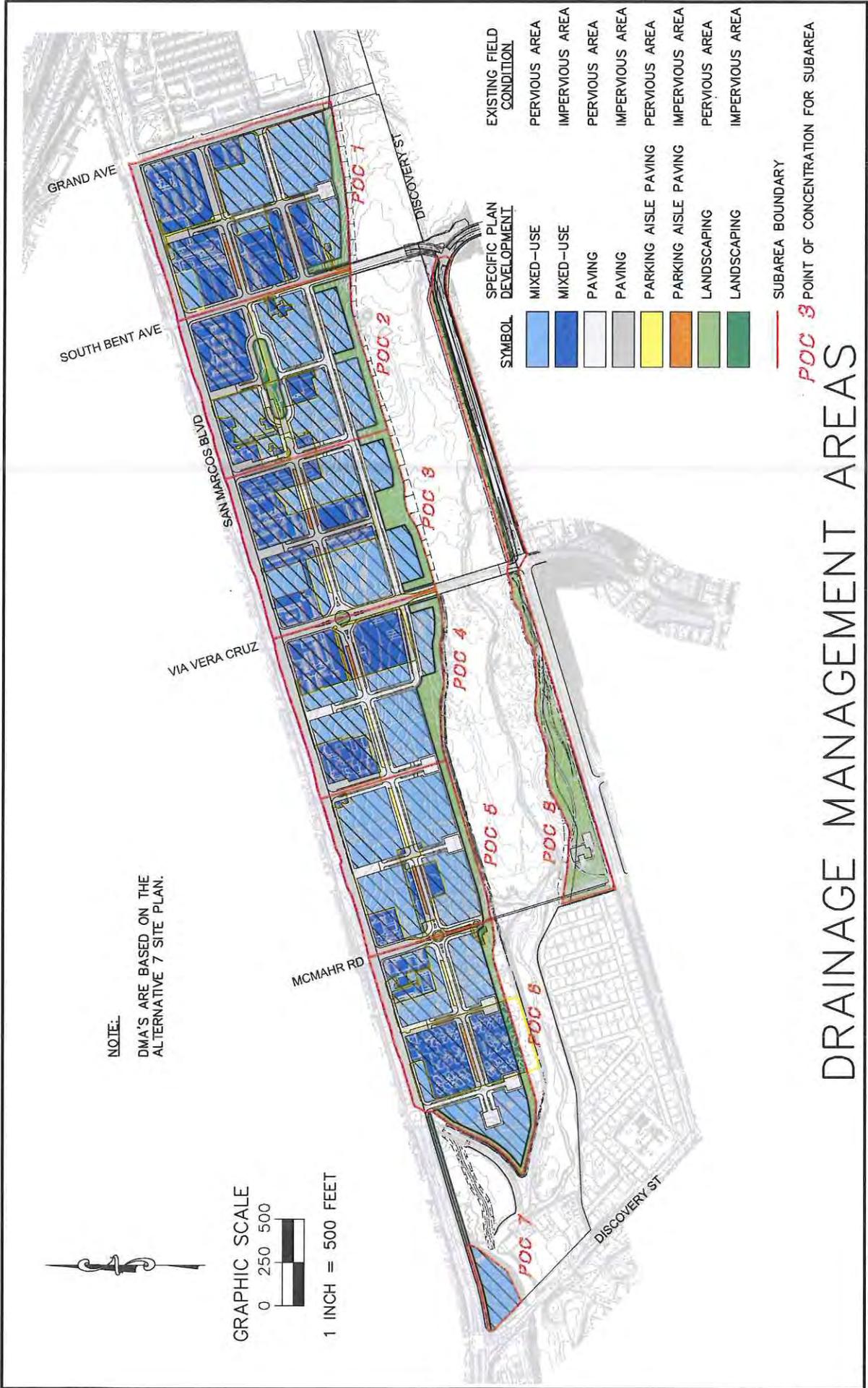
Specific Plan DMA Concept

The Specific Plan area was divided into a total of eight Drainage Management Areas (DMAs) with corresponding discharge points. Each of these eight DMAs was designated to share common hydrology and be constructed with backbone drainage systems in Phase I to correspond to function both individually and collectively in the specific plan area. (See **Figure 3-1**). It is intended that each DMA will have its own distinct water quality treatment and hydromodification facilities to address runoff and pollutants generated by all of the public streets and a designated portion of the private development land uses in each DMA. Each DMA in the Specific Plan area will be constructed with a shared water quality and HMP bioretention facility sized to meet the approved HMP plan adopted by the SDRWQCB and treat the 2-year storm for water quality required under the March 25, 2010 SUSMP requirements. The concept of shared facilities for a master plan area is allowed in the permit and is in fact preferred by the SDRWQCB. The City of San Marcos discussed the DMA approach and shared facility management approach for permit compliance with the SDRWQCB and gained conceptual approval as an acceptable approach to permit compliance.



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Figure 3-1 DMA areas wayne chang



DRAINAGE MANAGEMENT AREAS



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Shared facilities for public and private development for each of the DMAs ensures that water quality and HMP facilities and requirements are appropriately maintained and met by placing the shared facilities under a City managed community facilities district (CFD). The CFD will include monitoring and maintenance costs that will be required under the 401 permit for this project for water quality.

Compliance with the January 2011 Order R9 2007-0001 permit is based on each of the DMAs meeting the required sizing for water quality treatment and HMP in the shared facilities in the promenade. In order to be in compliance with Order R9 2007-0001, each individual DMA must:

1. Meet permit compliance requirements at the designated discharge points for each DMA; and
2. The entire Specific Plan must meet permit compliance requirements in its entirety.



Water Quality/HMP Shared Facility Concept

In short, the DMAs function and meet expected permit compliance requirements independently from each other but also must collectively achieve permit compliance for the entire specific plan area.

3.2 HYDROMODIFICATION ASSESSMENT

Chang Consultants prepared a hydromodification and water quality facility analysis in accordance with the adopted City SUSMP and HMP plan approved by the SDRWQCB. The study identified the required bioretention facilities to meet



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HMP and water quality facilities for public and private shared facilities. Bio retention facilities were selected as the permit required treatment control facility for DMAs 1-8 for the following reasons:

- Pollutants of concern must be treated by a medium pollutant efficiency removal rate or better;
- Bioretention facilities provide the appropriate pollutant removal efficiency rate for metals (selenium), nutrients, and bacteria.

The analyses were performed to provide base numerics for permit compliance over the development life of the Specific Plan area to ensure that permit compliance, water quality, and HMP effects were properly mitigated over the life of the project.

The City of San Marcos will construct hydromodification facilities to serve 100 percent of their infrastructure improvements a portion of the facilities will have excess capacity allowing some treatment and HMP capacity for private development projects. In most cases, an individual developer will be required to address their hydromodification needs as part of their project design and in accordance with this document and the current SUSMP requirements. Detailed hydromodification analyses must be prepared for each development project and submitted to the City for review and approval.

In addition, the percent capacity outlined for each DMA will be reported on an annual basis to the SDRWQCB under the 401 permit MMRP process to ensure that permit compliance has been continually met.

The following is a summary of the analysis contained in Appendix A:

3.3 HYDROMODIFICATION CRITERIA USED FOR SPECIFIC PLAN ANALYSIS

Hydromodification must be implemented to ensure that post-development peak flows and durations do not exceed pre-development peak flows and durations. The SUSMP criteria are generally defined as follows (see **Appendix A** for a more detailed description of the criteria):

1. The post-project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10 percent over and more than 10 percent of the length of the flow duration curve.



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2. For flow rates ranging from the lower flow threshold to Q_5 , the post-project peak flows shall not exceed pre-project peak flows.
3. Tables 7-1 through 7-5 in the HMP (See **Appendix B**) were used for sizing factors for various preferred facilities including bioretention. The sizing factors will yield similar results as the County of San Diego's BMP Sizing Calculator. Appendix A also has for the overall specific plan area. the results of the BMP sizing calculator
4. The sizing factor selection depends on the applicable lower flow threshold ($0.1Q_2$, $0.3Q_2$, or $0.5Q_2$).
5. SCWWRP's Hydromodification Screening Tool for Southern California was conducted for the San Marcos Creek in the Specific Plan Area (See **Appendix B**) and the analysis resulted in a $0.5Q_2$ lower flow threshold.
6. The HMP analysis used a conservative approach to ensure that the water quality/ HMP bioretention facilities were conservatively sized. Assumptions included:
 - a. Type D soils for the entire Specific Plan area;
 - b. Building setbacks;
 - c. Proximity to the floodwall;
 - d. Backbone underground utility clearances;
 - e. Geotechnical information;
 - f. Groundwater levels in the promenade;
 - g. Specific Plan recreational requirements; and
 - h. Street right of way requirements.

Underground systems were evaluated; however, due to proximity to the floodwall and the high groundwater in the promenade area (5 feet to 10 feet below grade), vault systems were deemed infeasible at the preliminary assessment level. In addition, Order R9 2007-0001 specifies that infiltration methods must be considered first and foremost before going to non-infiltration methods. Therefore, all HMP and water quality facilities in the promenade are bioretention facilities.



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3.4 SAN MARCOS CREEK CHANNEL SUSCEPTIBILITY ANALYSIS

A channel screening study has been performed for the project and is included in **Appendix B**. The study determined that the receiving waterbody, San Marcos Creek, has a low susceptibility to erosion. Consequently, the hydromodification analyses are based on a 50 percent lower flow threshold, or .5 Q₂. See **Figure 3-2**.

3.5 SUMMARY OF CHANG AND CONSULTANTS JUNE 2011 HMP/WATER QUALITY ANALYSIS

□ Approach and Factors

The Alternative 7 Specific Plan area was subdivided into eight subareas for independent hydromodification analyses (**see Figure 3-1**). Each subarea has a hydromodification point of compliance at its discharge point into San Marcos Creek. Seven subareas cover the primary Specific Plan development area (mixed-use, streets, Promenade, etc.) north of San Marcos Creek, while the eighth subarea covers the Discovery Street widening and park land south of San Marcos Creek (see **Figure 3-1**).

Subareas 1 through 6 support generally rectangular mixed-use development blocks bounded by north-south and east-west aligned streets. The southerly strip along San Marcos Creek will contain a landscaped Promenade with a multi-use trail. Drainage Management Areas (DMA) were delineated within each subarea. The DMA's define individual areas of mixed-use development, paving, and landscaping.

The proposed mixed-use development was assumed to contain 85 percent impervious surfaces and 15 percent pervious surfaces. The proposed streets consist of standard (asphalt or concrete) paved surfaces in the travel lanes as well as in the diagonal parking areas and in the widened parallel parking aisles.

Figure 3-1 delineates the post-project mixed-use, paving, and landscaping DMA's within each subarea. Under pre-project conditions, development (commercial, retail, industrial, streets, etc.) exists in portions of the Specific Plan area.

The pre-project developed areas were delineated in a general manner using aerial photographs, topographic mapping, and a field investigation. The pre-project developed areas were assumed to contain 90 percent impervious surfaces and 10 percent pervious surfaces based on the document review and field investigation. Each DMA category was further refined to reflect areas supporting pre-project development (90 percent impervious area) or with no pre-project development (pervious area).

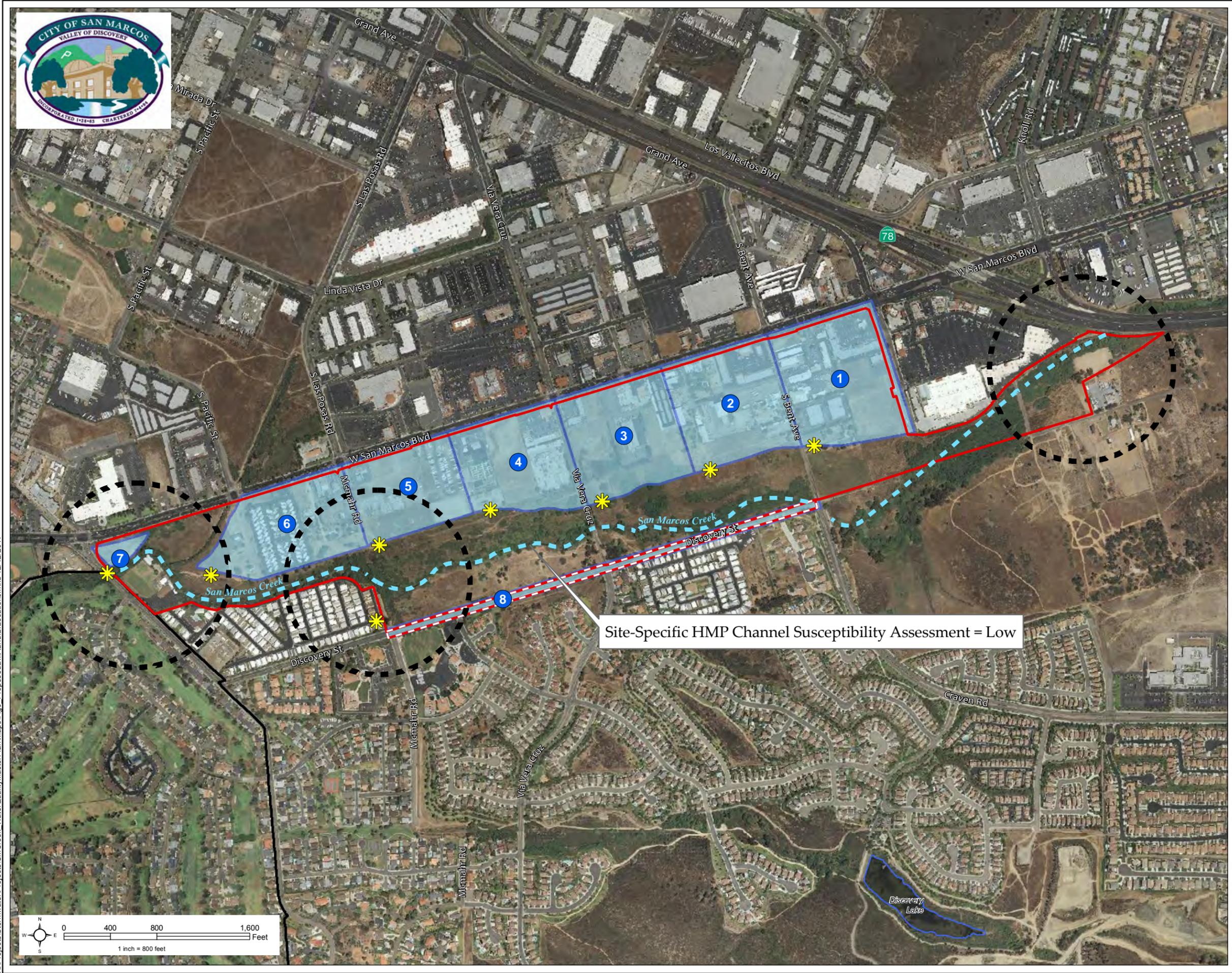


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Figure 3-2 – Proposed IBI and DMA Locations



San Marcos Creek Proposed Master WQTR IBI Monitoring Locations and HMP Drainage Management Areas



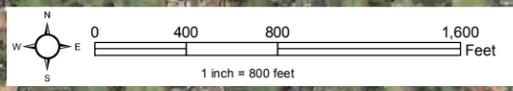
- 1 Drainage Management Areas ID#
- ★ Discharge Points
- ☾ Lakes
- HMP SCWRP Analysis
- Drainage Management Areas (DMA)
- Proposed IBI Monitoring Locations
- San Marcos Creek Specific Plan Area
- Discovery Street ROW
(Included in master WQTR analysis)
- San Marcos City Limits

Site-Specific HMP Channel Susceptibility Assessment = Low

Source of Data: City of San Marcos, 7/2009 & 12/2011
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Appendix C contains a spreadsheet summarizing the DMAs tributary to each point of compliance for Subareas 1 through 8. The spreadsheet defines individual DMAs for the post-project mixed-use development, paving, and landscaping categories. During final engineering of any future development projects in the Specific Plan area, these assumptions will need to be verified and adjusted by each project, as appropriate.

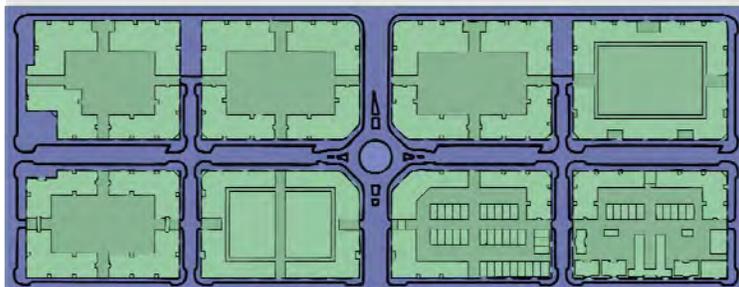
3.6 HYDROMODIFICATION FACILITY SIZING

The DMA results are used for hydromodification facility sizing within each of the eight subareas. Each DMA is multiplied by a runoff factor, which provides an area reduction due to infiltration through the DMA surface. (See **Appendix B**, Table 1).

The final step in the hydromodification sizing is to determine the necessary treatment areas and volumes for each DMA. The City of San Marcos intends to include bioretention basins in the Promenade within each subarea DMA.

Spurlock Poirier determined the bioretention area available in the Promenade within each subarea (see **Figure 3-3**). The bioretention basin sizing is calculated by multiplying the total subarea DMA by the appropriate sizing factors from Table 7-1 of the County of San Diego HMP (see **Appendix B**).

The sizing factors in Table 7-1 were chosen based on the following values: lower flow threshold ($0.5Q_2$), soil group (D), existing ground slope (flat), and rain gauge (Oceanside).



Private
Public

within the public right-of-way and the Promenade).

Therefore, the mixed-use areas were subtracted from the DMAs for the sizing. The bioretention basin results are summarized in **Table 3-1**. The sizing will provide the required flow control and will also satisfy the treatment control needs for the public areas.

For these values, the surface area, surface volume, and subsurface volume sizing factors are 0.065, 0.0542, and 0.0390, respectively. The bioretention basins will treat the public areas (streets and sidewalks



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Table 3-1
Bioretention Basin Sizing to Treat Public Areas

DMA	Adjusted DMA, ac	Surface Area, ac	Surface Volume, ac-ft	Subsurface Volume, ac-ft	Bio retention Area Available in Promenade (Alt 7) Surface Area, ac	Permit Compliance Met HMP/WQ
1	2.30	0.15	0.12	0.09	0.18	YES
2	3.92	0.25	0.21	0.15	0.30	YES
3	3.43	0.22	0.19	0.13	0.32	YES
4	3.61	0.23	0.20	0.14	0.31	YES
5	3.39	0.22	0.18	0.13	0.20	YES
6	3.29	0.21	0.18	0.13	0.37	YES
7	0.06	0.0038	0.0032	0.0023	0.0032	YES
8	3.28	0.21	0.18	0.13	0.18	YES

A comparison of the required bioretention basin surface area in Table 3-1 with the available surface area by Spurlock Poirier (See **Figure 3-3**) reveals that the available area is sufficient. Spurlock Poirier did not determine the available bioretention area in Subarea 8, but this is primarily park land, so sufficient area is available.

An additional analysis was performed to determine the bioretention basin sizing assuming each entire subarea is treated (including the mixed use areas). The results are provided in **Table 3-2**.



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Table 3-2
Bioretention Basin Sizing to Treat All Areas
(100% Public and 100% Private)

DMA	Adjusted DMA, ac	Surface Area, ac	Surface Volume, ac-ft	Subsurface Volume, ac-ft	% Remainder in Shared Facilities Available for Private Development (see Table 3-1)
1	9.32	0.61	0.51	0.36	7
2	11.15	0.72	0.60	0.43	11
3	10.21	0.66	0.55	0.40	23
4	9.12	0.59	0.49	0.36	22
5	11.10	0.72	0.60	0.43	4
6	8.86	0.58	0.48	0.35	44
7	1.33	0.09	0.07	0.05	0
8	3.28	0.21	0.18	0.13	n/a

The available bioretention area in the Promenade is not sufficient for the entire subarea. The available bioretention area constructed in the promenade would be constructed to provide 100% of the surface area for each DMA from Table 3-1 and for 100% of the public facilities and between 7% to 44% of the private development surface area in **Table 3-2**. Consequently, the private development areas will need to provide supplemental treatment systems on site to make up the difference.



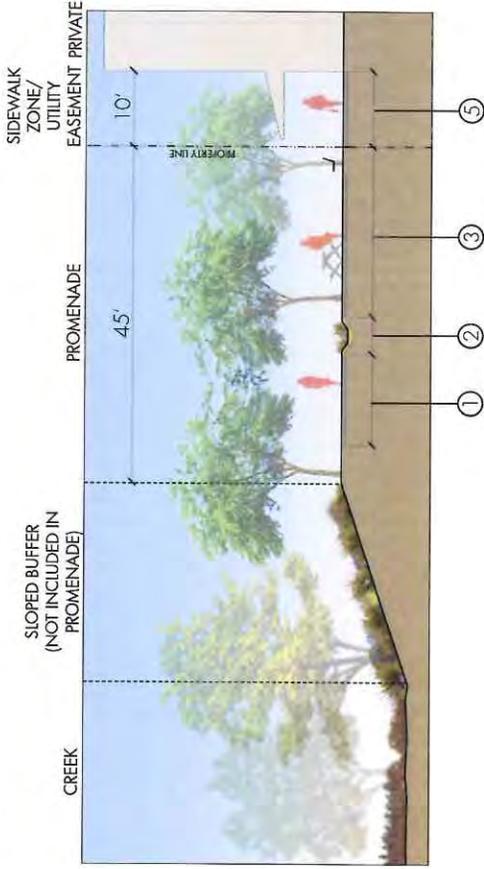
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Management Plan**

**MASTER WQTR DMA COMPLIANCE POINTS
FOR DEVELOPMENT IN SPECIFIC PLAN AREA**

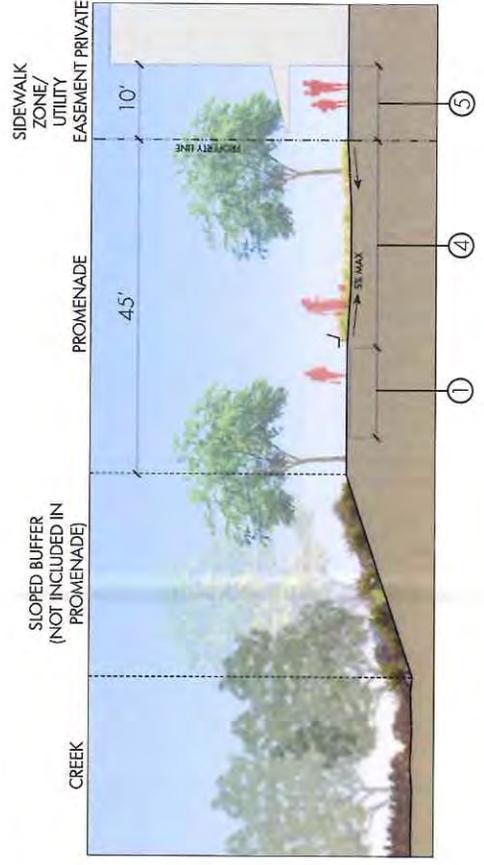
CREEKSIDE PROMENADE
 CONCEPTUAL BIO-INFILTRATION TAKEOFFS
 ALTERNATIVE 7



CREEKSIDE PROMENADE
ALTERNATIVE 7
SECTION A1

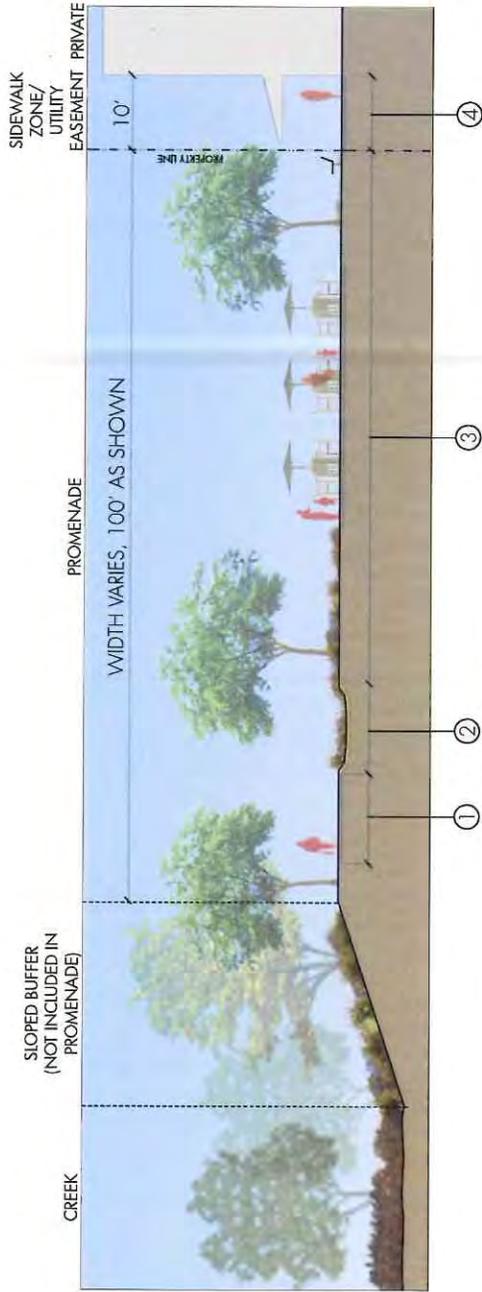


ALTERNATIVE 7
SECTION A2



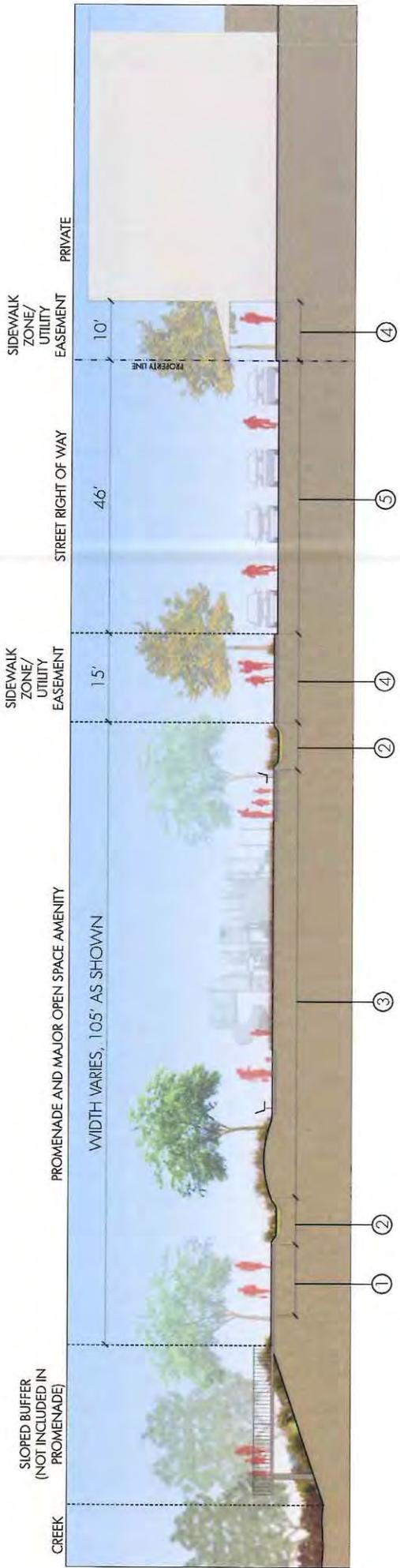
- ① 12' WIDE MULTIHUSE TRAIL
- ② INFILTRATION BAND, 10% WIDTH OF PROMENADE (4.5' SWALE AS SHOWN)
- ③ MINOR OPEN SPACE AMENITY AREA (22' AS SHOWN)
- ④ SELF-RETAINING/RECREATIONAL USE AREA (30' AS SHOWN)
- ⑤ SIDEWALK ZONE / UTILITY EASEMENT

CREEKSIDE PROMENADE
 ALTERNATIVE 7
 SECTION B



- ① 12' WIDE MULTITUDE TRAIL
- ② INFILTRATION BAND, 10% WIDTH OF PROMENADE (10' SWALE AS SHOWN)
- ③ MAJOR OPEN SPACE AMENITY AREA (70' AS SHOWN)
- ④ SIDEWALK ZONE / UTILITY EASEMENT

**CREEKSIDE PROMENADE
ALTERNATIVE 7
SECTION C**



- ① 12' WIDE MULTIHUSE TRAIL
- ② INFILTRATION BAND, 10% WIDTH OF PROMENADE (TWO 6' SWALES AS SHOWN)
- ③ MAJOR OPEN SPACE AMENITY AREA
- ④ SIDEWALK ZONE / UTILITY EASEMENT
- ⑤ STREET R.O.W. PER SPECIFIC PLAN



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3.7 CONCLUSION

The hydromodification analyses demonstrate that the Promenade bioretention area for flow and treatment control of run off generated with the required percent provides by the public areas to meet permit compliance. Private development will need to supplement this with LID to maximize infiltration onsite as required by the permit and specific plan (See **Appendix C**). The analyses contained herein are part of the Master Water Quality/HMP Management Plan and intended to provide general guidelines for BMPs in the Specific Plan area. More detailed analyses will be required for each final engineering project in the Specific Plan area. The detailed analyses should include confirmation of the downstream lower flow threshold and conditions in the project area. These conditions should be reassessed on an annual monitoring schedule to ensure accuracy of the results.



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4.0 WATER QUALITY POLLUTANT REMOVAL EFFECTIVENESS

4.1 STUDY FINDINGS

MOE made a water quality pollutant removal effectiveness for the overall specific plan area and on a DMA basis to provide a preliminary effectiveness assessment. (See Appendix A). MOE assumed that 20% of the urban runoff from the proposed impervious development (110 ac.) would be treated via engineered Bioretention Units, and the remaining 80% of the site will be treated via other BMPs or combinations of BMPs available. The City intends to implement the most effective BMPs for the uses that are permitted by the Specific Plan to achieve the removal efficiencies required by the current municipal stormwater permit. **Table 4-1** shows the general pollutant removal effectiveness of bioretention units which are listed as water quality treatment objectives for the Specific Plan Area, including flow-through planters, bioswales, and porous pavers.

**Table 4-1
Bioretention Pollutant Removal Effectiveness**

Pollutant	Removal Rate*	Removal Rate for Analysis
Total Suspended Solids	90%	90%
COD	N/A	82%
Bacteria	90%	90%
NH3	N/A	70% - low end of phosphorous
NO2+NO3	N/A	70% - low end of phosphorous
TKN	68% - 80%	74%
Total Phosphorous	70% - 83%	76%
Metals (Cu, Zn, Pb)	93% - 98%	95%
Metals (Cd, Ni)	N/A	93% - low end of metals

*Source: EPA, 1999

The pollutant removal effectiveness of the Bioretention Units has been documented in various locations, e.g., EPA, CASQA, LID manuals, etc. The following table lists the Removal Rates for properly designed and constructed Bioretention Units. For the Specific Plan, a conservative approach to pollutant removal effectiveness is taken. Table 4-1 also includes the % removal rates



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applied to the portion of urban runoff that is to be treated by Bioretention Units. Tables 4-2 and 4-3 show that for all pollutants of concern overalls and at each DMA level, a reduction and effective removal rate of medium or better would be achieved for the project.

Table 4-2

Comparison between Existing and Proposed Pollutant Concentrations – With Treatment (Bioretention) for Entire Study Area

Constituent	Units	Existing	Proposed with Treatment	Difference
TSS	(mg/L)	90.07	9.92	-80.14
COD	(mg/L)	109.59	4.13	-105.47
Fecal Coliform	(mpn/100 mL)	4,962.73	296.04	-4666.69
NH3	(mg/L)	0.73	0.54	-0.19
NO2+NO3	(mg/L)	0.84	0.63	-0.21
Nitrogen, Total Kjeldahl	(mg/L)	1.71	0.75	-0.96
Phosphorous, Total	(mg/L)	0.45	0.11	-0.34
Cd, Total	(ug/L)	0.84	0.08	-0.77
Cu, Total	(ug/L)	21.77	3.03	-18.74
Pb, Total	(ug/L)	29.66	2.94	-26.72
Ni, Total	(ug/L)	7.63	0.85	-6.78
Zn, Total	(ug/L)	190.74	19.02	-171.72
Oil and Grease	(mg/L)	2.57	0.10	-2.47



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Table 4-3

Percent Difference between Existing and Proposed Pollutant Concentrations – With Treatment (Bioretention) by Drainage Management Area

Pollutant	DMA								Total Project Area
	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5	BMP 6	BMP 7	BMP 8	
TSS	-90.6%	-91.4%	-86.7%	-89.7%	-85.6%	-86.6%	-78.5%	-88.7%	-89.0%
COD	-96.8%	-96.9%	-95.7%	-96.6%	-95.0%	-95.5%	-88.5%	-96.5%	-96.2%
Fecal Coliform	-94.3%	-94.3%	-94.4%	-94.0%	-94.9%	-93.7%	-95.6%	-91.4%	-94.0%
NH3	-34.7%	-11.6%	-31.6%	-37.8%	-12.6%	-14.8%	222.3%	-43.9%	-26.4%
NO2+NO3	-31.1%	-41.1%	-11.6%	-28.1%	-8.7%	-19.9%	41.9%	-26.7%	-25.3%
Nitrogen, Total Kjeldahl	-61.4%	-63.0%	-49.6%	-59.4%	-43.9%	-51.1%	11.6%	-58.5%	-56.1%
Phosphorous, Total	-78.7%	-81.9%	-68.7%	-76.3%	-67.3%	-69.4%	-56.1%	-71.1%	-75.0%
Cd, Total	-92.1%	-93.1%	-88.0%	-91.1%	-87.5%	-89.5%	-78.4%	-90.6%	-90.7%
Cu, Total	-88.0%	-90.3%	-79.6%	-85.9%	-80.4%	-83.4%	-69.1%	-89.8%	-86.1%
Pb, Total	-91.7%	-94.3%	-81.0%	-89.8%	-83.5%	-89.0%	-63.4%	-90.7%	-90.1%
Ni, Total	-91.0%	-92.7%	-82.6%	-89.7%	-81.2%	-87.5%	ND	-86.7%	-88.9%
Zn, Total	-91.8%	-93.3%	-85.2%	-90.6%	-84.4%	-88.5%	-45.5%	-89.4%	-90.0%
Oil and Grease	-96.3%	-96.1%	-95.7%	-96.3%	-95.1%	-95.4%	-91.4%	-96.4%	-95.9%

In order to perform a desktop validation of the results of the study, the proposed pollutant concentrations following bioretention treatment were compared with irreducible pollutant concentrations located in published studies. As the data is limited, some of the concentrations from the literature appear as ranges and not as absolute values. The pollutant concentrations presented in this study using the percent removal method are within reasonable range of the irreducible concentrations proposed by the literature. Tables 4-4 presents the comparison between the existing, proposed, and literature pollutant concentrations. Similarly, Table 4-5, is a summary of the results when analyzed on a DMA level.



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Table 4-4

Comparison between Existing, Proposed with Treatment, and Literature Pollutant Concentrations for Entire Study Area

Constituent	Units	Literature*	Existing	Proposed with Treatment
TSS	(mg/L)	TSS=10	90.07	9.92
COD	(mg/L)		109.59	4.13
Fecal Coliform	(mpn/100 mL)		4,962.73	296.04
NH3	(mg/L)		0.73	0.54
NO2+NO3	(mg/L)		0.84	0.63
Nitrogen, Total Kjeldahl	(mg/L)	1.1<[N _T <1.69	1.71	0.75
Phosphorous, Total	(mg/L)	0.048<[P]<1.3 98	0.45	0.11
Cd, Total	(ug/L)		0.84	0.08
Cu, Total	(ug/L)	[Cu]<10	21.77	3.03
Pb, Total	(ug/L)	[Pb]<5	29.66	2.94
Ni, Total	(ug/L)		7.63	0.85
Zn, Total	(ug/L)	[Zn]<50	190.74	19.02
Oil and Grease	(mg/L)		2.57	0.10

Note:

Irreducible concentrations reported for TSS, Cu, Pb, and Zn. Values for NO₃, Total N, and P represented as a range of values reported in same measurement units from literature.

* Barrett and Limonuzin, 2009.



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Table 4-5

Comparison between Existing, Proposed with Treatment, and Literature Pollutant Concentrations by Drainage Management Area

Constituent	Units	Literature*	DMA							
			BMP 1	BMP 2	BMP 3	BMP 4	BMP 5	BMP 6	BMP 7	BMP 8
TSS	(mg/L)	TSS=10	10.41	10.01	10.15	10.14	10.32	10.10	10.44	6.76
COD	(mg/L)		4.45	4.17	4.27	4.25	4.37	4.26	4.83	2.03
Fecal Coliform	(mpn/100 mL)		262.5	288.6	280.2	278.6	266.9	286.7	317.4	512.2
NH3	(mg/L)		0.59	0.55	0.56	0.56	0.58	0.56	0.58	0.25
NO2+NO3	(mg/L)		0.66	0.63	0.64	0.63	0.65	0.65	0.84	0.38
Nitrogen, Total Kjeldahl	(mg/L)	1.1<[N _T <1.69	0.80	0.76	0.77	0.77	0.79	0.77	0.83	0.43
Phosphorous, Total	(mg/L)	0.048<[P]<1.398	0.12	0.11	0.11	0.11	0.12	0.12	0.14	0.08
Cd, Total	(ug/L)		0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.05
Cu, Total	(ug/L)	[Cu]<10	3.23	3.07	3.12	3.13	3.20	3.10	3.09	1.77
Pb, Total	(ug/L)	[Pb]<5	3.20	2.97	3.05	3.03	3.13	3.05	3.66	1.22
Ni, Total	(ug/L)		0.94	0.86	0.89	0.88	0.92	0.88	1.00	0.27
Zn, Total	(ug/L)	[Zn]<50	20.67	19.28	19.77	19.69	20.31	19.64	21.81	8.26
Oil and Grease	(mg/L)		0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.06

Note:

Irreducible concentrations reported for TSS, Cu, Pb, and Zn. Values for NO₃, Total N, and P represented as a range of values reported in same measurement units from literature.

* Barrett and Limonuzin, 2009.

4.2 LARRY WALKER AND ASSOCIATES INDEPENDENT VALIDATION

The SDRWQCB requested independent third party validation of the water quality analysis and removal rates. This was conducted by Larry Walker and Associates (LWA) and is included in **Appendix A**.

LWA validated the pollutant removal rates for the project and provided recommendations for monitoring. LWA concluded that:

- The MOE assessment was conservative and therefore protective of water quality;
- The analysis provides a reasonable assessment and would result in a reduction of pollutant loads.



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- Representative outfalls are acceptable
- Two stations would be adequate;
- Either flow weighted composites or grab samples
- Continuous flow measures
- Storms greater than .25 inches and 72 hour separation
- 9 storms for statistical variation.

4.3 LAS POSAS/SAN MARCOS CREEK RESTORATION EXPECTED WATER QUALITY BENEFITS

Under the Phase I portion of the project, the Las Posas Creek and San Marcos Creek would be restored, enhanced, or additional wetlands created. Other similar projects were researched to determine what additional benefits could be achieved with the restoration. A literature review of available data sets were conducted by DMAX Engineering and are included in **Appendix D**.

The added water quality benefit of the creek restoration in the specific plan area cannot be used for development water quality and HMP compliance, however, it would provide an added water quality benefit.

Four similar restorations were reviewed, including one locally in San Diego: Forrester Creek. While it is difficult to compare projects, in general, the data suggests that under wet and dry weather conditions that a reduction in key pollutants (nitrogen, phosphorous, and bacteria) creek restorations would occur.

In addition, Forrester Creek showed an improved IBI score from 11 to 28. It is expected that the creek restorations will result in a similar if not better results.

4.4 RECOMMENDED FIELD VALIDATION

Based upon the results presented above, it is anticipated that future monitoring is implemented to validate the results. There are two types of monitoring that are expected:

1. Assess impacts of the specific plan area development on the watershed and;
2. Assess the discharge results from the specific plan area.

To determine the impacts of the SPA on the watershed, it is anticipated that upstream and downstream monitoring locations are utilized. It is important to capture baseline data to support potential changes in habitat, bioassessments



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and water quality. **Figure 3-1** shows three potential bioassessment location areas in the specific plan area.

At the discharge level, each DMA and the study area as a whole could be monitored individually to determine the range of effluent concentrations generated from each area or summarized in a study area collective result. It is important to distinguish run-on flow and pollutant concentrations while conducting monitoring of the discharges. The monitoring protocols, frequency, baseline conditions will be specifically addressed through the development of a Quality Assurance Plan that will be required under the 401 Permit and reviewed and approved by the SDRWQCB.

It is also encouraged to implement project (i.e., each development) specific monitoring locations to allow for investigations to occur when discharge runoff concentrations warrant such upstream investigations.

4.5 CONCLUSIONS

The San Marcos Creek Specific Plan calls for many opportunities to use planned surface areas as low impact development site design/treatment control BMPs. There are also opportunities to design and construct bioretention BMPs within the Specific Plan Area that meet the conceptual design of the Specific Plan.

The analyzed treatment systems consider not only the expected pollutant concentrations from the built-out Specific Plan Area, but also the expected treatment runoff quantities based on the regionally accepted treatment requirements (85th percentile rain events for flow and volume based treatment).

This analysis demonstrates an expected decrease in pollutant loading when comparing the existing site conditions to the permit compliant built-out Specific Plan for the Study Area.

It is important to note that the levels of the constituents expected to be generated are below the action levels for municipal permit monitoring activities and, at those levels, are not considered risks to human health or the environment.

Comparison of the proposed pollutant concentrations based on the percent removal with those from performance-based effluents show similar results. The pollutant concentrations from the literature validate the methods and the proposed post-treatment effluent concentrations presented in the study.

The analysis is considered conservative in nature because it does not consider the differences between the existing facilities, with their pollutant-generating activities exposed to rainfall, and the built-out conditions, which will likely be much less outdoor pollutant generating activities. A combination of changes in



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land use and new design and construction, and relocating pollutant activities indoors, supports this statement. The monitoring program approved by the SDRWQCB will be designed to confirm the preliminary analysis.

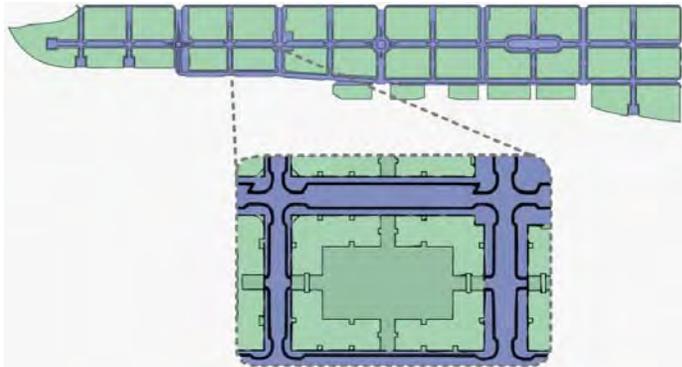


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5.0 PRIVATE DEVELOPMENT REQUIREMENTS

5.1 MODEL BLOCK DEVELOPMENT



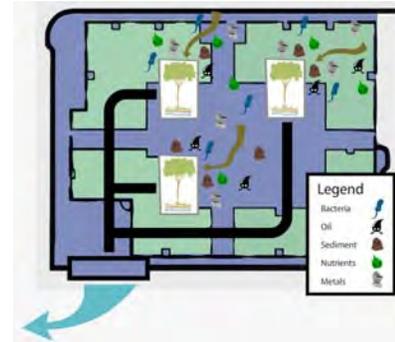
Private development in the specific plan area is required to be developed in model blocks. This assures a managed and cohesive development pattern within each DMA.

It also assures that permit compliance onsite and in the shared WQ/HMP facilities can

be tracked and reported on an annual basis

5.2 BASIC GUIDELINES FOR MODEL BLOCK PRIVATE DEVELOPMENT FOR PERMIT COMPLIANCE

The following are the guiding elements of the Master WQ/HMP Management Plan which a project specific WQTR will be developed for each project in addition to the Current SUSMP/HMP Requirements, project type requirements, and LID, Site Design, and Source Control requirements in Order R9 2007-0001:



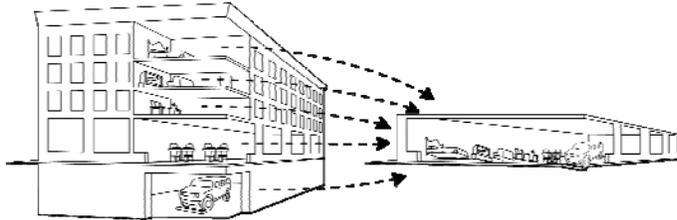
- All projects in the San Marcos Creek Specific Plan Area are categorized as SUSMP Priority projects and must adhere to the source control, site design, and treatment control requirements and criteria of the SUSMP.
- All projects in the Specific Plan Area must follow the City of San Marcos SUSMP in effect January 14, 2011 for WQ/HMP.
- All projects in the Specific Plan Area must show pre-project pollutant load and HMP calculations and post project pollutant load reduction and HMP calculations for all pollutants generated by land uses and potential land uses.



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- All projects in the specific plan area must show a pollutant load reduction over existing condition land uses through the selection of appropriate BMPs and design criteria for wet weather conditions and dry weather conditions.
- All projects must assume the worst case land use for the plan view acreage:



- The primary pollutants of concern are Nutrients, Bacteria (all) , selenium, DDE/DDT, sediment toxicity,
- All private development projects in the Specific Plan Area must develop a preliminary and final WQ/HMP plan for submittal and approval by the City.
- All projects must show and meet all TMDL load allocations on a project specific basis in place at the time the TMDL is in place.
- Projects in the Specific Plan area WILL NOT be granted waivers for site design, source control, LID, or treatment control requirements.
- All connections from the project private storm drain system to the City MS4 must have monitoring manholes installed and labeled;
- Projects must participate in the CFD.
- Projects must demonstrate maximum utilization of LID features: permeable pavement, landscape, flow through planters, and other viable runoff reduction measures allowed by the specific plan or technologically available at the time of development.

REFERENCE DOCUMENTS

Documents intended to be used in the preparation of project specific Water quality improvement plans in the Specific Plan Area include:

- City of San Marcos Current Stormwater Standards Manual and SUSMP
- Current City of San Marcos Water Quality Ordinance 14.15
- CASQA Current Treatment Control BMP Design Requirements



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- January 2010 Upper San Marcos Creek Nutrient Management Plan
- Bacteria I TMDL (SDRWQCB Region 9)
- Upper San Marcos Creek Nutrient TMDL and Management Plan (SDRWQCB Region 9)
- Final Regional Hydromodification Management Plan
- 2011 San Marcos Creek Specific Plan Area Preliminary Water Quality Treatment Analysis (MOE, 2011)
- 2011 San Marcos Creek Specific Plan HMP Analysis (Wayne Chang & Associates, 2011)

5.3 TEMPORARY WATER QUALITY IMPACTS (CONSTRUCTION/BIOLOGICAL)

For all phases of the project the current General Construction Permit (GCP) requirements will be followed on a project by project basis. Order R9 2008-0002 (Dewatering Permit for construction activities) may also need to be implemented for project specific construction activities.

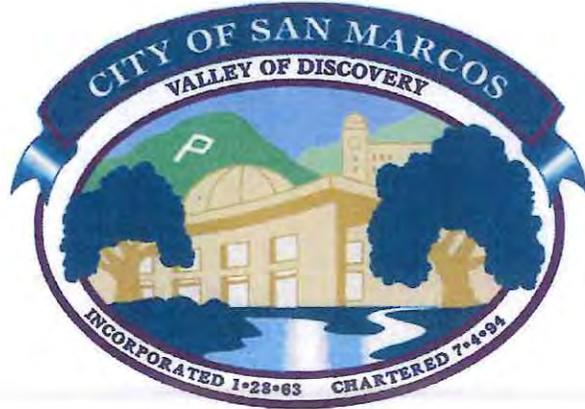
The GCP requires the preparation of a SWPPP. The City requires that this document and coverage under the GCP is completed prior to the issuance of grading permits. A risk level assessment and BMP sheets based on anticipated pollutants being generated during the construction phase will have pollutant specific BMPs for each of the four stages of construction (Demolition, grading, vertical construction, and landscaping). Permit coverage will be required prior to the start of any work and an effective combination of erosion and sediment controls, rain event action plans, testing of runoff, and enhanced inspections are required. Mobilization of BMPs 48 hours in advance of a predicted rain event is also required.

Biological resources impacts are also addressed during construction and are considered in the impacts on habitat. Anticipated BMPs include biological monitoring and placing visual barriers (i.e. orange fencing) to prevent construction activities in habitat areas will be included and coordinated with the MMRP.



**San Marcos Creek Specific Plan
Master Water Quality and Hydromodification
Management Plan**

APPENDIX A



San Marcos Creek Specific Plan Area Preliminary Water Quality Treatment Analysis



Prepared by
Mikhail Ogawa Engineering

Revised July 2011

Study Purpose

The City of San Marcos (City) has prepared a Specific Plan for the San Marcos Creek area. The San Marcos Creek Specific Plan (Specific Plan) represents an effort to create a planning framework for future growth and redevelopment of the approximately 214-acre area along San Marcos Creek in central San Marcos (Figure 1). The Specific Plan has been developed with a thorough analysis of environmental conditions and input from City decision-makers, landowners, neighbors, and the community-at-large. It provides a comprehensive vision for this creekside district along with goals, policies and development standards to guide future public and private actions relating to the Area's development and conservation of open space and natural resources. The Specific Plan also serves as a mechanism for ensuring that future development will be coordinated and well-planned.



Figure1: Not to Scale – Specific Plan and Study Area: red dashed line represents the Specific Plan Area and the blue shaded area is the Study Area (modified from San Marcos Creek Specific Plan, 2007)

During a 401 Certification pre-application meeting with the San Diego Regional Water Quality Control Board (RWQCB), the RWQCB staff requested that a study be conducted to compare pre-project¹ impacts on water quality to post-project¹ impacts to determine how much impact the completed Specific Plan Area would have on water quality and the beneficial uses of the receiving waters. The comparison is between (1) the existing land use with no existing treatment control Best Management Practices (BMPs) and (2) the completed Specific Plan Area with expected treatment control BMPs in place and operating.

Study Area

The Study Area consists of 135.5 acres on the north and south sides of San Marcos Creek between Grand Avenue and Discovery Street in the City of San Marcos (Figure 1). Existing development is generally located near San Marcos Boulevard. Development in the area between Grand Avenue and McMahr Road consists primarily of commercial and legal nonconforming industrial uses, including neighborhood "strip" retail centers, two gas stations, a lumberyard, three storage facilities, a construction material storage yard, auto services, a bowling alley, office uses,

¹ For the purposes of this report discussion, the term "project" refers to the completely built-out Specific Plan area.

and a fast food restaurant (San Marcos Creek Specific Plan, 2007). Additionally, there are several residential uses within the Study Area.

For the purposes of this analysis, existing land use means the current site conditions as they exist. The Vacant land use category is a combination of developable acreage that remains vacant in an undisturbed state and open space that is not developable. The existing land use within the Study Area consists of the following approximate acreages:

Streets:	12.65 ac
Commercial Acreage:	28.02 ac
Industrial Acreage:	17.57 ac
Residential Acreage:	12.66 ac
Vacant Acreage:	64.64 ac

The proposed land use is a mixed-use commercial core and "downtown" for San Marcos. The proposed land use will balance retail and entertainment uses with a mix of residential, office, and service uses to create a new "24-hour" neighborhood with active/passive use.

The proposed land use within the Study Area consists of the following:

Streets	42.6 ac
Mixed-Use ² :	75.6 ac
Improved Park Space ³ :	17.3 ac



Figure 2: Not to Scale – Proposed Land Use for Specific Plan and Study Area (San Marcos Creek Specific Plan, 2007)

As seen in Figures 2 and 4, there are planned pervious surface areas within the mixed use areas (shaded in green) that may be used for low impact development site design/treatment control BMPs. Per the specific plan those areas are described as courtyards, plazas and parks. The intent is to create community gathering spaces that have pervious surfaces.

The Study Area is within the San Marcos Hydrologic Area (904.5) of the Carlsbad Hydrologic Unit as defined by the RWQCB. Downstream of the Specific Plan Area is San Marcos Lake, a man-made lake (by way of a dam) that is surrounded by two golf courses and residential housing.

² For the purposes of the discussion and of this report, the term "mixed-use" includes hardscape, building coverage, and parking typically associated with commercial/residential/parking land uses

³ The Study Area Improved Park Space consists of linear greenways, multi-use trail, and urban parks.

Downstream of the lake, San Marcos Creek meanders through various land use areas and discharges into the Batiquitos Lagoon prior to ultimate discharge to the Pacific Ocean.

The approved State Water Resources Control Board (SWRCB) 2010 303(d) list provides information about waters that are determined to be impaired for certain pollutant types. The following is a list of waterbodies that the SWRCB has determined to be impaired that the San Marcos Creek Specific Plan Area is tributary to:

Table 1 – 2010 Approved 303(d) Listings Related to Specific Plan Area

Water Body Name	Pollutant/Stressor
San Marcos Creek	DDE, Phosphorus, Sediment toxicity, Selenium
San Marcos Lake	Ammonia (as N), Nutrients

Methods and Results

Drainage Management Areas

The proposed project will have a total of eight Drainage Management Areas (DMAs); delineated areas that share common hydrology and drainage systems – see Figure 3 below. It is intended that each DMA will have its own distinct treatment and flow controls to address runoff and pollutants generated within them. The analyses, and results presented below, were conducted on both the DMA level and the entire specific plan area.



Figure 3: Not to Scale – Proposed Drainage Management Areas

Pollutant Concentrations

This study uses a median concentration approach. Urban runoff contaminant concentrations have substantial variability based on the types of land use. In general, land use defines the imperviousness and types and amounts of pollutants that are present within the area of land use.

The approach estimates the existing concentrations of contaminants based on existing land use. The study uses the concentration values (Table 2) for the land use type from the National Stormwater Quality Database (NSDQ) Version 1.1 (Pitt et al., February 2004). This database represents monitoring data collected from over 3,750 individual storm events over nearly a ten-year period from more than 65 agencies throughout the country. The data characterize the median concentrations from specific land use types including, streets, residential, commercial, industrial and open space. A smaller subset of the data from sites within EPA Rainfall Zone 6 (southwestern US) was extracted from the national database as it better characterizes the study area. Medians were generated from this dataset for all land uses except Vacant, where only 2 events were recorded and the data was insufficient. Vacant concentrations were therefore

characterized from the national database. The NO₂ + NO₃ median concentration for streets land use was also characterized from the national database due to lack of data within Zone 6.

Table 2 – NSDQ Median Concentrations

Constituent	Units	Streets	Residential	Commercial	Industrial	Vacant**
TSS	(mg/L)	99	94.5	111	200	48.5
COD	(mg/L)	110	135	175	235	42.1
Fecal Coliform	(mpn/100 mL)	1700	2450	2700	4500	7200
NH ₃	(mg/L)	1.39	0.865	1.6	0.83	0.18
NO ₂ +NO ₃	(mg/L)	0.3*	1.1	1	1.7	0.59
Nitrogen, Total Kjeldahl	(mg/L)	2	2.25	2.55	3.35	0.74
Phosphorous, Total	(mg/L)	0.2385	0.455	0.47	1.1	0.31
Cd, Total	(ug/L)	1	1.1	1	2	0.38
Cu, Total	(ug/L)	42	25	17.5	55	10
Pb, Total	(ug/L)	24	50	23	102	10
Ni, Total	(ug/L)	8.9	14	11.5	24	ND
Zn, Total	(ug/L)	207.5	300	250	560	40
Oil and Grease	(mg/L)	3.5	3	4	4	1.3

(NSDQ Database, EPA Rainfall Zone 6 – Pitt et al., 2004)

* NO₂ + NO₃ value for Streets land use based on entire NSDQ dataset.

** Vacant land use values based on entire NSDQ dataset.

Based on the NSDQ and the existing land use information, the expected pre-project constituent concentrations are calculated by prorating and combining the NSDQ concentrations based on the representative land use area for each of the four categories (streets, residential, commercial, industrial and open space). The resulting concentrations are shown in the Table 3 below.

Table 3 – Estimated Existing Land use and Pollutant Concentrations for Entire Study Area

Constituent	Area	Streets	Residential	Commercial	Industrial	Vacant	Total
	Acres	12.65	12.66	28.02	17.57	64.64	135.54
	% of Total	9.33%	9.34%	20.67%	12.96%	47.69%	100%
Constituent	Units	Pollutant Concentrations					
TSS	(mg/L)	9.24	8.83	22.95	25.93	23.13	90.07
COD	(mg/L)	10.27	12.61	36.18	30.46	20.08	109.59
Fecal Coliform	(mpn/100 mL)	158.6	228.4	558.2	583.3	3,433.7	4,962.7
NH ₃	(mg/L)	0.13	0.08	0.33	0.11	0.09	0.73
NO ₂ +NO ₃	(mg/L)	0.03	0.10	0.21	0.22	0.28	0.84
Nitrogen, Total Kjeldahl	(mg/L)	0.19	0.21	0.53	0.43	0.35	1.71
Phosphorous, Total	(mg/L)	0.02	0.04	0.10	0.14	0.15	0.45
Cd, Total	(ug/L)	0.09	0.10	0.21	0.26	0.18	0.84
Cu, Total	(ug/L)	3.92	2.34	3.62	7.13	4.77	21.77
Pb, Total	(ug/L)	2.24	4.67	4.75	13.22	4.77	29.66
Ni, Total	(ug/L)	0.83	1.31	2.38	3.11	ND	7.63
Zn, Total	(ug/L)	19.37	28.02	51.68	72.59	19.08	190.74
Oil and Grease	(mg/L)	0.33	0.28	0.83	0.52	0.62	2.57

Using the same method, the proposed contaminant concentrations are calculated based on the proposed land use. Because the planned land use is a mixed-use concept (residential/commercial/parking), the most impactful median concentration values for each constituent are selected from the NSDQ database for the Residential, Commercial, and Parking (i.e. Streets) land use categories. Table 4 represents the median concentration values used to determine the proposed constituent concentrations (Table 5).

Table 4 – Proposed NSDQ Median Concentrations – Worst Case for Mixed Use Category for Entire Study Area

Constituent	Units	Streets	Mixed Use	Improved Park Space
TSS	(mg/L)	99	111	48.5
COD	(mg/L)	110	175	42.1
Fecal Coliform	(mpn/100 mL)	1700	2700	7200
NH3	(mg/L)	1.39	1.6	0.18
NO2+NO3	(mg/L)	0.3	1.1	0.59
Nitrogen, Total Kjeldahl	(mg/L)	2	2.55	0.74
Phosphorous, Total	(mg/L)	0.2385	0.47	0.31
Cd, Total	(ug/L)	1	1.1	0.38
Cu, Total	(ug/L)	42	42	10
Pb, Total	(ug/L)	24	50	10
Ni, Total	(ug/L)	8.9	14	ND
Zn, Total	(ug/L)	207.5	300	40
Oil and Grease	(mg/L)	3.5	4	1.3

(NSDQ Database, EPA Rainfall Zone 6 – Pitt et al., February 2004)

Mixed Use areas composed of Residential, Commercial, and Parking land uses.

Table 5 – Estimated Proposed Land Use and Pollutant Concentrations for Entire Study Area

Constituent	Area	Streets	Pervious Streets	Mixed Use	Improved Park Space	Total
	Acres	39.02	3.58	75.62	17.31	135.54
	% of Total	28.79%	2.64%	55.80%	12.77%	100%
Constituent	Units	Pollutant Concentrations				
TSS	(mg/L)	28.50	2.61	61.94	6.19	99.25
COD	(mg/L)	31.67	2.91	97.65	5.38	137.60
Fecal Coliform	(mpn/100 mL)	489.4	44.9	1,506.6	919.5	2,960.4
NH3	(mg/L)	0.40	0.04	0.89	0.02	1.35
NO2+NO3	(mg/L)	0.09	0.01	0.61	0.08	0.78
Nitrogen, Total Kjeldahl	(mg/L)	0.58	0.05	1.42	0.09	2.15
Phosphorous, Total	(mg/L)	0.07	0.01	0.26	0.04	0.38
Cd, Total	(ug/L)	0.29	0.03	0.61	0.05	0.98
Cu, Total	(ug/L)	12.09	1.11	23.44	1.28	37.91
Pb, Total	(ug/L)	6.91	0.63	27.90	1.28	36.72
Ni, Total	(ug/L)	2.56	0.24	7.81	ND	10.61
Zn, Total	(ug/L)	59.74	5.48	167.40	5.11	237.73
Oil and Grease	(mg/L)	1.01	0.09	2.23	0.17	3.50

Mixed Use areas composed of Residential, Commercial, and Parking land uses.

Based on this study approach and available data sets, without treatment for the proposed built-out Specific Plan Area, the pollutant loading for ten of the thirteen constituents would likely increase. Additionally, the reduction in Phosphorous and the sum of Nitrite and Nitrate would be negligible. Table 6 below represents the comparison between existing and proposed conditions.

Table 6 – Comparison Between Existing and Proposed Pollutant Concentrations – No Treatment for Entire Study Area

Constituent	Units	Existing	Proposed No Treatment	Difference
TSS	(mg/L)	90.07	99.25	9.18
COD	(mg/L)	109.59	137.60	28.01
Fecal Coliform	(mpn/100 mL)	4,962.7	2,960.4	-2,002.3
NH3	(mg/L)	0.73	1.35	0.62
NO2+NO3	(mg/L)	0.84	0.78	-0.06
Nitrogen, Total Kjeldahl	(mg/L)	1.71	2.15	0.43
Phosphorous, Total	(mg/L)	0.45	0.38	-0.08
Cd, Total	(ug/L)	0.84	0.98	0.13
Cu, Total	(ug/L)	21.77	37.91	16.14
Pb, Total	(ug/L)	29.66	36.72	7.06
Ni, Total	(ug/L)	7.63	10.61	2.98
Zn, Total	(ug/L)	190.74	237.73	46.99
Oil and Grease	(mg/L)	2.57	3.50	0.93

Treatment Controls Preliminary Design

The overall Specific Plan Area design phase is in a preliminary stage and selection of the final treatment systems has not yet been made. However, for purposes of this analysis, it is assumed that 100% of the urban runoff from the proposed development (118.2 ac.) will be treated via engineered bioretention best management practices (BMPs) including bioretention units, flow through planters, etc. There are many BMPs and combinations available and the City intends to implement or require the implementation of the most effective BMPs for the uses that are permitted by the Specific Plan.

Based on current local practice and guidelines – San Diego County LID Handbook and Model Standard Urban Stormwater Mitigation Plan – the amount of surface area required for the bioretention systems is 4% of the tributary impervious surface area.

The make up of the Specific Plan Area is conducive for meeting the 4% area required for the LID BMPs to be utilized for both the mixed use (highly developed) public right-of-ways and designated open space park areas. This study assumes that the necessary minimum of 4% area will be required through the City's regulatory development requirements.

It is important to note that of the 135.5 ac. within the Study Area, 17.3 acres are expected to be open space parks that will accommodate the use of bioretention BMPs to treat the runoff that is generated from these areas (Figures 2 and 5) and some public impervious surfaces, e.g. some streets and sidewalks.

The pollutant removal effectiveness of bioretention is published in various documents (e.g. EPA, CASQA, LID manuals, etc.). Table 7 lists the removal rates for bioretention BMPs. For this study, a conservative approach to pollutant removal effectiveness is taken, i.e., the lower estimates of available data ranges are used in the approach. The table also includes the percent (%) removal rates applied to the urban runoff that is to be treated by bioretention.

Table 7 – Bioretention Pollutant Removal Effectiveness

Pollutant	Published Removal Rate	Removal Rate for Analysis
TSS	90%*	90%
COD	97%**	97%
Bacteria	90%*	90%
NH3 (ammonia)	60% - 80%***	60%
NO3 (nitrate)	20%*****	20%
Nitrogen, Total Kjeldahl	65% - 75%***	65%
Total Phosphorous	70% - 83%*	70%
Metals (Cu, Zn, Pb)	92%***	92%
Metals (Cd, Ni)	N/A	92% - comparable to other heavy metals
Oil and Grease	> 97%****	97%

*EPA, 1999

**Low Impact Development Center

***Davis, et al, 2001

****Hsieh et al., 2003

*****Davis, et al., 2006

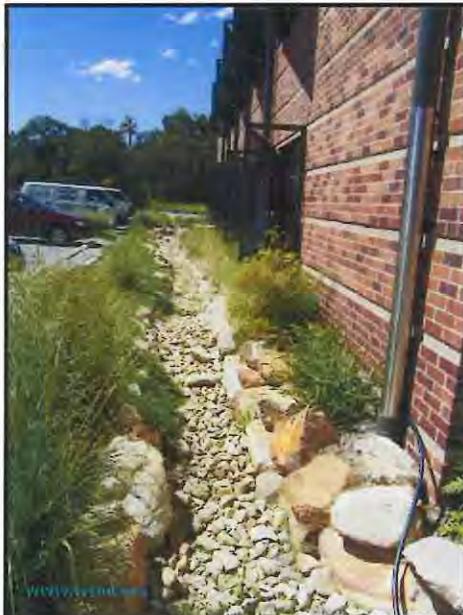


Figure 4: Example of system that meet conceptual plans of Specific Plan (WSUD.org)

Applying the treatment control BMPs discussed above, Table 8 below represents the built-out status with treatment controls applied. The negative numbers demonstrate a reduction in pollutant concentrations from existing conditions to proposed built-out conditions with treatment. Similarly, Table 9, is a summary of the results when analyzed on a DMA level. It is important to note, that for several of the pollutant comparisons in the BMP7 DMA area, the comparison in concentrations are shown as a significant increase – this is due to the initial concentrations being completely open space in its existing conditions and having relatively low or no expected pollutant generation.

Additionally, as shown in Figure 6, the Specific Plan calls for plazas, park areas and thus, opportunities for site design and pervious surfaces that can be used as treatment control BMPs.



Figure 5: Not to Scale – Figure showing opportunities for alternative pervious surfaces (San Marcos Creek Specific Plan, 2007)



Figure 6: Rendering showing opportunities for alternative pervious surfaces (San Marcos Creek Specific Plan, 2007)

Table 8 – Comparison between Existing and Proposed Pollutant Concentrations – With Treatment (Bioretention) for Entire Study Area

Constituent	Units	Existing	Proposed with Treatment	Difference
TSS	(mg/L)	90.07	9.92	-80.14
COD	(mg/L)	109.59	4.13	-105.47
Fecal Coliform	(mpn/100 mL)	4,962.73	296.04	-4666.69
NH3	(mg/L)	0.73	0.54	-0.19
NO2+NO3	(mg/L)	0.84	0.63	-0.21
Nitrogen, Total Kjeldahl	(mg/L)	1.71	0.75	-0.96
Phosphorous, Total	(mg/L)	0.45	0.11	-0.34
Cd, Total	(ug/L)	0.84	0.08	-0.77
Cu, Total	(ug/L)	21.77	3.03	-18.74
Pb, Total	(ug/L)	29.66	2.94	-26.72
Ni, Total	(ug/L)	7.63	0.85	-6.78
Zn, Total	(ug/L)	190.74	19.02	-171.72
Oil and Grease	(mg/L)	2.57	0.10	-2.47

Table 9 – Percent Difference between Existing and Proposed Pollutant Concentrations – With Treatment (Bioretention) by Drainage Management Area

Pollutant	DMA								Total Project Area
	BMP 1	BMP 2	BMP 3	BMP 4	BMP 5	BMP 6	BMP 7	BMP 8	
TSS	-90.6%	-91.4%	-86.7%	-89.7%	-85.6%	-86.6%	-78.5%	-88.7%	-89.0%
COD	-96.8%	-96.9%	-95.7%	-96.6%	-95.0%	-95.5%	-88.5%	-96.5%	-96.2%
Fecal Coliform	-94.3%	-94.3%	-94.4%	-94.0%	-94.9%	-93.7%	-95.6%	-91.4%	-94.0%
NH3	-34.7%	-11.6%	-31.6%	-37.8%	-12.6%	-14.8%	222.3%	-43.9%	-26.4%
NO2+NO3	-31.1%	-41.1%	-11.6%	-28.1%	-8.7%	-19.9%	41.9%	-26.7%	-25.3%
Nitrogen, Total Kjeldahl	-61.4%	-63.0%	-49.6%	-59.4%	-43.9%	-51.1%	11.6%	-58.5%	-56.1%
Phosphorous, Total	-78.7%	-81.9%	-68.7%	-76.3%	-67.3%	-69.4%	-56.1%	-71.1%	-75.0%
Cd, Total	-92.1%	-93.1%	-88.0%	-91.1%	-87.5%	-89.5%	-78.4%	-90.6%	-90.7%
Cu, Total	-88.0%	-90.3%	-79.6%	-85.9%	-80.4%	-83.4%	-69.1%	-89.8%	-86.1%
Pb, Total	-91.7%	-94.3%	-81.0%	-89.8%	-83.5%	-89.0%	-63.4%	-90.7%	-90.1%
Ni, Total	-91.0%	-92.7%	-82.6%	-89.7%	-81.2%	-87.5%	ND	-86.7%	-88.9%
Zn, Total	-91.8%	-93.3%	-85.2%	-90.6%	-84.4%	-88.5%	-45.5%	-89.4%	-90.0%
Oil and Grease	-96.3%	-96.1%	-95.7%	-96.3%	-95.1%	-95.4%	-91.4%	-96.4%	-95.9%

As an alternative to using median concentrations and percent removal to calculate proposed pollutant concentrations, expected effluent concentrations can be located in published literature for a variety of BMPs. These performance-based effluents have been documented for the some BMPs, although the literature is somewhat limited in respect to bioretention.

In order to perform a desktop validation of the results of the study, the proposed pollutant concentrations following bioretention treatment were compared with irreducible pollutant concentrations located in published studies. As the data is limited, some of the concentrations from the literature appear as ranges and not as absolute values. The pollutant concentrations presented in this study using the percent removal method are within reasonable range of the irreducible concentrations proposed by the literature. Table 10 presents the comparison between the existing, proposed, and literature pollutant concentrations. Similarly, Table 11, is a summary of the results when analyzed on a DMA level.

Table 10 – Comparison between Existing, Proposed with Treatment, and Literature Pollutant Concentrations for Entire Study Area

Constituent	Units	Literature*	Existing	Proposed with Treatment
TSS	(mg/L)	TSS=10	90.07	9.92
COD	(mg/L)		109.59	4.13
Fecal Coliform	(mpn/100 mL)		4,962.73	296.04
NH3	(mg/L)		0.73	0.54
NO2+NO3	(mg/L)		0.84	0.63
Nitrogen, Total Kjeldahl	(mg/L)	1.1<[N _T <1.69	1.71	0.75
Phosphorous, Total	(mg/L)	0.048<[P] ₉₈ <1.3	0.45	0.11
Cd, Total	(ug/L)		0.84	0.08
Cu, Total	(ug/L)	[Cu]<10	21.77	3.03
Pb, Total	(ug/L)	[Pb]<5	29.66	2.94
Ni, Total	(ug/L)		7.63	0.85
Zn, Total	(ug/L)	[Zn]<50	190.74	19.02
Oil and Grease	(mg/L)		2.57	0.10

Note:

Irreducible concentrations reported for TSS, Cu, Pb, and Zn. Values for NO₃, Total N, and P represented as a range of values reported in same measurement units from literature.

* Barrett and Limonuzin, 2009.

Table 11 – Comparison between Existing, Proposed with Treatment, and Literature Pollutant Concentrations by Drainage Management Area

Constituent	Units	Literature*	DMA							
			BMP 1	BMP 2	BMP 3	BMP 4	BMP 5	BMP 6	BMP 7	BMP 8
TSS	(mg/L)	TSS=10	10.41	10.01	10.15	10.14	10.32	10.10	10.44	6.76
COD	(mg/L)		4.45	4.17	4.27	4.25	4.37	4.26	4.83	2.03
Fecal Coliform	(mpn/100 mL)		262.5	288.6	280.2	278.6	266.9	286.7	317.4	512.2
NH3	(mg/L)		0.59	0.55	0.56	0.56	0.58	0.56	0.58	0.25
NO2+NO3	(mg/L)		0.66	0.63	0.64	0.63	0.65	0.65	0.84	0.38
Nitrogen, Total Kjeldahl	(mg/L)	1.1<[N _T <1.69	0.80	0.76	0.77	0.77	0.79	0.77	0.83	0.43
Phosphorous, Total	(mg/L)	0.048<[P]<1.398	0.12	0.11	0.11	0.11	0.12	0.12	0.14	0.08
Cd, Total	(ug/L)		0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.05
Cu, Total	(ug/L)	[Cu]<10	3.23	3.07	3.12	3.13	3.20	3.10	3.09	1.77
Pb, Total	(ug/L)	[Pb]<5	3.20	2.97	3.05	3.03	3.13	3.05	3.66	1.22
Ni, Total	(ug/L)		0.94	0.86	0.89	0.88	0.92	0.88	1.00	0.27
Zn, Total	(ug/L)	[Zn]<50	20.67	19.28	19.77	19.69	20.31	19.64	21.81	8.26
Oil and Grease	(mg/L)		0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.06

Note:

Irreducible concentrations reported for TSS, Cu, Pb, and Zn. Values for NO₃, Total N, and P represented as a range of values reported in same measurement units from literature.

* Barrett and Limonuzin, 2009.

Recommended Field Validation

Based upon the results presented above, it is anticipated that future monitoring is implemented to validate the results. There are two types of monitoring that are expected: that to determine impacts of the specific plan area development on the watershed and that to determine the discharge results from the specific plan area.

To determine the impacts of the SPA on the watershed, it is anticipated that upstream and downstream monitoring locations are utilized. It is important to capture baseline data to support potential changes in habitat, bioassessments and water quality. As each new phase is developed within the SPA, monitoring could take place to determine if cumulative changes to the watershed are occurring and to what extent.

At the discharge level, each DMA and the study area as a whole could be monitored individually to determine the range of effluent concentrations generated from each area or summarized in a study area collective result. It is important to distinguish run-on flow and pollutant concentrations while conducting monitoring of the discharges.

It is also encouraged to implement project (i.e., each development) specific monitoring locations to allow for investigations to occur when discharge runoff concentrations warrant such upstream investigations.

Conclusions

The San Marcos Creek Specific Plan calls for many opportunities to use planned surface areas as low impact development site design/treatment control BMPs. There are also opportunities to design and construct bioretention BMPs within the Specific Plan Area that meet the conceptual design of the Specific Plan. Figures 4 and 7 show examples of such BMPs.

The analyzed treatment systems consider not only the expected pollutant concentrations from the built-out Specific Plan Area, but also the expected treatment runoff quantities based on the regionally accepted treatment requirements (85th percentile rain events for flow and volume based treatment).

This analysis demonstrates an expected decrease in pollutant loading when comparing the existing site conditions to the built-out Specific Plan for the Study Area, when implementation of the example treatment control BMPs are included. It is important to note that the levels of the constituents expected to be generated are below the action levels for municipal monitoring activities and, at those levels, are not considered risks to human health or the environment.

Comparison of the proposed pollutant concentrations based on the percent removal with those from performance-based effluents show similar results. The pollutant concentrations from the literature validate the methods and the proposed post-treatment effluent concentrations presented in the study.

The analysis is considered conservative in nature because it does not consider the differences between the existing facilities, with their pollutant-generating activities exposed to rainfall, and the built-out conditions, which will likely be much less outdoor pollutant generating activities. A combination of changes in land use and new design and construction, and relocating pollutant activities indoors, supports this statement.

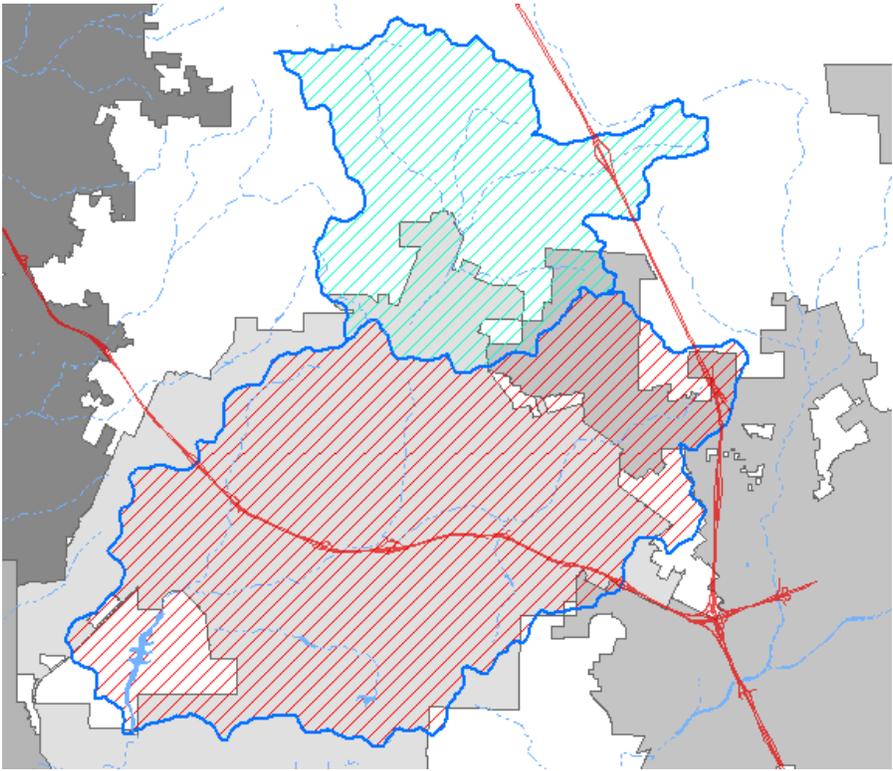


Figure 7: Example of system that meets conceptual plans of Specific Plan (WSUD.org)

References:

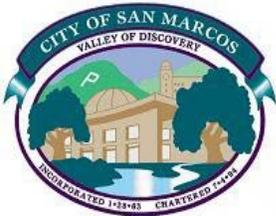
1. City of San Marcos, 2007. San Marcos Creek Specific Plan. City of San Marcos, San Marcos, California
2. Dahlenberg, John, 2006. Water Sensitive Urban Design – www.wsud.org Accessed on October 28, 2007
3. Davis, Allen P., Mohammad Shokouhian, Himanshu Sharma, and Christie Minami. 2001. Laboratory study of biological retention (bioretention) for urban storm water management. *Water Environment Research* 73: 5-14.
4. Davis, AP, et al. 2006. Water quality improvement through bioretention media: Nitrogen and phosphorus removal. *Water Environment Research*, 78 (3): 284-293.
5. Hsieh, et al., 2003. Multiple-Event Study of Bioretention for Treatment of Urban Storm Water Runoff. University of Maryland, College Park, Maryland.
6. Pitt, Robert et al., 2004. Findings from the National Stormwater Quality Database. Center for Watershed Protection, Ellicott City, Maryland.
7. United States Environmental Protection Agency, 1999. Storm Water Technology Fact Sheet – Bioretention. Office of Water, Municipal Technology Branch, Washington D.C.
8. Michael Barrett and Maelle Limonuzin, Center for Research in Water Resources, University of Texas, September 2009. Literature Review of Extended Detention and Biofiltration Systems prepared for the City of Austin.

UPPER SAN MARCOS CREEK WATERSHED (USMC) NUTRIENT MANAGEMENT PLAN



PREPARED BY:

City of San Marcos



County of San Diego



City of Escondido



JANUARY 2010

USMC Nutrient Management Plan

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1.0 USMC NUTRIENT MANAGEMENT PLAN OBJECTIVES

The Upper San Marcos Creek (USMC) Watershed MS4 Copermittees (City of San Marcos, County of San Diego, and City of Escondido) have established four primary objectives for this Nutrient Management Plan:

1. Establish baseline data to assess nutrient-related water quality in the watershed and to measure future improvements;
2. Identify potential sources of nutrients in the watershed and establish priorities for source control activities;
3. Identify best management practices (BMPs) and other actions that will help to reduce nutrient discharges into and from municipal separate storm sewer systems (MS4s) operated by the USMC Watershed MS4 Copermittees;
4. Establish a framework for collaboration among the USMC Watershed MS4 Copermittees, including, data collection, monitoring, outreach, and reporting.

The USMC Watershed MS4 Copermittees will meet on a regular basis to achieve these objectives.

2.0 USMC WATERSHED CHARACTERIZATION

The USMC Watershed is approximately 29 square miles and is comprised of two sub-watersheds (See Appendix A, Figure 1). The primary water bodies in the USMC watershed are Upper San Marcos Creek and Lake San Marcos.

Table 2.1 illustrates that the Twin Oaks hydrologic sub-area (HSA 904.53) is located in the northern portion of the watershed and makes up 31% of the total watershed land area. The County of San Diego has the most land use jurisdiction in HSA 904.53, followed by the Cities of San Marcos and Escondido. HSA 904.53 is predominantly occupied by agricultural, open space, and single-family residential land uses.

The Richland HSA (HSA 904.52) comprises the remainder of the watershed, and is located south of the Twin Oaks HSA and north of Lake San Marcos. HSA 904.52 comprises 69% of the total land area of the watershed. The City of San Marcos has the predominant land use jurisdiction in HSA 904.52, followed by the City of Escondido and the County of San Diego. HSA 904.52 is predominantly urban with single-family residential land uses and some commercial and industrial corridors.

Table 2.1
HSAs in Upper San Marcos Creek Watershed

HSA	Land Area (acres)	% of UPPER SAN MARCOS CREEK WATERSHED
Twin Oaks (904.53)	5,663	30.6
Richland (904.52)	12,863	69.4
TOTAL	18,526	100 %

This plan focuses on nutrient management activities by three Phase I MS4 municipalities. Table 2.2 summarizes each municipality's total land area within the USMC Watershed. The City of San Marcos comprises the majority of the land area followed by the County of San Diego, and the City of Escondido. The plan does not address nutrient contributions from other MS4s in the watershed, including those operated by Caltrans, utility agencies, or Phase II MS4 entities such as school districts, colleges, universities, and transit agencies. In addition, there are numerous other entities and private parties which may hold other permits and/or rights that may be potential nutrient sources. Although they are not included as part of this plan, the Phase 1 MS4s will endeavor to work cooperatively with all responsible parties in the watershed wherever feasible.

Table 2.2
MS4 Copermittee Jurisdictional Land in Upper San Marcos Creek Watershed

Agency	Land Area (square miles)	% of UPPER SAN MARCOS CREEK WATERSHED
City of San Marcos	16.9	58.2
County of San Diego	9.4	32.4
City of Escondido	2.7	9.4
TOTAL	29.0	100 %

Table 2.3 summarizes current water quality impairments in San Marcos Creek and Lake San Marcos as identified on the State of California's 303(d) List of Impaired Water Body Segments. Table 2.4 lists the beneficial uses of San Marcos Creek, Lake San Marcos, and unnamed intermittent streams that are established in the Water Quality Control Plan for the San Diego Basin (Basin Plan). This plan focuses only on addressing nutrient-related impairments, which most directly impact aquatic wildlife (WARM, WILD) and aesthetic beneficial uses (REC-2).

Table 2.3
2006 303(d) Listings for San Marcos Creek/Lake San Marcos
and Proposed 2008 303(d) Listings

303(d) Listed Water Body	2006
San Marcos Creek	DDE, phosphorous, sediment toxicity
Lake San Marcos	Ammonia as N, Nutrients, phosphorous

Table 2.4
Basin Plan Inland Surface Waters
Beneficial Uses for San Marcos Creek/Lake San Marcos

Water Body	Beneficial Uses
San Marcos Creek/Lake San Marcos (904.52 - Richland)	MUN (excepted), AGR, REC1, REC2, WARM, WILD
Unnamed intermittent streams (904.53 – Twin Oaks)	MUN (excepted), AGR, REC1, REC2, WARM, WILD

3.0 USMC WATERSHED POTENTIAL NUTRIENT SOURCES

This section identifies and describes potential sources of nutrients in the Upper San Marcos Creek Watershed. The USMC Watershed MS4 Copermittees conducted a watershed-based assessment of jurisdictional source inventories, available water quality monitoring data, and land use data to identify four priority source categories from the comprehensive list of potential sources shown in Table 3.1. These four source categories are likely contributors of nutrient loading in the Upper San Marcos Creek and Lake San Marcos. As shown in Table 3.1, management programs for many of these sources are already required pursuant to mandatory MS4 Permit compliance programs, including the Jurisdictional Urban Runoff Management Program (JURMP).

The relative nutrient loading from each potential source is unknown. Part of the initial work effort under this plan will involve iterative activities or data assessment studies to provide definitive information on a particular source’s threat-to-water quality with respect to nutrients and potential abatement efforts on a sub-watershed basis.

Until more is known about the relative loading from each source, the USMC Watershed MS4 Copermittees will focus management and abatement activities on the top four source categories suspected to be contributing a significant portion of the nutrient load:

- Residential areas
- Agriculture (including nurseries)
- Parks, and
- Golf courses.

Together, these sources represent almost 50% of the total watershed land area. They are also thought to be significant in terms of their potential for over-irrigation and fertilizer use, both of which have the potential to exacerbate nutrient loading in the watershed. Table 3.1 also gives an indication of the extent and magnitude of each source category within the Upper San Marcos Creek Watershed.

**Table 3.1
Potential Nutrient Sources in Upper San Marcos Creek Watershed**

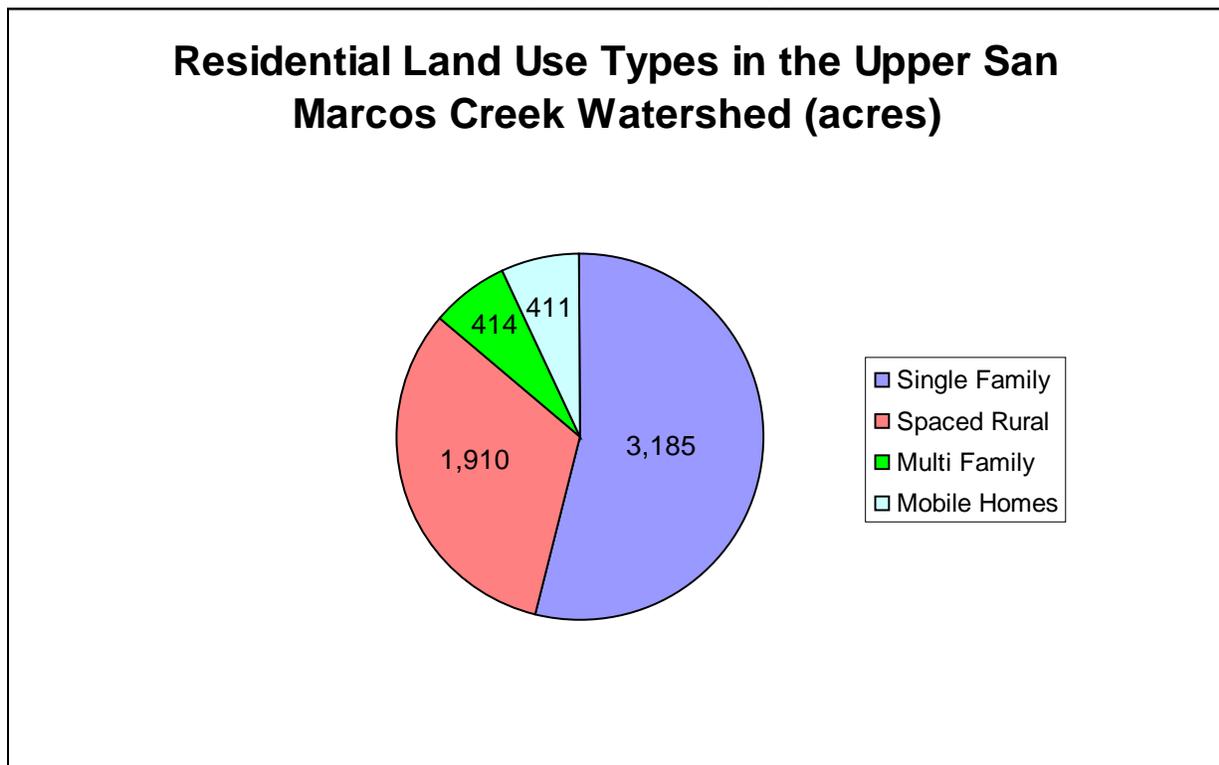
POTENTIAL NUTRIENT SOURCES	MANDATORY COMPONENT OF JURMP?	EXTENT WITHIN UPPER SAN MARCOS CREEK WATERSHED
PRIORITY SOURCE CATEGORIES UNDER THIS PLAN		
Residential Areas & Activities	Yes	5,949 acres (32.1%)
Agriculture, including nurseries	Yes (nurseries only)	2,133 acres (11.5%)
Parks & Recreational Areas	Yes	505 acres (2.7%)
Golf Courses (4 total)	Yes	422 acres (2.3 %)
Total		9,009 acres (48.6 %)
OTHER SOURCE CATEGORIES THOUGHT TO CONTRIBUTE NUTRIENT LOADING		
Aerial Deposition	No	Unknown
Animal Facilities	Yes	FUTURE DATA ASSESSMENT
Cemeteries	Yes	FUTURE DATA ASSESSMENT
Landscaping in Commercial/Industrial Areas	Yes	FUTURE DATA ASSESSMENT
Construction Sites	Yes	FUTURE DATA ASSESSMENT
Development (New and Redevelopment)	Yes	FUTURE DATA ASSESSMENT
Groundwater	No	Unknown
Landfills (including closed landfills)	Yes	FUTURE DATA ASSESSMENT

POTENTIAL NUTRIENT SOURCES	MANDATORY COMPONENT OF JURMP?	EXTENT WITHIN UPPER SAN MARCOS CREEK WATERSHED
Naturally Occurring Nutrients in Soil	No	FUTURE DATA ASSESSMENT
Phase II MS4s	No	FUTURE DATA ASSESSMENT
Sanitary Sewer Systems & Facilities	No	FUTURE DATA ASSESSMENT
Streets, Roads, and Highways	Yes	FUTURE DATA ASSESSMENT

3.1 Residential Areas and Activities

There are 5,949 acres (9.3 square miles) of residential development in the Upper San Marcos Creek Watershed (See Appendix A, Figure 2). This represents 32% of the total watershed land area. As shown in Table 3.2¹, single-family homes are the predominant residential land use type (54%), followed by spaced rural residential (32%). There are also significant multi-family and mobile home residential uses in the watershed (7% each). Table 3.2 describes nutrient-generating activities common in residential areas.

**Table 3.2
Summary of Land Use Types**



¹ Based on 2006 SANDAG Land Use Data

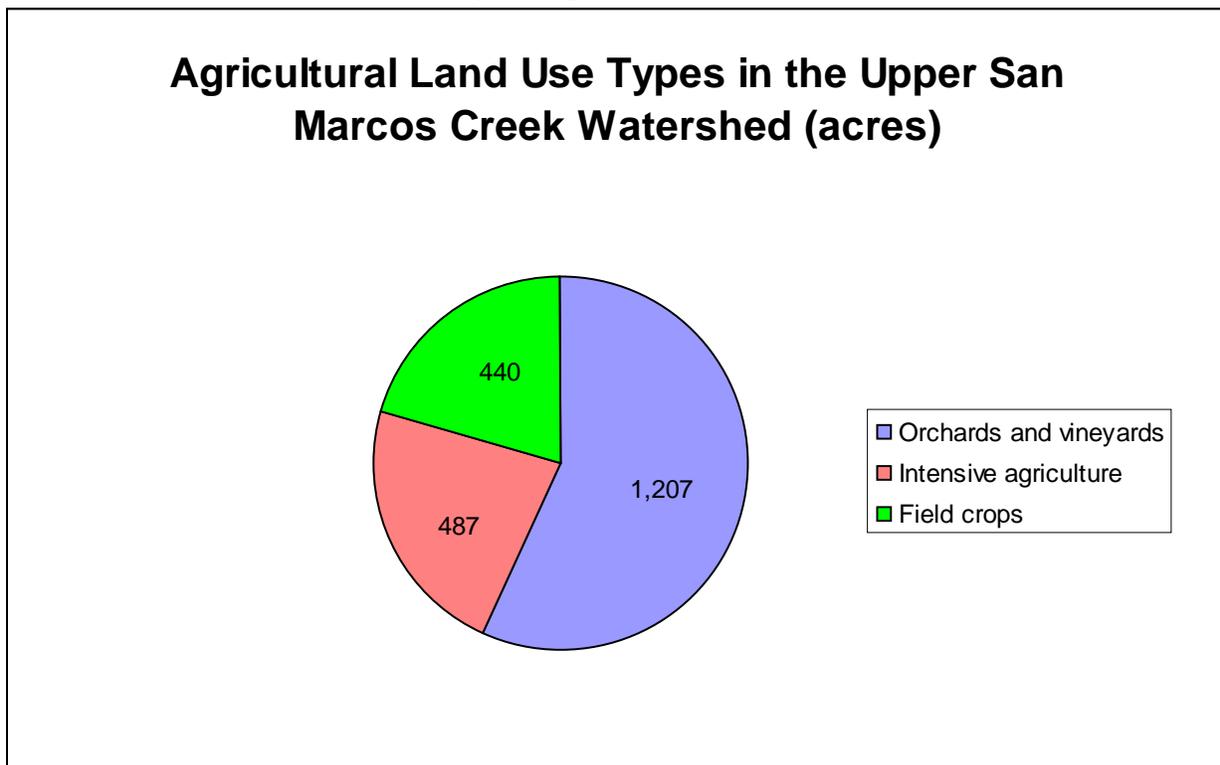
Table 3.3
Nutrient-Generating Activities Common to Residential Areas

ACTIVITY	DESCRIPTION
Automobiles and Boats	
Washing and cleaning	Washing and cleaning automobiles and boats can cause detergent and washwater with pollutants to run into the MS4 or directly into receiving waters.
Lawns, Gardens, and HOA-Maintained Areas	
Over-irrigation	Use of excessive water on lawns, gardens, or other green areas can cause runoff which carries pollutants to the MS4 or directly into receiving waters. Excessive water use can result from over-application, system leaks, or improperly adjusted sprinklers.
Fertilizer use	Overuse of fertilizer can cause contaminated runoff to enter the MS4 or receiving waters as a result of rain or irrigation flows.
Landscape drains	Landscape drains can convey irrigation water or groundwater with elevated levels of nutrients to the MS4 or directly to receiving waters.
Household and Home	
Outdoor cleaning	Cleaning outdoor areas such as sidewalks, driveways, and home exteriors by power washing or use of hazardous chemicals. Wash waters are often allowed to drain into the stormwater conveyance system or are not properly contained and disposed.
Pool, spa, and fountain care	Maintenance of swimming pools, spas, and ornamental water fixtures require chemical application and the discharging of polluted water and wash water. Water being drained is often allowed to flow into the MS4.
Materials and waste storage	Materials and waste that are not properly covered or contained have the potential to enter the MS4 or receiving waters as a result of rain or irrigation flows.
Waste disposal	Failure to properly dispose of material or waste into waste receptacles can lead to contamination of MS4s or receiving waters.
Sewer lateral maintenance	Failure to properly maintain private sewer laterals can lead to sewage overflows, which can contribute nutrients to receiving waters.
Pets	
Pet waste disposal	Failure to properly dispose of pet waste can lead to contaminated runoff entering MS4s or receiving waters as a result of rain or irrigation flows.
Pet cleaning	Pet cleaning and washing can cause detergent and wash waters with pollutants to run directly into MS4s or directly into receiving waters.
Livestock and Large Animals	
Manure management	Exposed manure from livestock, horses, or other large animals can enter the MS4 or receiving waters as a result of rain or irrigation flows.
Manure disposal	Failure to properly dispose of manure can lead to contaminated runoff entering MS4s or receiving waters as a result of rain or irrigation flows.
Composting	Failure to properly store and contain compost can result in nutrient loading to the MS4 or receiving waters.
Agriculture on Residential Parcels	
Over-irrigation	Use of excessive water leads to runoff, which can carry pollutants to the MS4 or directly into receiving waters.
Fertilizer use	Overuse of fertilizer can cause contaminated runoff to enter the MS4 or receiving waters as a result of rain or irrigation flows.

3.2 Agriculture (including Nurseries)

There are 2,133 acres (3.3 square miles) of agricultural land uses in the Upper San Marcos Creek Watershed (See Appendix A, Figure 3). This represents 12% of the total watershed land area. As shown in the Table 3.4 below², orchards and vineyards are the predominant type (57%), followed by intensive agriculture (23%), and field crops (21%). There are 42 nurseries and greenhouses in the unincorporated portion of the watershed, 6 within the City of San Marcos boundaries, and none in the City of Escondido. Table 3.5 describes nutrient-generating activities common in agricultural areas.

**Table 3.4
Summary of Agricultural Land Uses**



**Table 3.5
Nutrient-Generating Activities Common to Agricultural Areas**

ACTIVITY	DESCRIPTION
Irrigation management	Use irrigation water in a way that minimizes the amount of wasted water and the amount of water leaving the property and potentially reaching an MS4 or receiving water.
Nutrient management	Application of nutrients is necessary in agricultural settings, but the goal should be to apply only the amount of nutrients needed and usable by target plants, and at the appropriate time based on plant growth stage and environmental factors.
Erosion and runoff management	Erosion and runoff management involves modifying soil and container substrates to enhance their ability to hold water, creating barriers to the movement of sediments and water and capturing unused irrigation water for reuse or storage.

² 2006 SANDAG Land Use Data

3.3 Parks and Recreational Areas

There are 505 acres (0.79 square miles) of park land uses in the Upper San Marcos Creek Watershed (See Appendix A, Figure 4). This represents 2% of the total watershed land area. There are no parks in the unincorporated portion of the watershed, 52 within City of San Marcos boundaries, and none in the City of Escondido. Table 3.6 describes nutrient-generating activities common in landscaped park areas.

**Table 3.6
Nutrient-Generating Activities Common to Park Areas**

ACTIVITY	DESCRIPTION
Irrigation management	Use irrigation water in a way that minimizes the amount of wasted water and the amount of water leaving the property and potentially reaching an MS4 or receiving water.
Nutrient management	Application of nutrients is necessary in agricultural settings, but the goal should be to apply only the amount of nutrients needed and usable by target plants, and at the appropriate time based on plant growth stage and environmental factors.
Erosion and runoff management	Erosion and runoff management involves modifying soil and container substrates to enhance their ability to hold water, creating barriers to the movement of sediments and water and capturing unused irrigation water for reuse or storage.
Landscape Maintenance	Landscape Maintenance (shrub , grass, tree clippings, leaves) involves proper removal and disposal of organic matter from park areas in order to reduce the potential for organic matter to reach the MS4

3.4 Golf Courses

There are four separate golf courses throughout the Upper San Marcos Creek Watershed (See Appendix A, Figure 4). Of these four golf courses, two are within the unincorporated area, and one within each the City of San Marcos, and Escondido.

The total amount of land used by the four golf courses is 422.2 square acres (0.7 square miles). Golf courses in the County and Escondido are managed and/or owned by the same single private entity and comprise 65.1 % of the total golf course land use in the USMC watershed. Each golf course uses the following amount of area within the Upper San Marcos Creek Watershed:

- Lake San Marcos Executive Golf Course: 37 acres (0.06 square miles)
- Lake San Marcos Country Club Golf Course: 129 acres (0.20 square miles)
- Country Club (Escondido): 109 acres (0.17 square miles)
- Twin Oaks (San Marcos): 147 acres (0.23 square miles)

Table 3.7 describes nutrient-generation activities that are commonly associated with golf course operations.

Table 3.7

Nutrient-Generating Activities Common to Golf Courses

Source/Activity	Description
Fertilizer use	Overuse of fertilizer can cause polluted runoff.
Over irrigation	Over use of irrigation water for golf courses leads to excess runoff- resulting in nutrient rich water entering the MS4/receiving water bodies.
Wildlife waste	Wildlife (e.g., ducks) that gather in and around golf course.
MS4/receiving water protection	Unprotected inlets and exposed open channels.
Greenwaste management	Improper storage and/or disposal of greenwaste can pollute runoff.

4.0 IMPLEMENTATION PLAN

Implementation of this plan will involve a number of different activities, including monitoring, public education, enforcement of local ordinances to ensure private party compliance with nutrient discharge prohibitions, and municipal implementation of BMPs where appropriate.

4.1 Monitoring

This section describes current and planned water quality monitoring activities in the Upper San Marcos Creek Watershed. It is divided into two parts. “Core” monitoring activities are those required to maintain compliance with the MS4 Permit. “Enhanced” monitoring includes additional monitoring activities proposed by the Watershed Copermittees to: 1) assess water quality improvements resulting from implementation of this Nutrient Management Plan, and 2) identify and verify sub-watershed priorities for management action.

As an initial step, the USMC Watershed MS4 Copermittees reviewed historical sources of nutrient-related water quality data in the Upper San Marcos Creek Watershed. In addition to the Copermittee data described starting in Section 4.1.1, the review uncovered the following external sources of information:

- 904CBSAM3: This site, which is located on Upper San Marcos Creek near McMahr Road, about 1,300 feet upstream of the Discovery Street Bridge, was sampled during ambient conditions as part of the State of California’s Surface Water Ambient Monitoring Program (SWAMP) in 2002. Both ammonia as N and total phosphorous as P exceeded their respective aquatic life thresholds of 0.025 mg/L and 0.1 mg/L in four out of four samples taken. Nitrate + Nitrite as N did not exceed its aquatic life threshold (10 mg/L) in any of the four samples.
- SMC-00729: This site, which is located on Upper San Marcos Creek about 900 feet downstream of State Route 78, near Echo Lane, was sampled during ambient conditions on June 3, 2009, as part of a program conducted by the Southern California Stormwater Monitoring Coalition (SMC). Ammonia as N was measured at 0.05 mg/L. Nitrate as N was measured at 1.92 mg/L compared to a Basin Plan Water Quality Objective of 10 mg/L. Nitrite as N was measured at <0.01 mg/L compared to a Basin Plan Water Quality Objective of 1 mg/L. Total Kjeldahl Nitrogen (TKN) was measured at 0.98 mg/L. Total nitrogen was calculated to be 2.9 mg/L compared to a Basin Plan Water Quality Objective of 1 mg/L. Total orthophosphate as P was measured at 0.1 mg/L. Total phosphorous

was measured at 0.218 mg/L compared to a Basin Plan Water Quality Objective of 0.1 mg/L.

4.1.1 Core Monitoring

The San Diego Municipal MS4 Permit requires Copermittees to carry out a variety of mandated water quality monitoring activities at many locations throughout the San Diego region. These “core” monitoring programs are intended to: 1) assess the chemical, physical, and biological impacts to receiving waters resulting from urban runoff discharges, and 2) to identify and characterize sources of specific pollutants in urban runoff discharges. The Regional Receiving Waters Monitoring Program approved by the Regional Water Quality Control Board and implemented by the San Diego Regional Stormwater Copermittees does not currently include any monitoring stations in the Upper San Marcos Creek Watershed. However, the County of San Diego, the City of San Marcos, and the City of Escondido all conduct a Dry Weather Field Screening and Analytical Monitoring Program within their respective jurisdictions. Jurisdictional dry weather monitoring takes place between May 1 and September 30 each year and is designed to detect and eliminate illicit connections and illegal discharges to the MS4 using frequent, geographically widespread dry weather discharge monitoring and follow up investigations.

4.1.1.1 County of San Diego

The County of San Diego regularly monitors four stations as part of its jurisdictional Dry Weather Monitoring Program. The CAR 13 and CAR 14 monitoring stations are located at MS4 outfall locations immediately adjacent to the lake, on the lake’s west and east side respectively. The CAR 04 monitoring station is located within the San Marcos Creek channel as it crosses beneath the Discovery Street Bridge at the jurisdictional boundary between the County of San Diego and the City of San Marcos. The CAR 06 monitoring station is located in an earthen channel, near San Marcos Creek approximately seven miles upstream of Lake San Marcos at the jurisdictional boundary between the County of San Diego and the City of San Marcos.

Field data collected during site visits include site descriptions, qualitative observations of site conditions, as well as quantitative measurements of flow and physiochemical properties of water. Measurements of water flow and/or physiochemical properties are measured in situ. Grab samples are collected for field measurement of ammonia, nitrate, orthophosphate, MBAS, and additional laboratory analysis of constituents as required by the Permit or deemed valuable to the County’s monitoring program. A full explanation of procedures for the Dry Weather Monitoring Program is presented in the Dry Weather Analytical and Field Screening Monitoring Procedures Manual (County of San Diego, 2008). Additionally, the County has developed and annually updates a Quality Assurance Project Plan (QAPP) for the Program (County of San Diego, 2008). As established in the MS4 Permit, results that exceed the action levels established for various constituents trigger follow up investigations to seek out and abate the discharge sources. The action level for nitrate (nitrate-N) is 10.0 mg/l. The action level for phosphate (orthophosphate-P) is 2.0 mg/l.

CAR 13 is located on the western side of Lake San Marcos in a storm drain outlet that discharges directly to the lake at the terminus of San Marino Drive. The drainage area is

composed of residential properties and the Lake San Marcos Executive Golf Course. Flowing water is usually present at this site during dry weather conditions. No exceedances of action levels were recorded during the 2008 sampling dry weather sampling season. Between 2004 and 2007, various indicator bacteria exceeded action levels but there have been no exceedances of action levels for nitrate or phosphate. Upstream investigations have identified bacteria exceedances in two tributaries to the site, but no specific sources have been located. The County has identified the need for additional monitoring at this location to: 1) better characterize low flows during dry weather, and 2) characterize nutrient loading during storm events (see Section 4.1.2).

CAR 14 is located on the eastern side of Lake San Marcos in an earthen channel of a small tributary at the end of El Chico Lane. The drainage area for this station is composed of primarily residential properties, but also includes agricultural land uses (avocado orchards) and the Lake San Marcos Main Golf Course. Only ponded water has been observed at this site under dry weather sampling conditions. The site has been monitored since 2004. Between 2004 and 2007 there were no action level exceedances at this location. Indicator bacteria levels exceeded action levels in July 2008 sampling date and on a follow up visit in August 2008. Subsequent upstream investigations showed indicator bacteria levels below the action level and no discharge sources could be located. Ammonia exceeded its action level in September 2008 but was determined to be a localized environmental condition.

CAR 04 is located on San Marcos Creek upstream of Lake San Marcos at the Discovery Street Bridge. During 2008, this location was sampled twice. The site had flowing water on the first visit (July 21) and ponded water on the second visit (September 8). No action level exceedances have been recorded at this location from 2002 to 2008.

CAR 06 is located in an earthen channel near San Marcos Creek, approximately seven miles upstream of Lake San Marcos near the jurisdictional boundary between the County of San Diego and the City of San Marcos. The site receives runoff from portions of the Twin Oaks area and includes agricultural and rural residential land use types. Under dry weather conditions the site is most often dry, with water observed during only two out of the seven years sampled. In 2006, a referral of potential nitrate exceedances was made to the County of San Diego. In the years following the referral, the County has attempted investigation but the site remains dry during scheduled sampling visits preventing further sampling at the location. The County of San Diego Department of Agriculture, Weights and Measures concluded that the nitrate exceedance may be the result of subsurface flow potentially created by the irrigation practices of surrounding commercial nurseries, field grown agriculture, and to a lesser degree, equestrian and equine activities.

4.1.1.2 City of San Marcos

Within the Upper San Marcos Creek Watershed, the City of San Marcos has 27 core dry weather monitoring stations. Two stations are located within HSA 904.53 and 25 are located in HSA 904.52. The City of San Marcos has four primary drainage areas identified A, B, C, and D. An assessment of data collected since 2002 identifies that two primary drainage areas and monitoring locations (D-3 and B-3) indicate elevated levels of nutrients. Since 2002, six incidents of nutrient exceedance have occurred,

predominately at B-02 and B-03. However, there were no consistent trends. These monitoring locations are consistent with the primary land use nutrient sources in HSA 904.52.

4.1.1.3 City of Escondido

Within the Upper San Marcos Creek Watershed, the City of Escondido has five dry weather monitoring stations. The Upper San Marcos Creek Watershed comprises only 11 percent of Escondido's total area representation within the San Marcos Creek Watershed. All five of the dry weather stations are situated around or within the Country Club Golf Course. Three stations are located within the Country Club Golf Course (874.4.0, 874.3.0 and 874.2.0) and two outside/adjacent to the golf course (874.0.0 and 874.1.0). The following are descriptions of the dry weather station locations as the sole surface water body travels through the City of Escondido's jurisdiction:

874.4.0: located within the northern portion of the golf course as surface water immediately enters the City's jurisdiction and golf course (Nutmeg Street and Gary Lane) via an outfall pipe. Historical data for this station shows no past water quality issues. The station has had flow twice (Fiscal years 04-05 and 07-08) since the dry weather program was initiated in 2001.

874.3.0: located within golf course (County Club Road and La Brea Street) in a side unnamed tributary (open natural) prior to commingling with main open (natural) channel which transverses the course. Historical data for this station provides no past water quality issues. The station had flow once in fiscal year 2007-08.

874.2.0: located within the main golf course (open natural channel), downstream of the main golf course pond and the last exposed location prior to entering a subterranean portion of the MS4. This station has had past elevated total coliform (fiscal years 03-04 and 05-09) and fecal coliform levels in fiscal year 08-09. Upon investigation, the source of the elevated bacteria was the result of water fowl gathering in the golf course pond up-gradient of the station. No elevated nutrients were found in any of the past fiscal years.

874.1.0: located outside the golf course along a natural side drainage (natural channel at the end of Arroyo Road and County Club Road) which feeds to the City's MS4. Historically the station is dry.

874.0.0: located downstream of the golf course within a concrete channel which passes through a mobile home park/facility (within the City of San Marcos). Historical data for this station has shown elevated levels for total coliform and fecal coliform in fiscal year 08-09. As previously mentioned above, the source was water fowl gathering in the golf course pond. No elevated nutrients were found in any of the past fiscal years.

The layout of the five stations is used to provide water quality (dry weather flow) analysis as flow passes through the County Club Golf Course. Station 874.4.0 provides influent water quality as it enters both the City of Escondido and the golf course. Stations 874.3.0 and 874.2.0 provide water quality data as it passes through the golf course, which can be a prime candidate for providing nutrient loading (refer to section

3.4). Lastly station 874.0.0 provides the effluent results as flow has traveled through the entire portion of the golf course and additional runoff from surrounding areas. This station is used to characterize the final water quality as it leaves Escondido. Station 872.1.0 has been chronically dry throughout the majority of the dry weather program and has not contributed to the MS4 during dry periods of the year.

4.1.2 Enhanced Monitoring

“Enhanced” monitoring activities are those proposed by the USMC Watershed MS4 Copermittees to: 1) assess water quality improvements resulting from implementation of this Nutrient Management Plan, and 2) identify and verify watershed priorities for management action. Enhanced monitoring includes watershed-wide monitoring projects jointly funded and implemented by the Watershed Copermittees, enhancements to existing jurisdictional monitoring programs to improve focus on watershed issues of concern, and a shared commitment to collaboratively reviewing and analyzing watershed monitoring data in a way that enhances each Copermittee’s ability to identify and eliminate pollutant discharges.

4.1.2.1 Collaborative Watershed Monitoring Activities

The Watershed Copermittees will undertake a collaborative monitoring project to collect baseline information on flow as well as nutrient and sediment loading from multiple locations throughout the watershed during both wet and dry weather conditions. Monitoring will occur during FY 2009-10 and is summarized in the table below. All composite samples will be sent to a certified laboratory for analysis of Ammonia-N, Nitrate-N, Nitrite-N, Total Kjeldahl Nitrogen, Orthophosphate-P, Total Phosphorous, and Total Suspended Solids. Analysis of data collected through this project will be presented in the FY 2009-10 WURMP Annual Report, along with any additional planned monitoring that has been determined by that time. The WURMP Annual Report is scheduled for submittal to the RWQCB on January 31, 2011.

**Table 4.1
Collaborative Watershed Monitoring Project for FY 2009-10**

STATION	LATITUDE	LONGITUDE	LOCATION	FLOW	WET WEATHER	DRY WEATHER
LSM-05a	33.11959	-117.20581	Stormdrain outfall near intersection of La Plaza Dr. and San Pablo Dr.	Continuous flow monitoring: Nov 15 '09 – Jan 8 '09 + 1 month period in Spring '10	N/A	N/A
LSM-05b	33.11900	-117.20531	Stormdrain vault 150 'ft upstream of LMS-05	Continuous flow monitoring: Nov 15 '09 – Jan 08 '10 + 1 month period in Spring '10	N/A	N/A
LSM-04	33.11982	-117.20565	Outfall at Lake San Marcos boat dock near San Pablo Dr.	Continuous flow monitoring planned in Spring '10 for 1 month	N/A	N/A

STATION	LATITUDE	LONGITUDE	LOCATION	FLOW	WET WEATHER	DRY WEATHER
CAR-13	33.12012	-117.20997	Stormdrain outfall at southern terminus of San Marino Dr.	Continuous flow monitoring: Sep '09 – Dec '09	2 flow-weighted composite sampling events: Nov '09 – April '10	N/A
CAR-14	33.11896	-117.20744	Stormdrain outfall near La Plaza Dr. and El Chico Lane	N/A	2 flow-weighted composite sampling events: Nov '09 – April '10	N/A
Discovery Street	33.13053	-117.20037	San Marcos Creek at Discovery St. bridge	N/A	2 flow-weighted composite sampling events: Nov '09 – April '10	N/A
Via Vera Cruz	33.13166	-117.18687	San Marcos Creek at Via Vera Cruz	Continuous flow monitoring: Nov '09 – May '10	N/A	1 flow-weighted composite sampling event: May '10
Woodland Parkway	33.15404	-117.13048	East fork of San Marcos Creek at Woodland Parkway near Woodland Park	Continuous flow monitoring: Nov '09 – May '10	2 flow-weighted composite sampling events: Nov '09 – April '10	1 flow-weighted composite sampling event: May '10
CAR-06	33.17965	-117.15254	San Marcos Creek at intersection of Sycamore Dr. & Olive St.	Continuous flow monitoring: Nov '09 – May '10	2 flow-weighted composite sampling events: Nov '09 – April '10	1 flow-weighted composite sampling event: May '10

4.1.2.2 County of San Diego Dry Weather Monitoring Program Enhancements

In addition to the routine dry weather monitoring activities described in section 4.1.1.1, the County of San Diego will augment its program to identify illicit connections and illegal discharges by performing periodic sweeps of all accessible pipes and conveyances that drain directly into Lake San Marcos. Monitoring sweeps will consist of two staff physically inspecting each accessible above-surface conveyance into the Lake. It is anticipated that each monitoring sweep will take two to three days to complete. Staff will document whether each drain is dry or flowing. Flowing drains will be sampled for analysis of nutrients and an estimate of flow will be made. Nutrient results in excess of the Copermittees' established dry weather action levels will trigger a follow up investigation to identify and abate the source of the discharge. Monitoring sweeps will occur at least two times during FY 2009-10 (once during the summer and

once during a winter dry spell) and as appropriate during subsequent fiscal years. Results from County monitoring sweeps will be presented in the FY 2009-10 WURMP Annual Report, along with any future plans for monitoring sweeps that have been determined by that time. The FY 2009-10 WURMP Annual Report is scheduled for submittal to the RWQCB on January 31, 2011.

4.1.2.3 City of San Marcos Dry Weather Monitoring Program Enhancements

In addition to the core dry weather monitoring activities described in section 4.1.1.2, the City of San Marcos will augment its core monitoring program with an additional 20 future monitoring locations to identify and characterize other sources of nutrients. Focused monitoring will occur within San Marcos Creek and near outlets of Phase II agencies. The City of San Marcos will collaborate with the County of San Diego monitoring plan near CAR 13 through synchronized sampling along with the County's summer and winter monitoring sweeps and as appropriate during subsequent fiscal years.

4.1.2.4 City of Escondido Dry Weather Monitoring Program Enhancements

As described below (4.1.2.5), the City of Escondido plans to regularly collaborate with each Copermittee in reviewing and analyzing the combined Copermittee dry weather data. This review may result in coordinated dry weather monitoring efforts that will be conducted more than once during the dry weather monitoring season—an effort that would exceed the current Permit's core requirement. Through the core dry weather program the City of Escondido annually monitors the entire water course as it transverses through the city and monitors the effluent water as it travels into the next jurisdiction.

4.1.2.5 Collaborative Review and Analysis of Monitoring Data

The Watershed Copermittees are committed to collaboratively reviewing and analyzing watershed monitoring data in a way that enhances each Copermittee's ability to identify and eliminate pollutant discharges. For example, an exceedance of a dry weather action level in one jurisdiction will be communicated to upstream jurisdictions when appropriate. This will allow a more coordinated effort to seek out and abate illegal discharges and illicit connections to MS4s near jurisdictional boundaries. Also, Copermittees will coordinate dry weather sampling dates and locations as appropriate to better link upstream impacts on water quality results collected from downstream sampling locations. At least once a year, the Watershed Copermittees will collaborate on an assessment of available monitoring data to ensure that monitoring locations are appropriately coordinated throughout the watershed. Data gaps will be identified and plans to conduct additional monitoring will be discussed.

4.2 Residential Sources

This section describes current and planned activities to address nutrient loading from residential areas in the Upper San Marcos Creek Watershed. It is divided into two parts. "Core" residential activities are those required to maintain compliance with the MS4 Permit. "Enhanced" residential activities are more targeted in nature and focus on raising awareness, changing behaviors, and reducing nutrient loading from specific targeted residential activities in high priority areas.

4.2.1. Core Residential Activities

The MS4 Permit requires Watershed Copermittees to implement the activities outlined in Table 4.2 below as part of a jurisdictional program to manage discharges from residential areas and activities. Core residential activities will continue as currently implemented under existing JURMPs. Notably, Copermittees will enforce their local ordinances as they become aware of non-compliance with discharge prohibitions and minimum BMP requirements in residential areas.

Each Copermittee will also continue to operate a hotline to facilitate public reporting of illegal discharges in the watershed. Copermittees will record all instances of residential non-compliance, enforcement measures, and corrective actions for inclusion in the WURMP Annual Report.

**Table 4.2
Core Residential Activities**

PERMIT REQUIREMENT	COUNTY OF SAN DIEGO	CITY OF SAN MARCOS	CITY OF ESCONDIDO
D.3.c.(1) Identify high threat to water quality residential areas and activities.	County JURMP Section 8.2 describes residential sources in the unincorporated area.	City of San Marcos JURMP Section 8.2 describes residential sources in the City's jurisdiction.	City of Escondido JURMP Section 8.2 describes residential sources in the City's jurisdiction.
D.3.c.(2) Require the implementation of designated minimum BMPs for high priority residential areas and activities.	County JURMP Section 8.3 describes BMP requirements for residential areas and activities within the unincorporated area. Sec. 67.801-67.806 and 67.807 of the County's Code of Regulatory Ordinances Relating to Watershed Protection, Stormwater Management, and Discharge Control (WPO) contain the relevant ordinance provisions.	City of San Marcos JURMP Sections 8.3 and 8.3.2 describes BMP requirements and additional controls for residential areas and activities within the City's jurisdiction City of San Marcos Water Quality Ordinance 14.5 Contain the relevant ordinance provisions. In addition, the Property Appearance Ordinance enhances residential enforcement for over irrigation and landscape requirements fronting public streets.	City of Escondido JURMP Sections 8.3 and 8.3.2 describes BMP requirements and additional controls for residential areas and activities within the City's jurisdiction.
D.3.c.(3) Enforce stormwater ordinance for all residential areas and activities as necessary to maintain compliance.	County JURMP Section 8.4.1.2.2 describes enforcement procedures for addressing non-compliance in residential areas in the unincorporated area.	City of San Marcos JURMP Section 8.4.4 describes enforcement procedures for addressing non-compliance in residential areas in the City's jurisdiction.	City of Escondido JURMP Section 8.4.8 describes enforcement procedures for addressing non-compliance in residential areas in the City's jurisdiction.
D.5.b.(3) Develop and implement a plan to educate residential, general public, and school children target communities	County JURMP Sections 8.4.1 and 8.4.2 describe programs to educate residential and school children target audiences in the unincorporated area.	City of San Marcos JURMP Section 8.5 describes enforcement procedures for addressing non-compliance in residential areas in the City's jurisdiction.	City of Escondido JURMP Sections 8.4.4 and 10.3 describe programs to educate residential and school children target audiences in the City's jurisdiction.

4.2.2 Enhanced Residential Activities

4.2.2.1 Irrigation Reduction

The USMC Watershed MS4 Copermittees will implement a program during FY 2009-10 and FY 2010-11 that targets a reduction in over-irrigation flows from residential areas in the Upper San Marcos Creek Watershed. Activities will include outreach to residents through materials distribution, presentations, and mass media as appropriate. The Copermittees will explore the viability of implementing an incentive program (i.e., rebates for smart irrigation controllers, rain barrels, or other BMPs) during FY 2009-10 for possible implementation during FY 2010-11. Irrigation reduction programs will be coordinated with the Vallecitos Water District (VWD) to the greatest extent possible so that water conservation messages can be coordinated and to build upon VWD's existing water conservation efforts.

4.2.2.2 Template Water Quality Management Plan for Homeowners Associations (HOAs)

The Watershed Copermittees will collaborate on a project to develop a template water quality management plan for homeowners associations (HOA). Work will involve researching similar plans developed in other regions, soliciting input and feedback from select HOA representatives, and creating a template plan that is tailored to addressing the nutrient issues of concern in the Upper San Marcos Creek Watershed. A template plan will be finalized by the end of FY 2009-10. Copermittees will conduct outreach to as many HOAs in the watershed as possible during FY 2010-11 to encourage adoption of a water quality management plan.

4.2.2.3 Outreach to Professional Landscapers

The County of San Diego will undertake a project to educate professional landscapers about their role in controlling nutrient loading in the Upper San Marcos Creek Watershed. Activities will include development and distribution of outreach materials to landscapers and presentations to both professional landscapers associations and HOAs/residents interested in hiring a responsible landscape contractor. Activities will take place during FY 2009-10 and FY 2010-11.

4.3 Agricultural Sources, Including Commercial Nurseries and Greenhouses

This section describes current and planned activities to address nutrient loading from agricultural land uses, including commercial nurseries and greenhouses, in the Upper San Marcos Creek Watershed. It is presented in two parts. "Core" agricultural activities are those required to maintain compliance with the MS4 Permit. "Enhanced" agricultural activities are more targeted in nature and focus on raising awareness, changing behaviors, and reducing nutrient loading from specific targeted agricultural activities in high priority areas.

It is important to note that discharges from agricultural and nursery operations are directly regulated by the RWQCB pursuant to a conditional waiver of waste discharge requirements. In order to be eligible for Conditional Waiver No. 4, agricultural and nursery operator discharges must: 1) implement minimum management measures and

BMPs to minimize or eliminate pollutant discharges, 2) perform annual self-assessments and training, 3) form or join a monitoring group no later than December 31, 2010, and 4) file a notice of intent with the RWQCB to be part of an individual or group monitoring program no later than January 1, 2011.

4.3.1 Core Agricultural Activities

While the MS4 Permit requires Copermittees to actively prohibit most discharges into and from its MS4, it does not require all types of agriculture to be addressed as part of the Jurisdictional Urban Runoff Management Program. Copermittees are, however, required to implement the activities outlined in Table 4.3 below to effectively manage discharges from commercial nurseries and greenhouses. Notably, Copermittees will continue to enforce their local ordinances as they become aware of non-compliance with discharge prohibitions and minimum BMP requirements at commercial nurseries and greenhouses. Each Copermittee will continue to periodically inspect nurseries and greenhouses to assess compliance. Copermittees will record all instances of non-compliance, enforcement measures, and corrective actions at nurseries and greenhouses for inclusion in the WURMP Annual Report.

**Table 4.3
Core Agricultural Activities**

PERMIT REQUIREMENT	COUNTY OF SAN DIEGO	CITY OF SAN MARCOS	CITY OF ESCONDIDO
D.3.b.(1)(a) Annually update a watershed-based inventory of nurseries and greenhouses within its jurisdiction.	An updated inventory of nurseries and greenhouses in the unincorporated area is included in the County's FY 2008-09 JURMP Annual Report. There are 42 nurseries and greenhouses within the County's portion of the Upper San Marcos Creek Watershed.	An updated inventory of nurseries and greenhouses in the City of San Marcos Area is included in the City's FY 2008-09 JURMP Annual Report. There are 6 nurseries and greenhouses within the City's portion of the Upper San Marcos Creek Watershed; however, commercial businesses inventories are monitored through the City's JURMP in Section 7.2.2	The City of Escondido has no agricultural businesses located within the Upper San Marcos Creek Watershed; however, commercial businesses inventories are monitored through the City's JURMP in Section 7.2.2.3.
D.3.b.(2)(c) Notify the owner/operator of each nursery/greenhouse of applicable BMP requirements.	All nurseries and greenhouses in the unincorporated area have been notified of applicable BMP requirements.	FY 10 – San Marcos will notify all nurseries of applicable BMP requirements.	The City of Escondido has no agricultural businesses located within the Upper San Marcos Creek Watershed.

PERMIT REQUIREMENT	COUNTY OF SAN DIEGO	CITY OF SAN MARCOS	CITY OF ESCONDIDO
D.3.b.(2)(d) Require the implementation of designated minimum BMPs for nurseries and greenhouses.	County JURMP Section 7.2.3 describes BMP requirements for commercial sites and sources within the unincorporated area. Sec. 67.801-67.806 and 67.808 of the County's Code of Regulatory Ordinances Relating to Watershed Protection, Stormwater Management, and Discharge Control (WPO) contain the relevant ordinance provisions.	JURMP Section 7.2.3 describes BMP requirements for commercial sites and sources in the City. City of San Marcos Water Quality Ordinance 14.5 contains the relevant ordinance provisions	The City of Escondido has no agricultural businesses located within the Upper San Marcos Creek Watershed.
D.3.b.(3)(a) Conduct site inspections at nurseries and greenhouses for compliance with ordinances, permits, and the MS4 Permit.	County JURMP Section 7.2 describes the inspection process for nurseries and greenhouses within the unincorporated area.	JURMP Section 7.2.4 describes the inspection process for nurseries and greenhouses within the City.	The City of Escondido has no agricultural businesses located within the Upper San Marcos Creek Watershed.
D.3.b.(5) Enforce stormwater ordinance for all nurseries and greenhouses as necessary to maintain compliance.	The County's FY 2008-09 JURMP Annual Report Section 5.2 describes current enforcement procedures for addressing non-compliance at nurseries and greenhouses in the unincorporated area.	JURMP Section 7.2.4.2 describes enforcement procedures for addressing non-compliance at nurseries and greenhouses in the unincorporated area. City of San Marcos Water Quality Ordinance 14.5 Contain the relevant ordinance provisions	The City of Escondido has no agricultural businesses located within the Upper San Marcos Creek Watershed.
D.5. Develop and implement a plan to educate owners and operators of nurseries and greenhouses	County JURMP Section 10.3.1.3 describes programs to educate owners and operators of nurseries and greenhouses in the unincorporated area.	City JURMP Section 10.3.4 describes programs to educate owners and operators of nurseries and greenhouses in the unincorporated area	The City of Escondido has no agricultural businesses located within the Upper San Marcos Creek Watershed.

4.3.2 Enhanced Agricultural Activities

4.3.2.1 County of San Diego

The County of San Diego will initially focus its attention on better understanding and addressing the impacts of agricultural activities in the immediate vicinity of Lake San Marcos. To initiate this effort, the County will work with professional grove management companies active in the area to collect information on crop types, water usage, fertilization schemes, and existing best management practices. It is estimated that approximately 70% of the parcels with ongoing agricultural activity in the Lake San Marcos community are operated by professional grove management companies. Given the number (~30) and size (~3-5 acres) of these parcels, this sub-set of groves is a reasonable place to begin.

Once baseline information has been collected, the County will solicit assistance from the Farm and Home Advisor, or other agencies with expertise in agriculture, to assess

whether existing grove management practices are consistent with industry best practices. Operational efficiencies and other opportunities for improvement will be communicated to grove operators following property assessments. The County will follow up with each of the appropriate grove management companies to track implementation of any recommended improvements. This work will be conducted during FY 2009-10 and FY 2010-11.

4.3.2.2 City of San Marcos

The City of San Marcos will focus its immediate attention on understanding and addressing the impacts of agricultural activities in the Twin Oaks Valley Area to mirror County efforts around Lake San Marcos. The City will establish baseline information on types of practices and growers in the Twin Oaks Valley Area. This work will be conducted during FY 2009-10 and FY 2010-11.

4.3.2.3 City of Escondido

The City of Escondido has no agricultural businesses within the Upper San Marcos Creek Watershed.

4.4 Parks

The MS4 Permit requires the USMC Watershed MS4 Copermittees to implement the activities outlined in Table 4.4 below as part of a jurisdictional program to manage discharges from municipal areas. Core municipal activities will continue as currently implemented under existing JURMPs. Notably, the City of San Marcos will enforce its local ordinances as it becomes aware of non-compliance with discharge prohibitions and minimum BMP requirements in municipal park areas. These consist of work orders to correct any issues. All municipal parks in the USMC watershed are owned and maintained by the City of San Marcos. The City maintains SWPPPs for Municipal Parks. The City will assess current fertilizer practices and BMPs in monitoring locations that show elevated nutrient trends.

4.4.1. Core Activities

**Table 4.4
Core Activities for Parks**

PERMIT REQUIREMENT	COUNTY OF SAN DIEGO	CITY OF SAN MARCOS	CITY OF ESCONDIDO
D.3.a.(1)(a) source identification within its jurisdiction.	N/A	An updated inventory of parks in City of San Marcos Area is included in the City's FY 2008-09 JURMP Annual Report. There are 52 parks within the City's portion of the Upper San Marcos Creek Watershed; however, parks are monitored through the City's JURMP in Section 6.2.	N/A.
D.3.a.(2) Implement BMP requirements.	N/A	The City JURMP Section 6.3 describes BMP requirements for parks.	N/A.

PERMIT REQUIRMENT	COUNTY OF SAN DIEGO	CITY OF SAN MARCOS	CITY OF ESCONDIDO
D.3.a.(4) management of pesticides, herbicides, fertilizers	N/A	The City JURMP Section 6.3.2 describes designated minimum BMPs for parks and in City SWPPPs.	N/A.
D.3.a.(7)Conduct site inspections for compliance with ordinances, permits, and the MS4 Permit.	N/A	The City JURMP Section 6.4 describes inspection compliance with ordinances, permits and the MS4 Permit.	N/A.
D.3.a.(8) Enforce stormwater ordinance to maintain compliance.	N/A	The City JURMP Section 6.4.2 describes stormwater enforcement procedures.	N/A.
D.5. Develop and implement a plan to educate municipal departments and personnel	N/A	The City JURMP Section 10.0 describes education and outreach park staff.	N/A.

4.4.2. Enhanced Activities

4.4.2.1 County of San Diego

Within the Upper San Marcos Creek Watershed the County has no parks.

4.4.2.2 City of San Marcos

The City of San Marcos will focus its immediate attention on understanding and addressing the impacts of municipal parks in the USMC Watershed to identify baseline issues. The City will establish baseline information on effective source reduction BMPs. This work will be conducted during FY 2009-10 and FY 2010-11.

4.4.2.3 City of Escondido

Within the Upper San Marcos Creek Watershed the City of Escondido has no parks.

4.5 Golf Courses

This section describes current and planned activities to address nutrient loading from golf courses in the Upper San Marcos Creek Watershed. It is divided into two parts. “Core” golf course activities are those required to maintain compliance with the MS4 Permit. “Enhanced” golf course activities are more targeted in nature and focus on raising awareness, changing behaviors, and reducing nutrient loading from specific targeted golf course activities in high priority areas.

4.5.1. Core Activities

As described in the MS4 Permit, USMC Watershed MS4 Copermittees are required to add golf courses to their commercial inventories and update the inventories annually. Core activities performed under the JURMP are outlined in Table 4.5 below. Each Copermittee will enforce its local ordinance as it becomes aware of non-compliance with discharge prohibitions and minimum BMP requirements in golf courses. Compliance is determined through both active inspection of golf courses operations and responses to

public complaints about illegal discharges or insufficient BMPs. As described in section 4.1.1, the Core dry weather program assists in monitoring water quality and provides additional investigation if pollutants are detected (above the action level), triggering additional BMPs to protect water quality and monitoring.

**Table 4.5
Core Activities for Golf Courses**

PERMIT REQUIREMENT	COUNTY OF SAN DIEGO	CITY OF SAN MARCOS	CITY OF ESCONDIDO
D.3.b.(1)(a) Annually update a watershed-based inventory of golf courses within its jurisdiction.	An updated inventory of golf courses in the unincorporated area is included in the County's FY 2008-09 JURMP Annual Report.	An updated inventory of golf courses in the City of San Marcos Area is included in the City's FY 2008-09 JURMP Annual Report.	Golf course inventories are included in the commercial business inventory and are monitored through the City's JURMP in Section 7.2.2.3.
D.3.b.(2)(c) Notify the owner/operator of each commercial/industrial business of applicable BMP requirements.	Golf courses in the unincorporated area have been notified of applicable BMP requirements.	FY 10 – San Marcos will notify all golf courses of applicable BMP requirements.	The City of Escondido JURMP Section 7.2.3.1 describes BMP requirements for commercial businesses.
D.3.b.(2)(d) Require the implementation of designated minimum BMPs for commercial/industrial businesses	County JURMP Section 7.2.3 describes BMP requirements for commercial sites and sources within the unincorporated area. Sec. 67.801-67.806 and 67.808 of the County's Code of Regulatory Ordinances Relating to Watershed Protection, Stormwater Management, and Discharge Control (WPO) contain the relevant ordinance provisions.	JURMP Section 7.2.3 describes BMP requirements for commercial sites and sources in the City. City of San Marcos Water Quality Ordinance 14.5 Contain the relevant ordinance provisions	The City of Escondido JURMP Sections 7.2.3.1 and 7.2.3.2 describes designated minimum BMPs for commercial businesses.
D.3.b.(3)(a) Conduct site inspections at nurseries and greenhouses for compliance with ordinances, permits, and the MS4 Permit.	County JURMP Section 7.2 describes the inspection process for golf courses within the unincorporated area.	JURMP Section 7.2.4 describes the inspection process golf courses within the City.	The City of Escondido JURMP Section 7.2.4.3 describes inspection compliance with ordinances, permits and the MS4 Permit.
D.3.b.(5) Enforce stormwater ordinance for all commercial/industrial businesses as necessary to maintain compliance.	The County's FY 2008-09 JURMP Annual Report Section 5.2 describes current enforcement procedures for addressing non-compliance at golf courses in the unincorporated area.	JURMP Section 7.2.4 .2 describes enforcement procedures for addressing non-compliance at golf courses in the unincorporated area. City of San Marcos Water Quality Ordinance 14.5 Contain the relevant ordinance provisions	The City of Escondido JURMP Section 7.2.5 describes stormwater enforcement procedures.
D.5. Develop and implement a plan to educate owners and operators of commercial/industrial businesses.	County JURMP Section 10.3.1.3 describes programs to educate owners and operators of golf courses in the unincorporated area.	City JURMP Section 10.3.4 describes programs to educate owners and operators of golf courses in the unincorporated area	The City of Escondido JURMP Section 7.2.4.2 describes education and outreach for commercial business.

4.5.2. Enhanced Activities

Each Copermittee's enhancement activities will be carried out through its existing annual JURMP inspection and dry weather "Core" programs but will be collaboratively reviewed through the WURMP program to evaluate overall effectiveness and to determine any necessary program modifications. Based on individual golf courses, BMPs will be tailored to each site based on results from annual commercial inspections, complaint investigations, and through water quality investigations as a part of the dry weather program. Data collected annually will be provided through each Copermittee's JURMP annual report and aggregately presented in the WURMP annual report.

Appendix A

FIGURES

Figure 1
USMC - Watershed Map

Figure 2

USMC - Residential Sources

Figure 3

USMC - Agricultural Sources

Figure 4

USMC - Parks & Golf Courses

Figure 5

USMC - Water Quality Monitoring Locations

Appendix B

City of San Marcos Baseline Watershed Implementation Plan (FY 10 through first quarter FY 11)

