U.S. Environmental Protection Agency

# Los Angeles Area Lakes TMDLs
# *March 2012*

*Section 9 North, Center and Legg Lakes TMDLs*

# 9 North, Center, and Legg Lake TMDLs

Legg Lake (#CAL4053100019980917155807) is listed as impaired by ammonia, copper, lead, odor, and pH (SWRCB, 2010). (Note: trash impairment has been addressed by a previous TMDL.) This section of the TMDL report describes the nutrients impairments and the TMDLs developed to address them in North, Center, and Legg lakes (Section 9.2). Nutrient load reductions are required to achieve the chlorophyll *a* target; these reductions are also expected to alleviate ammonia, odor and pH problems. Comparison of metals data to their associated hardness-dependent water quality objectives indicates that copper and lead are currently achieving numeric targets at North, Center, and Legg lakes; therefore, TMDLs are not included for these pollutants. Analyses are presented below for lead (Section 9.3) and copper (Section 9.4).

## 9.1 Environmental Setting

North, Center, and Legg lakes are located in the Los Angeles River Basin (HUC 18070105) in the Whittier Narrows Recreation Area (WNRA) (Figure 9-1 and Figure 9-2). The WNRA land is 1,283 acres leased to the County of Los Angeles Department of Parks and Recreation in 1957. Legg Lake (also called South Lake) was the first lake constructed in the 1950s (construction involved excavating below the groundwater level). Two additional lakes, Center Lake and North Lake, were constructed in 1967 and are connected to Legg Lake, depending on flow conditions. The northern most lake is North Lake (surface area of 22.9 acres, average depth of 6.8 feet, and volume of 156 ac-ft), which is fed by two storm drains, one of which can either flow into North Lake or bypass North Lake and flow directly to Mission Creek. (It is assumed that this flow primarily enters North Lake.) North Lake itself also discharges to Mission Creek. During low flow periods, Center Lake (surface area of 10.8 acres, average depth of 11.8 feet, and volume of 127 ac-ft) contributes a small amount of flow to North Lake; this lake also discharges to Mission Creek (Figure 9-3). The southernmost lake, Legg Lake (surface area of 42.9 acres, average depth of 6.8 feet, and volume of 297 ac-ft) is continuously connected to Center Lake by a channel (Valentina Cabrera-Stagno, USEPA Region IX, personal communication, July 21, 2009). Overflow from the lake system drains from Center Lake to Mission Creek. (All surface areas are estimated based on Southern California Association of Governments 2005 land use data. Volume estimates were provided by the County of Los Angeles Department of Parks and Recreation. Average depths were calculated by dividing volume by surface area.)

There are several areas associated with the WNRA and Area D is located near the lakes. Some restrooms in this area are on septic systems (Restroom #5, Restroom #8, and the Adult Crew Sub-Office; personal communication, Joyce Gibson, park superintendent, Los Angeles County Department of Parks and Recreation, December 21, 2009), while the remaining restrooms are connected to the city sewer system. Recreational uses include fishing, and the California Department of Fish and Game periodically stock the lake with trout. Swimming is prohibited in the lakes, although the locations where the groundwater wells that pump supplemental water cascade to the lakes (this applies to North Lake and Center Lake) are accessible for contact recreation (Figure 9-4). Paddle boating is allowed in North Lake and radio-controlled model boating is allowed in Legg Lake. Bird feeding may be another recreational activity, although it is currently prohibited based on park rules. Park staff, however, have indicated that bird feeding is still a very common activity for lake visitors. While it has not been observed during recent fieldwork, bird feeding is mentioned in the draft Legg Lake Management Plan, which also includes results of a one-day bird population survey that identified over 600 resident birds (County of Los Angeles, 2008). Lake managers use algaecides to control algal growth in the lakes on an as-needed basis. Additional characteristics of the watershed are summarized below.

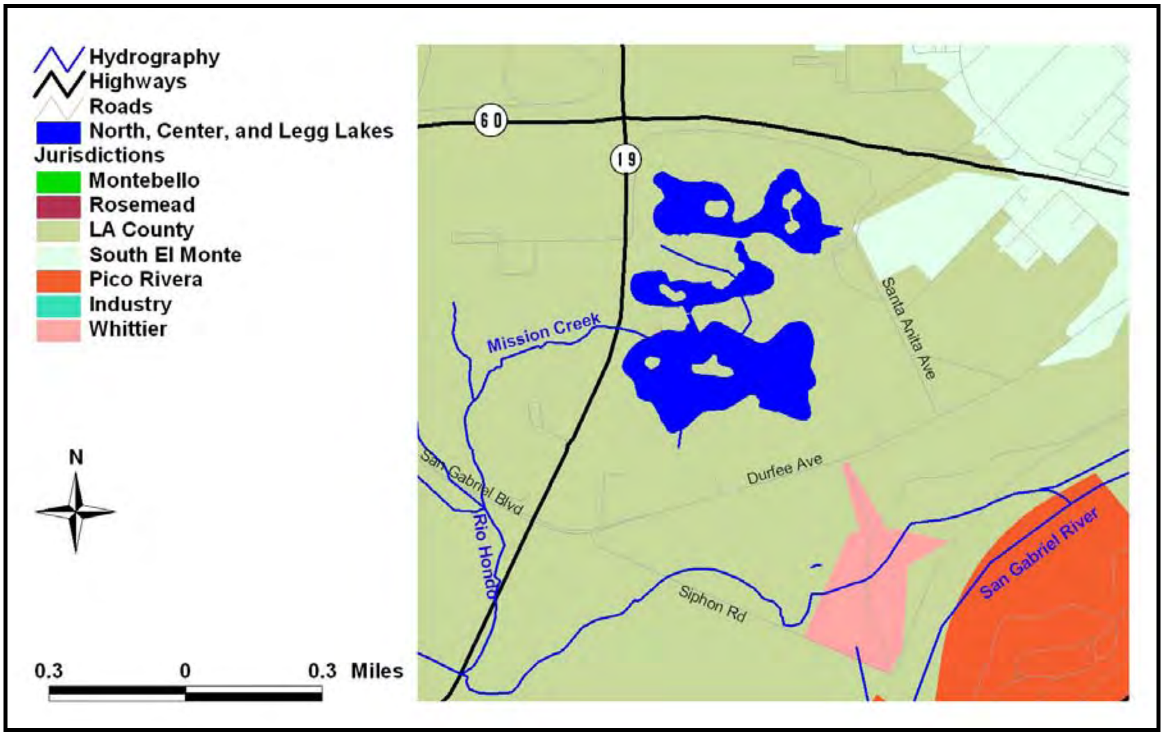


**Figure 9-1. Location of North, Center, and Legg Lakes**

**Figure 9-2. View of Legg Lake**

**Figure 9-3. Center Lake Discharges to Mission Creek**

Note: Groundwater is input to the North Lake and Center Lake via manmade rock cascades.

**Figure 9-4. Groundwater Input to North Lake**

## 9.1.1 Elevation, Storm Drain Networks, and Subwatershed Boundaries

The North, Center, and Legg lakes watershed (1,172 acres) ranges in elevation from 60 meters to 89 meters. Five subwatersheds comprise the drainage area to these lakes. The northwestern and northeastern subwatersheds each drain to separate storm drains that enter North Lake from the northeast side. These two subwatersheds were based on the county of Los Angeles subwatersheds. Three separate drainage areas have been delineated around the lakes to designate overland flow into each individual lake (Figure 9-5). The storm drain coverage was provided by the county of Los Angeles.

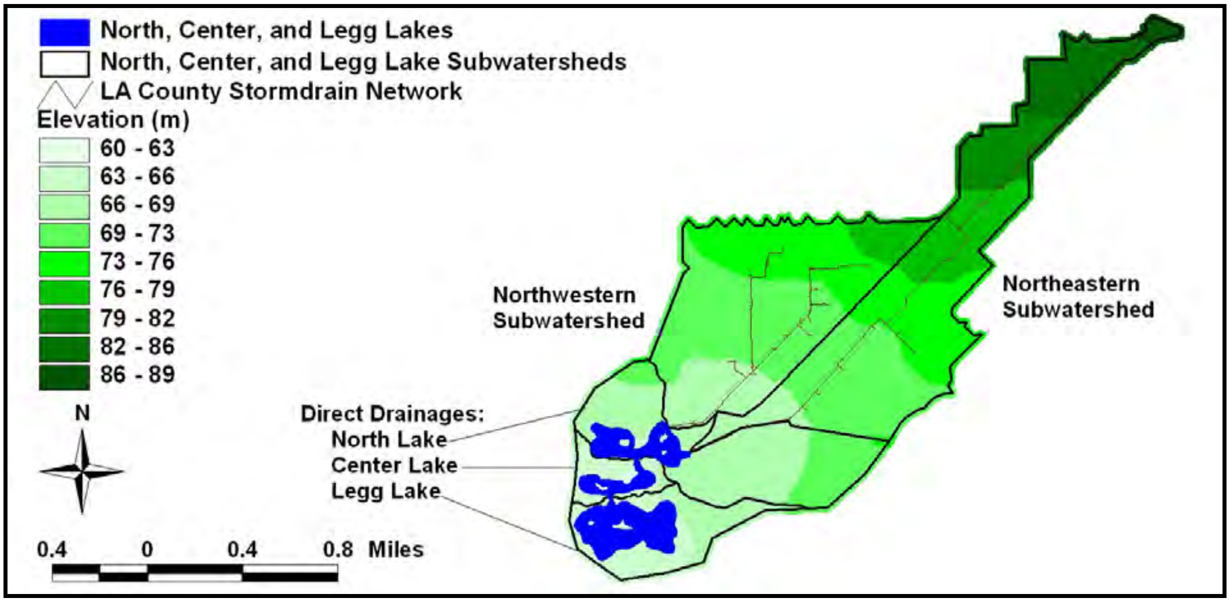


**Figure 9-5. Elevation, Storm Drain Networks, and TMDL Subwatershed Boundaries for the Legg Lake System**

## 9.1.2 MS4 Permittees

Figure 9-6 shows the MS4 stormwater permittees in the North, Center, and Legg lakes watershed. Loads generated from El Monte, South El Monte, and the county of Los Angeles in either the northwestern or northeastern subwatersheds are assigned wasteload allocations in the TMDLs because they drain to the storm drain network before discharging into the lakes. Figure 9-7 and Figure 9-8 show some of the storm drains to North Lake. Loads generated by South El Monte or the county of Los Angeles areas in the direct drainage subwatersheds are assigned load allocations. Caltrans roads in these subwatersheds are assigned wasteload allocations.

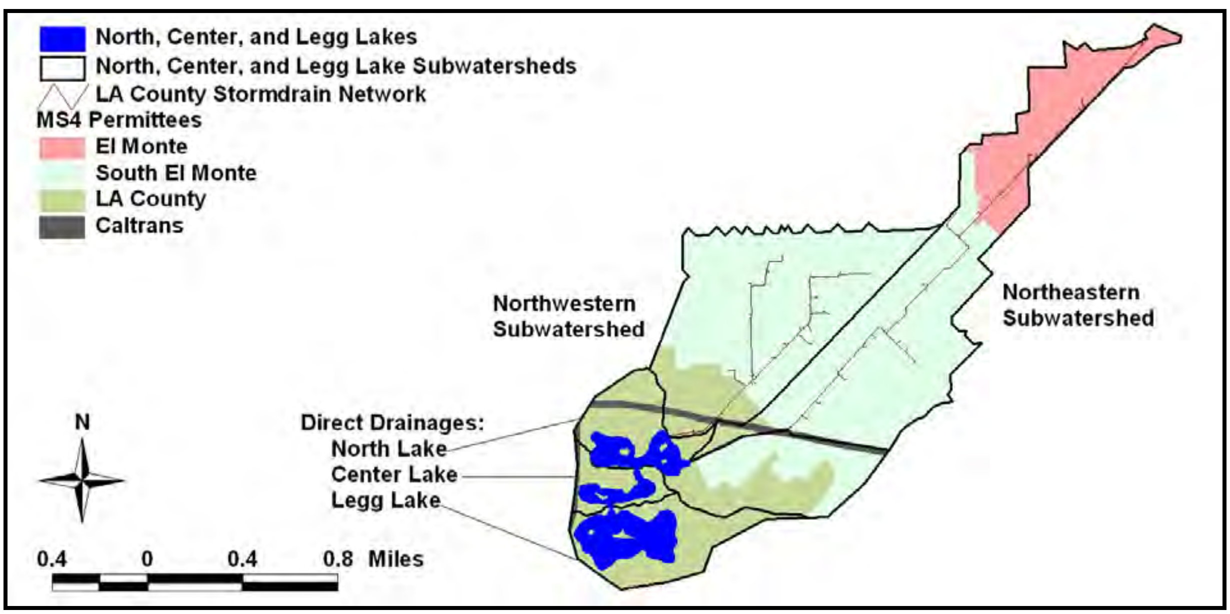


**Figure 9-6. MS4 Permittees and the Storm Drain Network in the North, Center, and Legg Subwatersheds**

**Figure 9-7. Smaller Storm Drain to North Lake (Northwestern Subwatershed)**

Note: Grates visible at the bottom discharge lake water into Mission Creek.

**Figure 9-8. Largest Storm Drain to North Lake (Northeast Subwatershed)**

## 9.1.3 Non-MS4 NPDES Dischargers

There are several additional NPDES permits (non-MS4) in the Legg Lake watershed (Table 9-1). These include five dischargers covered under a general industrial stormwater permit (see Section 3.1 for a detailed discussion of these permit types). These permits were identified by querying excel files of permits from the Regional Board website (excel files for each watershed are available from this link; www.waterboards.ca.gov/losangeles/water_issues/programs/regional_program/index.shtml#watershed; accessed on October 5, 2009). They are all in South El Monte in the northwestern subwatershed (Figure 9-9) and result in 9.27 disturbed acres. (Note: According to the permit database Vacco Industries has a disturbed area of 327 acres. Based on satellite imagery and parcel data, this area was estimated to be between 3.0 acres and 3.5 acres. Assuming the error in the database is due to a misplaced decimal point, a disturbed area of 3.27 acres was used for this facility.) Specific information is not available regarding these dischargers; therefore, they are assigned existing loads and wasteload allocations based on their area (industrial stormwater).

**Table 9-1. Non-MS4 Permits in the North, Center, and Legg Lakes Watershed**

| Type of NPDES Permit | Number of Permits | Subwatershed | Jurisdiction | Disturbed Area |
|---|---|---|---|---|
| General Industrial Stormwater (Order No. 97-03-DWQ, CAS000003) | 5 | Northwestern | South El Monte | 9.27 acres |

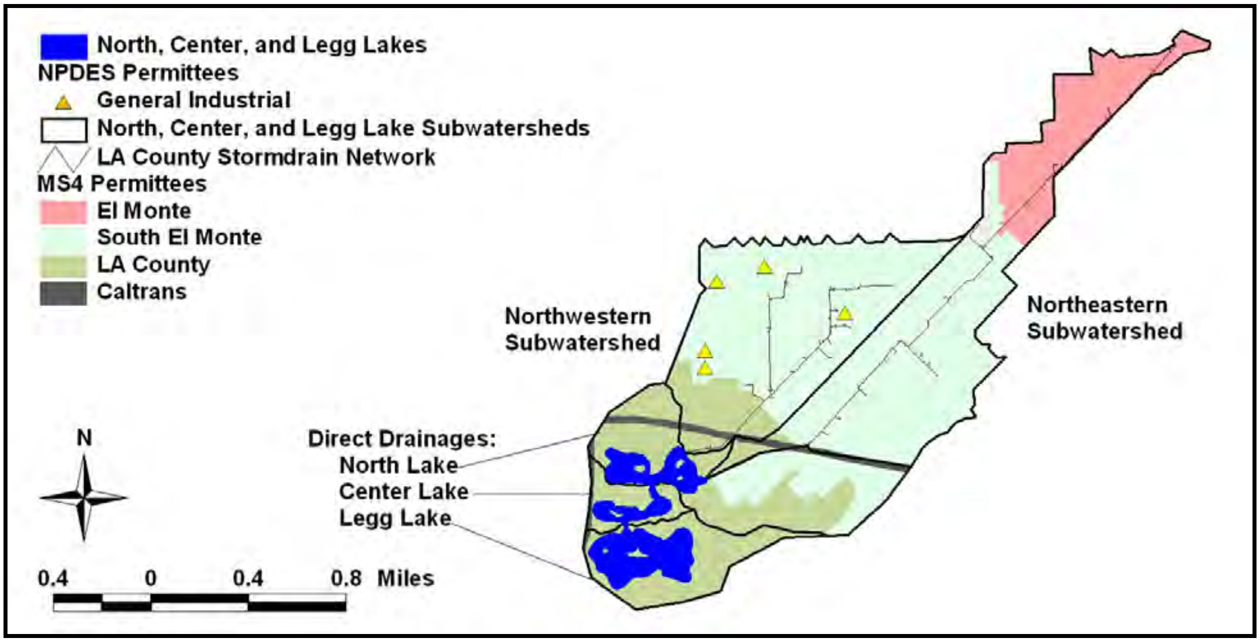


**Figure 9-9. Non-MS4 Permits in the Legg Lake Subwatersheds**

## 9.1.4 Land Uses and Soil Types

Several of the analyses for the North, Center, and Legg lakes watershed include source loading estimates obtained from the Los Angeles River Basin LSPC Model discussed in Appendix D (Wet Weather Loading) of this TMDL report. Land uses identified in the Los Angeles River Basin LSPC model for these subwatersheds are shown in Figure 9-10. Tetra Tech reviewed the SCAG 2005 database and current satellite imagery to confirm the acreage of agricultural areas present in the LSPC model. Land use classifications were changed to accurately reflect the conditions identified in the more recent data. Specifically, the following changes were made to maintain consistency with the SCAG 2005 land use database: in the direct drainage subwatershed to Legg Lake, approximately half of the agricultural area was reclassified as it is actually parkland and the agricultural areas assigned in the direct drainage to North Lake and northeastern subwatersheds were changed to vacant land. In addition, the agricultural area present in the northwestern subwatershed is classified by SCAG 2005 as nurseries; however, this area was reclassified to parkland as current satellite imagery shows this area to be Shiveley Park. For the purposes of estimating flows and pollutant loads to this lake system, all agricultural areas are reassigned as open space, with the exception of 1.02 acres located in the direct drainage to Legg Lake subwatershed, which were confirmed to be strawberry fields. The area classified as “other urban” in the LSPC land use categories is a high school according to SCAG 2005. Table 9-2 and Table 9-3 summarize the land use areas for the northern two subwatersheds and the direct drainage subwatersheds, respectively, by jurisdiction. These areas are combined because all of the northern watersheds are associated with WLAs and the direct drainage subwatersheds are all assigned LAs.

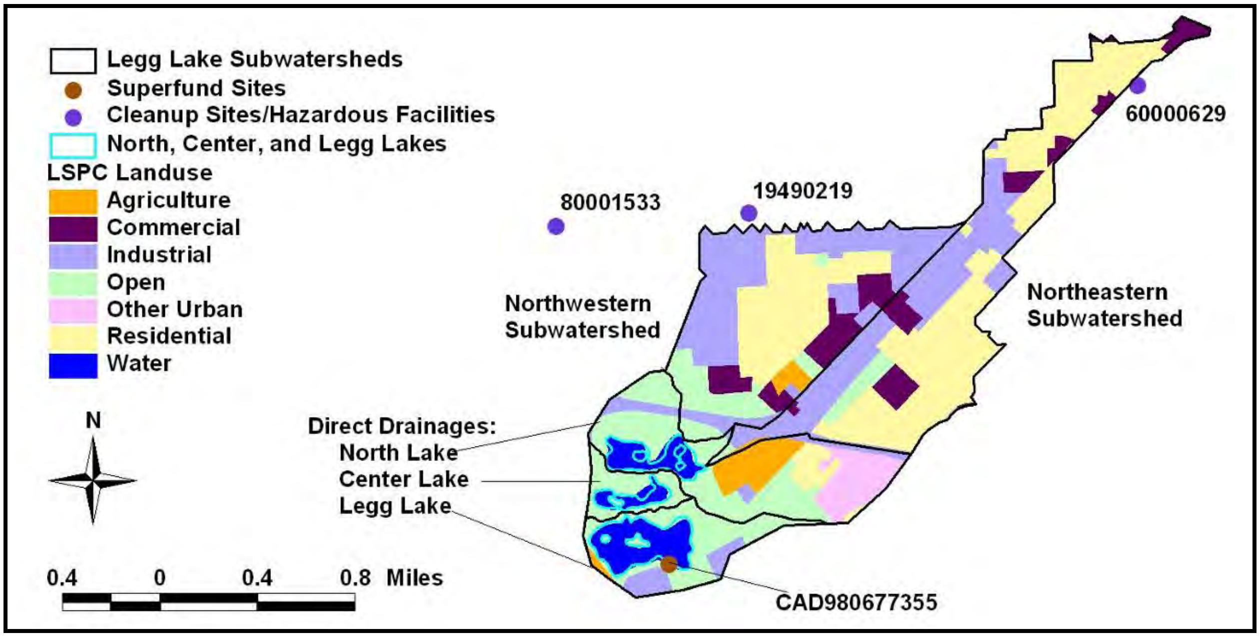


**Figure 9-10. LSPC Land Use Classes for the North, Center, and Legg Lake Subwatersheds**

**Table 9-2. Land Use Areas (ac) Draining from the Northern Subwatersheds to North, Center, and Legg Lakes**

| Land Use | El Monte | South El Monte | County of Los Angeles | Caltrans | Total |
|---|---|---|---|---|---|
| Agriculture | 0 | 0 | 0 | 0 | **0** |
| Commercial | 23.5 | 58.0 | 11.9 | 0 | **93.5** |
| Industrial/Roads | 6.49 | 269 | 13.4 | 11.5 | **300** |
| Open | 0 | 29.3 | 44.6 | 0 | **73.9** |
| Other Urban | 0 | 0 | 0 | 0 | **0** |
| Residential | 104 | 267 | 0.271 | 0 | **371** |
| **Total** | **134** | **623** | **70.2** | **11.5** | **838** |

**Table 9-3. Land Use Areas (ac) Draining from the Direct Drainage Subwatersheds to North, Center, and Legg Lakes**

| Land Use | South El Monte | County of Los Angeles | Caltrans | Total |
|---|---|---|---|---|
| Agriculture | 0 | 1.04 | 0 | **1.04** |
| Commercial | 0 | 0 | 0 | **0** |
| Industrial/Roads | 1.78 | 24.1 | 17.6 | **43.4** |
| Open | 29.8 | 202 | 0 | **232** |
| Other Urban | 28.2 | 12.1 | 0 | **40.3** |
| Residential | 15.8 | 1.19 | 0 | **17.0** |
| **Total** | **75.7** | **240** | **17.6** | **334** |

There are three Resource Conservation and Recovery Act (RCRA) cleanup sites close to the Legg Lake watershed (see Table 9-4); these are located within approximately 0.6 miles of the watershed boundary (Figure 9-10). There is one Superfund site in the watershed that treats groundwater contaminated with volatile organic compounds, which discharges to Legg Lake following treatment (Figure 9-11). Most of these sites are not likely to contribute to the existing impairments at Legg Lake, except possibly the El Monte Disposal Service. Lead is listed as a potential contaminant of concern at this site; however, as described below, recent lead samples collected from Legg Lake are below the CTR criteria resulting in a finding of non-impairment. Table 9-4 summarizes the available information regarding these sites.

Note: The above treatment facility discharges under the surface of the water in Legg Lake.

**Figure 9-11. Superfund Groundwater Remediation Site**

**Table 9-4. RCRA Cleanup and Superfund Sites Located within or near the Legg Lake Watershed**

| Envirostor # | Facility Name | Cleanup Status | Potential Contaminants of Concern |
|---|---|---|---|
| 80001533 (CAD008246746) | Boer Graphics / Paragon Press | Inactive | Information not listed in database |
| 19490219 | El Monte Disposal Service | Certified | Lead, Benzene, Arsenic, Motor oil |
| 60000629 | Hytone Cleaners | Active | Volatile organic compounds |
| CAD980677355 | San Gabriel Valley Area 1 Whittier Narrows Operable Unit | Active | Volatile organic compounds |

Figure 9-12 shows the predominant soil identified by STATSGO in the Legg Lake subwatersheds. The soil type is identified as Urban land-Sorrento-Hanford (MUKEY 660473), a hydrologic group B soil, which has moderate infiltration rates and moderately coarse textures.

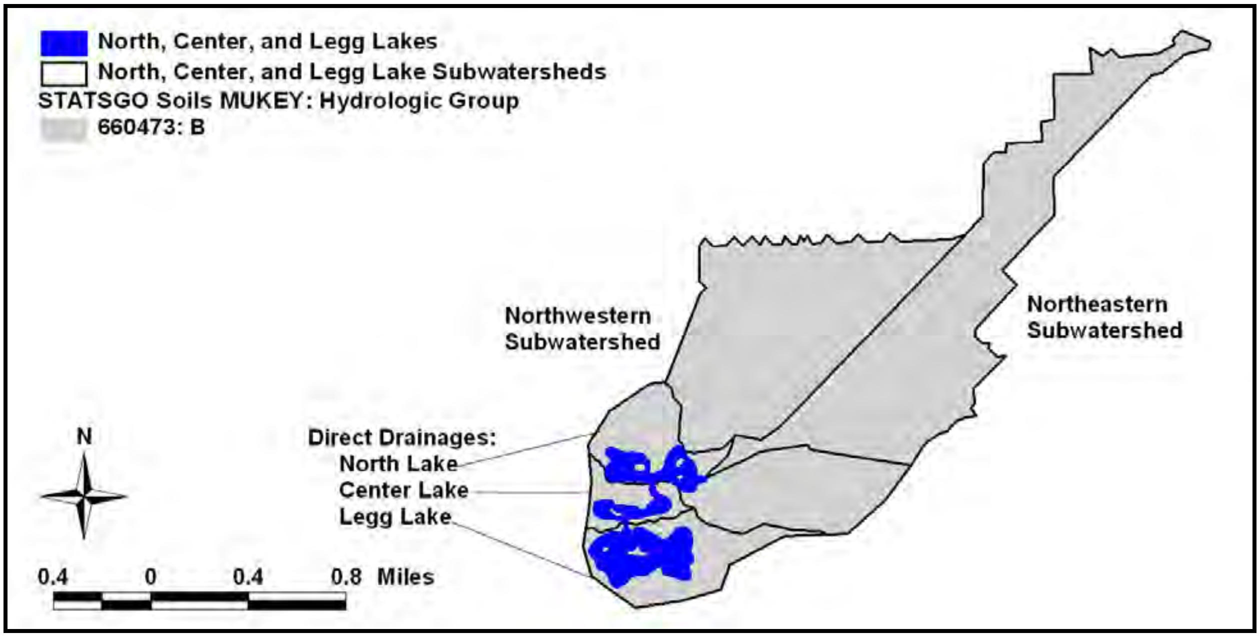


**Figure 9-12. STATSGO Soil Types Present in the Legg Lake Subwatersheds**

### 9.1.5 Additional Inputs

North, Center, and Legg lakes receive water from several additional sources; including reclaimed water, potable water, and post-treatment Superfund site discharge. Prior to May 2010 additional groundwater had been used to supplement water levels, but this input was discontinued.

An additional 1,239 ac-ft/yr of water are used to irrigate 568 acres of parkland adjacent to the Legg Lake system (6.3 percent of the total irrigation volume is assumed to reach the lake). Staff at the park indicate that approximately 10 percent of this is potable water and 90 percent is reclaimed wastewater. Irrigation with the reclaimed water source began in 2006. The usage total also includes irrigation at Norman's Nursery, which is outside the watershed of the Legg Lake System. In 2006, Norman's Nursery used approximately 6.7 percent of the reclaimed water applied at Whittier Narrows. Subtracting out the usage at Norman's Nursery leaves approximately 1,040 ac-ft of reclaimed water applied around the Legg Lake system. As previously noted, 10 percent of the irrigation water is potable water, resulting in an additional 124 ac-ft of water applied to the parkland. Some of the potable and reclaimed irrigation water applied to the parklands may reach the lakes.

The San Gabriel Valley Area 1 Whittier Narrows Operable Unit Superfund site (EPA #CAD980677355) treats contaminated groundwater from a 4 $mi^2$ area located in and around the North, Center, and Legg lakes watershed. There is no NPDES permit associated with this discharge. Contamination by volatile organic compounds (VOCs) was identified in local groundwater wells in the southern portion of the San Gabriel Basin in 1979. Contamination, caused by decades of improper chemical handling and disposal by hundreds of industries, resulted in high concentrations of compounds including tetrachloroethylene (PCE), trichloroethylene (TCE), 1-4 dioxane, perchlorate, and N-nitrosodimethylamine (NDMA) within groundwater wells. Remediation efforts, including containment of groundwater contamination and conveyance to and from the liquid-phase granular activated carbon groundwater treatment plant, began in September of 2000. Initial conveyance of treated groundwater from the treatment plant began in February of 2002 with discharge of this remediated groundwater to Legg Lake commencing in October of 2002. The treatment effectively removes the VOCs and has no impact on the concentrations of nutrients or metals in the treated groundwater. Continued groundwater monitoring has been completed by USEPA, and significant reductions in contaminant concentrations have been documented (USEPA, 2006). Annual average post-treatment flows from this source are approximately 2,534 ac-ft per year as measured by USEPA. The flow is discharged to the Legg and North lakes using a cascading water delivery method that had previously been used for the additional groundwater inputs prior to May 2010

## 9.2 NUTRIENT RELATED IMPAIRMENTS

A number of the assessed impairments for Legg Lake are associated with nutrients and eutrophication. Nutrient-related impairments for Legg Lake include ammonia, odor, and pH (SWRCB, 2010). The loading of excess nutrients enhances algal growth (eutrophication). Algal photosynthesis removes carbon dioxide from the water, which can lead to elevated pH in poorly buffered systems. Respiration during nighttime hours and decay of algae cause decreased dissolved oxygen (DO) concentrations. Algal blooms may also contribute to odor problems.

### 9.2.1 Beneficial Uses

California state water quality standards consist of the following elements: 1) beneficial uses, 2) narrative and/or numeric water quality objectives, and 3) an antidegradation policy. In California, beneficial uses are defined by the Regional Water Quality Control Boards (Regional Boards) in the Water Quality Control Plans (Basin Plans). Numeric and narrative objectives are specified in each region's Basin Plan, designed to be protective of the beneficial uses of each waterbody in the region. The existing beneficial uses assigned to Legg Lake include REC1, REC2, WARM, WILD, MUN, WET, GWR, and COLD. Descriptions of these uses are listed in Section 2 of this TMDL report. Elevated nutrient levels are currently impairing the REC1, REC2, WARM, and COLD uses by stimulating algal growth that may form mats that impede recreational and drinking water use, alter pH and dissolved oxygen (DO) levels, alter biology that impair the aquatic life use, and cause odor and aesthetic problems. At high enough concentrations WILD, MUN, and GWR uses could become impaired.

### 9.2.2 Numeric Targets

The Basin Plan for the Los Angeles Region (LARWQCB, 1994) outlines the numeric targets and narrative criteria that apply to Legg Lake. The following targets apply to the ammonia, odor, and pH impairments (see Section 2 for additional details and Table 9-5 for a summary):

- Most ammonia in fresh water is present in the ionized form of ammonium ($NH_4^+$). The Basin Plan expresses ammonia targets as a function of pH and temperature because it is un-ionized ammonia ($NH_3$) that is toxic to fish and other aquatic life. In order to assess compliance with the standard, the pH, temperature and ammonia must be determined at the same time. For the purposes of setting a target for the Legg Lake system in these TMDLs, a median temperature of 16.0 ºC and a 95$^{th}$ percentile pH of 9.6 were used, as explained in Section 2. The resultant acute (one-hour) ammonia target is 0.42 mg-N/L, the four-day average is 0.56 mg-N/L, and the 30-day average (chronic) target is 0.23 mg-N/L (Note: the median temperature and 95$^{th}$ percentile pH values were calculated from the observed data and used in the calculation of the acute and chronic targets. These are presented as example calculations since the actual target varies with the values determined during sample collection.).
- The Basin Plan addresses excess aquatic growth in the form of a narrative objective for nutrients. Excessive nutrient concentrations (e.g., nitrogen and phosphorous) in a waterbody can lead to nuisance effects such as algae, odors, and scum. The objective specifies, "waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses." The Regional Board has not adopted numeric targets for biostimulatory nutrients or chlorophyll *a* in Legg Lake; however, as

described in Tetra Tech (2006), summer (May – September) mean and annual average chlorophyll *a* concentrations of 20 µg/L are selected as the maximum allowable level consistent with full support of contact recreational use and are also consistent with supporting warm water aquatic life. The chlorophyll *a* target must be met at half of the Secchi depth during the summer (May – September) and annual averaging periods.

- The Basin Plan states that "waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible aquatic resources, cause nuisance, or adversely affect beneficial uses."
- The Basin Plan states "at a minimum the mean annual dissolved oxygen concentrations of all waters shall be greater than 7 mg/L, and no single determinations shall be less than 5.0 mg/L, except when natural conditions cause lesser concentrations." In addition, the Basin Plan states, "the dissolved oxygen content of all surface waters designated as WARM shall not be depressed below 5 mg/L as a result of waste discharges" and "the dissolved oxygen content of all surface waters designated as COLD shall not be depressed below 6 mg/L as a result of waste discharges." The Legg Lake system has a COLD beneficial use; therefore, the COLD DO target applies. Shallow, well-mixed lakes, such as the Legg Lake system, must meet the COLD DO target in the water column from the surface to 0.3 meters above the bottom of the lake.
- The Basin Plan states that "the pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.5 units from natural conditions as a result of waste discharge." Shallow, well-mixed lakes, such as Legg Lake, must meet the pH target in the water column from the surface to 0.3 meters above the bottom of the lake.

Nitrogen and phosphorus target concentrations are based on simulation of allowable loads with the NNE BATHTUB model (see Section 9.2.5). Based on the calibrated model for Legg Lake, the target nutrient concentrations within the lake are

- 0.65 mg-N/L summer average (May – September) and annual average
- 0.065 mg-P/L summer average (May – September) and annual average

**Table 9-5. Nutrient-Related Numeric Targets for North, Center, and Legg Lakes**

| Parameter | Numeric Target | Notes |
|---|---|---|
| Ammonia[1] | 0.42 mg-N/L acute (one-hour)<br>0.56 mg-N/L four-day average<br>0.23 mg-N/L chronic (30-day average) | Based on median temperature and 95$^{th}$ percentile pH |
| Chlorophyll *a* | 20 µg/L summer average (May – September) and annual average | |
| Dissolved Oxygen | 7 mg/L minimum mean annual concentrations and<br>6 mg/L single sample minimum except when natural conditions cause lesser concentrations | |

| Parameter | Numeric Target | Notes |
|---|---|---|
| pH | The pH of inland surface waters shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient pH levels shall not be changed more than 0.5 units from natural conditions as a result of waste discharge. (Basin Plan)<br><br>6.5 – 9.0 (EPA's 1986 Recommended Criteria) | The existing water quality criteria for pH is very broad and in cases where waste discharges are not causing the alteration of pH it allows for a wider range of pH than EPA's recommended criteria. For this reason, EPA's recommended criteria is included as a secondary target for pH. |
| Total Nitrogen | 0.65 mg-N/L summer average (May – September) and annual average | Based on simulation of allowable loads from the NNE BATHTUB model |
| Total Phosphorous | 0.065 mg-P/L summer average (May – September) and annual average | Based on simulation of allowable loads from the NNE BATHTUB model |

[1] The median temperature and 95$^{th}$ percentile pH values were calculated from the observed data and used in the calculation of the acute and chronic targets. These are presented as example calculations since the actual target is the water quality objective which is dependent on pH and temperature. When assessing compliance refer to the water quality objective as expressed in the Basin Plan..

### 9.2.3 Summary of Monitoring Data

Water quality in Legg Lake proper has been monitored since the early 1990s. Monitoring in North and Center lakes began more recently. This section summarizes the monitoring data relevant to the nutrient impairments. Shoreline sampling is not discussed as these samples are typically not reflective of the lake as a whole. Additional details regarding monitoring are discussed in Appendix G (Monitoring Data).

Legg Lake proper was monitored in 1992 and 1993 for water quality as part of the Urban Lakes Study from the lower section of the lake on the western side. Total Kjeldahl Nitrogen (TKN) generally ranged from 0.6 mg-N/L to 1.0 mg-N/L although three samples were less than the detection limit (0.01 mg-N/L) and one outlier had a concentration of 37 mg-N/L. The majority of the ammonium samples (33 of 43) were less than the detection limit (0.01 mg-N/L); ammonium concentrations as high as 0.4 mg-N/L were observed. All nitrite samples were less than the detection limit (0.01 mg-N/L), and nitrate concentrations did not exceed 0.2 mg-N/L. Both phosphate and total phosphorus were less than the detection limit (0.01 mg-P/L) in all 43 samples. pH ranged from 8.0 to 8.9. The summary table from the 1994 Lakes Study Report (UC Riverside, 1994) lists chlorophyll *a* concentrations ranging from 2 µg/L to 27 µg/L (average of 15 µg/L). The Study reported that algae levels and macrophyte growth were not problematic.

The Regional Board's 1996 Water Quality Assessment Database does not include data for Legg Lake or its watershed. The Assessment Report does include summary information for the impairments. Ammonia was partially supporting the aquatic life use; 43 ammonium samples were collected with concentrations ranging from non-detect to 0.35 mg-N/L. Raw data are not available to assess location, date, time, depth, temperature, or pH with regard to these samples. pH was listed as partially supporting the aquatic life use and not supporting the secondary drinking water use. Eighty-four measurements of pH ranged from 7.6 to 8.9. Odor was listed as not supporting the contact and non-contact recreation uses. The Legg Lake system was sampled multiple times during May, June, and July 2007 (data provided by the county of Los Angeles). Nineteen of 21 mid-lake samples of ammonia had concentrations ranging from less than the detection limit of 0.01 mg-N/L to 0.36 mg-N/L; two samples had ammonia concentrations of 0.51 mg-N/L and 0.53 mg-N/L (both were collected from Center Lake in May). None of these samples exceeded the acute or chronic ammonia criteria based on the associated pH and temperature measurements. Nitrate concentrations ranged from less than the detection limit of 0.02 mg-N/L to 0.59 mg-N/L. Orthophosphate ranged from less than the detection limits (either 0.01 mg-P/L or

0.02 mg-P/L, depending on the sampling event) to 0.07 mg-P/L. Dissolved oxygen concentrations for these samples ranged from 7.7 mg/L to 12.2 mg/L; pH ranged from 7.1 to 8.2.

North, Center, and Legg lakes were sampled by the USEPA and Regional Board on July 14, 2009. Ammonia, nitrite, nitrate, and orthophosphate samples were less than the detection limits (0.03 mg-N/L, 0.01 mg-N/L, 0.01 mg-N/L, and 0.0075 mg-P/L, respectively) in all three lakes. TKN ranged from 1.4 mg-N/L to 1.7 mg-N/L. Total phosphorus ranged from 0.046 mg-P/L to 0.089 mg-P/L. Chlorophyll *a* in the three lakes ranged from 37.4 µg/L to 93.4 µg/L. pH measurements ranged from 7.7 to 9.1 in the three lakes. DO ranged from 6.7 mg/L to 13.6 mg/L over the first 2 meters of depth from the surface. Measurements taken from 2.5 meters to 2.8 meters (Center Lake only) ranged from 1.7 mg/L to 1.9 mg/L.

USEPA sampled North, Center, and Legg lakes on June 8, August 11, and September 29, 2010 (see Appendix G for monitoring data). Secchi depth ranged from 0.5 m to 1.27 m. In-lake samples of TKN ranged from 0.57 to 1.4 mg-N/L. Ammonia samples ranged from 0.03 to 0.082 mg-N/L. Nitrate-nitrite concentrations were below the detection limit of 0.015 mg-N/L during the June event for all stations and the September events at all Legg 9 and 10; nitrate-nitrite of 0.059 to 0.081 mg-N/L was observed at Legg 8 in September. During the August and September events, nitrate ranged from below the detection limit of 0.05 mg-N/L to 0.29 mg-N/L, and nitrite samples were below detection limits of 0.25 mg-N/L. All 2010 orthophosphate measurements were below the detection limit of 0.5 mg-P/L; total phosphorus concentrations ranged from 0.02 mg-P/L to 0.06 mg-P/L. Chlorophyll *a* concentrations ranged from 11 µg/L to 44 µg/L. The August chlorophyll *a* data represent estimated values as the samples were held past the holding times. The September sample was split and half was processed within the standard holding time while half was held longer than the holding time and processed at the same relative time as the August sample had been processed. The ratio of the split sample was applied to the August sample to generate an estimated chlorophyll *a* value, had that sample been processed promptly. According to depth-profile measurements, pH ranged from 7.3 to 13.2 in the three lakes. DO ranged from 3.4 mg/L to 11.3 mg/L over the first 2 meters of depth from the surface. Measurements taken from 2.2 meters to 2.7 meters ranged from 1.2 mg/L to 6.6 mg/L (Center Lake).

In summary, exceedances of the allowable range of pH have been measured during historic and recent monitoring events. DO concentrations are typically above 6 mg/L throughout the water column although measurements near the bottom of Center Lake during one sampling event have been observed at less than 2 mg/L. No odors were observed during the recent sampling events by USEPA and/or the Regional Board. Chlorophyll *a* concentrations seem to have increased dramatically relative to conditions observed in the early 1990s. Shoreline sampling conducted in February 2009 by the Regional Board had chlorophyll *a* concentrations ranging from 26.7 µg/L to 115 µg/L. Although these samples were not used for calibration of the NNE BATHTUB model (Section 9.2.5), they do provide further indication of elevated algae levels under current conditions. The nutrient TMDLs for North, Center, and Legg lakes presented in Section 9.2.6 account for summer season critical conditions by assessing loading rates consistent with meeting the summer chlorophyll *a* target of 20 µg/L. These reductions in nutrient loading are expected to alleviate pH, odor, and DO problems associated with excessive nutrient loading and eutrophication.

### 9.2.3.1 Summary of Ammonia Non-Impairment

Legg Lake was listed as impaired for ammonia in 1996 based on an assessment in the Regional Board's Water Quality Assessment and Documentation Report (LARWQCB, 1996). Consistent with project plan recommendations provided in California's Impaired Waters Guidance (SWRCB, 2005), EPA and local agencies collected 50 additional samples between May 2007 and September 2010 to evaluate current water quality conditions. There was one ammonia exceedance in 50 samples (Appendix G, Monitoring Data). Therefore, Legg Lake meets ammonia water quality standards and USEPA concludes that preparing a TMDL for ammonia is unwarranted at this time. USEPA recommends that Legg Lake not be identified as impaired for ammonia in California's next 303(d) listing.

### 9.2.4 Source Assessment

The source assessment for the Legg Lake system includes load estimates from the surrounding watershed (Appendix D, Wet Weather Loading; Appendix F, Dry Weather Loading) including irrigation (6.3 percent of the total irrigation volume is assumed to reach the lake), groundwater used for supplemental water additions to maintain lake levels (Appendix F, Dry Weather Loading), discharge of treated groundwater from the Superfund site (Appendix F, Dry Weather Loading), and atmospheric deposition (Appendix E, Atmospheric Deposition). Table 9-6 summarizes the existing loads from sources in the Legg Lake watershed. The largest contributor of total nitrogen loading is the Superfund discharge (51.7 percent). The city of South El Monte contributes the majority of the total phosphorus load (56.6 percent).

**Table 9-6. Summary of Average Annual Flows and Nutrient Loading to the Legg Lake System**

| Subwatershed | Responsible Jurisdiction | Input | Flow (ac-ft/yr) | Total Phosphorus (lb-P/yr) (percent of total load) | Total Nitrogen (lb-N/yr) (percent of total load) |
|---|---|---|---|---|---|
| Direct to Center Lake | Caltrans | State Highway Stormwater[1] | 2.92 | 4.6 (0.2) | 36.1 (0.2) |
| Direct to Center Lake | County of Los Angeles | Runoff | 1.69 | 0.5 (<0.1) | 14.7 (0.1) |
| Direct to Legg Lake | Caltrans | State Highway Stormwater[1] | 0.75 | 1.2 (0.1) | 9.3 (<0.1) |
| Direct to Legg Lake | County of Los Angeles | Runoff | 19.4 | 26.0 (1.4) | 228.2 (1.0) |
| Direct to North Lake | Caltrans | State Highway Stormwater[1] | 12.1 | 19.1 (1.0) | 149.5 (0.6) |
| Direct to North Lake | County of Los Angeles | Runoff | 20.3 | 26.6 (1.4) | 226.0 (0.9) |
| Direct to North Lake | South El Monte | Runoff | 31.0 | 55.1 (2.9) | 369.3 (1.5) |
| Northwestern | Caltrans | State Highway Stormwater[1] | 5.91 | 9.4 (0.5) | 68.3 (0.3) |
| Northwestern | County of Los Angeles | MS4 Stormwater[1] | 33.5 | 53.6 (2.8) | 346.8 (1.5) |
| Northwestern | South El Monte[2] | MS4 Stormwater[1] | 308 | 526.3 (27.6) | 3,500.2 (14.7) |
| Northwestern | General Industrial Stormwater Permittees (in the city of South El Monte) | General Industrial Stormwater[1] | 3.63 | 5.8 (0.3) | 42.0 (0.2) |
| Northeastern | Caltrans | State Highway Stormwater[1] | 6.87 | 10.9 (0.6) | 79.4 (0.3) |
| Northeastern | El Monte | MS4 Stormwater[1] | 122 | 226.6 (11.9) | 1,377.0 (5.8) |
| Northeastern | County of Los Angeles | MS4 Stormwater[1] | 8.18 | 12.8 (0.7) | 91.4 (0.4) |
| Northeastern | South El Monte | MS4 Stormwater[1] | 287 | 498.7 (26.1) | 3,253.5 (13.6) |

| Subwatershed | Responsible Jurisdiction | Input | Flow (ac-ft/yr) | Total Phosphorus (lb-P/yr) (percent of total load) | Total Nitrogen (lb-N/yr) (percent of total load) |
|---|---|---|---|---|---|
| Direct to Legg Lake | Whittier Narrows Operable Unit Groundwater Treatment Plant | Treated Groundwater from Superfund Site | 2,534 | 172.3 (9.0) | 12,355.2 (51.7) |
| All Direct Drainage Subwatersheds | County of Los Angeles | Parkland Irrigation | 72.9 | 258.3 (13.5) | 1,685.2 (7.1) |
| Lake Surface | | Atmospheric Deposition[3] | 105 | NA | 56.3 (0.2) |
| **Total** | | | **3,471** | **1,908** | **23,888** |

[1] This input includes effluent from storm drain systems during both wet and dry weather.

[2] The total area for the City of South El Monte in the northwestern subwatershed is 317 acres. Discharges governed by the general construction and general industrial stormwater permits are currently located in the City of South El Monte. The disturbed area associated with general construction and general industrial stormwater permittees (9.27 acres) was subtracted out of the appropriate city area and allocated to these permits.

[3] Loads for atmospheric deposition are based on direct precipitation to the lake (calculated by the annual average precipitation multiplied by the surface area of the lake).

### 9.2.5 Linkage Analysis

The linkage analysis defines the connection between numeric targets and identified pollutant sources and may be described as the cause-and-effect relationship between the selected indicators, the associated numeric targets, and the identified sources. This provides the basis for estimating total assimilative capacity and any needed load reductions. To simulate the impacts of nutrient loading on the Legg Lake system, the nutrient numeric endpoints (NNE) BATHTUB Tool was set up and calibrated to lake-specific conditions. The NNE BATHTUB Tool is a version of the US Army Corps of Engineers (USACE) BATHTUB model and was developed to support risk-based nutrient numeric endpoints in California (Tetra Tech, 2006).

BATHTUB is a steady-state model that calculates nutrient concentrations, chlorophyll *a* concentration (or algal density), turbidity, and hypolimnetic oxygen depletion based on nutrient loadings, hydrology, lake morphometry, and internal nutrient cycling processes. BATHTUB uses a typical mass balance modeling approach that tracks the fate of external and internal nutrient loads between the water column, outflows, and sediments. External loads can be specified from various sources including stream inflows, nonpoint source runoff, atmospheric deposition, groundwater inflows, and point sources. Internal nutrient loads from cycling processes may include sediment release and macrophyte decomposition. The net sedimentation rates for nitrogen and phosphorus reflect the balance between settling and resuspension of nitrogen and phosphorus within the waterbody. Thus, internal loading is implicitly accounted for in the model. Since BATHTUB is a steady-state model, it focuses on long-term average conditions rather than day-to-day variations in water quality.

Target nutrient loads and resulting allocations are determined based on the secondary target – summer mean chlorophyll *a* concentration. The NNE spreadsheet tool allows the user to specify a chlorophyll *a* target and predicts the probability that current conditions will exceed the target, as well as showing a matrix of allowable nitrogen and phosphorus loading combinations to meet the target. The user-defined chlorophyll *a* target can be input directly by the user, or can be calculated based on an allowable change in water transparency measured as Secchi depth. Appendix A (Nutrient TMDL Development) describes additional details on the NNE BATHTUB Tool and its use in determining allowable loads of nitrogen and phosphorus.

In addition to loading rates of nitrogen and phosphorus, the NNE BATHTUB Tool requires morphometric data for the simulation of chlorophyll *a* during the summer. For the Legg Lake system, the three linked segments were simulated as one aggregate waterbody because 1) there are not enough water quality data to calibrate each segment separately and 2) simulation of cumulative loading and morphometry was needed to calibrate the model within recommended guidelines (Walker, 1987). For the system as a whole, the surface area is 76.6 acres, the average depth is 7.6 ft, and the cumulative volume is 580 ac-ft. Based on the phosphorus turnover ratio for this lake (Walker, 1987), the summer averaging period is appropriate (i.e., loads delivered from May through September are input to the model rather than annual loads).

The NNE BATHTUB Tool was set up to match the three 2010 summer sampling events. The August sampling event yielded only an estimated chlorophyll *a* value, however, it was used in generating a seasonal average for the model. Historic data from the 1990s are available, however they do not represent current conditions for the lake (reclaimed water used for irrigation, discharge of treated groundwater from a Superfund site, and higher observed chlorophyll *a* concentrations). July 2009 data do not reflect the change in flow from the Superfund site and discontinuation of the additional groundwater input. All samples collected during the 2010 sampling were collected at one-half of the Secchi depth. To predict the average observed total phosphorus concentration over this depth (0.041 mg-P/L), the calibration factors on the net phosphorus sedimentation rate would need to be set higher than the recommended value of 2. The phosphorus calibration factor was set at 2, which resulted in a predicted concentration of 0.06 mg-P/L, which is within the observed range for the lakes and provides a conservative estimate of the required total phosphorus load reduction. To predict the average observed total nitrogen concentration over one-half of the Secchi depth (1.08 mg-N/L), the calibration factor on the net nitrogen sedimentation was set to 2.46, which is within the recommended range for nitrogen.

To simulate the average observed chlorophyll *a* concentration, the calibration factor on concentration was set to 0.97 for a predicted concentration of 26.7 µg/L. If subsequent data are collected that will allow for calibration of the NNE BATHTUB model, then these TMDLs may be revisited. For now, this preliminary model is being used to determine the load reductions needed to attain the chlorophyll *a* target concentration, based on the best available information.

### 9.2.6 TMDL Summary

A waterbody's loading capacity represents the maximum load of a pollutant that can be assimilated without violating water quality standards (40 CFR 130.2(f)). This is the maximum nutrient load consistent with meeting the numeric target of 20 µg/L of chlorophyll *a* as a summer average. The methodology for determining the loading capacity is described briefly in this section. For more detail, refer to Appendix A (Nutrient TMDL Development).

Following calibration of the NNE BATHTUB Tool (Section 9.2.5), the allowable loading combinations of nitrogen and phosphorus were calculated using Visual Basic's GoalSeek function (Appendix A, Nutrient TMDL Development). The loading combination that is predicted to result in an in-lake ratio of total nitrogen concentration to total phosphorus concentration close to 10 was selected to match that typically observed in natural systems and to balance biomass growth and prevent limitation by one nutrient (Thomann and Mueller, 1987). The corresponding in-lake concentrations of nitrogen and phosphorus for the Legg Lake system are

- 0.65 mg-N/L summer average (May – September) and annual average
- 0.065 mg-P/L summer average (May – September) and annual average

For the Legg Lake system, the loading capacity for total nitrogen is 11,379 lb-N/yr. The loading capacity for phosphorus was set to the existing load of 1,908 lb-P/yr since the existing average observed concentration is meeting the target. These loading capacities can be further broken down into the wasteload allocations (WLAs), load allocations (LAs), and Margin of Safety (MOS) using the general TMDL equation:

$$TMDL = \sum WLA + LA + MOS$$

For total nitrogen, the allocatable load (divided among WLAs and LAs) is 42.9 percent of the existing load of 23,888 lb-N/yr, or 10,241 lb-N/yr. This value represents 90 percent of the loading capacity, while the MOS is 10 percent of the loading capacity. WLAs and LAs are developed assuming equal percent load reductions in all sources. The resulting TMDL equation for total nitrogen is then:

11,379 lb-N/yr = 9,135 lb-N/yr + 1,106 lb-N/yr + 1,138 lb-N/yr

For total phosphorus, the allocatable load is equal to the existing load and is divided among WLAs and LAs. The resulting TMDL equation for total phosphorous is then:

1,908 lb-P/yr = 1,541 lb-P/yr + 367 lb-P/yr + 0 lb-P/yr

Allocations are assigned for these TMDLs by requiring equal percentage reductions of all sources. Total phosphorus allocations are set to existing loads. Details associated with the WLAs, LAs, and MOS are presented in the following three sections.

As previously mentioned, in-lake concentrations of nitrogen and phosphorus have been determined for the lake system based on simulation of allowable loads with the NNE BATHTUB model (see Section 9.2.5). These in-lake concentrations are calculated from a complex set of equations that consider internal cycling processes (see Appendix A, Nutrient TMDL Development) and, therefore, differ from concentrations associated with various inflows. Nutrient concentrations associated with the WLA and LA inputs are described below. These values are provided as examples as they are calculated based on existing flow volumes (and will need to be recalculated if flow volumes change). Because the input concentrations do not consider internal cycling processes and are based on existing flow volumes, they do not match the allowable in-lake nitrogen and phosphorous concentrations.

### 9.2.6.1 Wasteload Allocations

Federal regulations require that NPDES permits incorporate water quality based effluent limitations (WQBELs) consistent with the requirements and assumptions of any available wasteload allocations (WLAs). These TMDLs establish WLAs and alternative WLAs for total phosphorous and total nitrogen. The alternative WLAs will be effective and supersede the WLAs in Table 9-7 if the conditions described in Section **Error! Reference source not found.** or in Section 9.2.6.1.2 are met.

Under any of the wasteload allocation schemes responsible jurisdictions are encouraged to consider the construction of wetland systems and bioswales (or other retention or treatment options) to treat the stormwater and supplemental water flows entering the lake, as well as stormwater diversion and infiltration using methods such as porous pavements and rain gardens. Implementing these options can reduce the lake's nutrient loads and, in the case of recirculation through constructed wetlands, reduce in-lake nutrient concentrations. Additionally, persons that apply algaecides as part of an overall lake management strategy must comply with the Aquatic Pesticide General Permit (General Permit Order No. 2004-0009-DWQ, CAG990005).

Local jurisdictions have performed studies on nearby waterbodies that may be considered when evaluating nutrient-reduction strategies for this lake. For example, the City of Los Angeles has modeled expected nutrient concentration reductions to stormwater flows to Echo Park Lake from constructed wetlands, and construction is currently underway. Information about this and other City of Los Angeles water quality improvement projects are available on the Proposition O website: http://www.lapropo.org/sitefiles/lariver.htm.

#### *9.2.6.1.1 Wasteload Allocations*

The northwestern and northeastern subwatersheds drain to a series of storm drains prior to discharging to the Legg Lake system. Therefore, all loads associated with these drainage areas are assigned WLAs. The loads attributed to the Caltrans areas in the direct drainage subwatersheds also receive WLAs along with facilities that operate under a general industrial stormwater permit. WLAs are also assigned to the Whittier Narrows Operable Unit Groundwater Treatment Plant. Relevant permit numbers are

- County of Los Angeles (including the cities of El Monte and South El Monte): Board Order 01-182 (as amended by Order No. R4-2006-0074 and R4-2007-0042), CAS004001
- Caltrans: Order No 99-06-DWQ, CAS000003
- General Industrial Stormwater: Order No. 97-03-DWQ, CAS000001

Each WLA must be met at the point of discharge. Total phosphorus WLAs represent a 0 percent reduction in existing loading, and total nitrogen WLAs represent an 57.1 percent reduction in existing loading (Table 9-7). As noted in Table 9-7 below, the concentration-based WLAs will be used to evaluate compliance with the allocations for the current discharges authorized by the general industrial stormwater permit and the construction stormwater permit and any future discharges in the watershed authorized by the general industrial and construction stormwater permits.

**Table 9-7. Wasteload Allocations for Nutrient Loading to the Legg Lake System**

| Subwatershed | Responsible Jurisdiction | Input | Flow (ac-ft/yr) | Total Phosphorus[4] (lb-P/yr) | Total Nitrogen[4] (lb-N/yr) |
|---|---|---|---|---|---|
| Direct to Center Lake | Caltrans | State Highway Stormwater[1] | 2.92 | 4.6 | 15.5 |
| Direct to Legg Lake | Caltrans | State Highway Stormwater[1] | 0.75 | 1.2 | 4.0 |
| Direct to North Lake | Caltrans | State Highway Stormwater[1] | 12.1 | 19.1 | 64.1 |
| Northwestern | Caltrans | State Highway Stormwater[1] | 5.91 | 9.4 | 29.3 |
| Northwestern | County of Los Angeles | MS4 Stormwater[1] | 33.5 | 53.6 | 148.7 |
| Northwestern | South El Monte[2] | MS4 Stormwater[1] | 308 | 526.3 | 1,500.6 |
| Northwestern | General Industrial Stormwater Permittees (in the city of South El Monte) | General Industrial Stormwater[1] | 3.63 | 5.8<br>(0.64 mg-P/L)[3] | 18.0<br>(1.8 mg-N/L)[3] |
| Northeastern | Caltrans | State Highway Stormwater[1] | 6.87 | 10.9 | 34.0 |
| Northeastern | El Monte | MS4 Stormwater[1] | 122 | 226.6 | 590.3 |

| Subwatershed | Responsible Jurisdiction | Input | Flow (ac-ft/yr) | Total Phosphorus[4] (lb-P/yr) | Total Nitrogen[4] (lb-N/yr) |
|---|---|---|---|---|---|
| Northeastern | County of Los Angeles | MS4 Stormwater[1] | 8.18 | 12.8 | 39.2 |
| Northeastern | South El Monte | MS4 Stormwater[1] | 287 | 498.7 | 1,394.8 |
| Direct to Legg Lake | Whittier Narrows Operable Unit Groundwater Treatment Plant | Treated Groundwater from Superfund Site | 2,534 | 172.3 | 5,296.8 |
| **Total** | | | **3,325** | **1,541** | **9,135** |

[1] This input includes effluent from storm drain systems during both wet and dry weather.

[2] The total area for the City of South El Monte in the northwestern subwatershed is 317 acres. Discharges governed by the general construction and general industrial stormwater permits are currently located in the City of South El Monte. The disturbed area associated with general construction and general industrial stormwater permittees (9.27 acres) was subtracted out of the appropriate city area and allocated to these permits. Any future discharges governed by the general construction and general industrial stormwater permits will receive the same concentration-based wasteload allocations (see footnote #3).

[3] For these responsible jurisdictions, the concentration-based WLA will be used to evaluate compliance.

[4] Each wasteload allocation must be met at the point of discharge.

#### *9.2.6.1.2 Alternative "Approved Lake Management Plan Wasteload Allocations"*

Concentration-based WLAs not exceeding the concentrations listed in Table 9-8 are effective and supersede corresponding WLAs for a responsible jurisdiction in Table 9-7 if:

1. The responsible jurisdiction requests that concentration-based wasteload allocations not to exceed the concentrations established in Table 9-8 apply to it;
2. The responsible jurisdiction provides to USEPA and the Regional Board a Lake Management Plan describing actions that will be implemented and cause each of the following to be met: the applicable water quality criteria for ammonia, dissolved oxygen and pH; and the chlorophyll *a* targets listed in Table 9-5. Responsible jurisdictions may work together to develop, submit and implement the Lake Management Plan. A Lake Management Plan may include the following types of actions: increasing the volume of the lake that is aerated; installing hydroponic islands to remove nutrients; increasing flow volume or circulation in the lake; reducing stormwater discharges by improved infiltration; treating stormwater or supplemental water inputs with a wetland system; alum treatment to immobilize nutrients in sediments; and/or fisheries management actions to reduce nutrient availability from sediments. The responsible jurisdiction may use monitoring data and modeling to show that the water quality criteria, targets and requested WLAs will be met;
3. The Regional Board Executive Officer approves the request and applies concentration-based wasteload allocations for total nitrogen and total phosphorus. These wasteload allocations are not to exceed the concentrations in Table 9-8 as a summer average (May-September) and annual average, and
4. USEPA does not object to the Regional Board's determination within 60 days of receiving notice of it.

The concentration-based WLAs must be met in the lake. However, if applicable water quality criteria for ammonia, dissolved oxygen and pH, and the chlorophyll *a* target are met, then the total phosphorus and total nitrogen allocations are considered attained.

**Table 9-8. Alternative Wasteload Allocations of Phosphorus and Nitrogen in the Legg Lake System if an Approved Lake Management Plan Exists**

| Subwatershed | Responsible Jurisdiction | Input | Maximum Allowable Wasteload Allocation Total Phosphorus[4] (mg-P/L) | Maximum Allowable Wasteload Allocation Total Nitrogen[4] (mg-N/L) |
|---|---|---|---|---|
| Direct to Center Lake | Caltrans | State Highway Stormwater[1] | 0.1 | 1.0 |
| Direct to Legg Lake | Caltrans | State Highway Stormwater[1] | 0.1 | 1.0 |
| Direct to North Lake | Caltrans | State Highway Stormwater[1] | 0.1 | 1.0 |
| Northwestern | Caltrans | State Highway Stormwater[1] | 0.1 | 1.0 |
| Northwestern | County of Los Angeles | MS4 Stormwater[1] | 0.1 | 1.0 |
| Northwestern | South El Monte[2] | MS4 Stormwater[1] | 0.1 | 1.0 |
| Northwestern | General Industrial Stormwater Permittees (in the city of South El Monte)[3] | General Industrial Stormwater[1] | 0.1 | 1.0 |
| Northeastern | Caltrans | State Highway Stormwater[1] | 0.1 | 1.0 |
| Northeastern | El Monte | MS4 Stormwater[1] | 0.1 | 1.0 |
| Northeastern | County of Los Angeles | MS4 Stormwater[1] | 0.1 | 1.0 |
| Northeastern | South El Monte | MS4 Stormwater[1] | 0.1 | 1.0 |
| Direct to Legg Lake | Whittier Narrows Operable Unit Groundwater Treatment Plant and County of Los Angeles[5] | Treated Groundwater from Superfund Site and Supplemental Water Additions | 0.1 | 1.0 |

[1] This input includes effluent from storm drain systems during both wet and dry weather.

[2] Discharges governed by the general construction and general industrial stormwater permits are currently located in the City of South El Monte. Any future discharges governed by the general construction and general industrial stormwater permits will receive the same concentration-based wasteload allocations (see footnote #3).

[3] For these responsible jurisdictions, the concentration-based WLA will be used to evaluate compliance.

[4] The concentration-based wasteload allocation must be met in the lake. However, if applicable water quality criteria for ammonia, dissolved oxygen and pH, and the chlorophyll *a* target are met, then the total phosphorus and total nitrogen allocations are considered attained.

[5] Currently the treatment plant supplements lake water levels entirely but in the past there has been a combination of County and treatment plant water used for this purpose. This allocation is given to the County of Los Angeles and the treatment plant jointly since in the future the County may resume supplemental water additions to the lakes.

### 9.2.6.2 Load Allocations

These TMDLs establish load allocations (LAs) and alternative LAs for total phosphorous and total nitrogen. The alternative LAs will be effective and supersede the LAs listed in Table 9-9 if the conditions described in Section 9.2.6.2.2 are met.

#### 9.2.6.2.1 Load Allocations

Loads associated with the non-Caltrans areas in the direct drainage subwatersheds are assigned load allocations (LAs). Total phosphorus LAs represent a 0 percent reduction in existing loading, and total nitrogen LAs represent an 57.1 percent reduction in existing loading. LAs are provided for each responsible jurisdiction and input. These loading values (in pounds per year) represent the TMDLs load allocations (Table 9-9).

**Table 9-9. Load Allocations for Nutrient Loading to the Legg Lake System**

| Subwatershed | Responsible Jurisdiction | Input | Flow (ac-ft/yr) | Total Phosphorus[1] (lb-P/yr) | Total Nitrogen[1] (lb-N/yr) |
|---|---|---|---|---|---|
| Direct to Center Lake | County of Los Angeles | Runoff | 1.69 | 0.5 | 6.3 |
| Direct to Legg Lake | County of Los Angeles | Runoff | 19.4 | 26.0 | 97.8 |
| Direct to North Lake | County of Los Angeles | Runoff | 20.3 | 26.6 | 96.9 |
| Direct to North Lake | South El Monte | Runoff | 31.0 | 55.1 | 158.3 |
| All Direct Drainage Subwatersheds | County of Los Angeles | Parkland Irrigation | 72.9 | 258.3 | 722.5 |
| Lake Surface | | Atmospheric deposition[2] | 105 | 0.00 | 24.1 |
| **Total** | | | **250** | **367** | **1,106** |

[1] Each load allocation must be met at the point of discharge.

[2] Loads for atmospheric deposition are based on direct precipitation to the lake (calculated by the annual average precipitation multiplied by the surface area of the lake).

#### 9.2.6.2.2 Alternative "Approved Lake Management Plan Load Allocations"

Concentration-based load allocations not exceeding the concentrations listed in Table 9-10 are effective and supersede corresponding load allocations for the responsible jurisdictions in Table 9-9 if:

1. The responsible jurisdictions request that concentration-based load allocations not to exceed the concentrations established in Table 9-10 apply to it;
2. The responsible jurisdictions provide to USEPA and the Regional Board a Lake Management Plan describing actions that will be implemented and cause each of the following to be met: the applicable water quality criteria for ammonia, dissolved oxygen and pH; and the chlorophyll *a* targets listed in Table 9-5. A Lake Management Plan may include the following types of actions: increasing the volume of the lake that is aerated; installing hydroponic islands to remove nutrients; increasing flow volume or circulation in the lake; reducing stormwater discharges by improved infiltration; treating stormwater or supplemental water inputs with a wetland system; alum treatment to immobilize nutrients in sediments; and/or fisheries management actions to reduce nutrient availability from sediments. The responsible jurisdictions may use monitoring data and modeling to show that the water quality criteria, targets and requested load allocations will be met;
3. The Regional Board Executive Officer approves the request and applies concentration-based load allocations for total nitrogen and total phosphorus. These load allocations are not to exceed the concentrations in Table 9-10 as a summer average (May-September) and annual average; and
4. USEPA does not object to the Regional Board's determination within 60 days of receiving notice of it.

Each concentration-based LA must be met in the lake. However, if applicable water quality criteria for ammonia, dissolved oxygen and pH, and the chlorophyll *a* target are met, then the total phosphorus and total nitrogen allocations are considered attained.

**Table 9-10. Alternative Load Allocations of Nutrient Loading to the Legg Lake System if an Approved Lake Management Plan Exists**

| Subwatershed | Responsible Jurisdiction | Input | Maximum Allowable Load Allocation Total Phosphorus[1] (mg-P/L) | Maximum Allowable Load Allocation Total Nitrogen[1] (mg-N/L) |
|---|---|---|---|---|
| Direct to Center Lake | County of Los Angeles | Runoff | 0.1 | 1.0 |
| Direct to Legg Lake | County of Los Angeles | Runoff | 0.1 | 1.0 |
| Direct to North Lake | County of Los Angeles | Runoff | 0.1 | 1.0 |
| Direct to North Lake | South El Monte | Runoff | 0.1 | 1.0 |
| All Direct Drainage Subwatersheds | County of Los Angeles | Parkland Irrigation | 0.1 | 1.0 |

[1] Each concentration-based load allocation must be met in the lake. However, if applicable water quality criteria for ammonia, dissolved oxygen and pH, and the chlorophyll *a* target are met, then the total phosphorus and total nitrogen allocations are considered attained.

### 9.2.6.3 Margin of Safety

TMDLs must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality. The MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. To account for the uncertainties concerning the relationship between nutrient loading and the resultant in-lake chlorophyll *a* an explicit MOS is included in these TMDLs. This explicit MOS is set at 10 percent of the loading capacity for total phosphorus and total nitrogen.

### 9.2.6.4 Critical Conditions/Seasonality

TMDLs must include consideration of critical conditions and seasonal variation to ensure protection of the designated uses of the waterbody at all times. Critical conditions for nutrient impaired lakes typically occur during the warm summer months when water temperatures are elevated and algal growth rates are high. Elevated temperatures not only reduce the saturation levels of DO, but also increase the toxicity of ammonia and other chemicals in the water column. Excessive rates of algal growth may cause large swings in DO, elevated pH, odor, and aesthetic problems. Loading of nutrients to lakes during winter months are often biologically available to fuel algal growth in summer months. These nutrient TMDLs account for summer season critical conditions by using the NNE Bathtub model to calculate possible annual loading rates consistent with meeting the summer chlorophyll *a* target concentration of 20 µg/L. These TMDLs are expected to alleviate any pH and odor problems associated with excessive nutrient loading and eutrophication. These TMDLs therefore protect for critical conditions.

### 9.2.6.5 Daily Load Expression

USEPA recommends inclusion of a daily load expression for all TMDLs to comply with the 2006 D.C. Circuit Court of Appeals decision for the Anacostia River. These TMDLs present a maximum daily load according to the guidelines provided by USEPA (2007). Because the majority of phosphorus loading to the Legg Lake system occurs during wet weather events that deliver pollutant loads from the surrounding watershed, the daily maximum allowable load of phosphorus is calculated from the maximum daily storm flow rate (estimated from the 99$^{th}$ percentile flow) to the system multiplied by the allowable concentrations consistent with achieving the long-term loading targets. The majority of the nitrogen load results from the discharge of treated Superfund water. Little variability in daily discharge flowrate is expected, so the maximum daily nitrogen load from this source is calculated by dividing the annual load by 365 days per year. The second highest source of nitrogen loading is wet weather runoff. Because the treated groundwater from the Superfund site likely continues at the same discharge rate during dry and wet weather, daily loads from both the Superfund discharge and wet weather events will be accounted for in the estimation of nitrogen and phosphorus daily maximum loads. These maximum loads are not allowed each day of the year because the annual loads specified by the TMDLs must also be achieved. The WLA and LA loads presented above are annual loading caps that cannot be exceeded.

No USGS gage currently exists in the watershed. USGS Station 11102000, Mission Creek near Montebello, CA, was selected as a surrogate for flow determination. This gage is downstream of where the Legg Lake system discharges to Mission Creek. The 99$^{th}$ percentile flow was chosen to represent the peak flow for this drainage. Choosing the 99$^{th}$ percentile flow eliminates errors due to outliers and is reasonable for development of a daily load expression.

The USGS StreamStats program was used to determine the 99$^{th}$ percentile flow for Mission Creek (30.2 cfs) (Wolock, 2003). To estimate the peak flow to the Legg Lake system, the 99$^{th}$ percentile flow for Mission Creek was scaled down by the ratio of drainage areas (1,172 acres/2,662 acres; Legg Lake watershed area/Mission Creek watershed area at the gage). The resulting peak daily flow estimate for the Legg Lake system is 13.3 cfs.

The average allowable concentrations of phosphorus and nitrogen were calculated from the allowable loads (1,908 lb-P/yr and 10,241 lb-N/yr, respectively; sum of WLAs and LAs) divided by the total volume reaching the lake (3,471 ac-ft). Multiplying the average allowable concentrations (0.20 mg-P/L for phosphorus and 1.09 mg-N/L for nitrogen) by the 99$^{th}$ percentile peak daily flow (13.3 cfs) yields the daily maximum load associated with wet weather runoff. The wet weather runoff daily maximum allowable loads of phosphorus and nitrogen for the Legg Lake system are 73.74 lb-P/d and 395.8 lb-N/d, respectively. These loads are associated with the MS4 stormwater permittees. The maximum daily loads for the treated groundwater from the Superfund site were calculated by dividing the annual allowable loads (Table 9-7) by 365 days, resulting in 0.47 lb-P/d and 14.5 lb-N/d. Combined, these two sources yield total maximum daily loads for phosphorous and nitrogen of 74.2 lb-P/d and 410 lb-N/d, respectively. As described above, in order to achieve in-lake nutrient targets as well as annual load-based allocations, the maximum allowable daily loads cannot be discharged to the lake every day. The WLA and LA loads presented above are annual loading caps that cannot be exceeded.

### 9.2.6.6 Future Growth

Areas in the northwestern and northeastern subwatersheds are nearly fully developed and most of the undeveloped land in the direct drainage subwatersheds has been set aside as parkland. If additional development occurs in this watershed, best management practices (BMPs) will be required such that loading rates are consistent with the allocations established by these TMDLs. Therefore, no load allocation has been set aside for future growth. It is unlikely that any additional dischargers of significant nutrient loading will be permitted in the watershed.

If any sources currently assigned load allocations are later determined to be point sources requiring NPDES permits, those load allocations are to be treated as wasteload allocations for purposes of determining appropriate water quality-based effluent limitations pursuant to 40 CFR 122.44(d)(1).

## 9.3 LEAD IMPAIRMENT

Legg Lake was listed as impaired for lead in 1996 based on an assessment in the Regional Board's Water Quality Assessment and Documentation Report (LARWQCB, 1996). Consistent with project plan recommendations provided in California's Impaired Waters Guidance (SWRCB, 2005), EPA and local agencies collected 45 additional samples (18 wet weather) between February 2009 and September 2010 to evaluate current water quality conditions. There were zero dissolved lead exceedances in 45 samples (Appendix G, Monitoring Data). USEPA also collected three sediment samples during August 2010 to further evaluate lake conditions. There were zero sediment lead exceedances of the 128 ppm freshwater (Probable Effect Concentrations) sediment target (Appendix G, Monitoring Data). Therefore, Legg Lake meets lead water quality standards, and USEPA concludes that preparing a TMDL for lead is unwarranted at this time. USEPA recommends that Legg Lake not be identified as impaired by lead in California's next 303(d) list.

## 9.4 COPPER IMPAIRMENT

Legg Lake was listed as impaired for copper in 1996 based on an assessment in the Regional Board's Water Quality Assessment and Documentation Report (LARWQCB, 1996). Consistent with project plan recommendations provided in California's Impaired Waters Guidance (SWRCB, 2005), EPA and local agencies collected 45 additional samples (18 wet weather) between February 2009 and September 2010 to evaluate current water quality conditions. There were zero dissolved copper exceedances in 45 samples (Appendix G, Monitoring Data). USEPA also collected three sediment samples during August 2010 to further evaluate lake conditions. There were zero sediment copper exceedances of the 149 ppm freshwater (Probable Effect Concentrations) sediment target (Appendix G, Monitoring Data). Therefore, Legg Lake meets copper water quality standards, and USEPA concludes that preparing a TMDL for copper is unwarranted at this time. USEPA recommends that Legg Lake not be identified as impaired by copper in California's next 303(d) list.

## 9.5 IMPLEMENTATION RECOMMENDATIONS

Implementation measures may be developed in the future by the Regional Board through an implementation plan, NPDES permits, or non-point source enforcement. This section describes USEPA's recommendations to the Regional Board as to the implementation procedures and regulatory mechanisms that could be used to provide reasonable assurances that water quality standards will be met. General information about various lake management strategies can be found in a USEPA document titled *Managing Lakes and Reservoirs (EPA 841-B-01-006)*. Lake management options that can reduce pollutant loading to lakes include but are not limited to: increasing the volume of the lake that is aerated; installing hydroponic islands to remove nutrients; increasing flow volume or circulation in the lake; reducing stormwater discharges by improved infiltration; treating stormwater or supplemental water inputs with a wetland system; alum treatment to immobilize nutrients in sediments; dredging in lake sediments; and/or fisheries management actions to reduce nutrient availability from sediments.

Additionally, responsible jurisdictions implementing these TMDLs are encouraged to utilize Los Angeles County's Structural Best Management Practice (BMP) Prioritization Methodology which helps identify priority areas for constructing BMP projects. The tool is able to prioritize based on multiple pollutants. The pollutants that it can prioritize includes bacteria, nutrients, trash, metals and sediment. More information about this prioritization tool is available at: www.labmpmethod.org.

If necessary, these TMDLs may be revised as the result of new information (See Section 9.6 Monitoring Recommendations).

### 9.5.1 Nonpoint Sources and the Implementation of Load Allocations

Regional Board may regulate nonpoint pollutant sources through the authority contained in sections 13263 and 13269 of the California Water Code, in conformance with the State Water Resources Control Board's Nonpoint Source Implementation and Enforcement Policy, and the Conditional Waiver for Discharges from Irrigated Lands, adopted by the Los Angeles Regional Water Quality Control Board on November 3, 2005. Additionally, South Coast Air Quality Management District has authority to regulate air emissions throughout the basin that affect air deposition. Load allocations are expressed in Table 9-9.

### 9.5.2 Point Sources and the Implementation of Wasteload Allocations

Wasteload allocations apply to MS4, General Industrial, and Caltrans Stormwater permits as well as supplemental water additions and the Whittier Narrows Operable Unit Groundwater Treatment Plant (Table 9-7 for Standard and Table 9-10 for Alternative Allocations). The mass-based wasteload allocations will be incorporated into the Caltrans and Los Angeles County MS4 permits. The concentration-based wasteload allocations will be incorporated into the General Industrial Stormwater permit. Wasteload allocations for Whittier Narrows Operable Unit Groundwater Treatment Plant and supplemental water additions will be implemented by the Regional Board.

### 9.5.3 Source Control Alternatives

Responsible jurisdictions are encouraged to consider the construction of wetland systems and bioswales (or other retention or treatment options) to treat the stormwater and supplemental water flows entering the lake, as well as stormwater diversion and infiltration using methods such as porous pavements and rain gardens. Implementing these options can reduce the lake's nutrient loads and, in the case of recirculation through constructed wetlands, reduce in-lake nutrient concentrations. The City of Los Angeles has modeled expected nutrient concentration reductions to stormwater flows to Echo Park Lake from constructed wetlands, and construction is currently underway. Information about this and other City of Los Angeles water quality improvement projects are available on Proposition O website: http://www.lapropo.org/sitefiles/lariver.htm.

The draft Legg Lake Management Plan identifies ongoing lake management activities that may impact existing impairments. These activities include the addition of beneficial bacteria to control excessive ammonia from waterfowl feces and to reduce aquatic weeds through the digestion of excessive nutrients in the sediment, signs prohibiting the feeding of waterfowl, and trash and debris removal (County of Los Angeles, 2008). The review of ammonia data did not indicate ammonia to be a problem; however, the reduction of excess bird populations due to bird feeding will reduce nutrient loading to the lake. Additionally, the plan recommends installing duck food dispensing machines and enforcing waterfowl feeding ordinances. These two practices would likely significantly reduce the additional fecal loading to the lake while allowing for bird feeding at the lake. The Legg Lake Management Plan also recommends the installation of bottom laid aeration and dredging to increase circulation and aeration. These activities would likely improve water quality by increasing circulation as well as reducing internal loading from lake sediments. Harvesting of weeds will also remove nutrients from the lake system but can cause repeated disturbance to the aquatic biota. Any ongoing nutrient control efforts should be continued and supplemented with other BMPs or management activities to fully address the existing impairments.

For example, source reduction and pollutant removal BMPs designed to reduce sediment loading could be implemented throughout the watershed as these management practices will also reduce the nutrient loading associated with sediments. Dissolved loading associated with dry and wet weather runoff also contributes nutrient loading to Legg Lake. Some of the sediment reduction BMPs may also result in decreased concentrations of nitrogen and phosphorus in the runoff water. Storage of storm flows in wet or dry ponds may allow for adsorption and settling of nutrients from the water column. BMPs that provide filtration, infiltration, and vegetative uptake and removal processes may retain nutrient loads in the upland areas.

Education of park maintenance staff regarding the proper placement, timing, and rates of fertilizer application will also result in reduced nutrient loading to the lake. Staff should be advised to follow product guidelines regarding fertilizer amounts and to spread fertilizer when the chance of heavy precipitation in the following days is low. Encouraging pet owners to properly dispose of pet wastes will also reduce nutrient loading associated with fecal material that may wash directly into the lake or into storm drains that eventually discharge to the lake. Discouraging feeding of birds at the lake will reduce nutrient loading associated with excessive bird populations.

In order to meet the fine particulate ($PM_{2.5}$) and ozone ($O_3$) national ambient air quality standards by their respective attainment dates of 2015 and 2024, the South Coast Air Quality Management District and the California Air Resources Board have prepared an air quality management plan that commits to reducing nitrogen oxides (NOx, a precursor to both $PM_{2.5}$ and ozone) by over 85 percent by 2024. These reductions will come largely from the control of mobile sources of air pollution such as trucks, buses, passenger vehicles, construction equipment, locomotives, and marine engines. These reductions in NOx emissions will result in reductions of ambient NOx levels and atmospheric deposition of nitrogen to the lake surface.

## 9.6 MONITORING RECOMMENDATIONS

Although estimates of the loading capacity and allocations are based on best available data and incorporate a MOS, these estimates may potentially need to be revised as additional data are obtained. The mass-based loading capacity will be affected by changes in flow volumes; therefore, loading capacities may be reconsidered if significant volume reductions or additions occur.

To provide reasonable assurances that the assigned allocations will indeed result in compliance with the chlorophyll *a* target, a commitment to continued monitoring and assessment is warranted. The purposes of such monitoring will be 1) to determine compliance with wasteload and load allocations, 2) to determine if numeric targets are being attained, 3) to evaluate whether numeric targets and allocations need to be adjusted to attain beneficial uses, 4) to evaluate the efficacy of control measures instituted to achieve the needed load reductions, and 5) to document trends over time in algal densities and bloom frequencies.

To assess compliance with the nutrient TMDLs, monitoring for nutrients and chlorophyll *a* should occur at least twice during the summer months and once in the winter. At a minimum, compliance monitoring should measure the following in-lake water quality parameters: ammonia, TKN or organic nitrogen, nitrate plus nitrite, orthophosphate, total phosphorus, total suspended solids, total dissolved solids and chlorophyll *a*. Measurements of the temperature, dissolved oxygen, pH and electrical conductivity should also be taken throughout the water column with a water quality probe along with Secchi depth measurement. All parameters must meet target levels at half the Secchi depth. DO and pH must meet target levels from the surface of the water to 0.3 meters above the lake bottom. Additionally, in order to accurately calculate compliance with wasteload allocations to the lake expressed in yearly loads, monitoring should include flow estimation or monitoring as well as the water quality concentration measurements. At Legg Lake wasteload allocations are assigned to supplemental water additions and the Whittier Narrows Operable Unit Groundwater Treatment Plant. These sources should be monitored once a year during the summer months (critical conditions) for at minimum, ammonia, TKN or organic nitrogen, nitrate plus nitrite, orthophosphate, total phosphorus, total suspended solids and total dissolved solids.

Wasteload allocations are assigned to stormwater inputs from various subwatersheds. These sources should be measured near the point where they enter the lakes twice a year for at minimum: ammonia, TKN or organic nitrogen, nitrate plus nitrite, orthophosphate, total phosphorus, total suspended solids and total dissolved solids. The nutrient TMDLs for Legg Lake conclude that a 0 percent reduction in total phosphorus loading and a 57.1 percent reduction in total nitrogen loading are needed to maintain a summer average chlorophyll *a* concentration of 20 µg/L. As an example of concentrations that responsible jurisdiction may need to target in order to meet and comply with the mass-based WLAs and LAs, this discussion provides concentrations calculated based on existing flow volumes (a recalculation is needed if flow volumes change). Assuming flow volumes remain at existing levels (Table 9-6), target concentrations may be 0.65 mg-P/L and 1.78 mg-N/L at the outlets of the northern subwatersheds, 1.91 mg-N/L and 0.58 mg-P/L for Caltrans areas, and 0.77 mg-N/L and 0.03 mg-P/L from the groundwater discharge from the Whittier Narrows Operable Unit Groundwater Treatment Plant discharge. Similarly, the targeted concentrations of total phosphorus and total nitrogen in runoff from the direct drainage subwatersheds may be 0.55 mg-P/L and 1.83 mg-N/L; targeted concentrations in the irrigation return flows to the lake may be 1.3 mg-P/L and 3.6 mg-N/L (6.3 percent of the total irrigation volume is assumed to reach the lake). As stated above, these concentrations are provided as guidelines; however, mass-based WLAs must be achieved.

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