3.0 POLLUTANT SOURCE CHARACTERIZATION AND PRIORITIZATION

This section identifies the potential sources of the pollutants of concern derived from both point and nonpoint sources. The discussion is provided in several parts: modeling results, specific pollutant sources, and a source prioritization. Watershed monitoring results are summarized for reference in Appendix B. The focus of this characterization and prioritization is primarily within the City TMDL Implementation Area. Both wet and dry conditions are discussed. The City's Pollutant Load and Analysis Tool (PLAT) was used to quantify the average annual pollutant loading of nutrients and other pollutants from the TMDL Implementation Area.

3.1 Special Study

To meet the Nutrient TMDL's Optional Study #3 requirements and the aforementioned objectives, the Work Plan outlined an approach that utilized previously existing information to develop mass-based WLAs, and used a combination of water quality sampling and hydrologic modeling to characterize current wet and dry weather loading from the TMDL Implementation Area. Water quality samples were collected monthly at each monitoring location. During the wet season, dry weather sampling events were scheduled seven days after measurable precipitation, or after flow rates had returned to base levels typical of the season, whichever period was shorter.

A total of eight monitoring sites were selected for the Special Study. The characteristics of the monitoring sites are presented in Tables 3.1 and 3.2. Figure 3.1 shows the monitoring sites and associated drainage areas. Drainage areas were determined using GIS layers, provided by the City, of storm drains and the flow paths of Wilmington Drain. Land use calculations were determined using a GIS layer obtained from the City.

Monitoring for nitrogen and phosphorus constituents was performed during the Special Study. The monitoring results for total nitrogen, total phosphorus, and flow rate are displayed on Figure 3.2 and summarized in Table 3.3. Table 3.3 shows data gathered during the flow monitoring period between February and December of 2012. This data was used characterize the pollutants generated within the implementation area and also used for model calibration. The amount of pollutants entering the City from neighboring cities are represented by monitoring locations Tor-S6, Tor-S7 and Tor-S9. Monitoring sites Tor-S1, Tor-S2, Tor-S4 and Tor-S5 measure pollutants and flow leaving the city boundary. The locations of monitoring sites Tor-S1 through Tor-S9 are indicated on Figure 3.1 as S1 through S9.

Table 3.2 Monitoring Site Drainage Areas and Majority Land Use

Monitoring Site	Map ID (on Figure 4)	Drainage Area (ac)	Predominant Land Use
Tor-S1	S1	154	Residential
Tor-S2	S2	248	Residential
Tor-S3	S3	2,115	Residential
Tor-S4	S4	852	Residential
Tor-S5	S5	797	Residential
Tor-S6, Tor-S7 and Tor-S9 drainage basin outside City of Torrance			

Table 3.3 Total Flow (gallons) and Total Mass (kg) of Nitrogen and Phosphorous During the Flow Monitoring Period - February and December of 2012

Monitoring Site	Total Annual Flow (Gallons)(1)	Total Nitrogen (kg)	Total Phosphorous (kg)
Walteria Lake Pumping Event (May 29 through June 5, 2012)			
Tor-S3[3]	5,557,715	30.5	4
Total Flow Leaving the City			
Tor-S1	114,947	0.6	0.1
Tor-S2	1,530,700	8.3	1.8
Tor-S4	2,079,514	13	1.5
Tor-S5	79,603,481	3,610	553
TOTAL	**83,328,643**	**3,632**	**557**
Total Flow Entering the City			
Tor-S6	134,162	0.7	0.1
Tor-S7	7,480,023	57	4.8
Tor-S9	1,337,848	6.5	1.6
TOTAL	**8,952,033**	**63.99**	**6.5**
Flow Generated from TMDL Area	**68,818,895**	**3,533**	**546**

Note:
(1) Discharge from Walteria Lake During Pumping (March 7 and December 31, 2012).

The SUSTAIN model is public domain software developed by USEPA. SUSTAIN includes algorithms for simulating urban hydrology, pollutant loading, and treatment processes packaged from multiple models that individually address such processes. Users have the option to import time series data from external watershed models (e.g., Hydrologic Simulation Program Fortran (HSPF) or SWMM instead of performing new land simulations in SUSTAIN.

3.4.1.3 Model Calibration/Verification

In the absence of field data specific to Torrance, LA County WMMS and N-SPECT models were first used to calibrate and validate some modules of PLAT. Annual load computed by PLOAD and P8 modules were compared to WMMS and N-SPECT output. The volume comparison results are attached as an appendix. Compared to WMMS output, PLAT annual volume is within 14% of the WMMS output.

The Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT) is a complex yet user-friendly GIS extension that helps coastal managers and local decision makers predict potential water-quality impacts from nonpoint source pollution and erosion. Input data includes land cover, elevation, precipitation, and soil characteristics to create the baseline information.

3.4.2 Average Annual Wet Weather Load

The annual average loadings generated by PLAT for each sub area in the TMDL Implementation Area between 2005 and 2006 are presented in Table 3.6. The data used in the model represent general observations in the Los Angeles Harbor/Dominguez Channel Watershed, which includes the Machado Lake subwatershed, and specific monitoring data from the TMDL Implementation Areas. Monitoring conducted as per the TMDL requirements was used to refine the PLAT modeling results in the Machado Lake watershed, as appropriate.

Table 3.6a PLAT Annual Average Loads by Sub Area

Sub Area	Area(1) (ac)	TSS (kg/yr)	TN (kg/yr)	TP (kg/yr)	Lead (kg/yr)	Zinc (kg/yr)
Baseball Field	155	15,650	28	4	1.93	23.21
Walnut Sump	923	71,451	127	22	11.45	146.97
Walteria Lake	2,118	2,989(2)	38	7	27.36(5)	371.34(5)
Airport	975	72,305	4,168	619	10.74	144.55
Airport Southeast	70	2,897	4	0.9	0.86	9.78

Table 3.6a Baseline Loads by Sub Area									
Sub Area	Area[1] (ac)	Average Volume (ac-ft)	TSS		TN		TP		Toxics
			mg/l	kg/yr	mg/l	kg/yr	mg/l	kg/yr	g/yr
Baseball Field	155	126	100.4	15,650	0.18	28	0.03	4	1.19
Walnut Sump	923	593	97.4	71,451	0.17	127	0.03	22	5.44
Walteria Lake[2]	2,118	25	97.2	2,989	1.24	38	0.23	7	0.23
Airport	975	921	63.5	72,305	3.66	4,168	0.54	619	5.51
Airport Southeast	70	15	157.5	2,897	0.22	4	0.05	0.9	0.22
Total	**4,241**			**165,292**		**4,365**		**653**	**12.59**

Notes:
(1) Area from PLAT
(2) Load entering Airport Sub Area

Table 3.7 Baseline Loading Rates From Implementation Area to Machado Lake

Constituent	Baseline Load[(1)] (kg/yr)	Allowable Load[(2)] (kg/yr)	Required Reduction (kg/yr)	Required Reduction[(3)] (%)
Total Nitrogen	4,365	3,008	1,357	31
Total Phosphorus	653	301	352	54
	Toxic Constituent (g/yr)			
Total PCBs	16.26	9.88	6.38	39.24
Total DDT	11.07	0.87	10.20	92.14
Dieldrin	3.17	0.54	2.63	82.98
Chlordane	9.51	0.31	9.20	96.74

Notes:
(1) The annual loading from the TMDL Implementation Area complies with the interim limit of total nitrogen, 7,370 kg/yr and total phosphorus of 3,760 kg/yr as listed in Table 3.
(2) Concentration based WLAs are met under the approved flow condition of 8.45 hm^3/yr.
(3) Percent of pollutant amount that is required to be removed.

3.6 Pollutant Source Characterization

The locations and density of pollutant sources in the TMDL Implementation Area are keys to understanding where BMPs and other implementation components should be focused. Typical sources for the pollutants of concern (nutrients) are fertilizers (residential and agricultural), atmospheric deposition, wastewater, leaking sewers, septic systems, animal operations, pets, native geology. The following sections provide a description of these sources.

3.6.1 Sanitary Sewer and SSOs

When sanitary sewers overflow or leak, they can release raw sewage into the environment. Many sanitary sewer networks in the United States were installed decades ago and are in need of replacement. Aging systems are a major source of sanitary sewer leakage. Severe weather, improper system operation and maintenance (O&M), clogs, and root growth can contribute to sanitary sewer leaks and overflows. Overflows can affect nearby waters and also back up into streets and basements (USEPA 2009). Raw sewage contains high concentrations of bacteria and nutrients from human and kitchen waste, as well as organic chemicals and metals.

The Walteria Lake subcatchment is served by Walteria Lake, which acts as an extended wet detention basin. Stormwater is pumped from the lake through a 54-inch diameter force main. During big storms and/or pumping conditions, there is a high potential for sediment resuspension. This may lead to high pollutant discharge into Machado Lake. To prevent pollutant discharge into Machado Lake and thereby meet WLAs, discharge from Walteria Lake could be diverted at two locations into potential BMP sites A1 and A2 as shown on Figure 5.5. However, A1 and A2 are designed based on Torrance watershed only. Additional capacity to treat flow volume pumped from Walteria Lake is not part of this report. A1 could be expanded with financial participation from the LACFCD.

5.3.4.1 Subcatchment Volume Associated with 85th Percentile, 24 Hour Storm

Wherever feasible, the City wants to capture and retain all non-stormwater runoff and all stormwater runoff from the 85th percentile, 24 hour storm event for the drainage area tributary to the BMP sites at Torrance airport, Walnut Sump and the Baseball Field. The 85th percentile, 24-hour storm event represents the rainfall event that is greater than 85 percent of all rainfall events over 0.1 inches in a 24-hour period. The 85th percentile isohyetal map developed by LACDPW was used to estimate the appropriate rainfall value of 0.85 in for the implementation area. This design storm is identified in the RAA Guidelines as an acceptable critical condition, and capture of design storm volumes by BMPs is a specified compliance metric in the Permits for TMDLs.

The applicability of the three BMP sites to capture and treat the 85th percentile runoff volume for each subcatchment was investigated. Calculations were performed to determine the approximate size required to capture the 85th-percentile, 24 hour storm volume for the project sites. The 85th-percentile, 24-hour storm volume was determined using the County of Los Angeles Modified Rational Method described using drainage area, runoff coefficient and 85th Percentile storm depth. The total surface area and volume requirements for each potential BMP site is summarized in Table 5.3. As shown in the table, the potential BMP sites A1, A2 and A3 have adequate surface area to implement underground storage/infiltration system to treat stormwater generated from their respective subcatchments. The total depth of the proposed underground storage/infiltration system will range between 4 and 8 feet.

Table 5.3 Summary of BMP Requirements –Torrance Airport

BMP Site	Drainage Area Treated (ac)	Percent Imperviousness	Treatability (1)	24 hr 85th Percentile Volume (ac-ft)	BMP Capacity (ac-ft)
A1	NA[2]	NA	NA	NA	22.4
A2	86	45	6.7%	2.8	12.0
A3	640	59	66.1%	27.2	32.8

Notes:

- Street sweeping – toxics and other pollutants released to the urban environment during dry weather conditions are likely to adsorb on street sediments, which provide mechanism for metals to reach downstream waterbodies. Street sweeping removes sediment, debris, and other pollutants from road and parking lots surfaces. Street sweeping is also proposed in subcatchments AS2 and AS3.
- Catch Basin Filter/Cleanouts – continuation of catch basin filter cleaning programs will contribute to removal of sediments prior to entering the storm drains. The pollutant removal mechanisms of catch basin filter filter inserts are: screening, sedimentation, flotation, and absorption. Debris and large particles are removed by screening; smaller particles and sediment along with associated hydrocarbons, metals, nutrients, toxics and pathogens are removed by settling; and hydrocarbons that are not associated with sediment are removed by absorption.

This EWMP through modeling which is discussed in Section 6 proposes combined efficiencies of non-structural BMPs 30 percent for sediment, 10 percent for phosphorus and 23 percent for nitrogen. Toxics removal is assumed to be directly related to sediment removal efficiency. The assumptions underlying the modeling efforts are discussed in Section 6.

Subcatchment AS1 has a total drainage area of about 249 acres with average imperviousness of about 60 percent. All of the stormwater runoff from AS1 will be captured by a total of 57 catch basin filters. All the 57 catch basin filters will be retrofitted to allow the installation of full capture filters. Based on two years (2005-2006) of simulation, Table 5.5 presents the expected outcome after implementation of distributed and non-structural BMPs in subcatchment AS1. The load reductions listed in the table are based on volume reduction. The catch basin filters considered have bacteria removal capabilities as shown in Appendix G.

Table 5.5 Torrance Airport Basin - Summary of Load Reduction from Quantified BMPs for Subcatchment AS1

	Load (lb/yr)		
BMP Scenario	**TSS**	**TP**	**TN**
Before BMP	19,627.3	167.8	1,130.5
Load Reduction(1)	5,888.2	16.8	260
% Load Reduction	30	10	23

	Pollutant Load (g/yr)			
Subcatchment	**Total PCB**	**Total DDT**	**Dieldrin**	**Chlordane**
Before BMP	1.94	1.31	0.38	1.13
Load Reduction(1)	0.58	0.39	0.11	0.34

Table 5.6 Torrance Airport Basin - Summary of Load Reduction from Quantified BMPs for Subcatchments AS2 and AS3.

BMP Scenario	Load (kg/yr)		
	TSS	TP	TN
Before BMP	52,677.8	451.3	3,037.5
Load Reduction (1)	48,779.6	321.3	2,308.5
% Load Reduction	92.6	71.2	76.0

Subcatchment	Pollutant Load (kg/yr)			
	Total PCB	Total DDT	Dieldrin	Chlordane
Before BMP	5.18	3.52	1.01	3.03
Load Reduction(1)	4.80	3.26	0.94	2.81
% Load Reduction	92.6	92.6	92.6	92.6

Note:
(1) Load reduction by combined non-structural BMPs

Table 5.9 Walnut Sump - Summary of Load Reduction from Quantified BMPs

BMP Scenario	Load (kg/yr) TSS	TN	TP
Before BMP	71,451	127	22
Load Reduction (1)	66,164	97.7	15.9
% Load Reduction	92.6	76.9	72.3

Subcatchment	Pollutant Load (g/yr) Total PCB	Total DDT	Dieldrin	Chlordane
Before BMP	7.03	4.79	1.37	4.11
Load Reduction (1)	6.51	4.43	1.27	3.81
% Load Reduction	92.6	92.6	92.6	92.6

Note:
(1) Load reduction by combined non-structural BMPs

The implementation will carried out in phases as listed below:

1. Phase I – Divert flow from storm drain 1040
2. Phase II – Install catch basin filter filters in WS-1
3. Phase III – Diversion and pump station for WS-2

In addition to contributing to meeting the TMDL reduction requirement of improving water quality, a centralized BMP at walnut Sump would provide other water resources benefits. A centralized BMP at this location would be designed to increase infiltration providing additional groundwater replenishment to the groundwater basin. Storage provided by the BMP would reduce potential flooding in the watershed treatment area. Further benefits could be determined during implementation. For example, the actual BMP design could include additional vegetation that would enhance habitat area in the area and Public Education.

Table 5.11 Baseball Field - Summary of Load Reduction from Quantified BMPs

BMP Scenario	Load (kg/yr)			
	TSS	TP	TN	
	Option 1			
Before BMP	15,650	4	28	
Load Reduction[(1)]	13,818.95	2.84	20.16	
% Load Reduction	88.3	71	72	
	Option 2			
Load Before BMP	15,650	4	28	
Load Reduction[(1)]	14,413.65	2.88	20.76	
% Load Reduction	92.1	72	74	
	Load (g/yr)			
BMP Scenario	**Total PCB**	**Total DDT**	**Dieldrin**	**Chlordane**
	Option 1			
Load Before BMP	1.54	1.05	0.30	0.90
Load Reduction[(1)]	1.36	0.93	0.26	0.79
% Load Reduction	88.3	88.3	88.3	88.3
	Option 2			
Before BMP	1.54	1.05	0.30	0.90
Load Reduction[(1)]	1.42	0.97	0.28	0.83
% Load Reduction	92.1	92.1	92.1	92.1

Note:
(1) Load reduction by combined non-structural and structural BMPs

In addition to contributing to meeting the TMDL reduction requirement of improving water quality, a centralized BMP at Baseball Field would provide other water resources benefits. A centralized BMP at this location would be designed to increase infiltration providing additional groundwater replenishment to the groundwater basin. Storage provided by the BMP would reduce potential flooding in the watershed treatment area. Further benefits could be determined during implementation. This BMP could be constructed without interfering with baseball field.