Legg Lake

El Monte's point source area for the Trash TMDL is approximately 0.10 square miles. LACFCD storm drain line BI 0529-Line B drains catch basins within that approximate 0.10 square mile portion of the City. The catch basins feeding the storm drain line are along Mountain View Road from approximately Garvey Avenue to the city limit boundary on south near Weaver Avenue. The storm drain line has a single outlet at North Lake. Six catch basins along Mtn. View Road have been retrofitted with trash exclusion devices. The devices consist of a combination of ARSs and FBIs at the highest traffic areas along this route. In order to address the required pollutant reductions for Legg Lake, six catch basins along Mountain View Road will be retrofitted with Modular Wetland Systems to remove both trash and nutrients.

The City is committed to trash reduction to the Legg Lake system and plans to retrofit more catch basins with trash excluders along this route as funding becomes available. The City will also explore increased frequency of sweeping along Mountain View Road, sweeping of alleyways, and increased frequency of sweeping of public parking lots. The discharge of trash from storm drains draining to Legg Lake will largely be controlled/reduced by the implementation of the trash excluders described above but additional measures for eliminating the trash impairment to Legg Lake (as described in the Trash TMDL for Legg Lake) will include placement of additional trash receptacles along Mountain View Road, Public Education regarding the Lake impairments, and Community Involvement to further promote water quality at the lake.

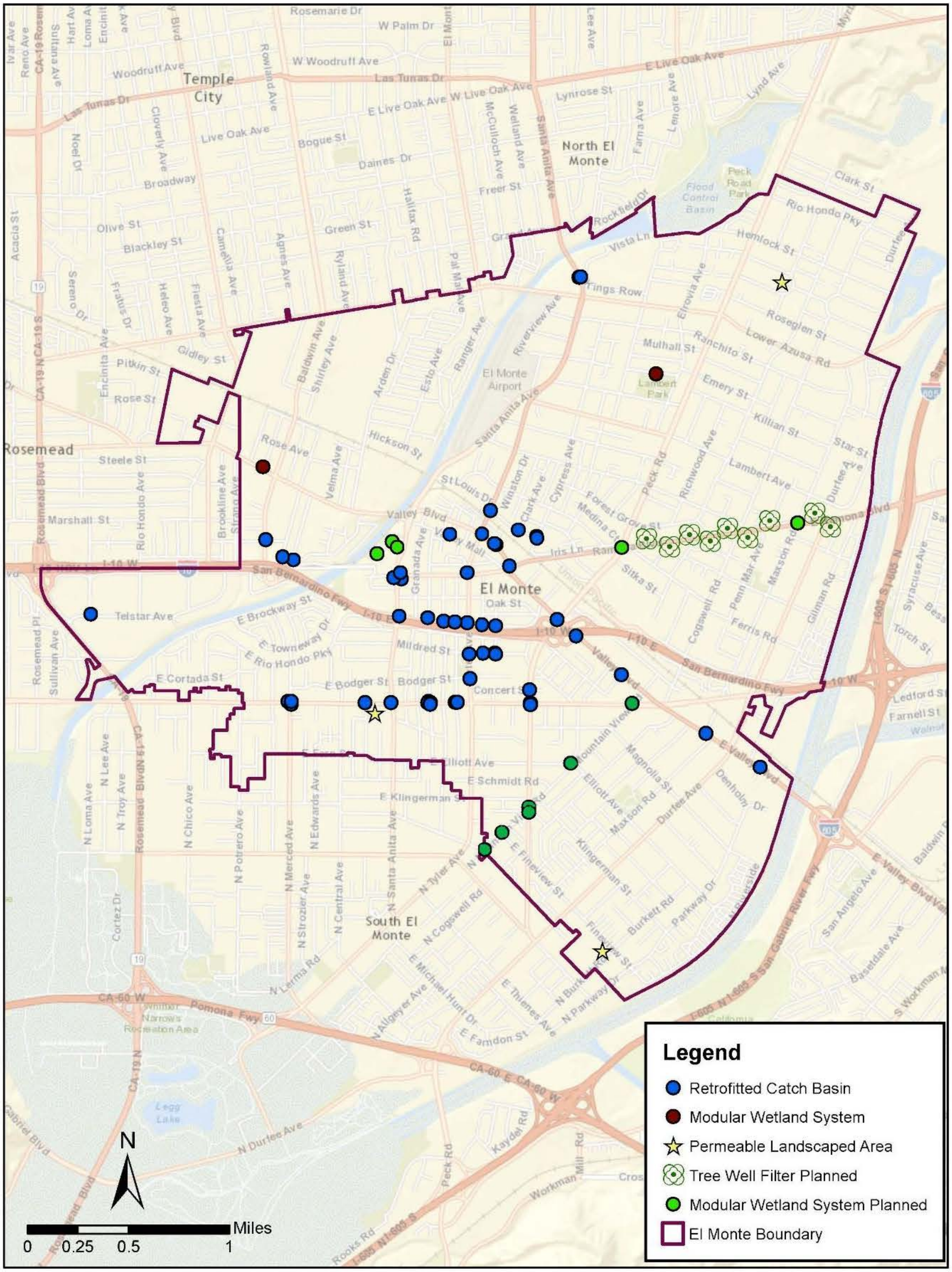
Peck Road Park Lake

Peck Road Park Lake is located north of the City. Although Attachment K of the Order lists the City as a responsible party to the Peck Road Park Lake TMDLs, research does not identify any direct or indirect storm water discharge originating from the City to the lake. A review of LACFCD maps and City records plus a field investigation supports this conclusion. Discharges from a residential area west of the lake drain into a spillway into the Rio Hondo downstream of the lake.

1.8.4 EXISTING AND PLANNED STRUCTURAL CONTROL MEASURES

There are approximately 300 catch basins in the City's jurisdiction. Of the 300, a total of 57 catch basins have been retrofitted to exclude trash and other debris. Filter Basket Inserts account for 20 of the

Figure 1-10: Existing and Planned Control Measures



1.9. REASONABLE ASSURANCE ANALYSIS (RAA)

Permittees electing to develop a watershed management program (WMP) or enhanced watershed management program (EWMP) are required to submit a Reasonable Assurance Analysis (RAA) as part of their draft WMP to demonstrate that applicable water quality based effluent limitations and receiving water limitations shall be achieved through implementation of the watershed control measures proposed in WMP. The City will conduct a RAA for each water body pollutant combination (WBPC) addressed by its WMP. The RAA will be quantitative and performed using a peer-reviewed model in the public domain. The RAA will commence with assembly of all available, relevant subwatershed data collected within the last 10 years, including land use and pollutant loading data, establishment of QA/QC criteria, QA/QC checks of the data, and identification of the data set meeting the criteria for use in the analysis. Data shall only be drawn from peer-reviewed sources and statistically analyzed to determine the best estimate for the performance and confidence limits on that estimate for the pollutants to be evaluated. The Regional Board has prepared a guidance document to provide information and guidance to assist permittees in development of the RAA. The document provides clarification of the regulatory requirements of the RAA along with recommended criteria for the permittees to follow to prepare an appropriate RAA for Regional Board approval.

The objective of the RAA shall be to demonstrate the ability of the WMP to ensure that Permittees MS4 discharges achieve applicable WQBELS and do not cause or contribute to exceedances of RWLs.

1.9.1 MODELING REQUIREMENTS FOR RAA

The WMMS meets the model requirements of the Reasonable Assurance Guidelines and is appropriate for conducting the required RAA.

Model input files: the model input/output files will be uploaded with this WMP.

The City has chosen to use the Watershed Management Modeling System (WMMS) to support/demonstrate/conduct the RAA. The WMMS was developed by the Los Angeles County Flood Control District and the U.S. EPA. The WMMS meets the requirements of Section G. of the RAA Guidelines and is appropriate for conducting the required Reasonable Assurance Analysis. WMMS modeled 38 subwatershed within City's jurisdiction. GIS "intersect" methods were used to include those portions of subwatersheds within the City's jurisdiction.

This RAA (using WMMS) and the associated IMP uses the Los Angeles County's HUC-12 equivalent boundaries. The City has verified with neighboring groups and cities that there are no gaps in the geographic areas addressed in the RAA or IMP.

Calibration

Since the original development of the WMMS LSPC model, Los Angeles County personnel have independently updated the model with meteorological data through 2012. The calibration of WMMS was fully documented, and is consistent with methods used in LSPC modeling efforts previously performed by the EPA to support TMDL development (Tetra Tech 2010). There is limited or insufficient storm flow and water quality data currently available near El Monte to facilitate additional calibration of modeling parameters. This lack of data was confirmed by Los Angeles County Department of Public Works employees that were involved in the development of the WMMS model. As the City collects monitoring data from both outfall and receiving water monitoring, the collected data will be used to further calibrate the model as part of the Adaptive Management Process.

Rain Data

The RAA is based on recorded rainfall depth metrics obtained for historical wet season data, classified as October 1st to April 30th, for the years 1986 to 2012. This wet season time period is referred to in the RAA as a "Wet Year", and was utilized to represent the evaluated critical condition, allowing for the modeling to capture variability of rainfall storm depths. Recorded rainfall depths were obtained from LA County Department of Public Works Rain Gage D108 data, located at El Monte Fire Station on Santa Anita Ave, between Valley Mall and Ramona Blvd. The wet year minimum, maximum and total annual rainfall depths are summarized in Table 1-7 below for only the last ten years of data, per the RAA Guidelines [1]). Based on the data from these last ten years, the 90th percentile rainfall value is 26.66 inches, which most closely corresponds to the 2004-2005 wet year. Therefore, the wet year for 2004-2005 was determined to be the representative year for the 90th percentile wet year.

1.9.2 MODELED POLLUTANT LOADING, ALLOWABLE LIMITS, AND REQUIRED PERCENT REDUCTION

The modeled (estimated) pollutant loadings, allowable limit, and percent reduction required to meet effluent limits are shown in tables and graphs in the subsections below.

1.9.2.1 LA River and Tributaries Metals TMDL

Table 1-8: Formula used for Metals Effluent Limit Calculation from Order R4-2012-0175

Constituent	Effluent Limitation Daily Maximum (kg/day)
Cadmium	WER[1] x 2.8 x 10^{-9} x daily volume (L) – 1.8
Copper	WER[1] x 1.5 x 10^{-8} x daily volume (L) – 9.5
Lead	WER[1] x 5.6 x 10^{-8} x daily volume (L) – 3.85
Zinc	WER[1] x 1.4 x 10^{-7} x daily volume (L) – 83

Table 1-9: LA River Copper

Wet Days	Copper Daily Limit (kg/day)	Modeled Copper Concentration (kg/day)	Percent Reduction Required
10/17/2004	0.63	14.04	96%
10/26/2004	1.07	4.76	78%
12/5/2004	0.34	3.50	90%
1/1/2005	0.15	2.55	94%
2/11/2005	4.22	9.35	55%
2/18/2005	2.30	3.12	26%
3/2/2005	0.19	6.76	97%
3/3/2005	0.30	0.99	69%
3/21/2005	0.15	7.86	98%
9/20/2005	0.12	1.16	89%

Figure 1-11: Scatter Plot for LA River Copper

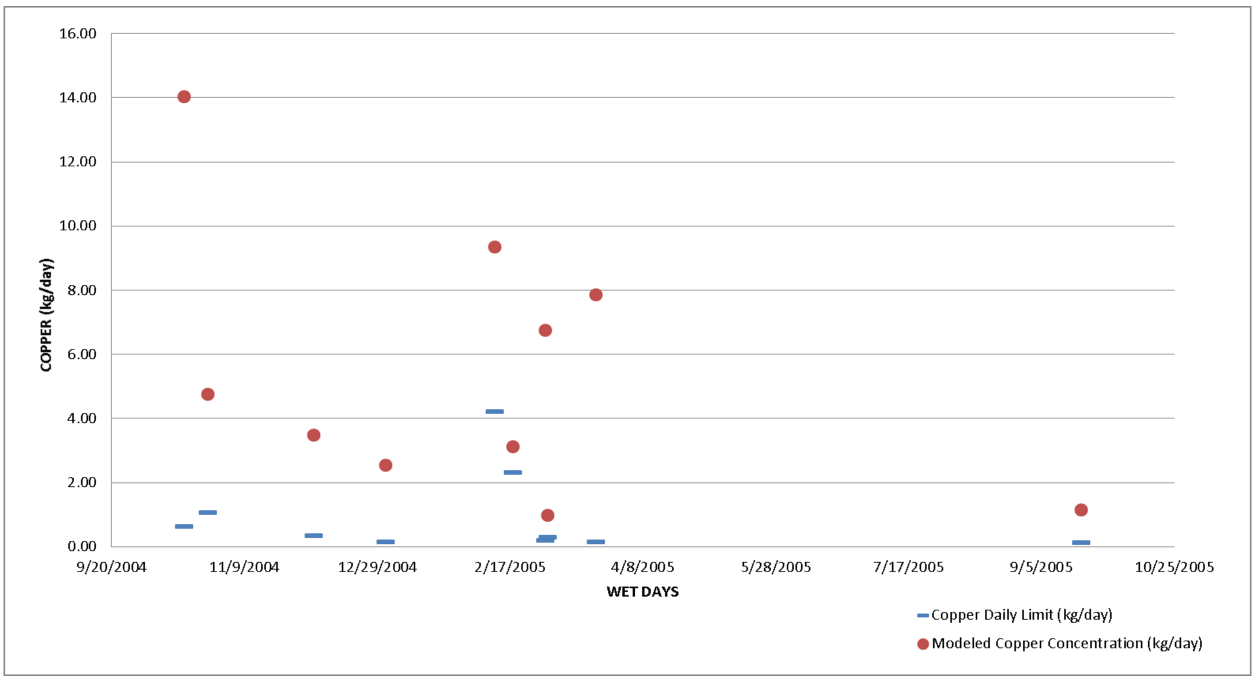


Table 1-10: LA River Lead

Wet Days	Lead Daily Limit (kg/day)	Modeled Lead Concentration (kg/day)	Percent Reduction Required
10/17/2004	2.75	12.41	78%
12/5/2004	1.63	3.16	48%
1/1/2005	0.94	1.87	50%
3/2/2005	1.08	6.10	82%
3/21/2005	0.93	7.15	87%

Figure 1-12: Scatter Plot for LA River Lead

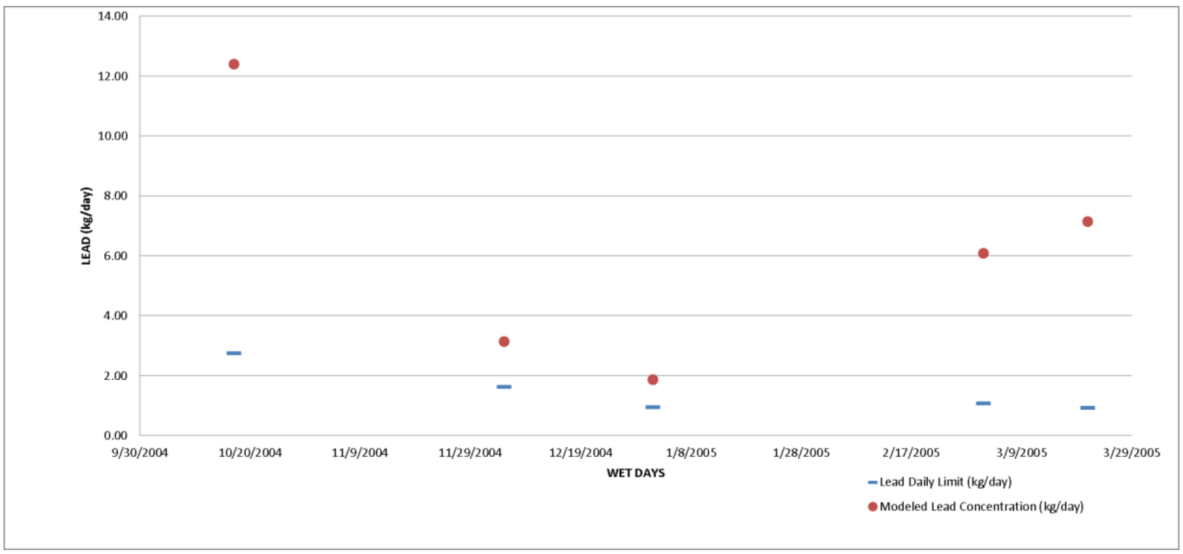
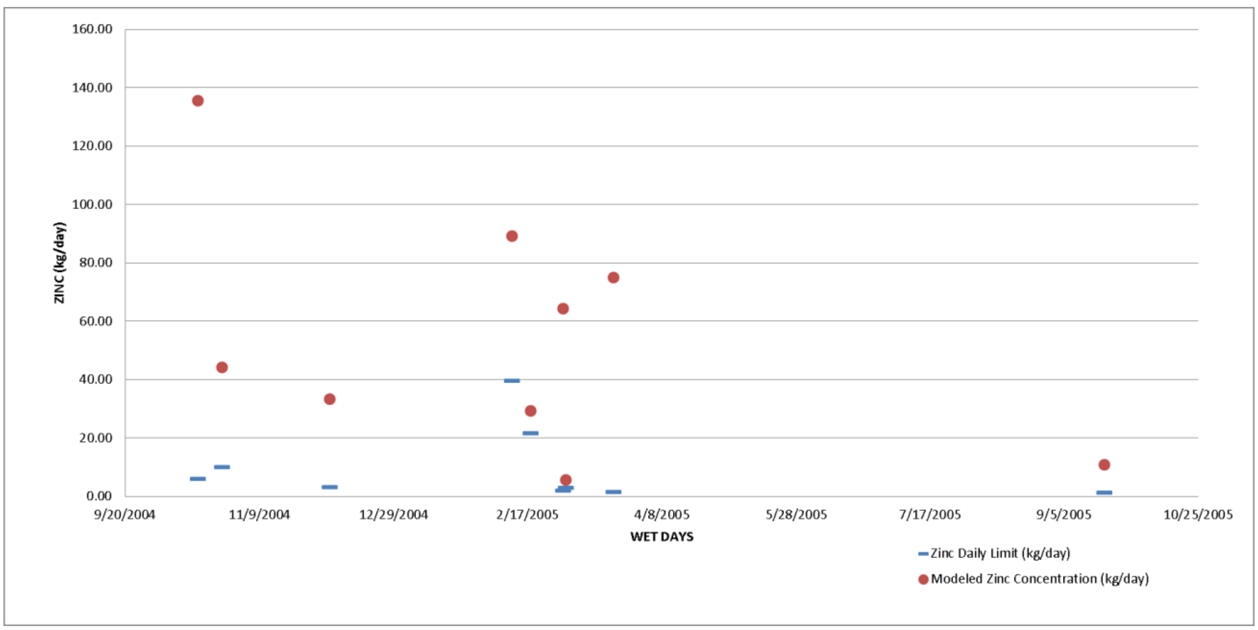


Table 1-11: LA River Zinc

Wet Days	Zinc Daily Limit (kg/day)	Modeled Zinc Concentration (kg/day)	Percent Reduction Required
10/17/2004	5.99	135.72	96%
10/26/2004	10.06	44.25	77%
12/5/2004	3.20	33.41	90%
2/11/2005	39.45	89.20	56%
2/18/2005	21.57	29.30	26%
3/2/2005	1.83	64.30	97%
3/3/2005	2.89	5.82	50%
3/21/2005	1.45	75.10	98%
9/20/2005	1.22	11.04	89%

Figure 1-13: Scatter Plot for LA River Zinc



1.9.2.3 LA River Watershed Bacterial TMDL

Table 1-14: LA River Bacteria

Wet Days	Modeled Fecal coliform Concentration(MPN/100ml)	Fecal coliform Limit* (MPN/100ml)	Percent Reduction Required
10/17/2004	226,946	400	99%
10/20/2004	145,482	400	99%
10/26/2004	190,556	400	99%
10/27/2004	115,818	400	99%
12/5/2004	144,759	400	99%
12/27/2004	196,810	400	99%
12/28/2004	196,928	400	99%
12/29/2004	193,972	400	99%
1/1/2005	164,171	400	99%
1/6/2005	160,153	400	99%
1/8/2005	184,944	400	99%
1/9/2005	192,883	400	99%
1/10/2005	117,454	400	99%
2/11/2005	133,256	400	99%
2/12/2005	109,231	400	99%
2/18/2005	111,080	400	99%
2/19/2005	143,016	400	99%
3/2/2005	175,000	400	99%
3/3/2005	154,757	400	99%
3/21/2005	198,547	400	99%
3/22/2005	142,444	400	99%
9/20/2005	100,956	400	99%

*Utilized fecal coliform as surrogate pollutant for E. coli in all modeling performed.

1.9.2.5 San Gabriel River and Impaired Tributaries Metals and Selenium TMDLs

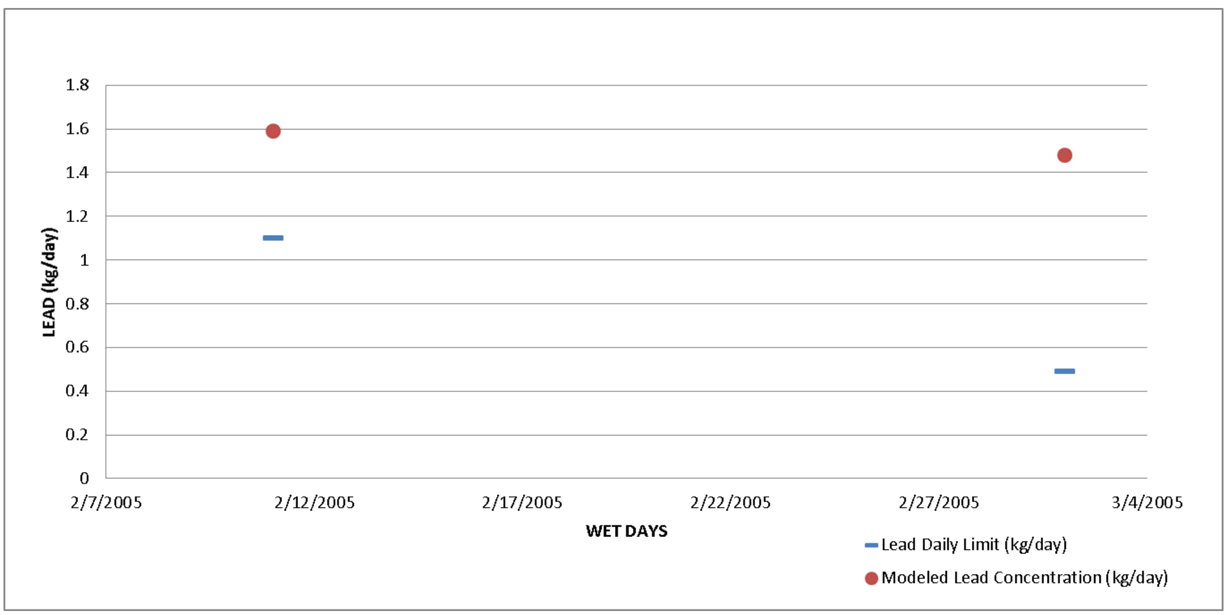
Table 1-18: Waste Load Allocation from Order R4-2012-0175

Water Body	WLA Daily Maximum (kg/day)		
	Copper	Lead	Zinc
San Gabriel Reach 2	---	81.34 µg/L x daily storm volume (L)	---
Coyote Creek	24.71 µg/L x daily storm volume (L)	96.99 µg/L x daily storm volume (L)	144.57 µg/L x daily storm volume (L)

Table 1-19: San Gabriel River Lead

Wet Days	Lead Daily Limit (kg/day)	Modeled Lead Concentration (kg/day)	Percent Reduction Required
2/11/2005	1.1	1.59	31%
3/2/2005	0.49	1.48	67%

Figure 1-17: Scatter Plot for San Gabriel River Lead



1.9.2.6 San Gabriel River, Estuary and Tributaries Indicator Bacterial TMDL (Pending[8])

Table 1-20: San Gabriel River Bacteria

Wet Days	Modeled Fecal coliform Concentration(MPN/100ml)	Fecal coliform Limit* (MNP/100ml)	Percent Reduction Needed
1/8/2005	70,340	400	99%
1/9/2005	71,590	400	99%
1/10/2005	59,180	400	99%
1/23/2005	24,326	400	98%
1/24/2005	42,082	400	99%
1/26/2005	41,164	400	99%
2/10/2005	50,730	400	99%
2/11/2005	60,860	400	99%
2/12/2005	50,810	400	99%
2/16/2005	43,366	400	99%
2/18/2005	59,365	400	99%
2/19/2005	72,760	400	99%
3/2/2005	51,862	400	99%
3/3/2005	49,355	400	99%
3/4/2005	28,539	400	98%

*Utilized fecal coliform as surrogate pollutant for E. coli in all modeling performed.

[8] Pending Basin Plan Amendment Approval.

1.9.4 TMDL SUMMARY AND ACTION REQUIRED

Table 1-21: TMDL Summary and Action Required

TMDLs	Water Body	El Monte Action Required
Los Angeles River Watershed Trash TMDL	LA River	Retrofit catch basins with trash excluders for zero trash by Sept. 30, 2016
Los Angeles River Nitrogen Compounds and Related Effects TMDL	LA River	None; Modeled concentration below limit
Los Angeles River and Tributaries Metals TMDL	LA River	Install BMPs to achieve required percent reduction
Los Angeles River Watershed Bacteria TMDL	LA River	Wet – Implement/install BMPs to achieve required percent reduction
		Dry – Develop Load Reduction Strategy for Bacteria by March 23, 2016
Los Angeles Area Lakes TMDL (Peck Road Park Lake)	Peck Road Park Lake	None; no discharge to lake
Legg Lake Trash TMDL	LA River	Retrofit catch basins with trash excluders for zero trash by March 6, 2016
Los Angeles Area Lakes TMDL (Legg Lake Nutrients)	Legg Lake	Retrofit catch basins with BMPs to remove nutrients to comply with WLAs
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL	LA River	Collaborate with Lower Los Angeles River Watershed Group on TMDL monitoring (yearly)
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL	San Gabriel River	Collaborate with Lower San Gabriel River Watershed Management Group on TMDL monitoring (yearly)
San Gabriel River and Impaired Tributaries Metals and Selenium TMDL	San Gabriel River	Install BMPs to achieve required percent reduction
San Gabriel River Bacteria TMDL (Pending)	San Gabriel River	Implement/install BMPs to achieve required percent reduction

1.10. COMPLIANCE AND BMP IMPLEMENTATION SCHEDULES

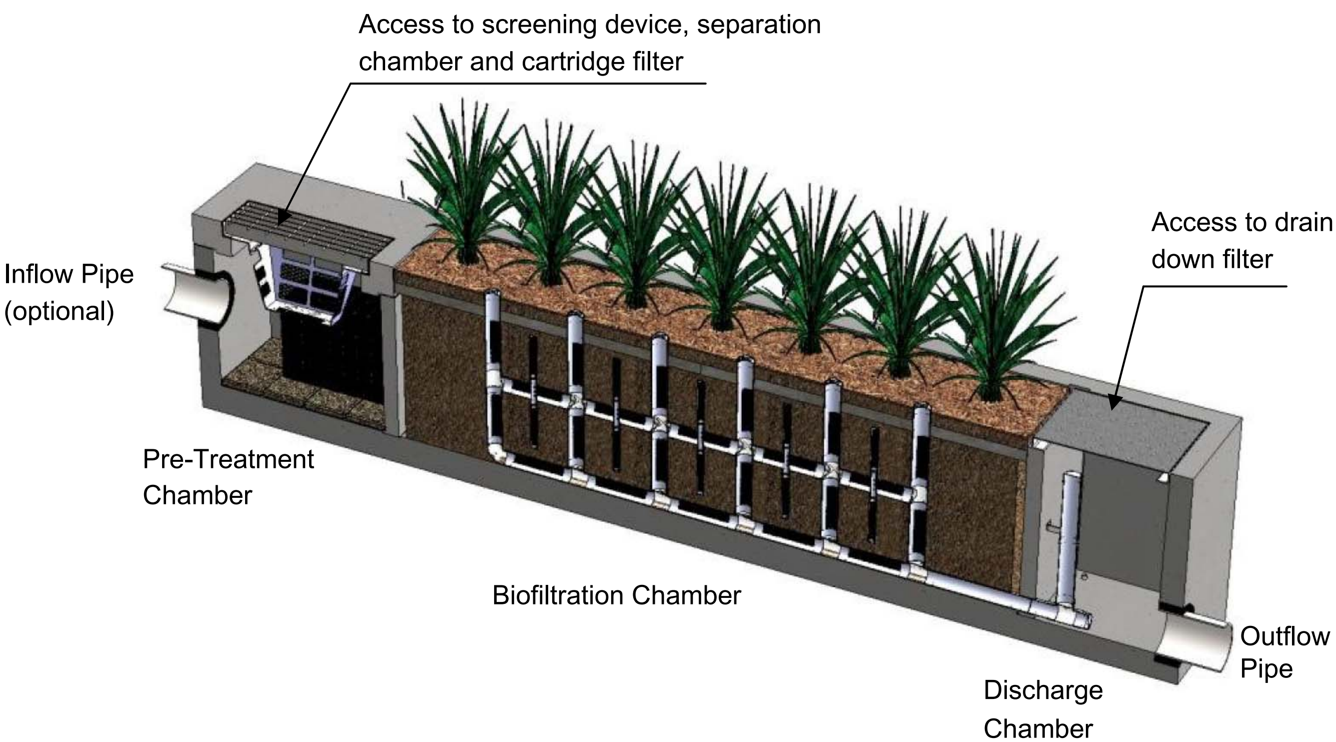
The City will implement the following BMPs per the schedules shown in order to be in compliance with the Trash TMDL for the Los Angeles River and the Trash and Nutrient TMDLs for Legg Lake.

Maintenance Guidelines for
Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
    - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
    - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
    - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
    - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
    - (*Service time varies*).

System Diagram



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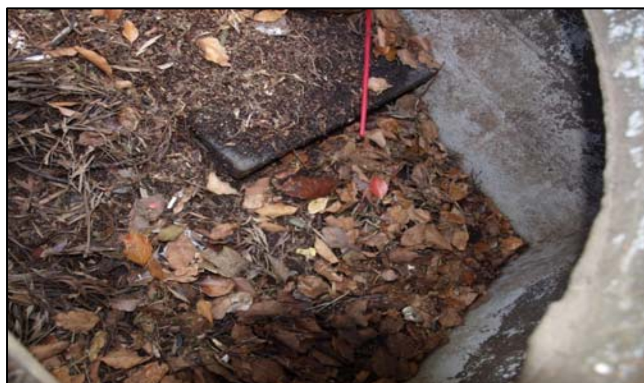

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E. Info@modularwetlands.com

www.modularwetlands.com

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

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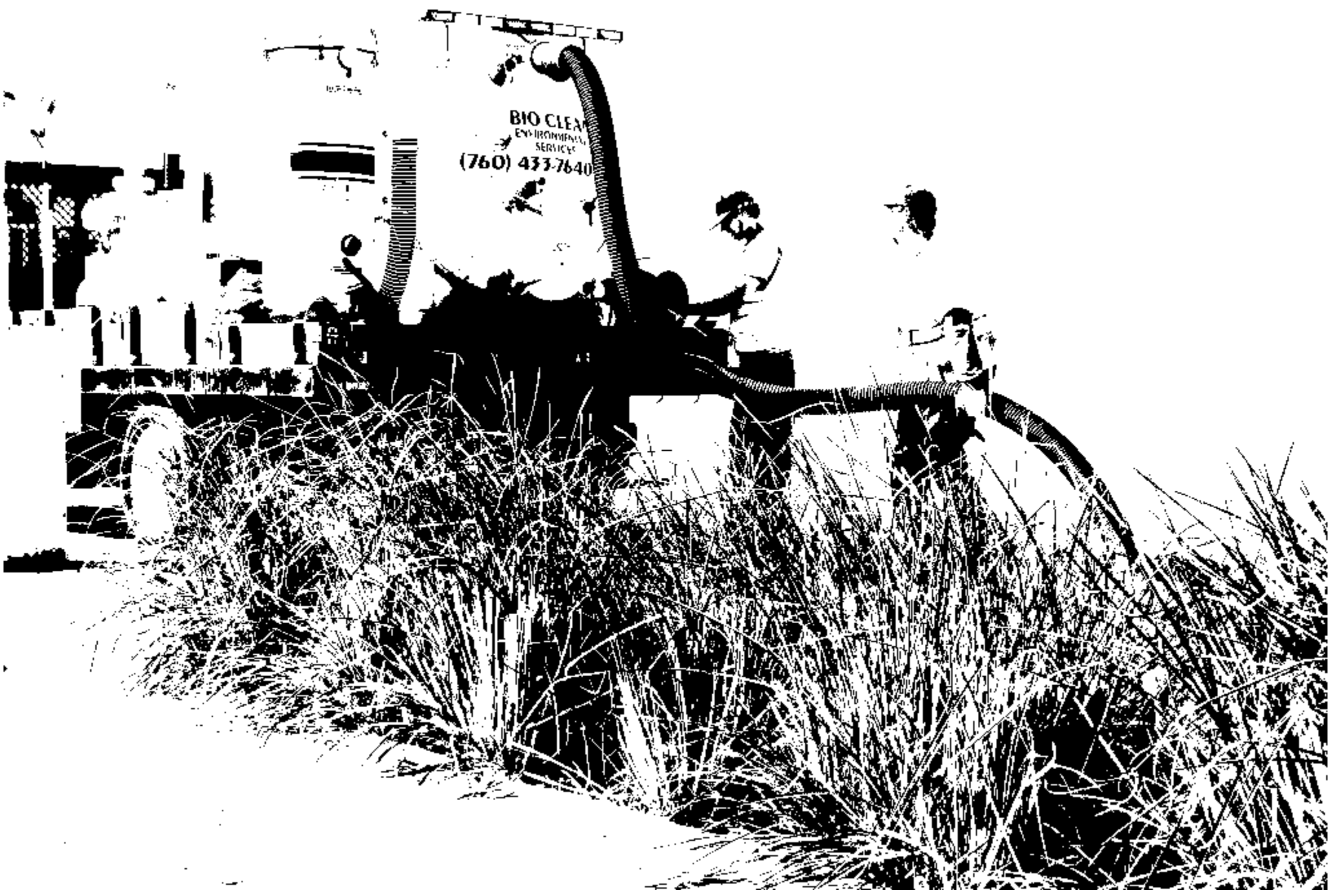

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MWS-LINEAR 2.0 STORMWATER FILTRATION SYSTEM

NATURE AND TECHNOLOGY WORKING TOGETHER IN PERFECT HARMONY.

The need for a new stormwater treatment system is evident. Federal and state requirements on cities and industry to reduce stormwater runoff increase every year as our population explodes. The EPA is now reporting that stormwater runoff represents the nation's number one water quality problem, and is the reason why nearly half of our rivers and lakes are not even clean enough to support fishing or swimming. ***Nearly half.***

To combat this catastrophe, we turned to the expert in this field: **Nature.** By developing technology that imitates the processes found in nature, we've created the most advanced stormwater filtration system available. Years ahead of current EPA requirements, our clients understand that when they invest in our new technology, they are investing in the future. For all of us.

GRATE TYPE

CURB TYPE

MWS–LINEAR TESTED REMOVAL EFFICIENCIES

TSS	Nitrate	Copper	Zinc	Oils & Grease	Bacteria	Turbidity
82% - 98%	74%	>53% - 93%	79% - 81%	84% - 99%	60% - 89%	>90%

SIZING

Model #	Dimensions (ft)	WetlandMedia Surface Area (sq ft)	Treatment Flow Rate (cfs)
MWS-L-3-6	3 x 6	34	0.076
MWS-L-4-8	4 x 8	50	0.116
MWS-L-4-13	4 x 13	63	0.144
MWS-L-4-15	4 x 15	76	0.175
MWS-L-4-17	4 x 17	90	0.206
MWS-L-4-19	4 x 19	103	0.236
MWS-L-4-21	4 x 21	117	0.267

VOLUME SIZING

The Modular Wetland System is the only biofilter that can be installed downstream of detention systems.

T 760.433.7640 E info@modularwetlands.com www.modularwetlands.com

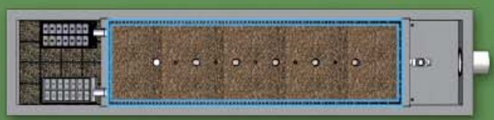
SYSTEM OPERATIONS

Pre-Filter Cartridge

35 sq ft surface area per cartridge ensures higher effectiveness and lower maintenance requirements.

This pre-filter eliminates maintenance in the Wetland Chamber.

TOP VIEW



Perimeter Wetland Chamber

Pre-filtered runoff entering the wetland chamber flows into a peripheral void area, maximizing the media surface area.

Over 2x to 3x more surface area than traditional downward flow bioretention systems.

INTERNAL HIGH FLOW BYPASS CONFIGURATION AVAILABLE

FEATURES

1. **PRE-TREATMENT CHAMBER**
   Captures incoming runoff and contains the first three stages of treatment.
2. **GRATE TYPE CATCH BASIN INLET**
   A standard 41” x 24” grate type traffic rated catch basin opening directs stormwater into the system.
3. **CATCH BASIN INSERT FILTER**
   Provides the first stage of treatment by capturing trash & litter, gross solids, and sediment.
4. **SETTLING CHAMBER**
   Provides the second stage of treatment by separating out larger suspended solids.
5. **PRE-FILTER CARTRIDGE**
   Provides the third stage of treatment by physically and chemically capturing fine TSS, metals, nutrients, and bacteria.
6. **WETLAND CHAMBER**
   Provides the final stage of treatment through a combination of physical, chemical and biological processes.
7. **DISCHARGE CHAMBER**
   Contains flow control, high flow bypass and optional drain down filter.
8. **MULTI-LEVEL FLOW CONTROL**
   Orifice plates and/or valves are used to control the flow through the treatment stages.

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Water Resources Research Center
Blaisdell House, UMass
310 Hicks Way
Amherst, MA 01003

Massachusetts Stormwater
Evaluation Project

(413) 545-5532
(413) 545-2304 FAX
www.mastep.net

MASTEP Technology Review

Technology Name: Modular Wetlands Systems Linear – by Modular Wetland Systems, Inc.

Studies Reviewed:

Technical Evaluation Report; Modular Wetland System Stormwater Treatment System Performance Monitoring. Herrera Environmental Consultants. 2013.

Date: December 27, 2013

Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating:
Generally well-run study. 28 storms and 16.5" rainfall were monitored. Sound methods, solid documentation. 38% of average annual rainfall, somewhat less than TARP requirement. Pollutant removal efficiencies reported according to statistical analysis that differs somewhat from TARP recommendations.

TARP Requirements Not Met:
- 45.7% of average annual rainfall monitored; TARP requires 50%.
- Sediment removal evaluated by TSS analysis method, but not by SSC method.

Other Comments
- 74%-84.9% TSS removal documented; 61.7% - 70.4% total phosphorus removal; 45% TKN; 60.5% - 63.3% dissolved zinc (68.55 total zinc) and 32.5% - 35.9% dissolved copper (68.5% total copper) removal documented.
- The unit tested was undersized for the basin it drains.
- The test site experienced unusually high sediment loads containing a large proportion of fine particles (silts and clays).
- These challenging conditions suggest that removal efficiencies reported above may be conservative: under less challenging conditions, improved performance may be obtainable.
- No mention of a scour test; this is usually not a significant issue with filter systems, which do not generally have a mechanism by which captured sediments can be re-entrained and exported.

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

April 2014

GENERAL USE LEVEL DESIGNATION FOR BASIC, ENHANCED, AND PHOSPHORUS TREATMENT

For the

MWS-Linear Modular Wetland

Ecology's Decision:

Based on Modular Wetland Systems, Inc. application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Basic treatment
   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.
2. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Phosphorus treatment
   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.
3. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Enhanced treatment
   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

4. Ecology approves the MWS - Linear Modular Wetland Stormwater Treatment System units for Basic, Phosphorus, and Enhanced treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:
   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
   - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
   - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
5. These use level designations have no expiration date but may be revoked or amended by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use:

Applicants shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the MWS – Linear Modular Wetland Stormwater Treatment System units, in accordance with Modular Wetland Systems, Inc. applicable manuals and documents and the Ecology Decision.
2. Each site plan must undergo Modular Wetland Systems, Inc. review and approval before site installation. This ensures that site grading and slope are appropriate for use of a MWS – Linear Modular Wetland Stormwater Treatment System unit.
3. MWS – Linear Modular Wetland Stormwater Treatment System media shall conform to the specifications submitted to, and approved by, Ecology.
4. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.
   - Typically, Modular Wetland Systems, Inc. designs MWS - Linear Modular Wetland systems for a target prefilter media life of 6 to 12 months.
   - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
   - Owners/operators must inspect MWS - Linear Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the

first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
    - Standing water remains in the vault between rain events, or
    - Bypass occurs during storms smaller than the design storm.
    - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
    - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6. Discharges from the MWS - Linear Modular Wetland Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: Modular Wetland Systems, Inc.
Applicant's Address: *PO. Box 869*
Oceanside, CA 92054

Application Documents:

- *Original Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011
- *Quality Assurance Project Plan*: Modular Wetland system – Linear Treatment System performance Monitoring Project, draft, January 2011.
- *Revised Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011
- *Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014*
- *Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014.*

Applicant's Use Level Request:

General use level designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The MWS – Linear Modular wetland is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 50-percent of Total Phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 30-percent of dissolved Copper from stormwater with influent concentrations between 0.005 and 0.020 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 60-percent of dissolved Zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/l.

Ecology Recommendations:

- Modular Wetland Systems, Inc. has shown Ecology, through laboratory and field-testing, that the MWS - Linear Modular Wetland Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Total phosphorus, and Enhanced treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The MWS-Linear Modular wetland has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

<u>Field Testing</u>

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).

- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Modular Wetland Systems, Inc. should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Modular Wetland Systems, Inc. should use these data to establish required maintenance cycles.
2. Modular Wetland Systems, Inc. should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Modular Wetland Systems, Inc. will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at http://www.modularwetlands.com/

Contact Information:

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Applicant website: http://www.modularwetlands.com/

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

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Revision History

Date	**Revision**
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment