DRAFT REPORT

CITY OF LA HABRA HEIGHTS REASONABLE ASSURANCE ANALYSIS

Prepared for

The City of La Habra Heights
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Acronyms

cfs	cubic feet per second
City	City of La Habra Heights
EPA	United States Environmental Protection Agency
EWMP	Enhanced Watershed Management Plan
HRU	Hydrologic Response Unit
IOQC	Interflow Concentrations
LACDPW	Los Angeles County Department of Public Works
LARWQCB	Los Angeles Regional Water Quality Control Board
LSPC	Loading Simulation Program in C++

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NLCD	National Land Cover Dataset
MS4	Municipal Separate Stormwater Sewer System
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
POTFS	Scour Potency Factor
POTFW	Wash-off Potency Factor
RAA	Reasonable Assurance Analysis
SCCWRP	Southern California Coastal Water Research Project
SOQC	Surface Outflow Concentrations
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WMMS	Watershed Modeling Management System
WMP	Watershed Management Plan

The City of La Habra Heights (City) as Co-Permittee to Order R4-2012-0175 conducted a Reasonable Assurance Analysis (RAA) to determine whether the City's waste load allocations for copper, lead, and zinc in Coyote Creek and selenium in San Jose Creek are currently being achieved or will require additional control measures to achieve compliance.

The Watershed Management Modeling System (WMMS) developed for Los Angeles County was utilized to perform the City's RAA. Baseline conditions, critical wet conditions, and critical dry conditions were simulated using the WMMS for both Coyote and San Jose Creek for the time period ranging from January 1, 2000 through March 31, 2012. Based on the obtained results, wet weather exceedances of daily waste load allocations in the City's subwatersheds that drain to Coyote Creek were found less than three percent of the time for copper and less than one percent of the time for zinc. There were no exceedances of lead in during the time period modeled. Dry weather exceedances of copper occurred approximately one percent of the time during dry critical conditions. Waste load allocations for selenium in San Jose Creek were exceeded less than one percent of the time during daily dry critical conditions. It is also noted that the Los Angeles Regional Water Quality Control Board has determined that both Zinc and Selenium are meeting water quality standards in Coyote Creek and San Jose Creek.

Using the State Water Resources Control Board (SWRCB) method of determining impairment for toxicants in water, modeled pollutant loading during critical conditions to Coyote Creek and San Jose Creek from the City's land use is not a major cause of impairment within the waterbodies.

Based on the results of the RAA, additional control measures will not be necessary in order for the City to obtain compliance with waste load allocations. However, the City of La Habra Heights is committed to environmental stewardship and continues to investigate ways to reduce its impact on storm water pollution. Measures that the City will be pursuing are available in the City of La Habra Heights Watershed Management Plan.

The City of La Habra Heights the (City) as Co-Permittee to Los Angeles Regional Water Quality Control Board Order R4-2012-0175 (NPDES Permit No. CAS004001) is required to perform a Reasonable Assurance Analysis (RAA) as part of developing its Watershed Management Plan (WMP). A RAA involves using publicly available modeling software to demonstrate that applicable water quality based effluent limitations and receiving water limitations will be achieved through implementation of the watershed control measures proposed in the WMP. Pollutant combinations assessed by a RAA fall into one of three categories:

- Category 1 (Highest Priority): Water body-pollutant combinations for which water quality-based effluent limitations and/or receiving water limitations are established in Part VI.E, Total Maximum Daily Load (TMDL) Provisions, and Attachments L through R of the Municipal Separate Stormwater Sewer System (MS4) Permit.
- Category 2 (High Priority): Pollutants for which data indicate water quality impairment in the receiving water according to the State Water Resources Control Board's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State's Listing Policy) and for which MS4 discharges may be causing or contributing to the impairment.
- Category 3 (Medium Priority): Pollutants for which there are insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable water limitations contained in Order R4-2012-0175 and for which MS4 discharges may be causing or contributing to the exceedance.

In order to comply with the requirements of the Los Angeles Regional MS4 Permit, the City has decided to conduct a RAA for Category 1 pollutants established in Attachment P (TMDLs in San Gabriel River Watershed Management Area) of the permit. This technical memorandum provides the methodology, assumptions, and limitations used in developing the City's RAA as well as the results of the analysis.

1.1 PHYSIOGRAPHIC SETTING

The City of La Habra Heights is located in the eastern portion of Los Angeles County within the geographic center of the greater Los Angeles metropolitan area. While being located within the second largest urban population center in the United States, the setting of the city is best classified as rural.[1]

Located in the Puente Hills, the City's natural terrain is characterized by canyons and steep hillsides. Elevations in the City range from 350 feet to 1400 feet (City of La Habra Heights, 2004). Among these canyon areas is the Puente Hills Wildlife Corridor which is dominated by native plant communities such as grass lands, inland coastal sage scrub, mixed chaparral, and riparian woodlands. This corridor connects directly to the Cleveland National Forest. Because of the City's small population and natural canyon terrain, native habitats blend with man-made settings. This is enabled by City policies which encourage rural character, animal husbandry, and open space.

[1] Rural has been defined by the City as natural terrain and dense vegetation; houses which blend in with the setting; privacy and large distances between homes; no "city" improvements such as curbs, gutters, sidewalks and streetlights (La Habra Heights, 2004).

The City consists of 6.2 square miles in total land area with an abundance of open space lands including trees, shrubs, grasslands and wildlife, creating a sharp contrast to the dense suburban development found within neighboring cities. The City is committed to protecting its natural and rural environment. Over 20 percent of the City's land area is devoted to permanent, natural open space. Open space refers to unimproved land or water devoted to the preservation of natural resources, for outdoor recreation, or for public health and safety concerns. This includes wildlife habitats, rivers, groundwater recharge areas, and areas with mineral deposits. Trails, parks, outdoor recreation areas, private open space, commercial open space, utility easements, scenic roadways, and areas requiring the regulation of hazardous conditions such as earthquake fault zones, unstable soils, flood plains, and watersheds are also considered open space (City of La Habra Heights, 2004).

1.2 CLIMATE

Like most of Southern California, La Habra Heights has a Mediterranean climate characterized by hot, dry summers, and cool, somewhat rainy winters. Average summer temperatures range from highs in the high 80's to lows in the mid 60's (degrees Fahrenheit). Average winter temperatures range from highs in the low 70's to lows in the high 40's. From November to March, monthly precipitation averages range from approximately 1 to 3 inches (City of La Habra Heights, 2013).

1.3 WATERSHEDS

The City of La Habra Heights is within the San Gabriel River watershed. Surface water runoff from the City drains towards La Mirada Creek and San Jose Creek. La Mirada Creek is a tributary of La Canada Verde Creek which drains to Coyote Creek. Both San Jose Creek and Coyote Creek are tributaries to the San Gabriel River (Figures 1.1 and 1.2). These areas are within the jurisdiction of the Los Angeles Regional Water Quality Control Board (LARWQCB).

The City is within the United States Geological Survey's (USGS) San Gabriel River Hydrologic Unit and the Lower San Gabriel Hydrologic Area. The San Gabriel River Hydrologic Unit has a drainage area of 1,608 square miles. The Lower San Gabriel Hydrologic Area is approximately 165 square miles.

1.3.1 San Gabriel River

The San Gabriel River receives drainage from a 682 square mile area of eastern Los Angeles County and has a main channel length of approximately 58 miles. Its headwaters originate in the San Gabriel Mountains with the East, West, and North Forks. The river flows through a heavily developed commercial and industrial area before emptying into the Pacific Ocean in Long Beach (Figure 1.1). The main tributaries of the river are Walnut Creek, San Jose Creek, and Coyote Creek. At 6.2 square miles, the City comprises less than 1 percent of this overall drainage area.

1.3.2 Coyote Creek Subwatershed

The Coyote Creek subwatershed drains approximately 185 square miles of densely urbanized residential, commercial, and industrial development, along with some areas of open space and natural lands (Table 1.1). Coyote Creek's channel is concrete-lined in the urban areas near the

Los Angeles/Orange County border. Coyote Creek joins the San Gabriel River above the tidal prism in Long Beach south of Willow Street. At the northern end of the subwatershed, La Mirada Creek is a tributary La Canada Verde Creek. La Mirada drains the upper region of the Coyote Creek subwatershed. La Mirada Creek is located within zoned areas of open space.

Table 1.1. Proportion of La Habra Heights within the Coyote Creek Subwatershed

Coyote Creek Subwatershed	
Coyote Creek Watershed	185.0 square miles[1]
City of La Habra Heights	5.1 square miles
City Percent of Watershed	2.8%

Source: LACDPW 2014a

1.3.2.1 San Jose Creek Subwatershed

San Jose Creek drains approximately 83 square miles of urbanized residential, commercial, and industrial development and open space and natural lands (Table 1.2). The creek is concrete lined in its eastern portion and soft bottomed just before it joins the San Gabriel River.

Table 1.2. Proportion of La Habra Heights within the San Jose Creek Subwatershed

San Jose Creek Subwatershed	
San Jose Creek Watershed	83.4 square miles[1]
City of La Habra Heights	1.1 square miles
City Percent of Watershed	1.3%

Source: LACDPW 2014b

Figures 1.1 and 1.2 present the City's jurisdictional boundaries within both the Coyote Creek and San Jose Creek subwatersheds.

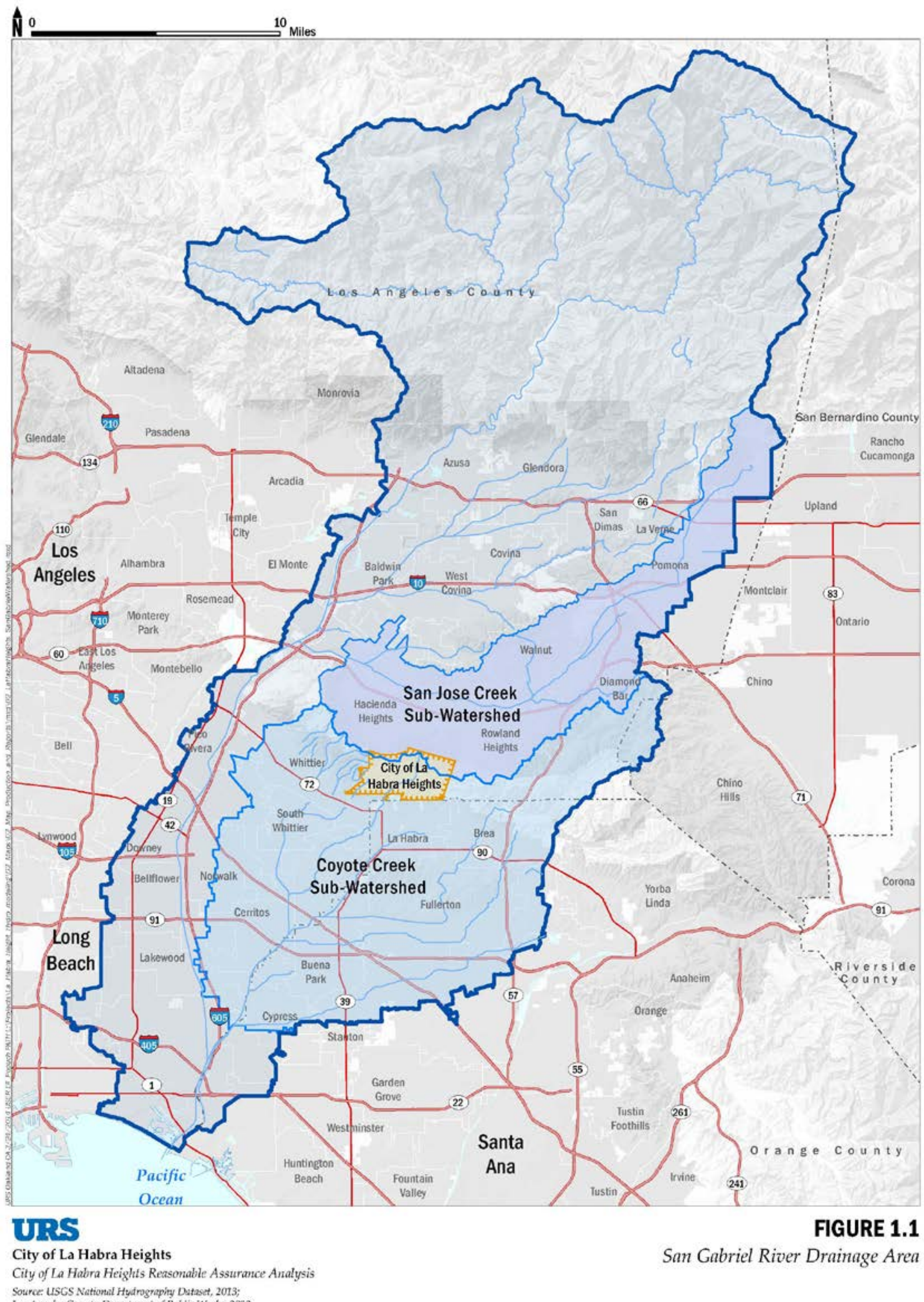


Figure 1.1. Regional Map: Coyote Creek and San Jose Creek Subwatershed Areas within the San Gabriel River Watershed

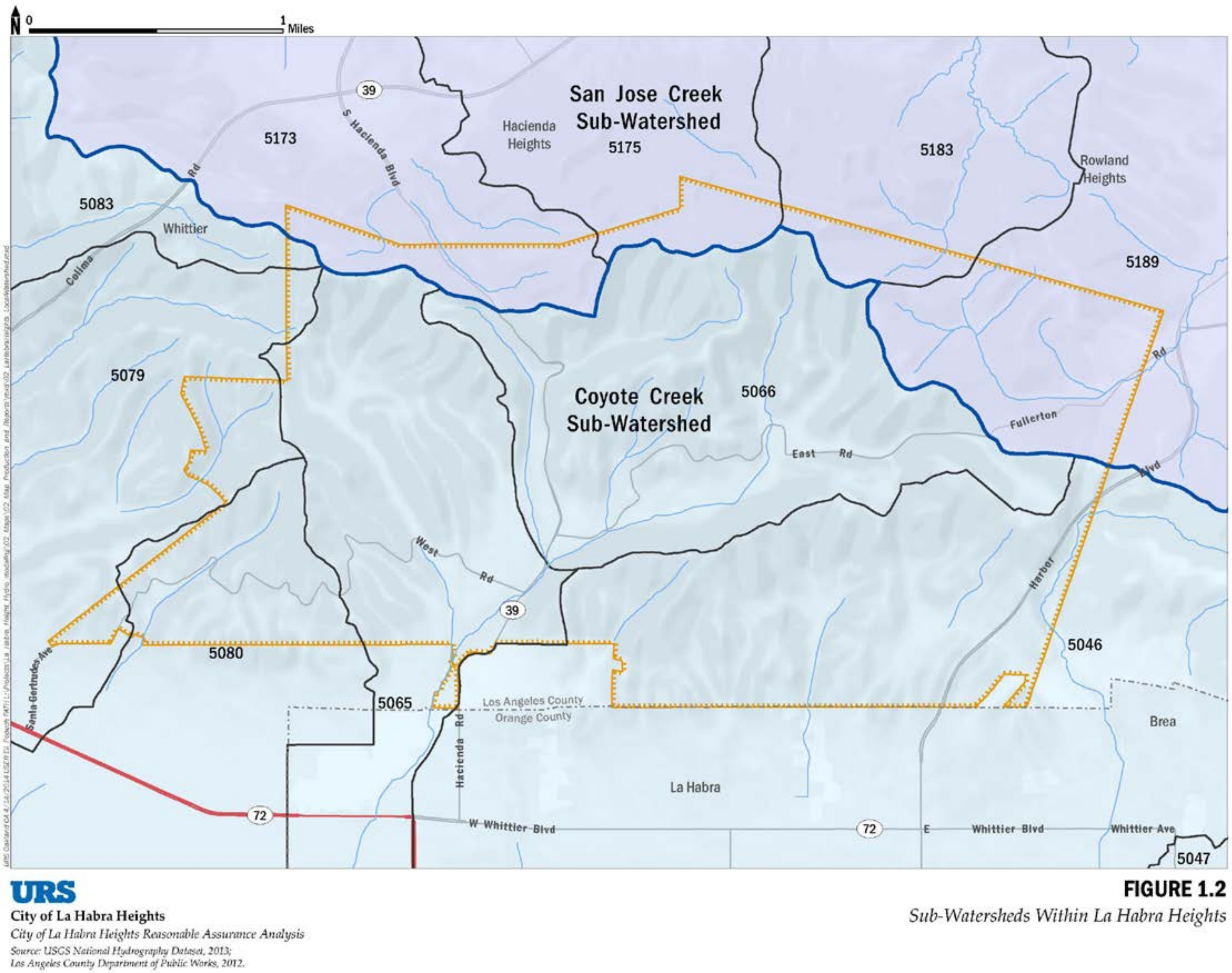


Figure 1.2. Coyote Creek and San Jose Creek Subwatershed Areas within La Habra Heights Jurisdictional Area

LARWQCB adopted Waste Discharge Requirements for MS4 discharges within the Coastal Watersheds of Los Angeles County, Order No. R4-2012-0175 (NPDES Permit No. CAS004001). As required in Part VI.C.5.b.iv (5) of the permit, permittees electing to develop a WMP or enhanced watershed management program (EWMP) are required to submit a RAA as part of their draft E/WMP. The objective of the RAA is to demonstrate the ability of WMPs and EWMPs to ensure that permittees' MS4 discharges achieve applicable water quality based effluent limitations and do not cause or contribute to exceedances of receiving water limitations.

A RAA involves providing an initial assessment of current baseline pollutant loading for water body pollutants using relevant subwatershed data and the best available representative land use and pollutant loading data collected within the last 10 years. Baseline loading estimates include modeling critical conditions that are used in each respective TMDL.

The City of La Habra Heights is conducting this RAA for Category 1 (Highest Priority) pollutants as established in Part VI.E TMDL Provisions and Attachment P of the MS4 Permit. Attachment P lists both Coyote Creek and San Jose Creek as impaired with waste load allocations for a combination of wet weather and dry weather critical conditions as outlined in Table 2.1 below.

Table 2.1. TMDLs in San Gabriel River Watershed Management Area

Name	Pollutant	Waste Load Allocations[1]		Source
		Wet	Dry	
Coyote Creek	Copper	24.71 µg/L x daily storm volume (L)	0.941 kg/day	Vehicle brake pads, atmospheric deposition, soil erosion
	Lead	96.99 µg/L x daily storm volume (L)	N/A	Automobile operation, industry, legacy pollutant
	Zinc	144.57 µg/L x daily storm volume (L)	N/A	Vehicle tires, galvanized metal, atmospheric deposition
San Jose Creek (Reach 1 and 2)	Selenium	N/A	0.232 kg/day 5 µg/L[2]	Soil erosion

Notes:

[1] In Coyote Creek, wet weather Total Maximum Daily Loads apply when the maximum daily flow in the creek is equal to or greater than 156 cubic feet per second (as measured at Los Angeles County Department of Public Works flow gage station F354-R; Dry weather waste load allocations apply when flow at F354-R are below 156 cfs (LARWQCB 2006).

[2] Dry weather Total Maximum Daily Loads apply in San Jose Creek when flow at Los Angeles County Department of Public Works flow gage station F312B is below or equal to the median flow of 19 cubic feet per second (LARWQCB 2006).

Acronyms:
µg/L = micrograms per liter
kg/day = kilograms per day
L = liters
N/A = not applicable

2.1 POTENTIAL SOURCES OF POLLUTANTS OF CONCERN

2.1.1 Copper

Coyote Creek is designated as impaired for dissolved copper and included on the Clean Water Act Section 303(d) list of impaired waterbodies for this pollutant. The source of the dissolved copper in this watershed is unknown (SWRCB 2011). Possible urban sources of metal loading include runoff from light industrial, transportation, and retail/commercial land uses with critical sources from auto repair, motor freight transportation, and auto dealerships. Other potential urban sources of metals to the watershed include wet and dry atmospheric deposition and natural background loading.

Urban sources of copper include industrial sources and vehicle brake pads. Motor vehicles are a major source of copper, a metal that originates from brake pad wear. Copper and other pollutants are deposited on roads and other impervious surfaces and then transported to aquatic habitats via stormwater runoff.

Pollutant loads of copper from urban land uses is expected to decrease due to Senate Bill (SB) 346 which was signed into law on September 25, 2010. This legislation phases out copper in vehicle brake pads over a period of years; milestones include the following dates:

- January 1, 2021: Limits the use of copper in motor vehicle brake pads to no more than five percent by weight.
- January 1, 2025: Limits the use of copper in motor vehicle brake pads to no more than 0.5 percent by weight.

Full implementation of the legislation is expected to remove approximately 61 percent of the copper from urban runoff in metropolitan Los Angeles area watersheds. Although vehicle brake pad wear is not expected to contribute as much copper in rural La Habra Heights as in the more urbanized metropolitan Los Angeles area, a decrease in copper loading is expected from vehicles due to the law’s implementation.

2.1.2 Lead

Coyote Creek is also designated as impaired for lead. The source of lead is associated with wet weather discharges from major municipal point sources (SWRCB 2011). Sources of lead in the urban environment also include automobile operation and industries with practices that may expose metals to stormwater. Lead was formerly used as an additive in gasoline. This has caused widespread contamination of soils near highways and streets and in drainageways in urban areas. Exhaust particulates, fluid losses, drips, spills and mechanical wear products continue to contribute lead to street dust.

2.1.3 Zinc

Coyote Creek has previously been listed as impaired for zinc, but more recently LARWQCB has found that water quality standards are being met in the creek (SWRCB 2011). Dissolved zinc loading can occur during wet weather storm events. Road dust, contaminated by tire wear, and erosion of zinc plated material (i.e. galvanized chain link fences) contributes most of the zinc to urban runoff.

2.1.4 Selenium

San Jose Creek and Coyote Creek have previously been listed as impaired for selenium, but more recently LARWQCB has found that water quality standards are being met (SWRCB 2011). Selenium is not typically associated with urban runoff. However, selenium is present in local marine sedimentary rocks (Orange County 2006). Sources of selenium include irrigation of soils that are naturally high in selenium, activities that mobilize groundwater to the surface (e.g., dewatering activities), petroleum refinery effluents, and runoff or discharges from certain mining activities (EPA 2007). While many of these sources are not relevant to La Habra Heights (i.e. refinery effluents and mining activities), the City is founded on the La Vida Shale member of the Monterey Formation which can contain natural sources of (Dibblee and Ehrenspeck 2001).

It is believed that much of the selenium in San Jose Creek results from natural soils in the watershed because many of the impairments in San Jose Creek occur after the channel becomes soft-bottomed. Special studies will allow further assessment of sources of selenium in San Jose Creek (EPA 2007).

3.1 MODEL SELECTION

The Watershed Management Modeling System (WMMS) was selected to address the modeling needs for the City's RAA. The WMMS is one of the models specified in the MS4 permit for use in conducting a RAA.

WMMS is a regionally calibrated open source model developed for Los Angeles County that utilizes the Loading Simulation Program in C++ (LSPC). LSPC is a comprehensive data management and long-term dynamic rainfall-runoff simulation model system used for continuous simulation of runoff quantity and quality from pervious and impervious lands. The runoff component of the model operates on a collection of subwatershed areas that receive precipitation and generate runoff.

The water quality component of the WMMS utilizes Hydrologic Response Units (HRUs) that represents variability in non-point source pollutant loadings based on land use, soil hydrologic group, slope, and pervious and impervious lands. Specifically, water quality is simulated by the removal of sediment-associated water quality constituents by washoff; this is accomplished in the model by multiplying the washoff detached sediment by a washoff potency factor (the amount of a water quality constituent that is associated with an amount of sediment for a land segment). The WMMS system uses a Microsoft Access database that manages model data and weather text files, which are used to simulate the watersheds.

As per the LSPC manual (Tetra Tech 2009), the subwatersheds found within the jurisdiction of La Habra Heights were truncated to be within the City's boundaries in order to determine its specific loading, only these areas were simulated in the model. HRUs were assigned in each subwatershed based on site specific characteristics of areas within the City. These characteristics include, slope, hydrologic soils group, land use, and degree of imperviousness. None of the regionally calibrated model parameters associated with specific HRU types were modified for the subwatersheds within the City (with the exception of cover and the addition of selenium loading see section 3.2.10 and 3.211 respectively).

3.2 DATA SOURCES & PARAMETERS

Baseline loading from the City was modeled using metrics derived from long-term historical data (daily rainfall, modeled flow/runoff volume, and modeled pollutant loading) using the WMMS for each subwatershed area within the City's jurisdictional area. Baseline loading estimates were generated for both critical conditions (consistent with the TMDL definitions listed in Attachment P of the MS4 permit and/or within the Water Quality Control Plan for the Los Angeles Region) and average conditions for the time period of January 1, 2000 through March 31, 2012. Critical conditions for baseline estimates were based on the following:

- Dry weather critical conditions in Coyote Creek exist when the maximum daily flow at Los Angeles County Department of Public Works (LACDPW) flow gage station F354-R is below 156 cubic feet per second (cfs).
- Wet weather critical conditions exist in Coyote Creek when the maximum daily flow at LACDPW flow gage station F354-R is equal to or above 156 cfs.

- Dry weather critical conditions in San Jose Creek exist when flow at LACDPW flow gage station F312B is below or equal to the median flow of 19 cfs.

Baseline pollutant loading from land use within the City's jurisdictional area was based on the 90th percentile of long term modeled flow rates and constant pollutant loading factors established within the WMMS which are consistent with regionally established event mean concentrations (See Section 3.2.11).

Due to the rural nature of the City of La Habra Heights, the initial assumptions made by the WMMS were refined to use more site-specific loading factors based on each of the City's respective land uses. Specific parameters changed from the baseline WMMS are summarized in Table 3.1, and specifically detailed in as well as the data sources used to refine the WMMS model (see Sections 3.2.1 to 3.2.11). A complete list of all the modeling parameter values used in the RAA can be found in Appendix C.

Table 3.1. Summary of WMMS Parameters Refined in La Habra Heights RAA

Parameter	Baseline Value	Refined Value
Land-based Sediment Contributions (COVER)	0.00 for all pervious HRU	0.27 for all pervious HRU (See Section 3.2.9)
Land Use Attributes (AREA AC)	HRU acreages based on County data and encompass entire subwatershed	HRU acreages based on La Habra Heights General Plan and parcel information. Encompass only the City's jurisdictional area (See Section 3.2.10)
Water Quality Constituents (GQUAL) - Constant Loading Parameters	No SOQC or IOQC values for selenium	SOQC & IOQC values for selenium obtained from Ackerman and Schiff, 2003. (See Section 3.2.11)

Source; Ackerman and Schiff, 2003.

Acronyms:
COVER = fraction of land surface which is shielded from rainfall erosion
GQUAL = general water quality
HRU = hydrologic response unit
IOQC = interflow concentrations
SOQC = surface outflow concentrations

3.2.1 Topography Data

Topography data was acquired from the National Elevation Dataset. The highest resolution files available (0.3 arc seconds; approximately 10 meters) were utilized in the City's RAA model. Slope was calculated from the NED in ArcGIS and the slope was averaged over the City's jurisdictional area. Average slope in the City is over 10 percent, this data was used as a parameter in assigning the appropriate HRUs in the analysis.

3.2.2 Stream Network

Each delineated subwatershed in the WMMS within the City's jurisdiction was represented with a single stream assumed to be a completely mixed, one-dimensional segment with a trapezoidal cross-section. USGS National Hydrography Dataset (NHD) was the original source for stream reach data in the WMMS.

3.2.3 Drainage Area

Drainage area data was determined from utilizing the delineated subwatershed shapefile within the WMMS with consideration of the City's jurisdictional border. The watershed boundaries in the WMMS are HUC-12 equivalent boundaries relative to the national HUC-12 boundaries. The areas obtained for each subwatershed draining the City is summarized in Table 3.2.

Table 3.2. Drainage Area By Subwatershed

Watershed	WMMS Subwatershed	Area of Subwatershed within the City (acres)	Total Subwatershed Area (acres)	Percent of Subwatershed within the City (%)
Coyote Creek	5046	901.3	4,873.7	18.5
	5065	751.5	1,140.5	65.9
	5066	1,170.0	1,170.0	100.0
	5079	140.4	1,477.6	9.5
	5080	270.3	1,501.1	18.0
	5083	8.5	1,028.5	0.8
San Jose Creek	5173	156.9	2,409.3	6.5
	5175	81.1	1,603.8	5.1
	5183	78.1	1,318.3	5.9
	5189	383.6	2,274.8	16.9

Sources: LACDPW 2012 and Wilhelm 2014

3.2.4 Meteorological Data

Meteorological data is a critical component of the watershed model. LSPC requires appropriate representation of precipitation and potential evapotranspiration. Hourly precipitation (or finer resolution) data was used in the model. Rainfall-runoff processes for each subwatershed were driven by precipitation data from the most representative station. Two precipitation and evapotranspiration meteorological stations were utilized by the WMMS model in the LHH RAA and are listed below in Tables 3.3 and 3.4 with their locations illustrated in Figure 3.1.

Table 3.3. Precipitation Station Data used in the La Habra Heights RAA

Station #	Description	Latitude (deg°min'sec'')	Longitude (deg°min'sec'')	Elevation (ft)	Percent Complete	Start Date	End Date
1088B	La Habra Heights - Mutual Water Co.	33°56'52''	117°57'55''	445	100%	01/04/1986	04/26/2012
106F	Whittier City Hall	33°58'57''	118°02'50''	300	100%	01/02/1986	04/26/2012

Acronyms:
ft = feet
deg= degree
min=minute
sec=second

Table 3.4. Evapotranspiration Station Data used in the La Habra Heights RAA

Station #	Description	Latitude (deg°min'sec'')	Longitude (deg°min'sec'')	Elevation (ft)	Percent Complete	Start Date	End Date
23129	Long Beach Daugherty Airport	33°49'60''	118 °10'00''	10	100%	12/31/1985	04/30/2012
96	Puddingstone Dam	34 °05'31''	117 °48'24''	1030	100%	12/31/1985	04/30/2012

Acronyms:
ft = feet
deg= degree
min=minute
sec=second

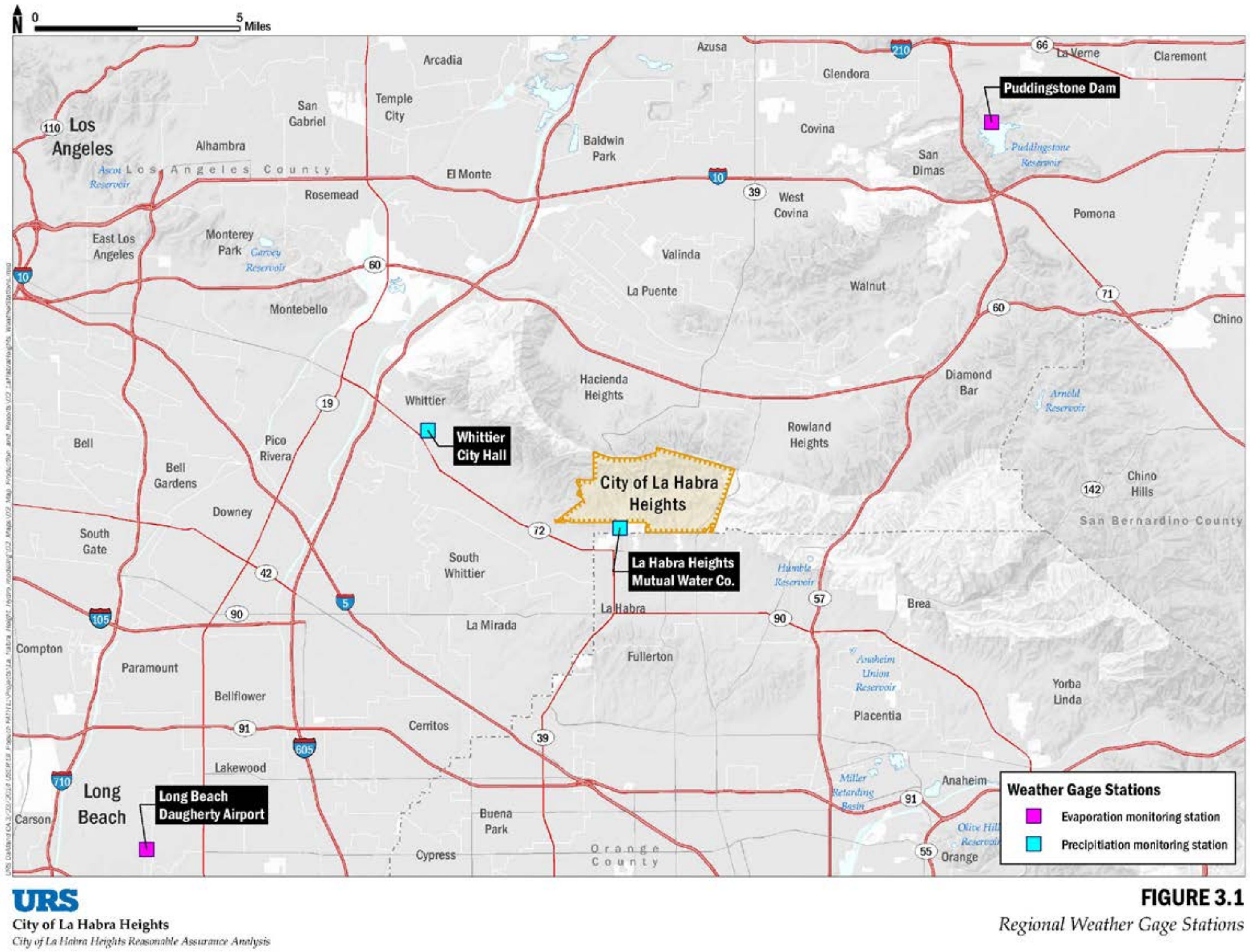


Figure 3.1. Location of Meteorological Stations

3.2.5 Soils

Soil data for the watersheds were obtained from the State Soil Geographic Database (STATSGO2) provided by the Natural Resources Conservation Service (NRCS 2006). The STATSGO2 data was used to determine the total area that each hydrologic soil group covered within each sub-watershed. The sub-watersheds were represented by the hydrologic soil group that had the highest percentage of coverage within the boundaries of the sub-watershed and are summarized in Table 3.5.

There are four main hydrologic soil groups (Groups A, B, C, and D). These groups, which are described below, range from soils with low runoff potential to soils with high runoff potential (USDA 1997).

- **Group A Soils:** Have high infiltration rates and consist of soils that are deep and well drained to excessively drained and are often sandy with coarse textures.
- **Group B Soils:** Have moderate infiltration rates when wet and consist chiefly of soils that are moderately deep to deep, moderately well to well drained, and moderately fine to moderately course textures.
- **Group C Soils:** Have slow infiltration rates and are soils with layers impeding downward movement of water, or soils that have moderately fine or fine textures.
- **Group D Soils:** Have very slow infiltration rates and have soils that are clayey and impede downward movement of water, or can be shallow soils over an impervious layer. Soils have a high water table.

The predominant soils identified within the City consist mainly of Soper-Fontana-Calleguas-Balcom-Anaheim and Zamora-Urban Land-Ramona soil types which belong to hydrologic soil group C or D respectively. A small outcropping of the Urban Land-Sorrento-Hanford soil type is located within subwatershed 5080 which belong to hydrologic soil group B.

Table 3.5. Hydrologic Soils Group By Subwatershed

Watershed	Subwatershed	Soil Map Unit Key	Percent of Subwatershed	Hydrologic Soils Group
Coyote Creek	5046	660477	55%	C
		660480	45%	
	5065	660477	73%	C
		660480	27%	
	5066	660477	100%	C
	5079	660477	77%	C
		660480	23%	
	5080	660477	10%	D
		660480	90%	
	5083	660477	100%	C

Table 3.5. Hydrologic Soils Group By Subwatershed

Watershed	Subwatershed	Soil Map Unit Key	Percent of Subwatershed	Hydrologic Soils Group
San Jose Creek	5173	660477	100%	C
	5175	660473	12%	C
		660477	88%	
	5183	660477	100%	C
	5189	660477	100%	C

Source: NRCS 2006

660473: Urban Land-Sorrento-Hanford

660477: Soper-Fontana-Calleguas-Balcom-Anaheim

660480: Zamora-Urban Land-Ramona

3.2.6 Reach Characteristics

Reach characteristics in WMMS were pre-populated during the initial model development and were not altered in the City's RAA analysis. The original source of reach characteristics were obtained from the USGS NHD.

3.2.7 Point Sources

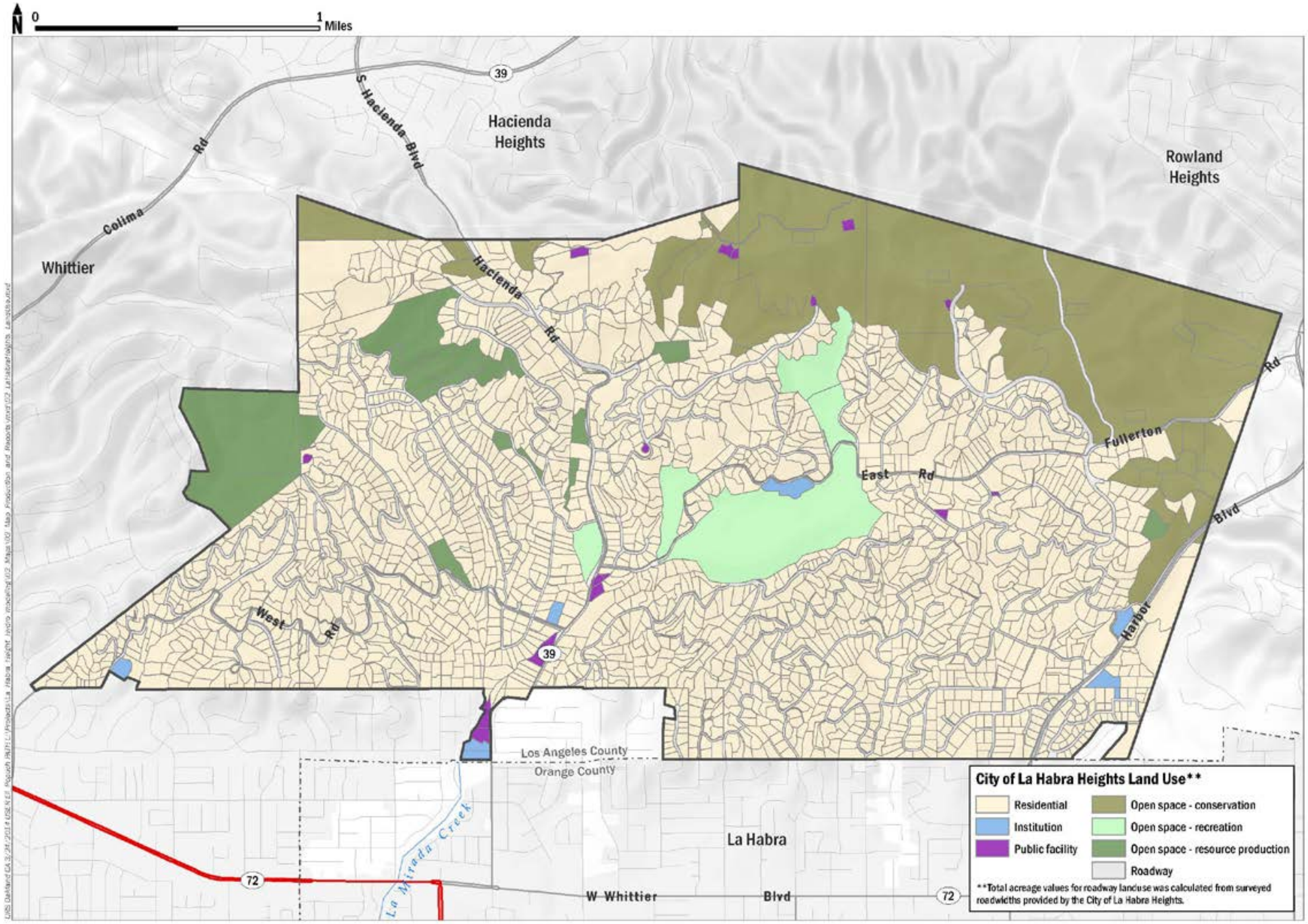
There are no point source discharges (other than MS4 discharges) within the City's boundaries. This was confirmed through querying the following databases:

- United States Environmental Protection Agency's (EPA) Storage and Retrieval Data Warehouse
- State Water Resources Control Board's California Integrated Water Quality System
- State Water Resources Control Board's Storm Water Multiple Application and Report Tracking System

3.2.8 Land Use

Parcel and zoning data was acquired from the City of La Habra Heights (Wilhelm 2014). Post-processing of the data included delineating city roadways into a city roads land use category and determining percent impervious and pervious cover.

Land use within the City falls into seven categories as described by La Habra Heights General Plan (La Habra Heights 2004) (Figure 3.2). The City's land use types and corresponding WMMS HRUs are described below to provide support for the percent impervious assumptions.



URS

City of La Habra Heights

City of La Habra Heights Reasonable Assurance Analysis

Source: City of La Habra Heights, 2013.

FIGURE 3.2

City of La Habra Heights Land Use

Figure 3.2. Land Use in the City of La Habra Heights

3.2.8.1 Residential

Residential land use is the most common land use within the City of La Habra Heights. Most residential dwelling units within the City are single-family detached units. A typical residential parcel within the City is one- acre in size with the total hardscape limited by hardscape area standards. For the purposes of the RAA model, a residential parcel is assumed to be 21 percent impervious due to hardscape of the residence's footprint and associated private roads. This assumption is based on information acquired from the 2006 National Land Cover Dataset (NLCD) Land Use Land Cover Data Set (Fry et. al 2011) and supported with information from the Los Angeles County Hydrology Manual (LACDPW 2006).

3.2.8.2 Public Facilities

There are two categories of public facilities in La Habra Heights. One category includes facilities that are directly under the control of the City: the City Hall, the Community Center, and the Fire Department. The other category is composed of public facilities answerable to non-local mandates; these include the water district facilities, portions of the communications antenna farm and the power transmission sites throughout the City. The 2006 NLCD Land Use Land Cover Data Set was not used to determine percent impervious cover for public facilities due to the relatively large cell size used in the dataset (30 meter) compared with the relatively small total land use of public facilities in the City. Percent impervious for public facilities are assumed to be 80 percent in the RAA based on average institutional values from the Los Angeles County Hydrology Manual (LACDPW 2006).

3.2.8.3 Institutions

Institutional land uses include those uses that are neither residential nor public facilities. They are private or quasi-public facilities. These uses provide services to individuals that can include educational, health, religious, and cultural activities. In many cases, more than one of these services are offered at the same location. Institutional uses do not include commercial or industrial activities, which are not allowed or zoned for in the City of La Habra Heights. These private and quasi-private institutions are permitted only in areas served by the single arterial highway (Hacienda Road) within the City. Like in public facilities, the 2006 NLCD Land Use Land Cover Data Set was not used to determine percent impervious cover and was assumed to be 80 percent in the RAA based on average Institutional values from the Los Angeles County Hydrology Manual (LACDPW 2006).

3.2.8.4 Open Space – Conservation

Approximately 20 percent of the City's land area is land owned by the Puente Hills Land Fill Native Habitat Preservation Authority. The Authority's property in La Habra Heights is part of a wildlife corridor that extends from the San Gabriel River to the Cleveland National Forest. This corridor will persist if dedicated links of regional open space can continue to be acquired for natural conservation purposes. All open space land uses are assumed to be completely pervious for the purpose of the RAA due to the WMMS model not including a HRU that considers natural areas of imperviousness (i.e. rock formations).

3.2.8.5 Open Space – Recreation

The category of open space for recreation includes the Hacienda Golf Club and the Las Palomas Riding Ring, which are member-supported recreational facilities, as well as Powder Canyon, and the City Park. Open Space is assumed to be zero percent impervious due to minimal amounts of hardscape in these areas.

3.2.8.6 Open Space – Resource Production

A number of sites throughout the City are identified as open space that have historically been used for, or can potentially be used for, production of natural gas and oil. Property owners may request a change of land use designation and its implementing zoning. As it now exists, such land may not be suitable for residential uses and must be cleaned or remediated before it is safe for human habitation. State law mandates the necessary procedures to convert the natural gas and oil well sites to other uses.

3.2.8.7 City Roads

Roadways in the city of La Habra Heights consist of mainly residential, lane, country roads, and traffic corridors (specifically Hacienda Blvd). Local streets are lightly traveled and narrow. Spatial information regarding roads under the jurisdiction of the City was obtained from La Habra Heights Geographic Information System circulation layer (Wilhelm 2014). The area of city roads was combined with the land use layer to provide spatial information for each HRU. City roads are considered to be rural with an imperviousness of 45 percent (CalEPA 2010).

Geographic Information System data was not available for private roads; as such, the RAA includes private roads as part of the Residential HRU with respect to loading.

3.2.9 Assigning Hydrologic Response Groups

The narrative descriptions in combination with a subwatershed's average slope, hydrologic soil group, and proportion of imperviousness were used to assign acreages to different HRUs that the WMMS model utilizes in determining the loading of pollutants. The proportion of each land use assigned to a specific HRU is summarized in Table 3.6. Residential parcels required further assessment as multiple HRUs are applicable. In order to accomplish this 20 random residential parcels were chosen and the land use visually assessed to determine the appropriate acreages to assign in the model. Descriptions of HRUs utilized by the La Habra Heights RAA are described below.

Table 3.6. Land Use and Hydrologic Response Group Comparison

La Habra Heights Parcel Zoning	WMMS HRU[1]	Proportion of Land Use	Impervious / Pervious
Residential	Low Density Single Family Steep	0.21	Impervious
	Vacant Steep	0.70	Pervious
	Agriculture Moderate Slope	0.02	Pervious
	Urban Grass Irrigated	0.07	Pervious
Public Facilities	Institutional	0.80	Impervious
	Urban Grass Non-Irrigated	0.20	Pervious
Institutions	Institutional	0.80	Impervious
	Urban Grass Non-Irrigated	0.20	Pervious
Open Space- Conservation	Vacant Steep	1.00	Pervious
Open Space- Recreation	Urban Grass Irrigated	1.00	Pervious
Open Space- Resource Production	Vacant Steep	1.00	Pervious
City Roads	Secondary Roads	0.45	Impervious
	Urban-Grass Non-Irrigated	0.55	Pervious

Notes: [1] Vacant Steep and Agricultural HRU assigned dependent on the hydrologic soil group assigned in each subwatershed (Tetra Tech 2010a and 2010b).

3.2.9.1 Institutional

Institutional land is impervious, urban land managed by institutions (e.g. schools, government buildings, etc.).

3.2.9.2 Urban Grass Non Irrigated

Urban Grass Non Irrigated is pervious urban land with natural cover such as trees, shrubs, or bare ground.

3.2.9.3 Urban Grass Irrigated

Urban Grass Irrigated is pervious urban land with managed vegetation. This includes irrigated lawns, landscaped areas, and other urban grass.

3.2.9.4 Vacant Steep (C and D)

Vacant Steep is pervious land that has no designated use (i.e. vacant), has a slope of 10 percent or greater, and moderately high to high runoff potential when thoroughly wet.

3.2.9.5 Low Density Single Family Steep

Low Density Single Family is urban, impervious land used for single family homes with a slope of 10 percent or greater. In the City's RAA, private roads are also included within this HRU.

3.2.9.6 Agriculture Moderate Slope (B and D)

Agriculture Moderate Slope is pervious land used for agriculture with a slope of less than 10 percent. While the average slope in the City is typically greater than 10 percent, no corresponding HRU for a steep classification exists within the WMMS and the moderate slope HRU was deemed most appropriate for use. Additionally, there is no Agricultural HRU that corresponds with a C hydrologic soil group, therefore the D grouping was used in order to assume a worst case scenario.

3.2.9.7 Secondary Roads

Secondary Roads is impervious land used as roadways. This includes residential streets, but not major motor transportation arteries such as freeways.

3.2.10 Canopy Cover

Percent tree canopy cover was determined over the City's jurisdictional area using Percent Tree Canopy (Version 1.0) data from the 2001 National Land Cover Database (Homer et. al 2007). The percent tree canopy cover was averaged over the City's jurisdictional area and an average value of 27 percent was obtained. This value was then applied to all pervious land use HRU's within the RAA.

3.2.11 Pollutant Loading

WMMS includes estimates of continuous and variable water quality concentrations for each modeled subwatershed that are consistent with event mean concentrations by calibrating to in-stream monitoring data throughout the region. This calibration was fully documented, and is consistent with methods used in LSPC modeling efforts previously performed by EPA to support TMDL development (Tetra Tech 201a and 2010b). A review of regional data show that pollutant delivery varies spatially and temporally with storm size. Because the WMMS-LSPC calibration uses continuous simulation (rather than only using event mean concentrations that are static), it predicts long term, continuous, hourly water quality concentrations in a robust and representative way.

Calibration of selenium was not accomplished in the WMMS as it was not a pollutant considered during the models design. Pollutant loading data for selenium (Table 3.7) was obtained from a study performed by Ackerman and Schiff of Southern California Coastal Water Research Project (SCCWRP) in 2003. Information provided from the study was used to populate selenium concentrations in surface outflow and interflow (SOQC and IOQC) parameters for HRUs. Due to a lack of monitoring data for selenium, the wash-off potency factor (POTFW) and scour potency factor (POTFS) for HRUs were unable to be calculated.

Table 3.7. Pollutant Loading Factors for Selenium assigned to Hydrologic Response Units

SCCWRP Land Use	Corresponding HRU	SOQC (µg/L)	IOQC (µg/L)
Agriculture	Agriculture Moderate Slope (D)	1.86	1.86
Commercial	Institutional	0.35	0.35
Open	Vacant Steep (C/D)	0.35	0.35
	Open Space		
	Urban Grass Irrigated		
	Urban Grass Non-Irrigated		
Residential	Low Density Single Family Steep	0.47	0.47

Source: Ackerman and Schiff 2003

Acronyms:
µg/L
HRU = hydrologic response unit
IOQC = concentrations in interflow
SCCWRP = Southern California Coastal Water Research Project
SOQC = concentrations in surface outflow

4.1 ASSUMPTIONS

Assumptions are inherent to the modeling process when attempting to represent a natural system as accurately as possible. Assumptions in the City's RAA are consistent with assumptions used in developing the WMMS (Tetra Tech 2010a and 2010b). The assumptions associated with the LSPC model and its algorithms are described in the Hydrological Simulation Program - Fortran User's Manual (Bicknell et al. 2001). There were several additional modeling assumptions used in the La Habra Heights model which deviate from the initial WMMS model, which are summarized below.

- The average percent of canopy cover for all pervious HRU designations within the City's jurisdictional area is assumed to be 27 percent based upon Percent Tree Canopy (Version 1.0) data from the 2001 National Land Cover Database (Homer et. al 2007).
- Loading contributions from North Harbor Blvd were excluded from the analysis as it is under the jurisdiction of Los Angeles County.
- Private roads in La Habra Heights contain little vehicle traffic and therefore are assumed to function more closely to the low density single family HRU than the secondary roads HRU.
- Open Space areas are assumed to be 100 percent permeable due to the lack of availability of an HRU that considers natural areas of imperviousness (i.e. rock formations).

4.2 LIMITATIONS

- The WMMS model is not intended to accurately represent all non-storm-related base flow hydrologic conditions.
- While the WMMS was calibrated regionally, local calibration of the model could not be accomplished due to the absence of flow gage stations and appropriate water quality data within the modeled subwatersheds. Methodology for how the WMMS model is regionally calibrated can be found in the Los Angeles County Watershed Model Configuration and Calibration Reports (Tetra Tech 2010a and 2010b)
- Flow data for Coyote Creek gage F354-R was available only for dates December 1, 2001 through October 1, 2002 and September 30, 2003 through April 26, 2012. As such, the analysis for critical conditions in Coyote Creek encompassed only those days with stream gage data.
- Flow data for San Jose Creek gage F312B contains a data gap for the periods of February 24, 2000 through February 29, 2000 and February 12, 2001 through March 8, 2001. Due to missing data, the analysis for dry critical conditions in San Jose Creek could not be accomplished for these dates.
- Wash-off potency factors and scour potency factor for selenium were not developed during the WMMS model creation. Pollutant loading for selenium in WMMS was instead accomplished by using modeled runoff and event mean concentrations determined by Ackerman and Schiff of SCCWRP.

5.1 SUMMARY OF MODEL OUTPUT

5.1.1 Baseline Loading – Average Conditions

As discussed in Section 3.2, baseline loading of pollutants in the RAA is based upon the 90th percentile of modeled flow from the period of January 1, 2000 through March 31, 2012. Results of the RAA are summarized for Coyote Creek and San Jose Creek in Tables 5.1 and 5.2 below. The 90th percentile of flow was relatively low for all subwatersheds within both Coyote and San Jose Creeks which is expected due to the relatively small size of the watersheds and the large number of days with no rainfall. In all Coyote Creek subwatersheds, baseline loading of copper, lead, and zinc were relatively low, with the highest baseline loading concentrations of copper, lead and zinc occurring in subwatershed 5079. Average baseline selenium loading was also very low in all subwatersheds of San Jose Creek during the simulation period with the highest modeled concentration observed in subwatershed 5175.

Table 5.1. Modeled Baseline Average Concentrations in Coyote Creek Subwatersheds

Subwatershed	Modeled 90th Percentile of Flow (cfs)	Copper (µg/L)	Lead (µg/L)	Zinc (µg/L)
5046	0.565	0.017	0.008	0.067
5065	1.311	0.014	0.007	0.063
5066	0.822	0.040	0.020	0.172
5079	0.066	0.061	0.027	0.271
5080	0.170	0.017	0.008	0.065
5083	0.004	0.008	0.003	0.017

Table 5.2. Modeled Baseline Average Concentrations in San Jose Creek Subwatersheds

Subwatershed	Modeled 90th Percentile of Flow (cfs)	Selenium (µg/L)
5173	0.095	0.007
5175	0.039	0.013
5183	0.024	0.007
5189	0.182	0.012

5.1.2 Baseline Loading – Critical Conditions

The total number of critical event days (days in which the critical conditions are met) was determined by comparing stream flow data from gage F354-R with the wet weather critical condition criteria (average daily flow greater than 156 cfs). Daily output concentrations from the model for the identified critical event days were then compared against the applicable waste load allocation. Results detailing wet weather critical conditions in Coyote Creek show higher average concentrations of copper, lead, and zinc when compared to baseline conditions which was expected due to increased runoff and mobilization of sediment which can contain sorbed metals (Table 5.3).

The number of modeled exceedances for copper, lead and zinc in each subwatershed of Coyote Creek during wet weather critical conditions were compared against the SWRCB's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (SWRCB 2004). The minimum number of exceedances necessary for a subwatershed to be considered impaired based on the total number of critical event days is 55 (for each respective pollutant). The largest number of modeled exceedances in Coyote Creek was 19 (2.99 %) for copper in subwatershed 5083, well below the threshold for impairment. There were no exceedances for lead during wet weather critical conditions in Coyote Creek and the maximum number of exceedances for zinc was five (0.16%) in subwatershed 5083. Results for the number of wet weather critical condition waste load allocation exceedances are summarized in Table 5.4.

Table 5.3. Modeled Average Concentrations for Wet Critical Conditions in Coyote Creek Subwatersheds

Subwatershed	Copper (µg/L)	Lead (µg/L)	Zinc (µg/L)
5046	2.95	1.29	10.26
5065	1.33	0.59	5.27
5066	2.76	1.24	10.58
5079	2.68	1.11	10.71
5080	2.95	1.30	9.96
5083	2.39	0.79	4.95

Table 5.4. Number of Exceedances for Wet Critical Conditions in Coyote Creek Subwatersheds

Watershed	Total # of Critical Event Days	# of Copper Exceedances	Copper Exceeded (%)	# of Lead Exceedances	Lead Exceeded (%)	# of Zinc Exceedances	Zinc Exceeded (%)
5046	635	16	2.50	0	0	4	0.63
5065	635	4	0.63	0	0	0	0
5066	635	14	2.20	0	0	5	0.79
5079	635	15	2.36	0	0	5	0.79
5080	635	16	2.50	0	0	4	0.63
5083	635	19	2.99	0	0	1	0.16

Notes: In Coyote Creek, wet weather Total Maximum Daily Loads apply when the maximum daily flow in the creek is equal to or greater than 156 cubic feet per second as measured at Los Angeles County Department of Public Works flow gage station F354-R

The process for determining the number of dry weather critical event days in Coyote Creek was similar to wet critical condition events (in this case comparing against days with an average flow at F354-R below 156 cfs). Results for dry weather critical conditions for copper in Coyote Creek demonstrated average concentrations lower than baseline and wet critical conditions as expected (Table 5.5). In order to determine whether the dry group waste load allocation for copper was being met, the proportion of the subwatershed area within the larger Coyote Creek watershed was multiplied by the waste load allocation of 0.941 kg/day. The number of modeled exceedances for copper in each subwatershed of Coyote Creek during dry weather critical conditions was again small ranging from 25 to 36 (0.9 to 1.3%) in the six modeled subwatersheds of Coyote Creek (Table 5.6). The number of critical dry weather exceedances was compared with SWRCB's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (SWRCB 2004). The minimum number of exceedances necessary for a subwatershed to be considered impaired based on the total number of dry critical event days is 251.The largest number of modeled dry weather exceedances in Coyote Creek was 36 for copper in subwatershed 5080, well below the threshold for impairment.

Table 5.5. Modeled Average Concentrations for Dry Critical Conditions in Coyote Creek Subwatersheds

Subwatershed	Copper (µg/L)
5046	0.18
5065	0.08
5066	0.17
5079	0.16
5080	0.18
5083	0.18

Table 5.6. Number of Exceedances for Dry Critical Conditions in Coyote Creek Subwatersheds

Watershed	#of Critical Event Days[1]	Copper Waste Load Allocation[2] (kg/day)	# of Copper Exceedances	Copper Exceeded (%)
5046	2772	0.00716	36	1.3
5065	2772	0.00597	36	1.3
5066	2772	0.00930	34	1.2
5079	2772	0.00112	25	0.9
5080	2772	0.00215	36	1.3
5083	2772	0.00007	33	1.2

Notes: [1]In Coyote Creek, wet weather Total Maximum Daily Loads apply when the maximum daily flow in the creek is equal to or greater than 156 cubic feet per second as measured at Los Angeles County Department of Public Works flow gage station F354-R

[2] Waste load allocations for dry critical conditions are based on the proportion of the Coyote Creek watershed area within the City's jurisdiction multiplied by the grouped waste load allocation.

The number of dry weather critical events in San Jose Creek was determined based on median flow at LACDPW flow gage station F312B, days with an average flow below or equal to the median flow of 19 cfs were considered to be dry critical condition days with a dry waste load allocation in effect. Modeled average concentrations for selenium during dry critical conditions ranged from 0.002 to 0.006 µg/L in the four San Jose Creek subwatersheds within La Habra Heights (Table 5.7). Like copper in Coyote Creek, selenium is a shared waste load allocation amongst the permittees. The waste load allocation for the City was determined by taking the waste load allocation of 0.232 kg/day and multiplying it by the proportion of the watershed that that is within the City's jurisdictional borders (Table 5.8).

While modeled selenium loading contributions were small in the San Jose Creek subwatersheds, there were some exceedances of the waste load allocation. Modeled exceedances of the selenium waste load allocation amounted from four to six critical condition days (0.26 to 0.39%). The number of exceedances was small when compared with the 136 exceedances necessary to demonstrate impairment based on the number of critical condition days as per the SWRCB policy for determining impairment. The largest number of modeled exceedances occurred in subwatershed 5173. This is most likely due to the relatively large proportion of residential land use which has a larger EMC value for selenium compared to open space (which is the major land use in the other subwatersheds draining to San Jose Creek).

Table 5.7. Modeled Average Concentrations for Dry Critical Conditions in San Jose Creek Subwatersheds

Subwatershed	Selenium (µg/L)
5173	0.006
5175	0.005
5183	0.002
5189	0.005

Table 5.8. Number of Exceedances for Dry Critical Conditions in San Jose Creek Subwatersheds

Watershed	#of Critical Event Days	Waste Load Allocation[1] (kg/day)	# of Selenium Exceedances	Selenium Exceeded (%)
5173	1533	0.0007	6	0.39
5175	1533	0.0004	4	0.26
5183	1533	0.0003	0	0
5189	1533	0.0017	0	0

Notes: [1] The dry-weather loading capacity for San Jose Creek Reach 1 is 0.232 kg/day, which is the product of the numeric target for selenium (5 µg/L) and the median non-water reclamation plant flow of 19 cubic feet per second (LARWQCB 2006). Waste load allocation based on the proportion of the San Jose Creek watershed area within the City's jurisdiction multiplied by the grouped waste load allocation.

5.1.3 Control Measures

Based on the low levels of modeled exceedances for all considered pollutants in the RAA and determining that the modeled exceedances were not causing impairment per the policy, it is not necessary for the City to implement additional control measures specifically to the control of pollutants with waste load allocations in the San Gabriel River Management Area. However, additional control measures are being considered by the City's WMP in order to take a proactive approach in managing the City's stormwater and watersheds.

6.1 CONCLUSIONS

The obtained results from the RAA suggest that the City's land use is not a major source of impairment in the Coyote Creek and San Jose Creek watersheds. Wet weather exceedances of waste load allocations in the City's subwatersheds that drain to Coyote Creek was less than three percent for copper and less than one percent for zinc. There were no exceedances of lead during the time period modeled. Dry weather exceedances of copper occurred approximately one percent of the time when dry critical conditions existed. Waste load allocations within San Jose Creek for selenium were exceeded less than one percent of the time within the City's subwatersheds that drain to San Jose Creek. Based on the models results and SWRCB's method of determining impairment for toxicants, waste load allocation exceedances during critical conditions for Coyote Creek and San Jose Creek from the City's land use is not a major cause of impairment within the waterbodies.

Additional control measures will not be necessary in order for the City to obtain compliance with waste load allocations based on the results of the City's RAA. However, the City of La Habra Heights is committed to environmental stewardship and continues to investigate ways to reduce its impact on storm water pollution. Best management practices that the City will be pursuing are available in the City of La Habra Heights Watershed Management Plan.

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Appendix A

Model Output

HYDROGRAPHS

Coyote Creek Subwatershed Hydrographs

Figure A.1. Coyote Creek Subwatershed 5046 Hydrograph (01/01/2000 – 03/31/2012)

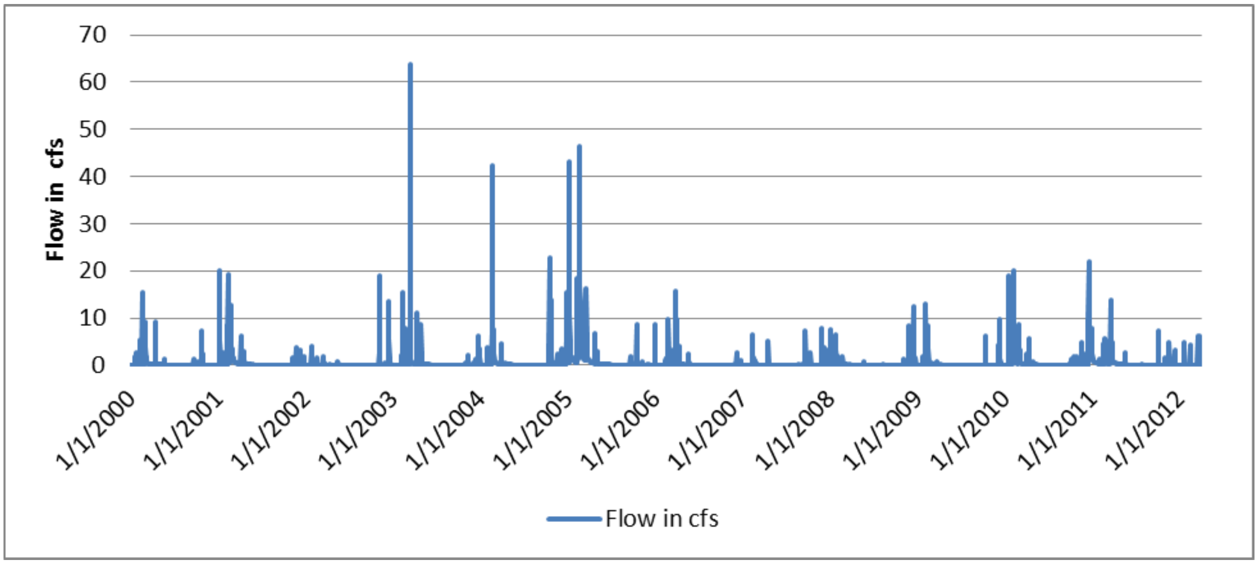


Figure A.2. Coyote Creek Subwatershed 5065 Hydrograph (01/01/2000 – 03/31/2012)

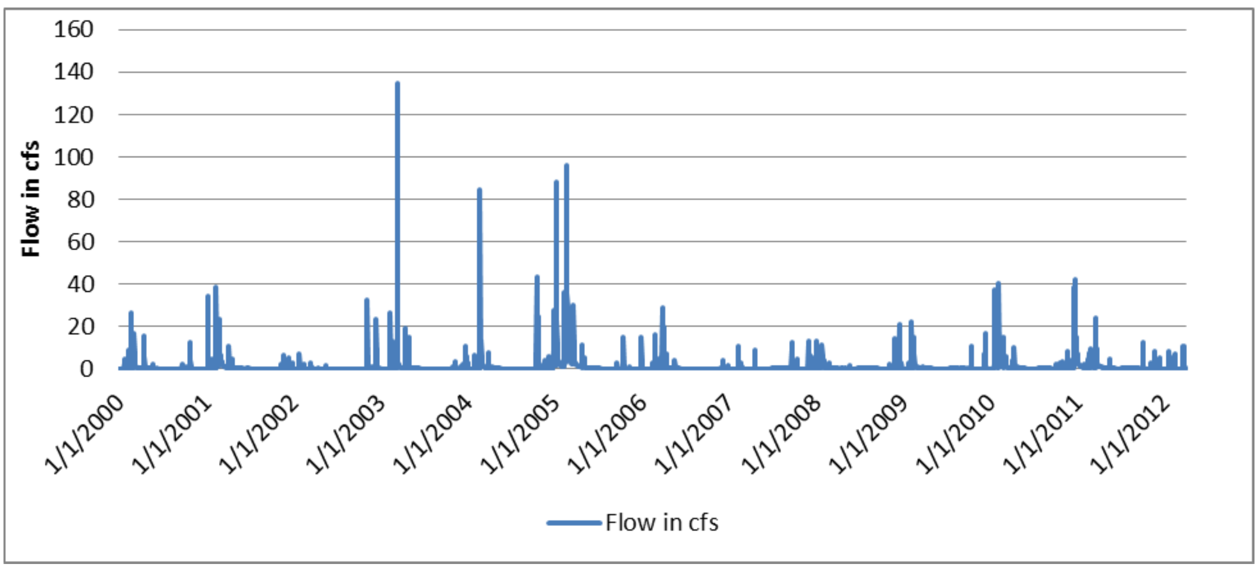


Figure A.3. Coyote Creek Subwatershed 5066 Hydrograph (01/01/2000 – 03/31/2012)

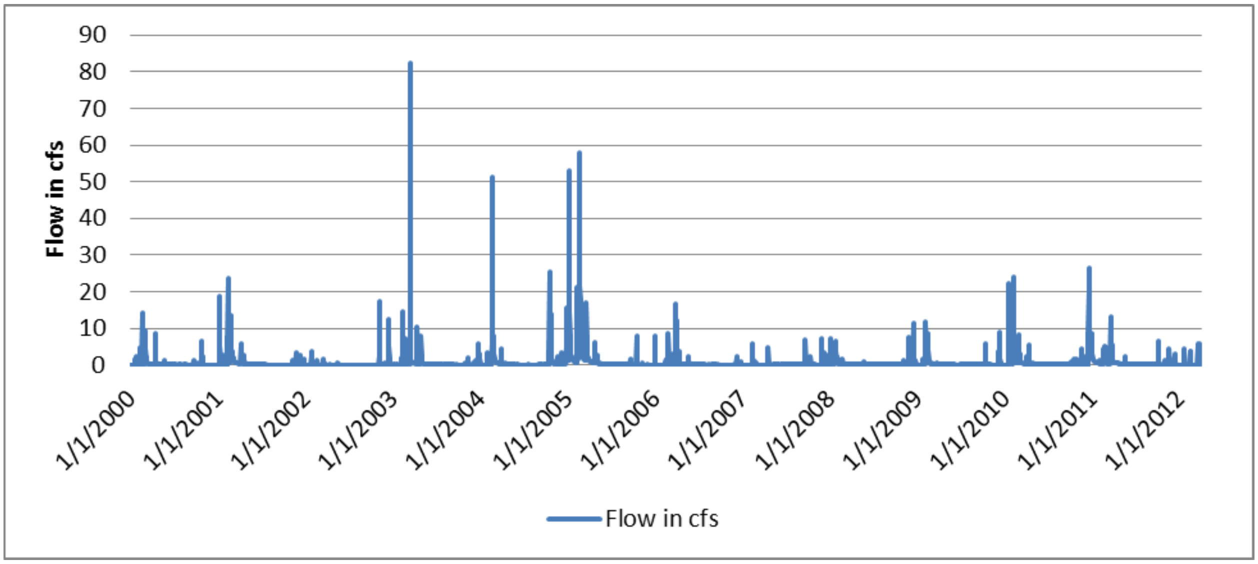


Figure A.4. Coyote Creek Subwatershed 5079 Hydrograph (01/01/2000 – 03/31/2012)

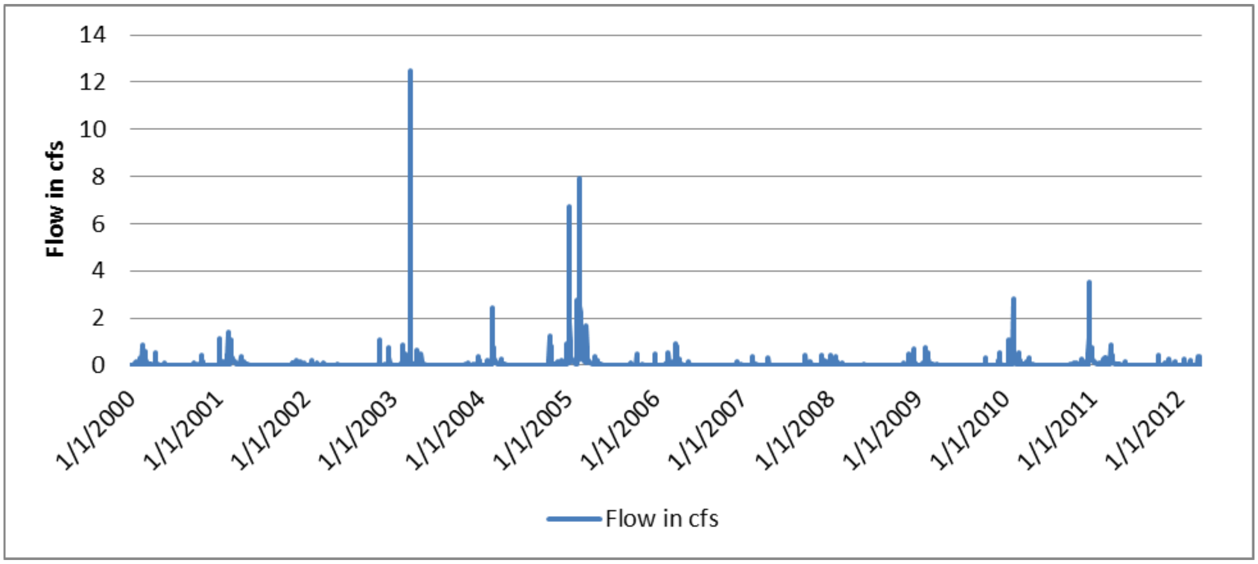


Figure A.5. Coyote Creek Subwatershed 5080 Hydrograph (01/01/2000 – 03/31/2012)

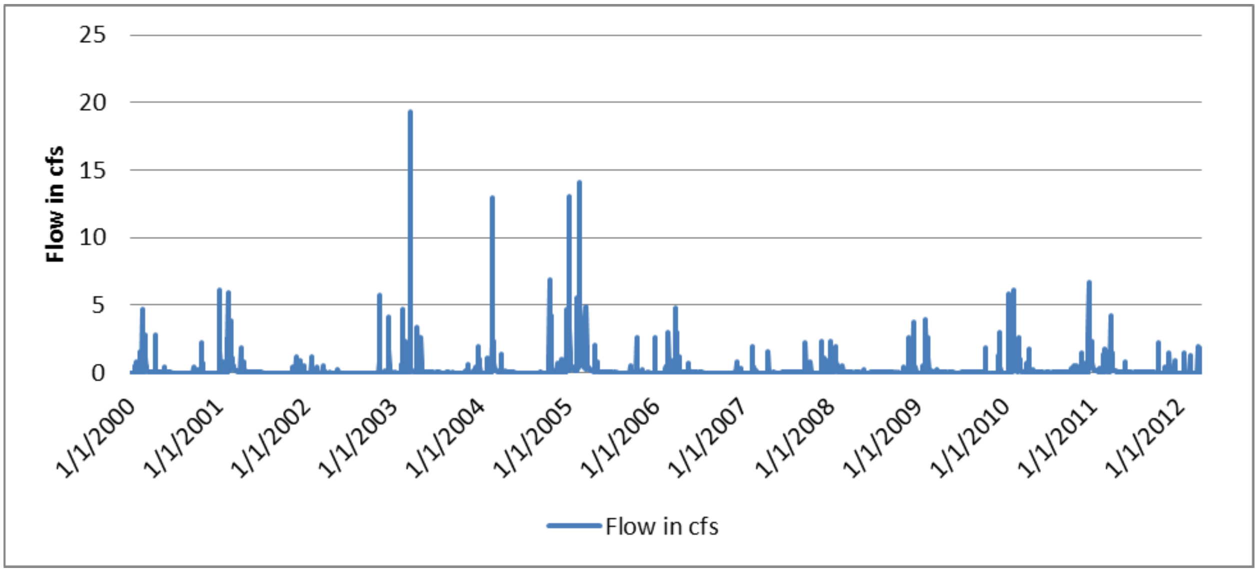
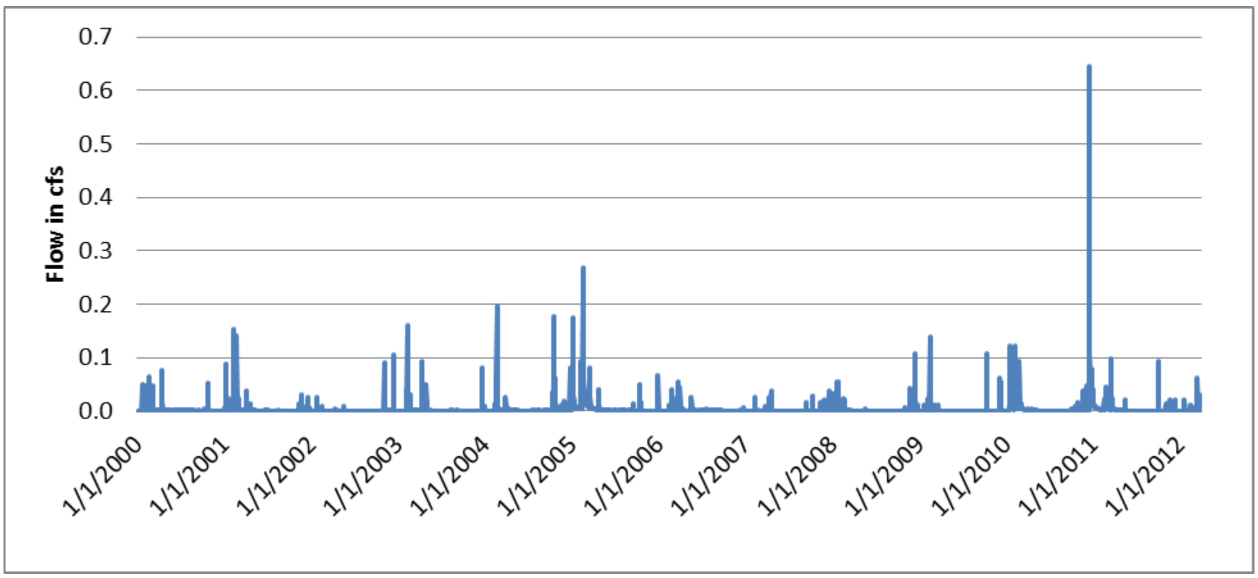


Figure A.6. Coyote Creek Subwatershed 5083 Hydrograph (01/01/2000 – 03/31/2012)



San Jose Creek Subwatershed Hydrographs

Figure A.7. San Jose Creek Subwatershed 5173 Hydrograph (01/01/2000 – 03/31/2012)

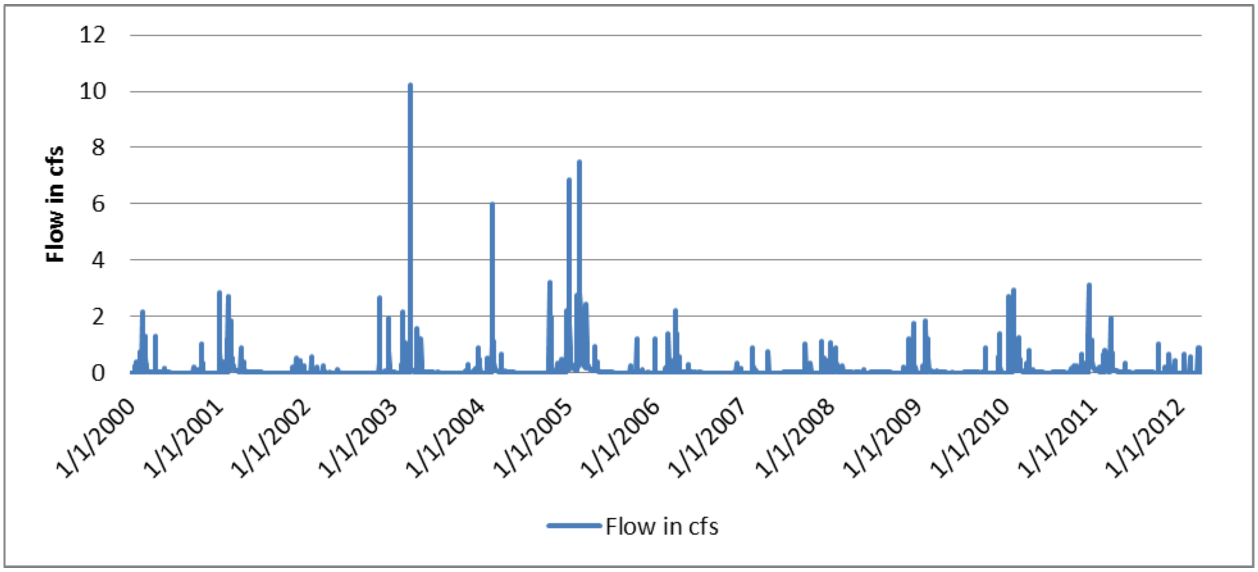


Figure A.8. San Jose Creek Subwatershed 5175 Hydrograph (01/01/2000 – 03/31/2012)

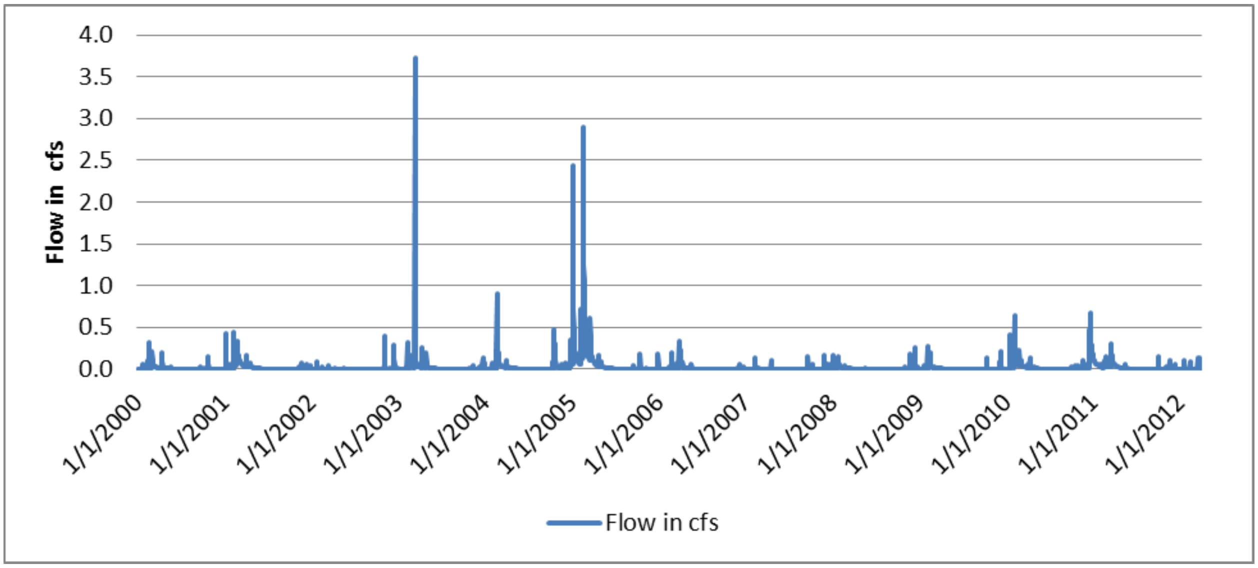


Figure A.9. San Jose Creek Subwatershed 5183 Hydrograph (01/01/2000 – 03/31/2012)

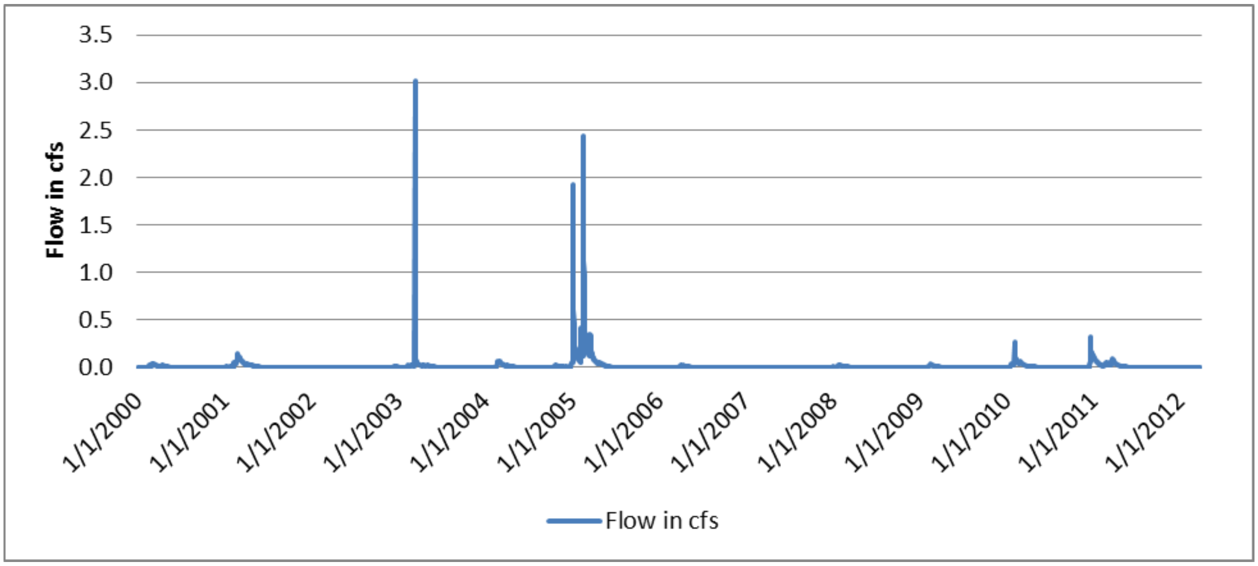
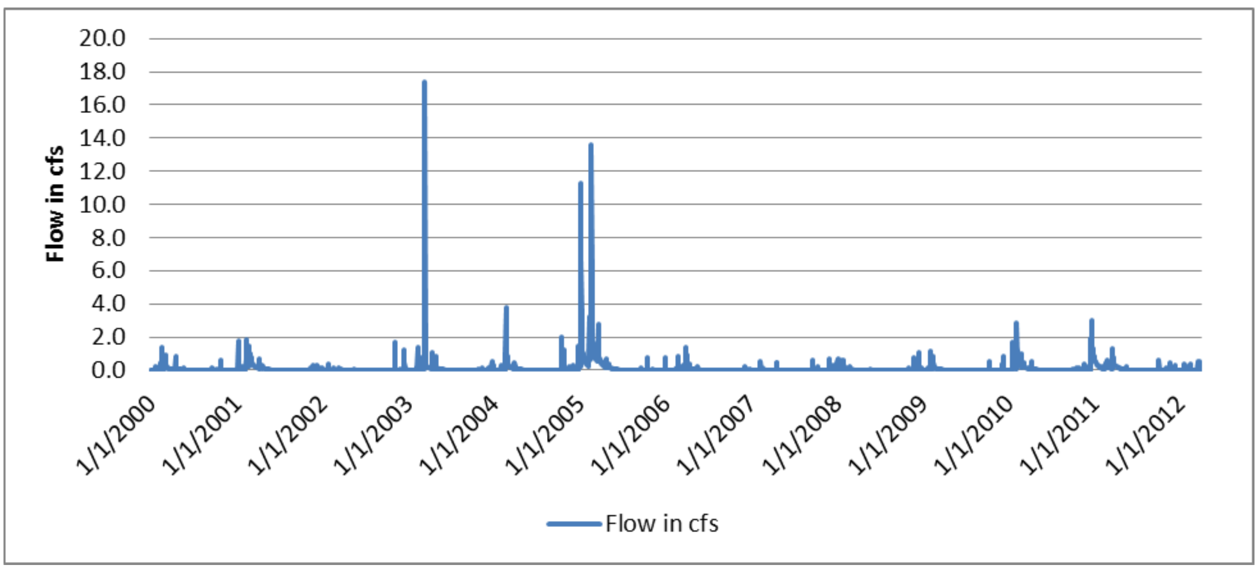


Figure A.10. San Jose Creek Subwatershed 5189 Hydrograph (01/01/2000 – 03/31/2012)



POLLUTOGRAPHS

Coyote Creek Subwatershed Pollutographs

Figure A.11. Coyote Creek Subwatershed 5046 Copper Pollutograph (01/01/2000 – 03/31/2012)

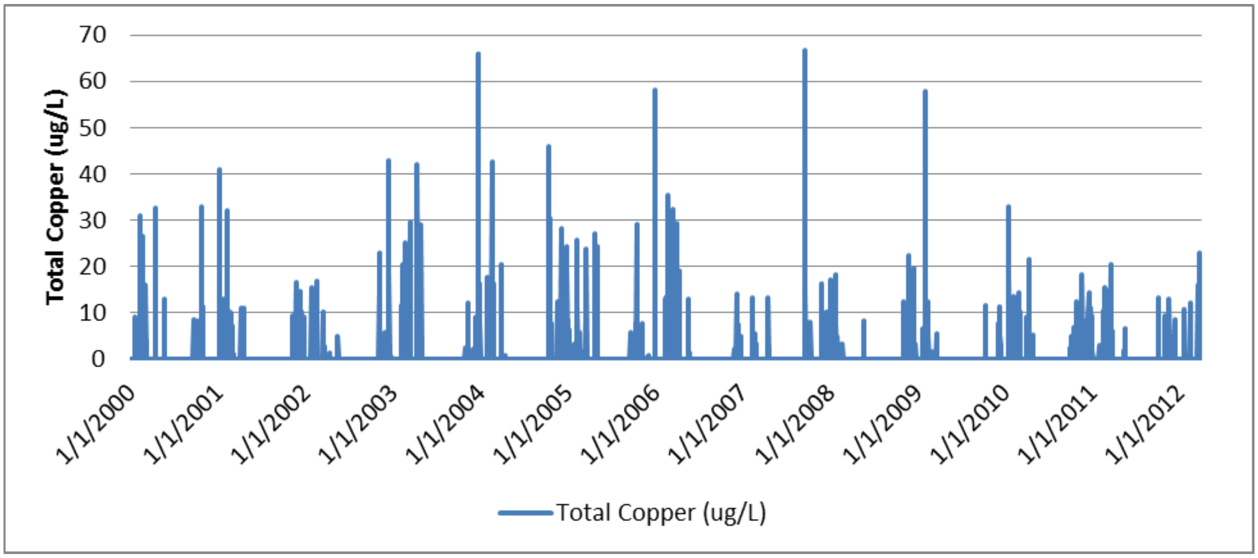


Figure A.12. Coyote Creek Subwatershed 5046 Lead Pollutograph (01/01/2000 – 03/31/2012)

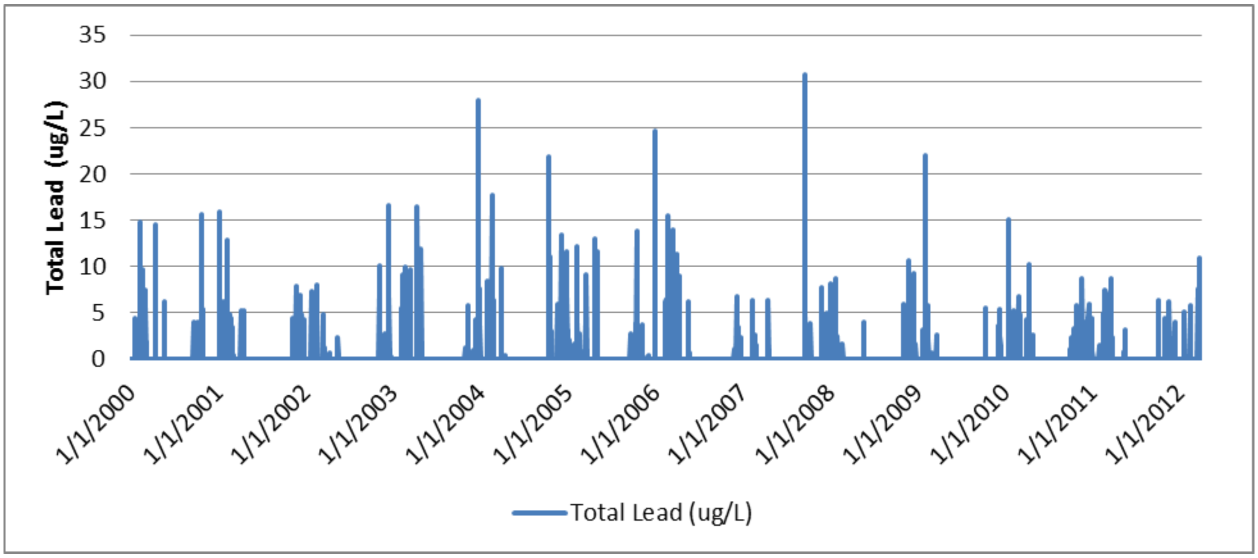


Figure A.13. Coyote Creek Subwatershed 5046 Zinc Pollutograph (01/01/2000 – 03/31/2012)

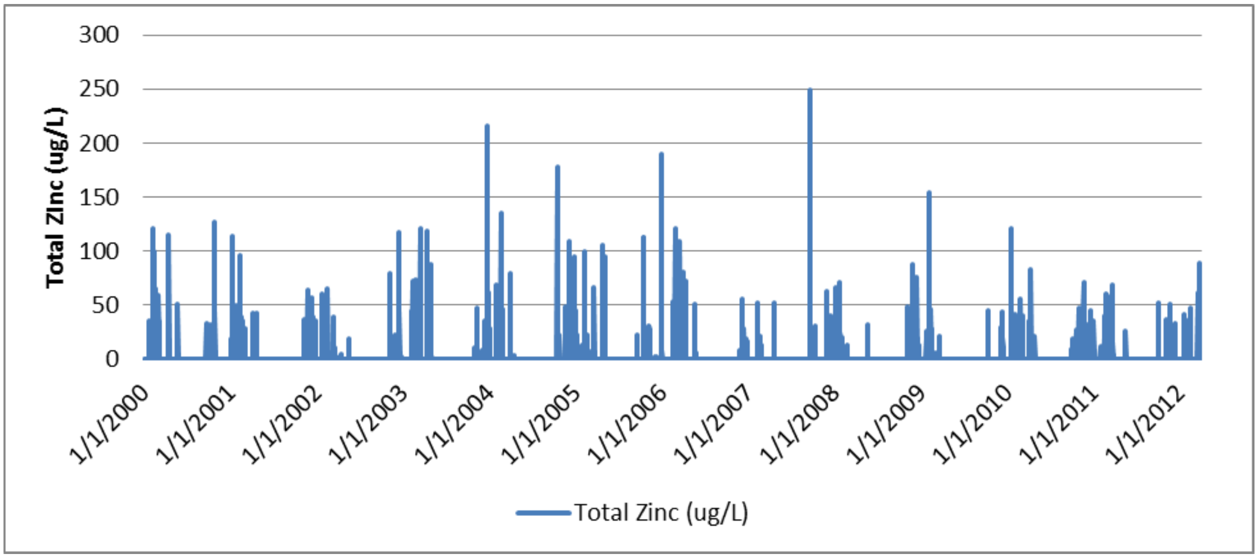


Figure A.14. Coyote Creek Subwatershed 5065 Copper Pollutograph (01/01/2000 – 03/31/2012)

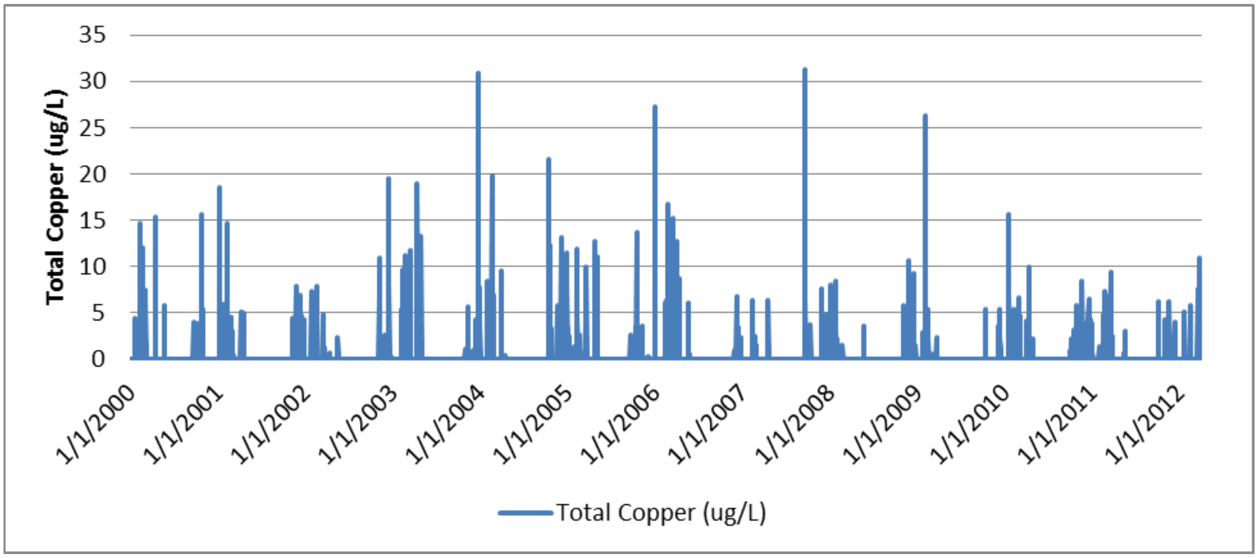


Figure A.15. Coyote Creek Subwatershed 5065 Lead Pollutograph (01/01/2000 – 03/31/2012)

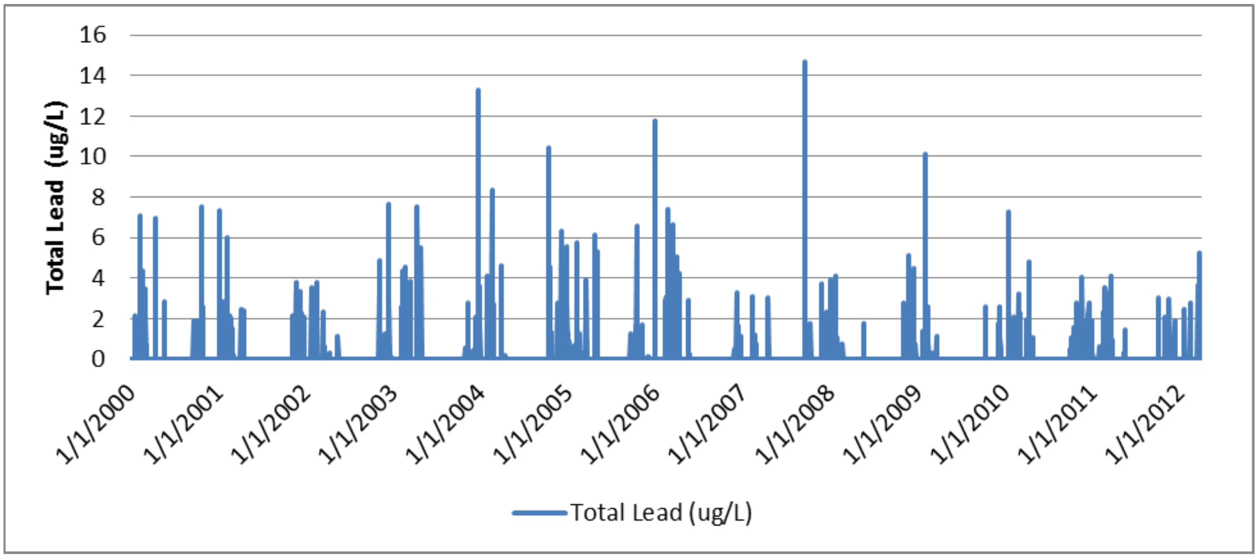


Figure A.16. Coyote Creek Subwatershed 5065 Zinc Pollutograph (01/01/2000 – 03/31/2012)

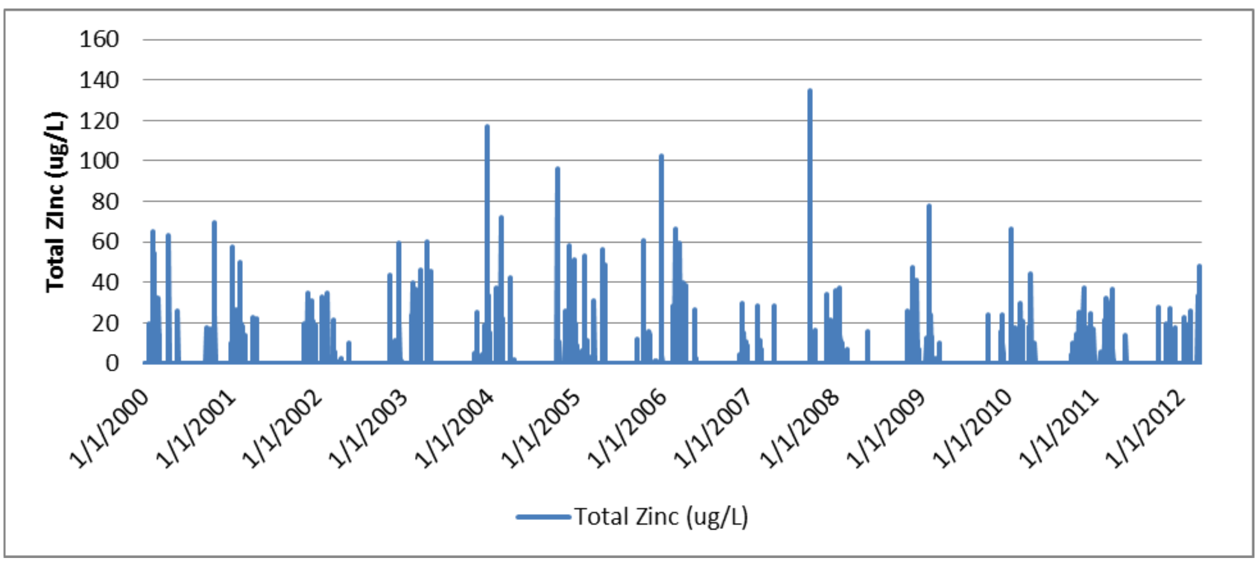


Figure A.17. Coyote Creek Subwatershed 5066 Copper Pollutograph (01/01/2000 – 03/31/2012)

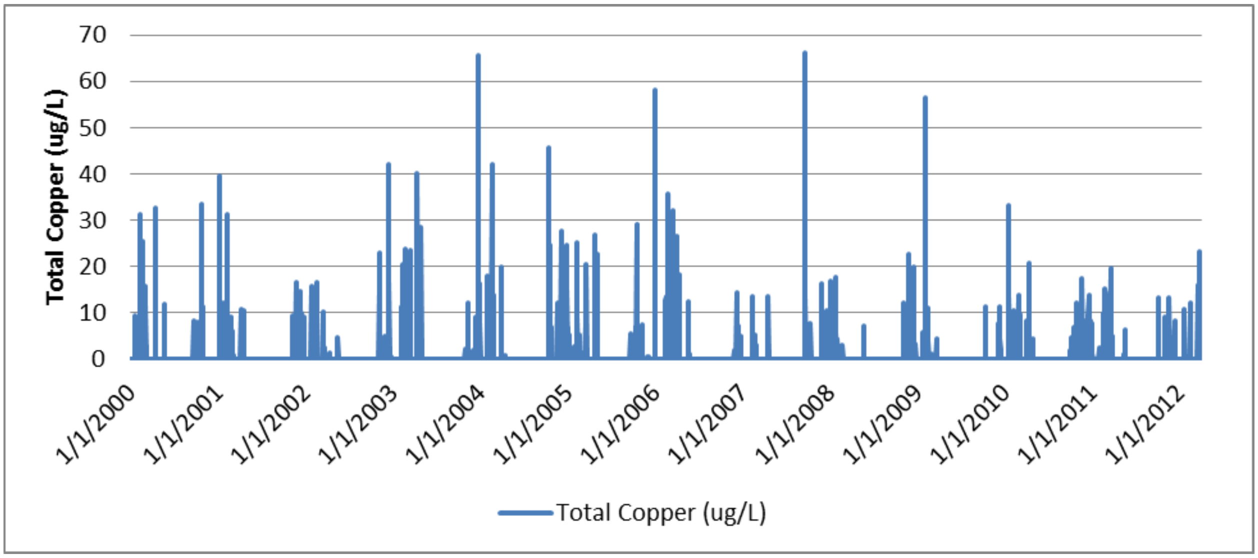


Figure A.18. Coyote Creek Subwatershed 5066 Lead Pollutograph (01/01/2000 – 03/31/2012)

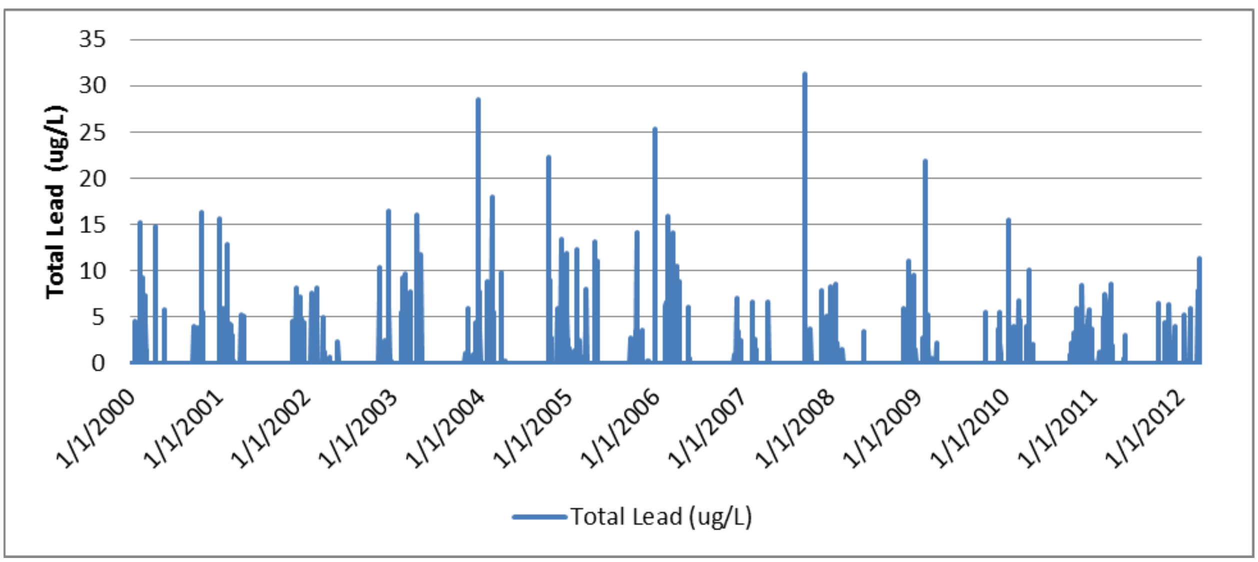


Figure A.19. Coyote Creek Subwatershed 5066 Zinc Pollutograph (01/01/2000 – 03/31/2012)

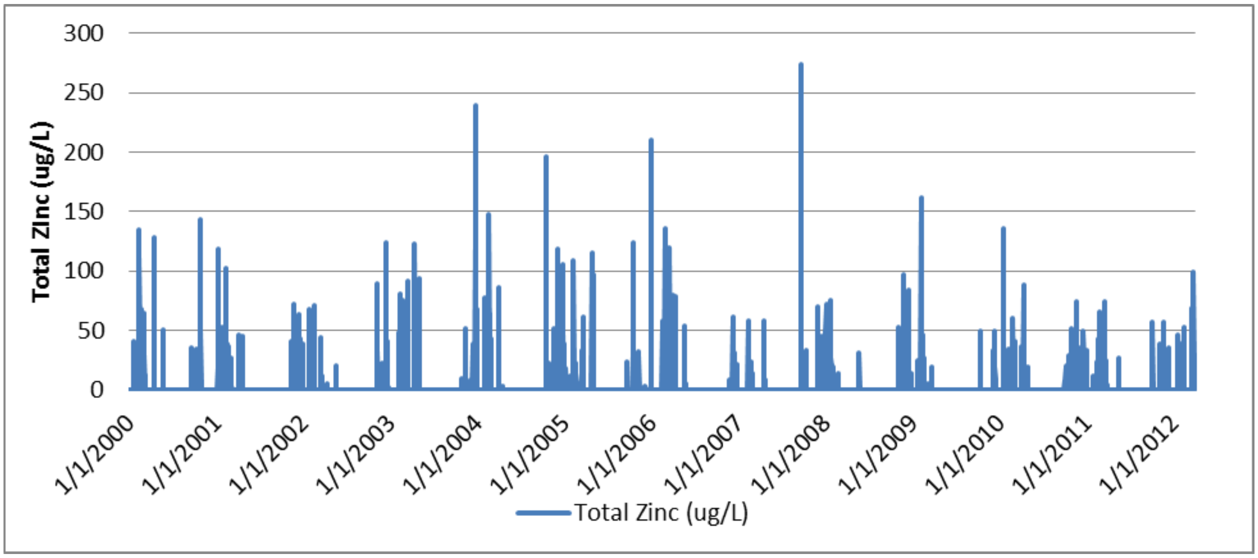


Figure A.20. Coyote Creek Subwatershed 5079 Copper Pollutograph (01/01/2000 – 03/31/2012)

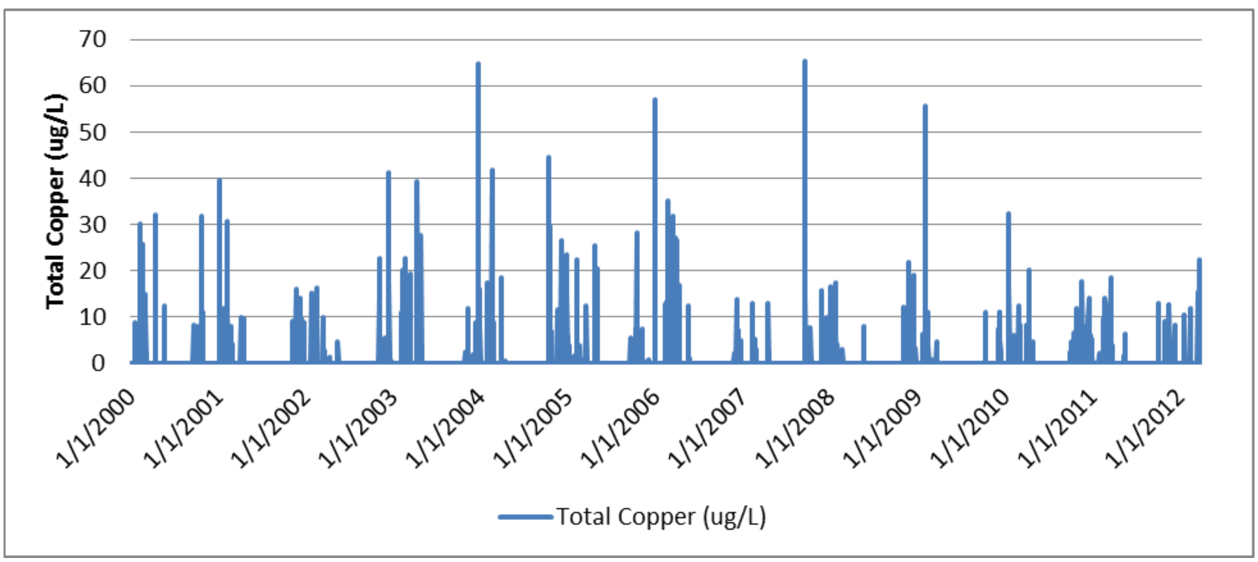


Figure A.21. Coyote Creek Subwatershed 5079 Lead Pollutograph (01/01/2000 – 03/31/2012)

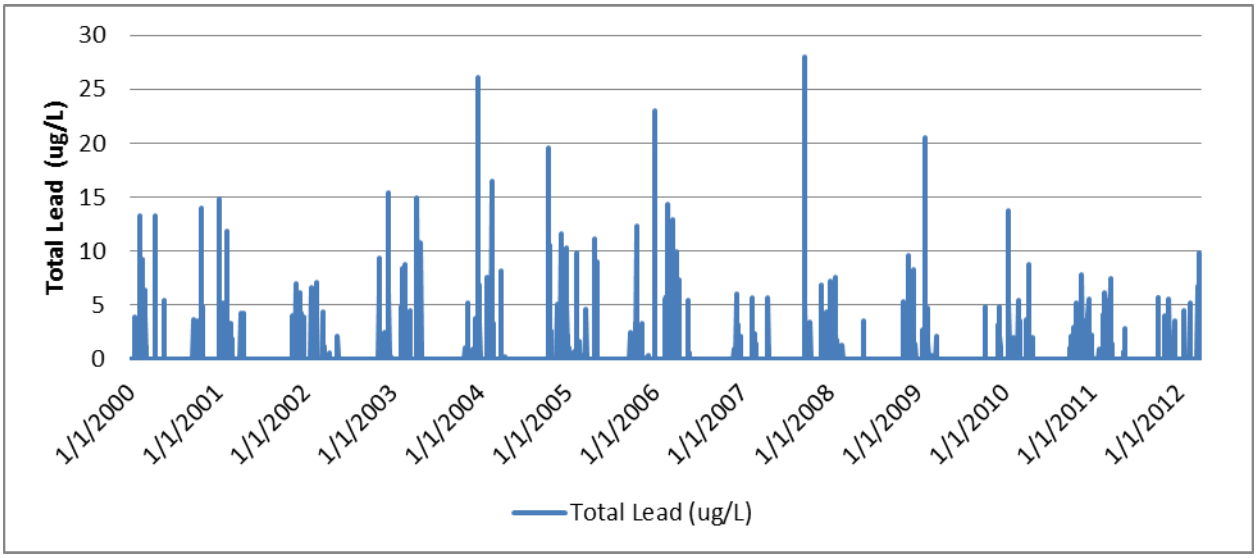


Figure A.22. Coyote Creek Subwatershed 5079 Zinc Pollutograph (01/01/2000 – 03/31/2012)

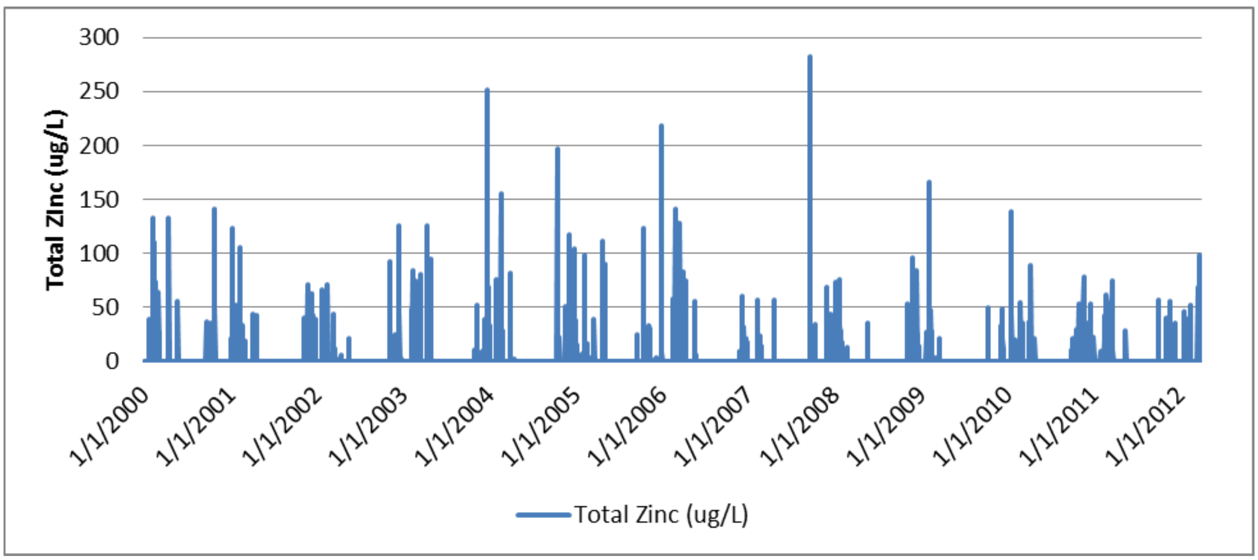


Figure A.23. Coyote Creek Subwatershed 5080 Copper Pollutograph (01/01/2000 – 03/31/2012)

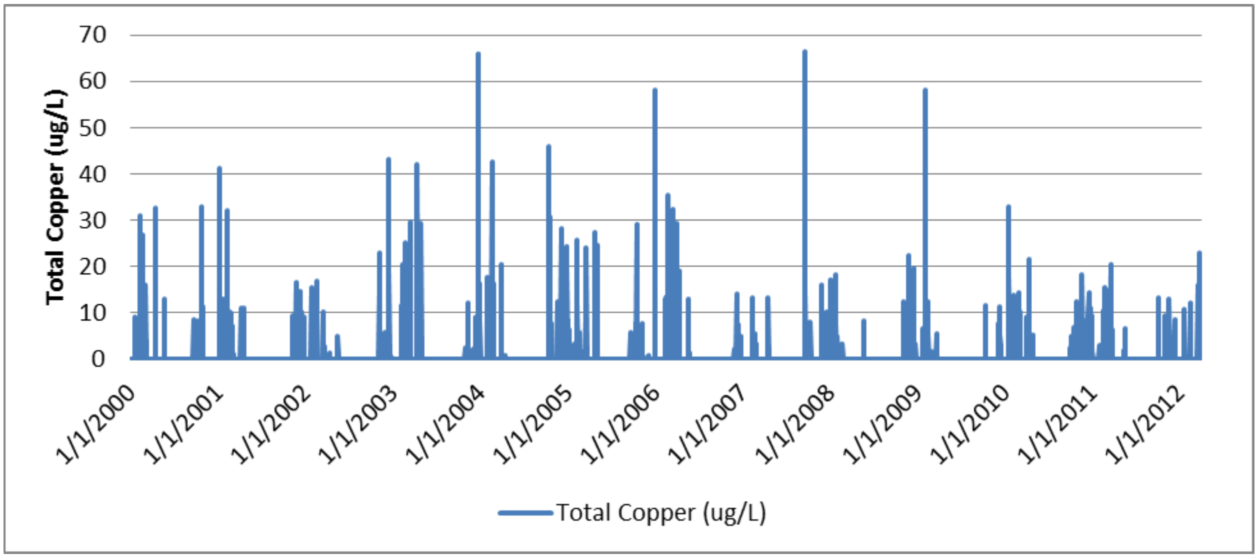


Figure A.24. Coyote Creek Subwatershed 5080 Lead Pollutograph (01/01/2000 – 03/31/2012)

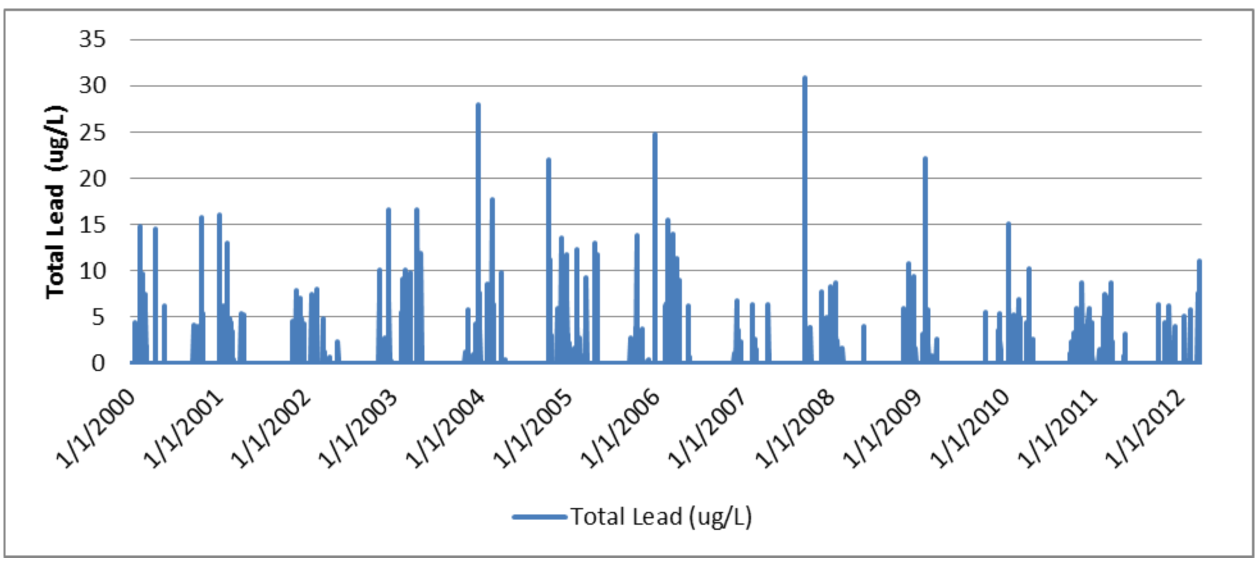


Figure A.25. Coyote Creek Subwatershed 5080 Zinc Pollutograph (01/01/2000 – 03/31/2012)

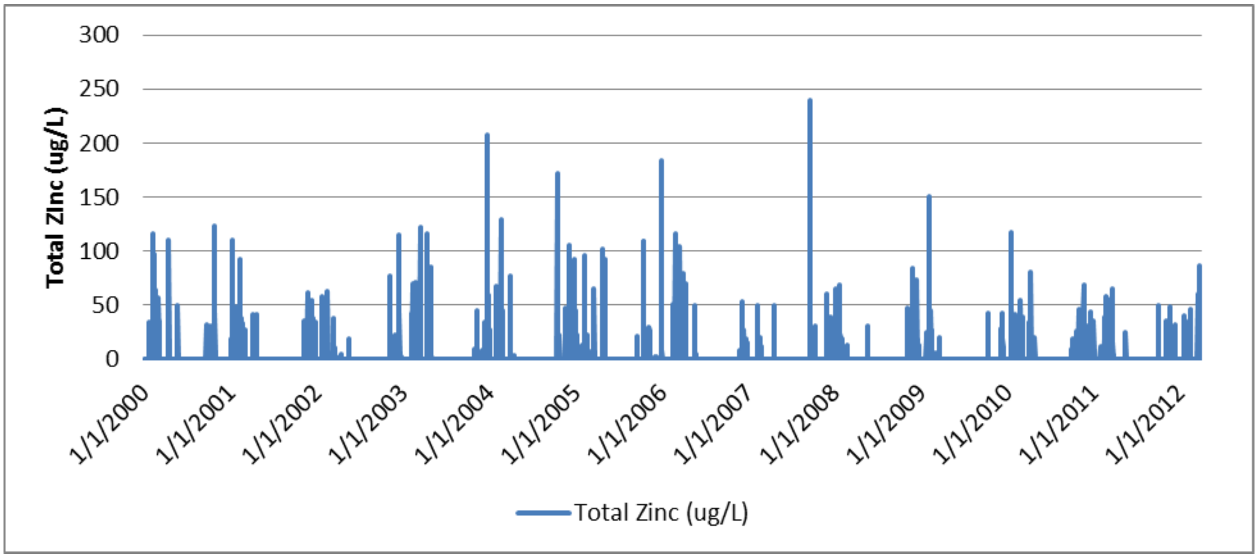


Figure A.26. Coyote Creek Subwatershed 5083 Copper Pollutograph (01/01/2000 – 03/31/2012)

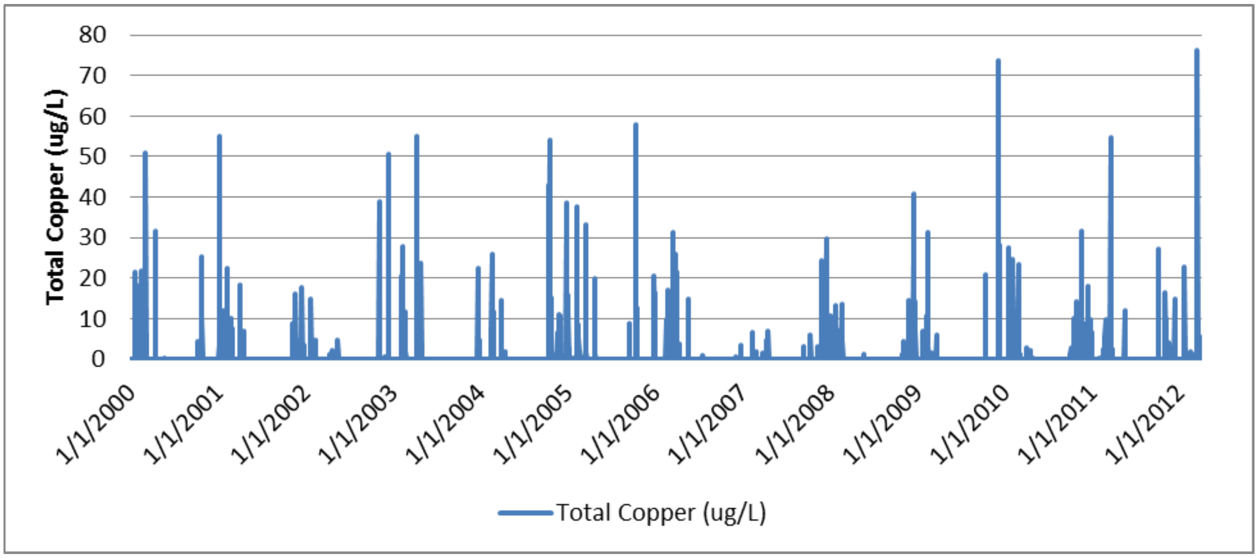


Figure A.27. Coyote Creek Subwatershed 5083 Lead Pollutograph (01/01/2000 – 03/31/2012)

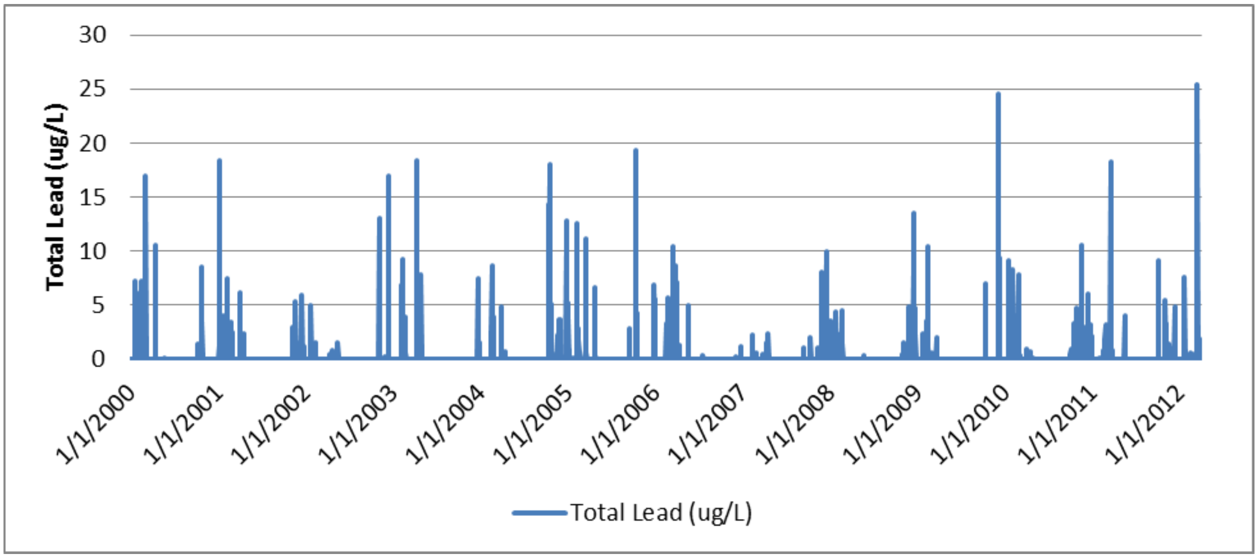
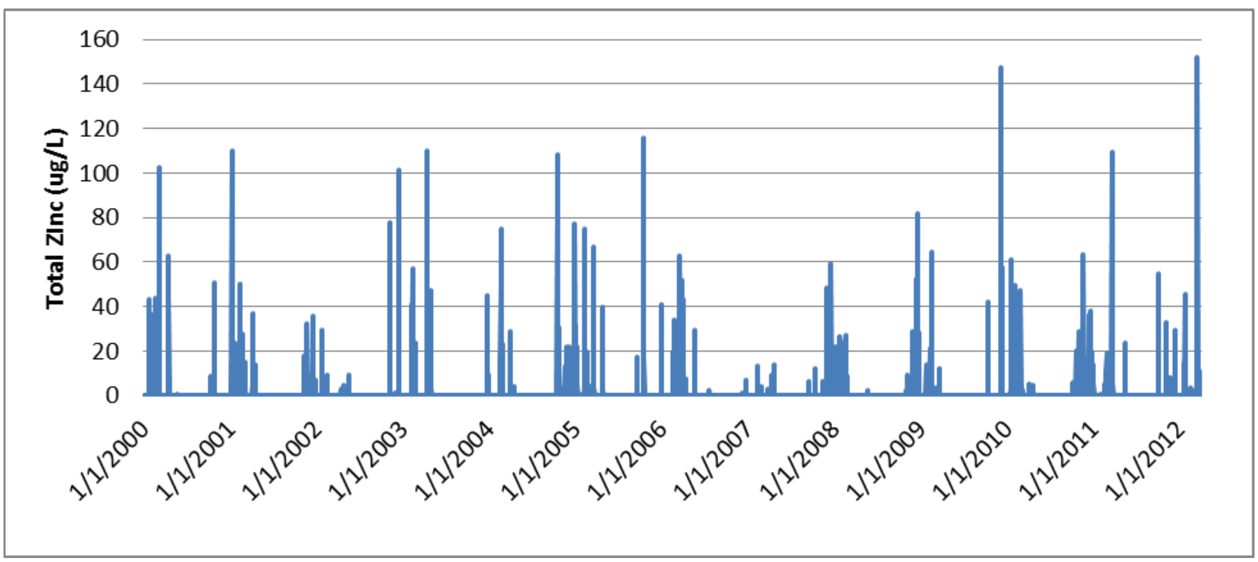


Figure A.28. Coyote Creek Subwatershed 5083 Zinc Pollutograph (01/01/2000 – 03/31/2012)



San Jose Creek Subwatershed Pollutographs

Figure A.29. San Jose Creek Subwatershed 5173 Selenium Pollutograph (01/01/2000 – 03/31/2012)

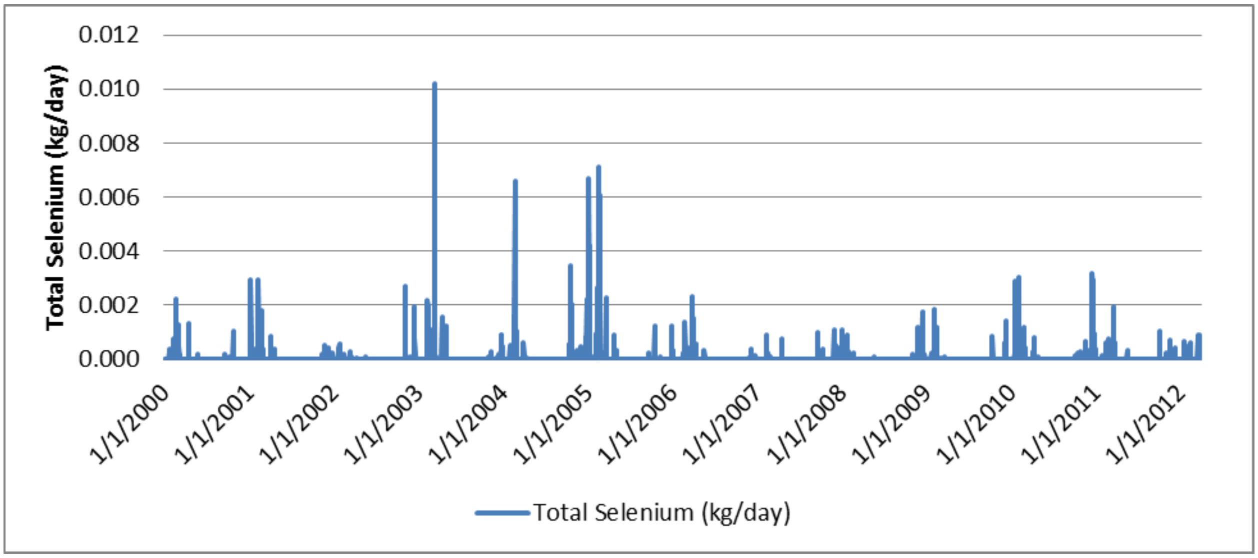


Figure A.30. Coyote Creek Subwatershed 5175 Selenium Pollutograph (01/01/2000 – 03/31/2012)

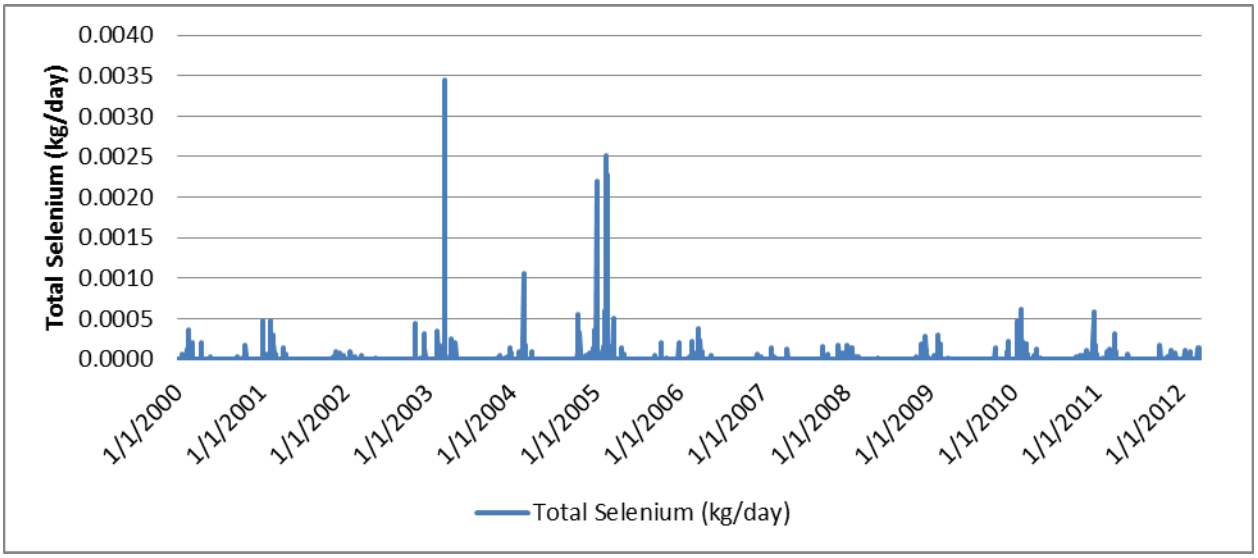


Figure A.31. Coyote Creek Subwatershed 5183 Selenium Pollutograph (01/01/2000 – 03/31/2012)

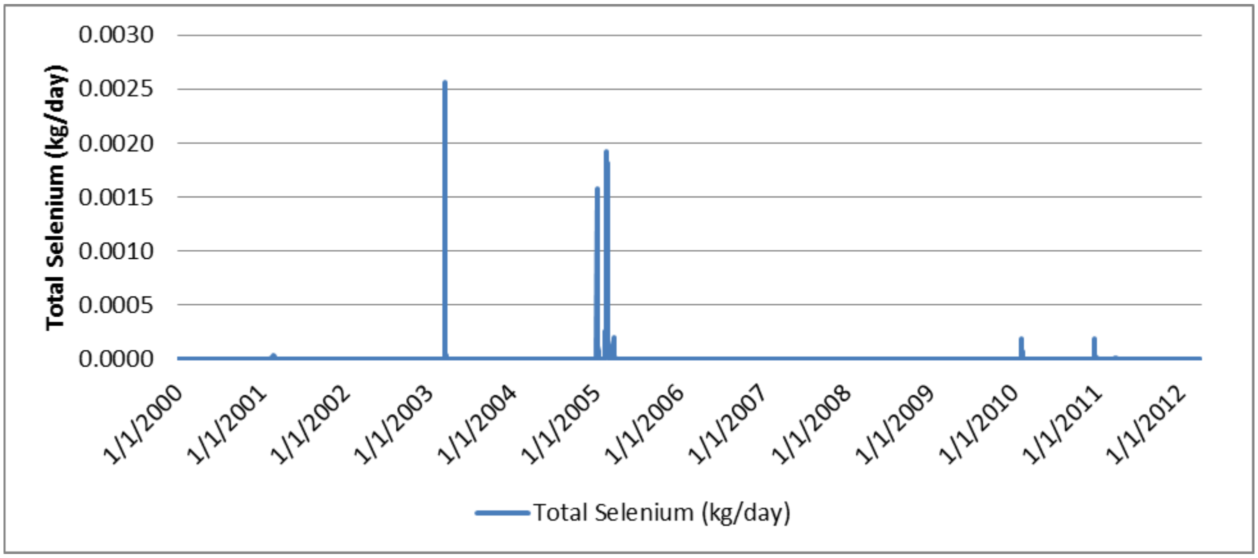
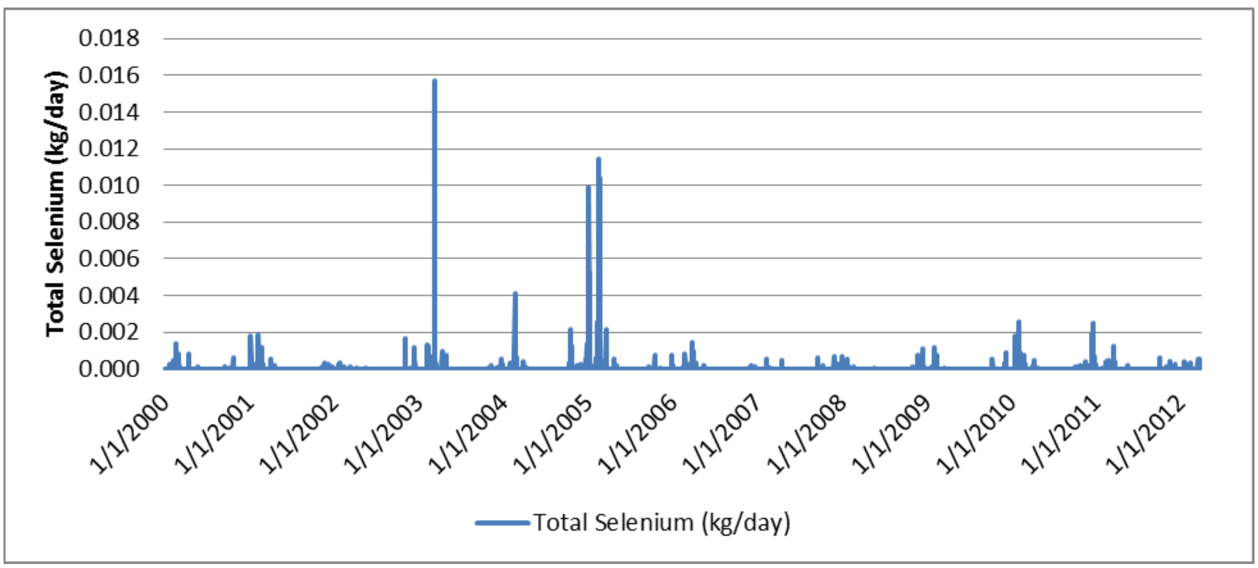


Figure A.32. Coyote Creek Subwatershed 5189 Selenium Pollutograph (01/01/2000 – 03/31/2012)



Appendix B

Summary of Data Sources

Table B.1. Summary of Data Sources used in the WMMS La Habra Heights Reasonable Assurance Analysis

Data Type	File Name	Source	Data Period	Notes
Geometric Data				
Topography Layer(s)	n34w118.dbf n34w119.dbf n35w118.dbf n35w119.dbf	USGS National Elevation Dataset (NED)	Accessed 02/2014	
Land Use	Parcel History.gdb City_Streets.dbf	City of La Habra Heights	Accessed 02/2014	
Stream Network	NHDH_CA.gdb	USGS National Hydrography Dataset (NHD)	Accessed 02/2014	
Drainage Areas	WMMS LAC Subwatersheds	WMMS	2012	
Meteorological Data				
Precipitation	1088B.pre 106F.pre	WMMS	01/04/1986 - 04/26/2012	
Evaporation	23129.air 96.air	WMMS	12/31/1985 - 04/30/2012	
Soil Hydrologic Data				
Hydrologic Soil Groups	gsmsoilmu_a_ca.shp	Natural Resources Conservation Service (NRCS).2006. STATSGO2	2006	
Percent of Area Distribution	gsmsoilmu_a_ca.shp	Natural Resources Conservation Service (NRCS).2006. STATSGO2	2006	
Fraction of Sand, Silt, and Clay for Different Soil Groups	N/A	N/A	N/A	
Average Slope	Sta.bmp	Calculated from USGS National Elevation Dataset (NED)	NED Accessed 02/2014	Calculated from USGS DEM 0.3 arc seconds
Vegetative Cover for Different Soil Groups	NLCD2001_CAN_N33W117_v1.tif	Percent Tree Canopy (Version 1.0) data (NLCD 2001)	Accessed 02/2014	
Hydrologic Data				
In-Stream Flow	N/A	N/A	N/A	
In-Stream Depth	N/A	N/A	N/A	
Point Source Data*				
Point Source Location				
Point Source Discharge				
Point Source Concentration				

Notes: *No point sources of discharge are located within the City of La Habra Heights.

Appendix C

Model Input Parameters

```
c-----------------------------------------------------------------------------
------------
c LSPC -- Loading Simulation Program, C++
c Version 4.1.0 - April 11, 2011
c
c Designed and maintained by:
c     Tetra Tech, Inc.
c     10306 Eaton Place, Suite 340
c     Fairfax, VA 22030
c     (703) 385-6000
c-----------------------------------------------------------------------------
------------
c LSPC MODEL INPUT FILE
c This input file was created at 11:33:57pm on 03/23/2014
c-----------------------------------------------------------------------------
------------
c0   general control
c
c    snowfg   if = 1 run snow module
c    pwatfg   if = 1 run pwater
c    sedfg    if = 1 run sediment
c    pqalfg   if = 1 run general quality
c    tempfg   if = 1 run temperature module
c    oxfg     if = 1 run DO-BOD module
c    nutfg    if = 1 run nutrients module
c    plkfg    if = 1 run plank module
c    phfg     if = 1 run pH-CO2 module
c    mstlfg   if = 1 run mstlay module
c    pestfg   if = 1 run pest module
c    nitrfg   if = 1 run nitr module
c    phosfg   if = 1 run phos module
c    tracfg   if = 1 run tracer module
c    mdasfg   if = 1 run mdas module
c
c       snowfg  pwatfg  sedfg   pqalfg  tempfg  oxfg    nutfg   plkfg   phfg
mstlfg  pestfg   nitrfg   phosfg   tracfg   mdasfg
        0       1       1       1       0       0       0       0       0
        0       0       0       0       0       0
c-----------------------------------------------------------------------------
------------
c10  weather file definition (name and parameters)
c
c    wfileid    weather file id
c    wfilename  weather file name
c    wparamnum  number of parameters in the weather file
c    wparamid   weather paramter id
c               1-precipitation (in/ivl)
c               2-potential evaporation (in/ivl)
c               3-air temperature (degree F)
c               4-wind speed (mile/ivl)
c               5-solar radiation (ly/ivl)
c               6-dew point (degree F)
c               7-cloud cover (tenth)
c
c       wfileid   wfilename   wparamnum   wparamid...
        1       23129.air       1       2
        17      D96.air 1       2
        1014    D106.pre        1       1
        1021    D1088.pre       1       1
c-----------------------------------------------------------------------------
------------
c15  weather station definition (station id and associated weather files)
c
c    wstationid  weather station id
```

```
c    wfilenum   number of files for the weather station
c    wfileid    weather file id (card 10)
c
c   wstationid   wfilenum   wfileid...
        14      2       1014    1
        21      2       1021    17
c-------------------------------------------------------------------------------
------------
c20  weather parameter multiplier
c
c    wstationid  weather station id (card 15)
c    wparmmult   multiplier for each weather parameter
c                       1- multiplier for precipitation
c                       2- multiplier for potential evaporation
c                       3- multiplier for air temperature
c                       4- multiplier for wind speed
c                       5- multiplier for solar radiation
c                       6- multiplier for dew point
c                       7- multiplier for cloud cover
c
c  wstationid  wparmmult1...
        14      1.000000        1.000000
        21      1.000000        1.000000
c-------------------------------------------------------------------------------
------------
c30     output file path     input (weather) file path  (each must be a
continuous string)
        C:\LA_Mapwindow\DATA\Output\    C:\LA_MapWindow\Weather\
c-------------------------------------------------------------------------------
------------
c40     general watershed controls
c
c    nsubbasin   number of subwatersheds
c    nrchid      number of stream channels (corresponds with number of
subwatersheds)
c    nrgid       number of stream groups to assign parameters
c    ndefid      number of land groups to assign parameters
c    ndeluid     maximum number of land use
c
c       nsws   nrch    nrgroup    nlgroup    nlandp
        10      10      1       1       21
c-------------------------------------------------------------------------------
------------
c45  general output controls
c
c    Standard    Output standard model parameters
c    Snow        Output snow related parameters
c    Hydrology  Output hydrology related parameters
c    Sediment    Output sediment related parameters
c    GQUAL              Output general water quality related parameters
c    AGCHEM             Output agricultural water quality related parameters
c    RQUAL              Output biochemical water quality related parameters
c    Custom      Output user specified parameters
c    Landuse     Output landuse summary
c                               if = 0 no output
c                               if = 1 average annual output
c                               if = 2 yearly output
c                               if = 3 monthly output
c    Stream      Output stream summary
c                               if = 0 no output
c                               if = 1 average annual output
c                               if = 2 yearly output
c                               if = 3 monthly output
c    Threshold   Output threshold analysis summary
```

```
c                               if = 0 no output
c                               if = 1 average monthly output
c
c       Standard  Snow  Hydrology  Sediment  GQUAL  AGCHEM   RQUAL  Custom
Landuse  Stream  Threshold
        1       0       0       0       0       0       0       0       1
        1       1
c-----------------------------------------------------------------------------
------------
c46  user specified output parameter list
c
c   PRECP   AIRTMP  SNOTMP  SNOWF   RAINF   PRAIN   MELT   SNOWE  WYIELD  PACK
PACKF   PACKW   PACKI   PDEPTH  COVINDX   NEGHTS  XLNMELT     RDENPKF
SKYCLEAR    SNOCOV  DULLNESS    ALBEDO    PAKTEMP     DEWTMP  SURS    UZS
LZS     AGWS    SURO    IFWO  AGWO    PERO    TAET    PERC    INFIL   GWI
IGWI    AGWI      DEP     AVDEP   HRAD    AVVEL   SAREA   VOLUME   RO  TAU
WSSD   SCRSD   SOSED  SOBER   SSEDC  LSSED   LRSED  LBEDDEP  LDEPSCR
LROSED  SQO     WASHQS  SCRQS   SOQO    POQUAL  SOQUAL  IOQUAL    GOQUAL  POQC
CONC  CONCOUT  CONCSQAL   MATSQAL  MATIN   MATOUT   MATOSQAL  DOX   DOXMIN
DOXMAX   DOXAV   DOXX   BOD   BODX  NO3   NO3X   TAM    TAMX    NO2    NO2X
PO4    PO4X   SNH4   SNH4X   SPO4   SPO4X    PHYTO   PHYTOX   PHYCLA   BENAL
ORN     ORNX    ORP     ORPX   ORC    ORCX   PH   ALK    TIC   TICX   CO2   CO2X
TEMP   MDASNH4   MDASNO3   MDASSO4   MDASDFe  MDASTFe  MDASDAl    MDASTAl
MDASpH    MDASACID   MDASALK    MDASOrgN   MDASH2O    MDASH   MDASCa
MDASCO3   MDASOrg   MDASNO2
c-----------------------------------------------------------------------------
------------
c50  model simulation time period
c
c    mstart   model start day.
c    mend     model end day.
c    delt     time step in minutes.
c    mostart  model output start day.
c    moend    model output end day.
c    optlevel  if = 1 general output (daily)
c              if = 2 output per time interval (min)
c
c       mstart   mend    delt   mostart    moend   optlevel
        10/1/1998       3/31/2012       60      1/1/2000       3/31/2012
        1
c-----------------------------------------------------------------------------
------------
c60  group information
c
c    subbasin  subbasin id
c    defid     group parameter id
c    nwst      number of weather stations assigned to the watershed  (<=5)
c    wsti = station id
c    wti = weighting to calculate input
c
c       subbasin   defid   nwst  wst1   wt1   wst2   wt2   ...
        5046    1       1       21      1.000000
        5065    1       1       21      1.000000
        5066    1       1       21      1.000000
        5079    1       1       21      1.000000
        5080    1       1       21      1.000000
        5083    1       1       14      1.000000
        5173    1       1       21      1.000000
        5175    1       1       21      1.000000
        5183    1       1       21      1.000000
        5189    1       1       21      1.000000
c-----------------------------------------------------------------------------
------------
c70  modeled land use names
```

```
c
c    deluid     landuse id
c    deluname   landuse name
c
c       deluid    deluname
        1       HD_SF_Residential
        2       LD_SF_Res_Moderate
        3       LD_SF_Res_Steep
        4       MF_Res
        5       Commercial
        6       Institutional
        7       Industrial
        8       Transportation
        9       Secondary_Roads
        10      Urban_Grass_Irrigated
        11      Urban_Grass_NonIrrigated
        12      Agriculture_Moderate_B
        13      Agriculture_Moderate_D
        14      Vacant_Moderate_B
        15      Vacant_Moderate_D
        16      Vacant_Steep_A
        17      Vacant_Steep_B
        18      Vacant_Steep_C
        19      Vacant_Steep_D
        20      Water
        21      Water_Reuse
c-------------------------------------------------------------------------------
------------
c80  land use to stream routing
c
c    defid       landuse default group id
c    deluid      land use id
c    route_suro  fraction of surface runoff that routes to the stream (0-1)
c    route_ifwo  fraction of interflow outflow that routes to the stream (0-1)
c    route_agwo  fraction of groundwater outflow that routes to the stream
(0-1)
c
c    Note: The remaining fraction is routed directly to the next downstream
reach segment(s)
c
c  defid  deluid  route_suro  route_ifwo  route_agwo
        1       1       1.000000        1.000000        1.000000
        1       2       1.000000        1.000000        1.000000
        1       3       1.000000        1.000000        1.000000
        1       4       1.000000        1.000000        1.000000
        1       5       1.000000        1.000000        1.000000
        1       6       1.000000        1.000000        1.000000
        1       7       1.000000        1.000000        1.000000
        1       8       1.000000        1.000000        1.000000
        1       9       1.000000        1.000000        1.000000
        1       10      1.000000        1.000000        1.000000
        1       11      1.000000        1.000000        1.000000
        1       12      1.000000        1.000000        1.000000
        1       13      1.000000        1.000000        1.000000
        1       14      1.000000        1.000000        1.000000
        1       15      1.000000        1.000000        1.000000
        1       16      1.000000        1.000000        1.000000
        1       17      1.000000        1.000000        1.000000
        1       18      1.000000        1.000000        1.000000
        1       19      1.000000        1.000000        1.000000
        1       20      1.000000        1.000000        1.000000
        1       21      1.000000        1.000000        1.000000
c-------------------------------------------------------------------------------
------------
```

```
c90  land use information
c
c    subbasin   subbasin id
c    deluid     land use id
c    deluname   land use name
c    perimp     1 imperivous land (subsurface processes disabled)
c               2 pervious  land (subsurface processes activated)
c    area_ac    area (acres)
c    slsur      slope of overland flow plane (none)
c    lsur       length of overland flow plane (feet)
c
c  subbasin  deluid  deluname  perimp  area_ac  slsur  lsur
        5046    1       HD_SF_Residential       1       0.000000
        0.040000        300.000000
        5046    2       LD_SF_Res_Moderate      1       0.000000
        0.040000        300.000000
        5046    3       LD_SF_Res_Steep 1       176.109395      0.040000
        300.000000
        5046    4       MF_Res  1       0.000000        0.040000
        300.000000
        5046    5       Commercial      1       0.000000        0.040000
        300.000000
        5046    6       Institutional   1       5.131054        0.040000
        300.000000
        5046    7       Industrial      1       0.000000        0.040000
        300.000000
        5046    8       Transportation  1       0.000000        0.040000
        300.000000
        5046    9       Secondary_Roads 1       12.781862       0.040000
        300.000000
        5046    10      Urban_Grass_Irrigated   2       58.703132
        0.040000        300.000000
        5046    11      Urban_Grass_NonIrrigated        2       16.905039
        0.040000        300.000000
        5046    12      Agriculture_Moderate_B  2       0.000000
        0.040000        300.000000
        5046    13      Agriculture_Moderate_D  2       16.772323
        0.040000        300.000000
        5046    14      Vacant_Moderate_B       2       0.000000
        0.050000        300.000000
        5046    15      Vacant_Moderate_D       2       0.000000
        0.050000        300.000000
        5046    16      Vacant_Steep_A  2       0.000000        0.300000
        300.000000
        5046    17      Vacant_Steep_B  2       0.000000        0.300000
        300.000000
        5046    18      Vacant_Steep_C  2       614.905622      0.300000
        300.000000
        5046    19      Vacant_Steep_D  2       0.000000        0.300000
        300.000000
        5046    20      Water   2       0.000000        0.050000
        300.000000
        5046    21      Water_Reuse     2       0.000000        0.050000
        300.000000
        5065    1       HD_SF_Residential       1       0.000000
        0.040000        300.000000
        5065    2       LD_SF_Res_Moderate      1       0.000000
        0.040000        300.000000
        5065    3       LD_SF_Res_Steep 1       132.647989      0.040000
        300.000000
        5065    4       MF_Res  1       0.000000        0.040000
        300.000000
        5065    5       Commercial      1       0.000000        0.040000
        300.000000
```

5065 6 Institutional 1 10.780515 0.040000
300.000000
5065 7 Industrial 1 0.000000 0.040000
300.000000
5065 8 Transportation 1 0.000000 0.040000
300.000000
5065 9 Secondary_Roads 1 10.480644 0.040000
300.000000
5065 10 Urban_Grass_Irrigated 2 44.215996
0.040000 300.000000
5065 11 Urban_Grass_NonIrrigated 2 15.504804
0.040000 300.000000
5065 12 Agriculture_Moderate_B 2 0.000000
0.040000 300.000000
5065 13 Agriculture_Moderate_D 2 12.633142
0.040000 300.000000
5065 14 Vacant_Moderate_B 2 0.000000
0.050000 300.000000
5065 15 Vacant_Moderate_D 2 0.000000
0.050000 300.000000
5065 16 Vacant_Steep_A 2 0.000000 0.300000
300.000000
5065 17 Vacant_Steep_B 2 0.000000 0.300000
300.000000
5065 18 Vacant_Steep_C 2 525.203549 0.300000
300.000000
5065 19 Vacant_Steep_D 2 0.000000 0.300000
300.000000
5065 20 Water 2 0.000000 0.050000
300.000000
5065 21 Water_Reuse 2 0.000000 0.050000
300.000000
5066 1 HD_SF_Residential 1 0.000000
0.040000 300.000000
5066 2 LD_SF_Res_Moderate 1 0.000000
0.040000 300.000000
5066 3 LD_SF_Res_Steep 1 154.120284 0.040000
300.000000
5066 4 MF_Res 1 0.000000 0.040000
300.000000
5066 5 Commercial 1 0.000000 0.040000
300.000000
5066 6 Institutional 1 9.135998 0.040000
300.000000
5066 7 Industrial 1 0.000000 0.040000
300.000000
5066 8 Transportation 1 0.000000 0.040000
300.000000
5066 9 Secondary_Roads 1 12.540831 0.040000
300.000000
5066 10 Urban_Grass_Irrigated 2 227.221577
0.040000 300.000000
5066 11 Urban_Grass_NonIrrigated 2 17.611682
0.040000 300.000000
5066 12 Agriculture_Moderate_B 2 0.000000
0.040000 300.000000
5066 13 Agriculture_Moderate_D 2 14.678122
0.040000 300.000000
5066 14 Vacant_Moderate_B 2 0.000000
0.050000 300.000000
5066 15 Vacant_Moderate_D 2 0.000000
0.050000 300.000000
5066 16 Vacant_Steep_A 2 0.000000 0.300000
300.000000

5066 17 Vacant_Steep_B 2 0.000000 0.300000
300.000000
5066 18 Vacant_Steep_C 2 734.724465 0.300000
300.000000
5066 19 Vacant_Steep_D 2 0.000000 0.300000
300.000000
5066 20 Water 2 0.000000 0.050000
300.000000
5066 21 Water_Reuse 2 0.000000 0.050000
300.000000
5079 1 HD_SF_Residential 1 0.000000
0.040000 300.000000
5079 2 LD_SF_Res_Moderate 1 0.000000
0.040000 300.000000
5079 3 LD_SF_Res_Steep 1 9.265989 0.040000
300.000000
5079 4 MF_Res 1 0.000000 0.040000
300.000000
5079 5 Commercial 1 0.000000 0.040000
300.000000
5079 6 Institutional 1 1.158242 0.040000
300.000000
5079 7 Industrial 1 0.000000 0.040000
300.000000
5079 8 Transportation 1 0.000000 0.040000
300.000000
5079 9 Secondary_Roads 1 0.445738 0.040000
300.000000
5079 10 Urban_Grass_Irrigated 2 3.088663
0.040000 300.000000
5079 11 Urban_Grass_NonIrrigated 2 0.834351
0.040000 300.000000
5079 12 Agriculture_Moderate_B 2 0.000000
0.040000 300.000000
5079 13 Agriculture_Moderate_D 2 0.882475
0.040000 300.000000
5079 14 Vacant_Moderate_B 2 0.000000
0.050000 300.000000
5079 15 Vacant_Moderate_D 2 0.000000
0.050000 300.000000
5079 16 Vacant_Steep_A 2 0.000000 0.300000
300.000000
5079 17 Vacant_Steep_B 2 0.000000 0.300000
300.000000
5079 18 Vacant_Steep_C 2 0.000000 0.300000
300.000000
5079 19 Vacant_Steep_D 2 124.742777 0.300000
300.000000
5079 20 Water 2 0.000000 0.050000
300.000000
5079 21 Water_Reuse 2 0.000000 0.050000
300.000000
5080 1 HD_SF_Residential 1 0.000000
0.040000 300.000000
5080 2 LD_SF_Res_Moderate 1 0.000000
0.040000 300.000000
5080 3 LD_SF_Res_Steep 1 54.482587 0.040000
300.000000
5080 4 MF_Res 1 0.000000 0.040000
300.000000
5080 5 Commercial 1 0.000000 0.040000
300.000000
5080 6 Institutional 1 0.790729 0.040000
300.000000

```
5080    7       Industrial      1       0.000000        0.040000
300.000000
5080    8       Transportation  1       0.000000        0.040000
300.000000
5080    9       Secondary_Roads 1       4.025620        0.040000
300.000000
5080    10      Urban_Grass_Irrigated   2       18.160862
0.040000        300.000000
5080    11      Urban_Grass_NonIrrigated        2       5.117885
0.040000        300.000000
5080    12      Agriculture_Moderate_B  2       0.000000
0.040000        300.000000
5080    13      Agriculture_Moderate_D  2       5.188818
0.040000        300.000000
5080    14      Vacant_Moderate_B       2       0.000000
0.050000        300.000000
5080    15      Vacant_Moderate_D       2       0.000000
0.050000        300.000000
5080    16      Vacant_Steep_A  2       0.000000        0.300000
300.000000
5080    17      Vacant_Steep_B  2       0.000000        0.300000
300.000000
5080    18      Vacant_Steep_C  2       182.550651      0.300000
300.000000
5080    19      Vacant_Steep_D  2       0.000000        0.300000
300.000000
5080    20      Water   2       0.000000        0.050000
300.000000
5080    21      Water_Reuse     2       0.000000        0.050000
300.000000
5083    1       HD_SF_Residential       1       0.000000
0.040000        300.000000
5083    2       LD_SF_Res_Moderate      1       0.000000
0.040000        300.000000
5083    3       LD_SF_Res_Steep 1       1.552663        0.040000
300.000000
5083    4       MF_Res  1       0.000000        0.040000
300.000000
5083    5       Commercial      1       0.000000        0.040000
300.000000
5083    6       Institutional   1       0.000000        0.040000
300.000000
5083    7       Industrial      1       0.000000        0.040000
300.000000
5083    8       Transportation  1       0.000000        0.040000
300.000000
5083    9       Secondary_Roads 1       0.000000        0.040000
300.000000
5083    10      Urban_Grass_Irrigated   2       0.517554
0.040000        300.000000
5083    11      Urban_Grass_NonIrrigated        2       0.000000
0.040000        300.000000
5083    12      Agriculture_Moderate_B  2       0.000000
0.040000        300.000000
5083    13      Agriculture_Moderate_D  2       0.147873
0.040000        300.000000
5083    14      Vacant_Moderate_B       2       0.000000
0.050000        300.000000
5083    15      Vacant_Moderate_D       2       0.000000
0.050000        300.000000
5083    16      Vacant_Steep_A  2       0.000000        0.300000
300.000000
5083    17      Vacant_Steep_B  2       0.000000        0.300000
300.000000
```

```
5083    18      Vacant_Steep_C  2       6.289888        0.300000
300.000000
5083    19      Vacant_Steep_D  2       0.000000        0.300000
300.000000
5083    20      Water   2       0.000000        0.050000
300.000000
5083    21      Water_Reuse     2       0.000000        0.050000
300.000000
5173    1       HD_SF_Residential       1       0.000000
0.040000        300.000000
5173    2       LD_SF_Res_Moderate      1       0.000000
0.040000        300.000000
5173    3       LD_SF_Res_Steep 1       23.500071       0.040000
300.000000
5173    4       MF_Res  1       0.000000        0.040000
300.000000
5173    5       Commercial      1       0.000000        0.040000
300.000000
5173    6       Institutional   1       0.964665        0.040000
300.000000
5173    7       Industrial      1       0.000000        0.040000
300.000000
5173    8       Transportation  1       0.000000        0.040000
300.000000
5173    9       Secondary_Roads 1       3.066195        0.040000
300.000000
5173    10      Urban_Grass_Irrigated   2       7.833357
0.040000        300.000000
5173    11      Urban_Grass_NonIrrigated        2       3.988738
0.040000        300.000000
5173    12      Agriculture_Moderate_B  2       0.000000
0.040000        300.000000
5173    13      Agriculture_Moderate_D  2       2.238102
0.040000        300.000000
5173    14      Vacant_Moderate_B       2       0.000000
0.050000        300.000000
5173    15      Vacant_Moderate_D       2       0.000000
0.050000        300.000000
5173    16      Vacant_Steep_A  2       0.000000        0.300000
300.000000
5173    17      Vacant_Steep_B  2       0.000000        0.300000
300.000000
5173    18      Vacant_Steep_C  2       115.297776      0.300000
300.000000
5173    19      Vacant_Steep_D  2       0.000000        0.300000
300.000000
5173    20      Water   2       0.000000        0.050000
300.000000
5173    21      Water_Reuse     2       0.000000        0.050000
300.000000
5175    1       HD_SF_Residential       1       0.000000
0.040000        300.000000
5175    2       LD_SF_Res_Moderate      1       0.000000
0.040000        300.000000
5175    3       LD_SF_Res_Steep 1       3.565438        0.040000
300.000000
5175    4       MF_Res  1       0.000000        0.040000
300.000000
5175    5       Commercial      1       0.000000        0.040000
300.000000
5175    6       Institutional   1       0.483839        0.040000
300.000000
5175    7       Industrial      1       0.000000        0.040000
300.000000
```

```
5175	8	Transportation	1	0.000000	0.040000
300.000000
5175	9	Secondary_Roads	1	0.000000	0.040000
300.000000
5175	10	Urban_Grass_Irrigated	2	1.188479
0.040000	300.000000
5175	11	Urban_Grass_NonIrrigated	2	0.120960
0.040000	300.000000
5175	12	Agriculture_Moderate_B	2	0.000000
0.040000	300.000000
5175	13	Agriculture_Moderate_D	2	0.339566
0.040000	300.000000
5175	14	Vacant_Moderate_B	2	0.000000
0.050000	300.000000
5175	15	Vacant_Moderate_D	2	0.000000
0.050000	300.000000
5175	16	Vacant_Steep_A	2	0.000000	0.300000
300.000000
5175	17	Vacant_Steep_B	2	0.000000	0.300000
300.000000
5175	18	Vacant_Steep_C	2	75.422245	0.300000
300.000000
5175	19	Vacant_Steep_D	2	0.000000	0.300000
300.000000
5175	20	Water	2	0.000000	0.050000
300.000000
5175	21	Water_Reuse	2	0.000000	0.050000
300.000000
5183	1	HD_SF_Residential	1	0.000000
0.040000	300.000000
5183	2	LD_SF_Res_Moderate	1	0.000000
0.040000	300.000000
5183	3	LD_SF_Res_Steep	1	0.000000	0.040000
300.000000
5183	4	MF_Res	1	0.000000	0.040000
300.000000
5183	5	Commercial	1	0.000000	0.040000
300.000000
5183	6	Institutional	1	0.009194	0.040000
300.000000
5183	7	Industrial	1	0.000000	0.040000
300.000000
5183	8	Transportation	1	0.000000	0.040000
300.000000
5183	9	Secondary_Roads	1	0.000000	0.040000
300.000000
5183	10	Urban_Grass_Irrigated	2	0.000000
0.040000	300.000000
5183	11	Urban_Grass_NonIrrigated	2	0.002298
0.040000	300.000000
5183	12	Agriculture_Moderate_B	2	0.000000
0.040000	300.000000
5183	13	Agriculture_Moderate_D	2	0.000000
0.040000	300.000000
5183	14	Vacant_Moderate_B	2	0.000000
0.050000	300.000000
5183	15	Vacant_Moderate_D	2	0.000000
0.050000	300.000000
5183	16	Vacant_Steep_A	2	0.000000	0.300000
300.000000
5183	17	Vacant_Steep_B	2	0.000000	0.300000
300.000000
5183	18	Vacant_Steep_C	2	78.131778	0.300000
300.000000
```

```
        5183    19      Vacant_Steep_D  2       0.000000        0.300000
        300.000000
        5183    20      Water   2       0.000000        0.050000
        300.000000
        5183    21      Water_Reuse     2       0.000000        0.050000
        300.000000
        5189    1       HD_SF_Residential       1       0.000000
        0.040000        300.000000
        5189    2       LD_SF_Res_Moderate      1       0.000000
        0.040000        300.000000
        5189    3       LD_SF_Res_Steep 1       14.925257       0.040000
        300.000000
        5189    4       MF_Res  1       0.000000        0.040000
        300.000000
        5189    5       Commercial      1       0.000000        0.040000
        300.000000
        5189    6       Institutional   1       0.066601        0.040000
        300.000000
        5189    7       Industrial      1       0.000000        0.040000
        300.000000
        5189    8       Transportation  1       0.000000        0.040000
        300.000000
        5189    9       Secondary_Roads 1       1.958248        0.040000
        300.000000
        5189    10      Urban_Grass_Irrigated   2       4.975086
        0.040000        300.000000
        5189    11      Urban_Grass_NonIrrigated        2       2.410065
        0.040000        300.000000
        5189    12      Agriculture_Moderate_B  2       0.000000
        0.040000        300.000000
        5189    13      Agriculture_Moderate_D  2       1.421453
        0.040000        300.000000
        5189    14      Vacant_Moderate_B       2       0.000000
        0.050000        300.000000
        5189    15      Vacant_Moderate_D       2       0.000000
        0.050000        300.000000
        5189    16      Vacant_Steep_A  2       0.000000        0.300000
        300.000000
        5189    17      Vacant_Steep_B  2       0.000000        0.300000
        300.000000
        5189    18      Vacant_Steep_C  2       357.890613      0.300000
        300.000000
        5189    19      Vacant_Steep_D  2       0.000000        0.300000
        300.000000
        5189    20      Water   2       0.000000        0.050000
        300.000000
        5189    21      Water_Reuse     2       0.000000        0.050000
        300.000000
c-------------------------------------------------------------------------------
------------
c92  SNOW-FLAGS
c defid     parameter group id
c deluid    landuse id
c iceflag   0 = Ice formation in the snow pack is not simulated
c           1 = Ice formation is simulated
c forest    0.0 - 1.0  Fraction of LAND covered by Forest (winter
transpiration)
c       defid LUID ICEFLAG FOREST
c-------------------------------------------------------------------------------
---------------
c93  SNOW-PARM
c LAT      Latitude of the pervious land segment (PLS) - ENERGY BALANCE METHOD
ONLY (degree)
c          Positive for the northern hemisphere, negative for southern
```

```
c MELEV    Mean elevation of LAND above sea level - ENERGY BALANCE METHOD ONLY
(ft)
c SHADE    Fraction of LAND shaded from solar radiation (i.e. by trees) -
ENERGY BALANCE METHOD ONLY
c SNOWCF   Precipitation-to-snow multiplier (accounts for poor gage-catch
efficiency during snow)
c COVIND   Maximum snowpack (water equivalent) at which the entire LAND is
covered with snow (in)
c       defid LUID       LAT     MELEV     SHADE    SNOWCF    COVIND
c-------------------------------------------------------------------------------
---------------
c94  SNOW-PARM2
c RDCSN    Density of cold, new snow relative to water (For snow falling at
temps below freezing.
c          At higher temperatures the density of snow is adjusted)
c TSNOW    Air temperature below which precipitation will be snow, under
saturated conditions (deg F)
c          Under non-saturated conditions the temperature is adjusted
slightly.
c SNOEVP   Adapts sublimation equation to field conditions - ENERGY BALANCE
METHOD ONLY
c CCFACT   Adapts snow condensation/convection melt equation to field
conditions - ENERGY BALANCE METHOD ONLY
c MWATER   Maximum water content of the snow pack, in depth of water per depth
of water.
c MGMELT   Maximum rate of snowmelt by ground heat, in depth of water per day
(in/day)
c         This is the value which applies when the pack temperature is at the
freezing point.
c       defid LUID     RDCSN     TSNOW    SNOEVP    CCFACT    MWATER    MGMELT
c-------------------------------------------------------------------------------
---------------
c96  SNOW-INIT
c   Pack-snow   Initial quantity of snow in the pack (water equivalent).
c   Pack-ice    Initial quantity of ice in the pack (water equivalent).
c   Pack-watr   Initial quantity of liquid water in the pack.
c   RDENPF      Density of the frozen contents (snow and ice) of the pack,
relative to water.
c   DULL        Index of the dullness of the snow pack surface, from which
albedo is estimated - ENERGY BALANCE METHOD ONLY
c   PAKTMP      Mean temperature of the frozen contents of the snow pack.
c
c   COVINX      Current snow pack depth (water equivalent) required to obtain
complete areal coverage of LAND.
c               If the pack is less than this amount, areal coverage is
prorated (PACKF/COVINX).
c   XLNMLT      Current remaining possible increment to ice storage in the
pack.
c               Relevant when Ice formation is simulated (iceflag = 1)
c   SKYCLR      Fraction of sky which is assumed to be clear at the present
time.
c       defid LUID Pack-snow  Pack-ice Pack-watr    RDENPF      DULL    PAKTMP
c-------------------------------------------------------------------------------
---------------
c100 pwat-parm1
c    pervious and impervious land hydrology control
c
c    (value of 0 = use constant pwat-parm4; 1 = use corresponding monthly
variable card)
c
c    vcsfg    interception storage capacity
(card 150)
c    vuzfg    upper zone nominal storage
(card 160)
```

```
c    vnnfg    manning's n for the overland flow plane           (card 170)
c    vifwfg   interflow inflow parameter
(card 180)
c    vircfg   interflow recession constant
(card 190)
c    vlefg    lower zone evapotranspiration (e-t) parameter     (card 200)
c
c       vcsfg  vuzfg  vnnfg  vifwfg  vircfg  vlefg
        0      0      0      0       0       0
c------------------------------------------------------------------------------
------------
c110 pwat-parm2
c
c    defid   parameter group id
c    deluid  landuse id
c    lzsn    lower zone nominal soil moisture storage (inches)
c    infilt  infiltration capacity of the soil (in/hr)
c    kvary   variable groundwater recession (1/inches)
c    agwrc   base groundwater recession (none)
c
c       defid deluid lzsn      infilt      kvary      agwrc
        1     1      0.000000        0.000000        0.000000
        0.000000
        1     2      0.000000        0.000000        0.000000
        0.000000
        1     3      0.000000        0.000000        0.000000
        0.000000
        1     4      0.000000        0.000000        0.000000
        0.000000
        1     5      0.000000        0.000000        0.000000
        0.000000
        1     6      0.000000        0.000000        0.000000
        0.000000
        1     7      0.000000        0.000000        0.000000
        0.000000
        1     8      0.000000        0.000000        0.000000
        0.000000
        1     9      0.000000        0.000000        0.000000
        0.000000
        1     10     7.000000        0.100000        0.000000
        0.800000
        1     11     7.000000        0.100000        0.000000
        0.800000
        1     12     7.000000        0.400000        0.000000
        0.800000
        1     13     7.000000        0.100000        0.000000
        0.800000
        1     14     7.000000        0.400000        0.000000
        0.800000
        1     15     7.000000        0.100000        0.000000
        0.800000
        1     16     7.000000        1.000000        0.000000
        0.980000
        1     17     7.000000        0.400000        0.000000
        0.960000
        1     18     7.000000        0.200000        0.000000
        0.950000
        1     19     7.000000        0.100000        0.000000
        0.940000
        1     20     7.000000        0.100000        0.000000
        0.940000
        1     21     7.000000        0.100000        0.000000
        0.800000
c------------------------------------------------------------------------------
```

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------------
c120 pwat-parm3
c
c    defid   parameter group id
c    deluid  landuse id
c    petmax  air temperature below which e-t will is reduced (deg F)
c    petmin  air temperature below which e-t is set to zero (deg F)
c    infexp  exponent in the infiltration equation (none)
c    INFILD  ratio between the maximum and mean infiltration capacities over
the PLS (none)
c    deepfr  fraction of groundwater inflow that will enter deep groundwater
(none)
c    basetp  fraction of remaining potential e-t that can be satisfied from
baseflow (none)
c    agwetp  fraction of remaining potential e-t that can be satisfied from
active groundwater (none)
c
c       defid deluid   petmax     petmin     infexp     infild     deepfr
basetp     agwetp
        1       1       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       2       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       3       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       4       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       5       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       6       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       7       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       8       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       9       45.000000       35.000000       0.000000
        0.000000        0.000000        0.000000        0.000000
        1       10      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       11      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       12      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       13      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       14      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       15      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       16      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       17      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       18      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       19      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
        1       20      45.000000       35.000000       2.000000
        2.000000        0.000000        0.000000        0.000000
        1       21      45.000000       35.000000       2.000000
        2.000000        0.500000        0.000000        0.000000
c-------------------------------------------------------------------------------
------------
c130 pwat-parm4
```

```
c
c    defid   parameter group id
c    deluid  landuse id
c    cepsc   interception storage capacity (inches)
c    uzsn    upper zone nominal storage (inches)
c    nsur    Manning's n for the assumed overland flow plane (none)
c    intfw   interflow inflow parameter (none)
c    irc     interflow recession parameter (none)
c    lzetp   lower zone e-t parameter (none)
c
c       defid deluid   cepsc      uzsn     nsur       intfw       irc
lzetp
        1       1       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       2       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       3       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       4       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       5       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       6       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       7       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       8       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       9       0.050000        0.000000        0.011000
        0.000000        0.000000        0.000000
        1       10      0.100000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       11      0.100000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       12      0.100000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       13      0.100000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       14      0.150000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       15      0.150000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       16      0.200000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       17      0.200000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       18      0.200000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       19      0.200000        0.500000        0.200000
        1.000000        0.600000        0.700000
        1       20      0.000000        0.500000        0.011000
        1.000000        0.600000        0.700000
        1       21      0.100000        0.500000        0.200000
        1.000000        0.600000        0.700000
c-------------------------------------------------------------------------------
-----------
c140 pwat-state1
c    initial conditions for the simulation
c
c    defid   parameter group id
c    deluid  landuse id
c    ceps    initial interception storage.
c    surs    initial surface (overland flow) storage.
c    uzs     initial upper zone storage.
```

```
c    ifws    initial interflow storage.
c    lzs     initial lower zone storage.
c    agws    initial active groundwater storage.
c    gwvs    initial index to groundwater slope.
c
c       defid deluid ceps      surs       uzs      ifws       lzs       agws
gwvs
        1       1       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       2       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       3       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       4       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       5       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       6       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       7       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       8       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       9       0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       10      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       11      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       12      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       13      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       14      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       15      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       16      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       17      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       18      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       19      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       20      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
        1       21      0.000000        0.000000        0.400000
        0.000000        9.000000        2.000000        0.500000
c------------------------------------------------------------------------------
-------
c150 mon-interception storage (cepscm)
c    only required if vcsfg=1 in pwat-parm1 (see card 100)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec interception storage capacity at start of each month (inches)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c------------------------------------------------------------------------------
-------
c160 mon-upper zone nominal storage (uzsnm)
c    only required if vuzfg=1 in pwat-parm1 (see card 100)
```

```
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec upper zone nominal storage at start of each month (inches)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c------------------------------------------------------------------------------
---------
c170 mon-Manning's roughness coefficient (nsurm)
c    only required if vnnfg=1 in pwat-parm1 (see card 100)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec Manning's roughness coefficient at start of each month (none)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c------------------------------------------------------------------------------
---------
c180 mon-interflow inflow parameter (intfwm)
c    only required if vifwfg=1 in pwat-parm1 (see card 100)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec interflow inflow parameter at start of each month (none)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c------------------------------------------------------------------------------
---------
c190 mon-interflow recession constant (ircm)
c    only required if vircfg=1 in pwat-parm1 (see card 100)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec interflow recession constant at start of each month (none)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c------------------------------------------------------------------------------
-------
c200 mon-lower zone evapotranspiration parameter (lzetpm)
c    only required if vlefg=1 in pwat-parm1 (see card 100)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec lower zone evapotranspiration parameter at start of each month
(none)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c------------------------------------------------------------------------------
-------
c201   Irrigation Application Option Flags
cIrrigation flag decide whether to run irrigation
c
c    irrigfg   if = 1 run irrigation option
c    petfg     if = 1 use constant PET rather than time series from the air
file
c    monVaryIrrig   if = 1 use monthly varying ET coefficient
c
c       irrigfg  petfg  monVaryIrrig
        1       0       0
```

```
c-----------------------------------------------------------------------------
------------
c202 Irrigation PET Value
c   defid        Group ID number.
c   petval       Constant PET value to calculate actual ET (in/hr)
c
c       defid    petval
c-----------------------------------------------------------------------------
---------------
c203 Irrigation Application Options
c   defid        Group ID number.
c   deluid       Landuse ID number
c   startmonth   startmonth of irrigation requirement
c   endmonth     endmonth of irrigation requirement
c   fraction1    fraction of irrigation requirement applied over the canopy.
c   fraction2    fraction of irrigation water applied directly to the soil
surface.
c   fraction3    fraction of irrigation water applied to the upper soil zone
via buried systems
c   fraction4    fraction of irrigation water likewise applied to the lower
soil zone.
c   fraction5    fraction of irrigation water entering directly into the local
groundwater, such as seepage irrigation.
c   etcoeff      Coefficient to calculate actual ET, based on PET.
c   etdays       Number of threshold days to calculate irrigation demand
(pet*etcoeff - precip)
c                (if etdays = 0 then irrigation demand = pet * etcoeff)
c
c       defid   deluid  startmonth      endmonth        fraction1
fraction2       fraction3       fraction4       fraction5       etcoeff etdays
        1       1       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       2       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       3       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       4       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       5       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       6       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       7       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       8       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       9       1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       10      1       12      0.000000        1.000000
        0.000000        0.000000        0.000000        0.706000        1
        1       11      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       12      1       12      0.000000        1.000000
        0.000000        0.000000        0.000000        1.000000        1
        1       13      1       12      0.000000        1.000000
        0.000000        0.000000        0.000000        1.000000        1
        1       14      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       15      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       16      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       17      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
```

```
        1       18      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       19      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       20      1       12      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000        1
        1       21      1       12      0.000000        1.000000
        0.000000        0.000000        0.000000        0.706000        1
c-------------------------------------------------------------------------------
---------------
c204 Monthly-variable ET coefficients
c   defid        Group ID number.
c   deluid       Landuse ID number
c   monetcs      Monthly-variable coefficient to calculate actual ET for
Jan..Dec
c
c       defid   deluid  monETCs1        monETCs2        monETCs3
monETCs4        monETCs5        monETCs6        monETCs7        monETCs8
monETCs9        monETCs10       monETCs11       monETCs12
c-------------------------------------------------------------------------------
---------------
c205 Irrigation Withdrawal Options
c       Irrigation withdrawal information for each watershed
c    subbasin    subbasin id
c    rchid       reach id from where water is withdrawn (if reach does not
exist then
c                etdemand is assumed to be satisfied from an external source)
c    irrigdep    depth of irrigation withdrawal pipe (ft)
c
c       subbasin        rchid
        5046    0       0.000000
        5065    0       0.000000
        5066    0       0.000000
        5079    0       0.000000
        5080    0       0.000000
        5083    0       0.000000
        5173    0       0.000000
        5175    0       0.000000
        5183    0       0.000000
        5189    0       0.000000
c-------------------------------------------------------------------------------
---------------
c250 general quality constituent control
c
c    defid    parameter group id
c    dwqid    general quality id
c    qname    name of qual (must be a continuous string)
c    qunit    units for quality constituent output (mg/l), (ug/l), or
(#/100ml)
c    qsdfg    if = 0 no sediment associated qual
c                    if = 1 sediment associated in pervious/impervious land
(qsdfg should be > 0 in card 281)
c                    if = 2 sediment associated in pervious/impervious land
c                           and sediment associated qual is added to the
dissolved part
c    gqsdfg   if = 0 general quality constituent
c             if = 1 general quality constituent simulated as a sediment (only
one qual can be simulated as a sediment in each group)
c    qsofg    if = 1 then then accumulation and removal occur daily
c             if = 2 then then accumulation and removal occur every interval
c    potfcfg  if = 1 then apply background concentration potency factor (card
260) to only surface output
c             if = 2 then apply background concentration potency factor (card
260) to total land output
```

```
c
c       defid dwqid   qname  qunit  qsdfg  gqsdfg  qsofg  potfcfg
        1      3       TN      (mg/l)  2       0       2       1
        1      7       TP      (mg/l)  2       0       2       1
        1      11      TCu     (ug/l)  2       0       2       1
        1      12      TPb     (ug/l)  2       0       2       1
        1      14      TZn     (ug/l)  2       0       2       1
        1      16      TSe     (ug/l)  0       0       2       1
c-------------------------------------------------------------------------------
------------------------------
C255 subsurface quality control
c
c    (value of 0 = use constant qual-input; 1 = use corresponding monthly
variable card)
c
c    vqofg       if = 1 the accumulation rate and limiting storage of QUALOF
varies monthly   (cards 270, 271)
c    qsowfg      if = 1 the constituent is a QUALSURO (surface flow
associated).
c    vsqcfg      if = 1 the concentration of this constituent in surface
outflow varies monthly   (card 272)= 1 read table 272
c    qifwfg      if = 1 the constituent is a QUALIF (interflow associated).
c    viqcfg      if = 1 the concentration of this constituent in interflow
outflow varies monthly   (card 273)= 1 read table 273
c    qagwfg      if = 1 the constituent is a QUALGW (groundwater associated).
c    vaqcfg      if = 1 the concentration of this constituent in groundwater
outflow varies monthly (card 274)
c    adfglnd     if = 1 atmosperic deposition on land
c    maddfglnd   if = 1 atmosperic dry deposition varies monthly on land (card
275)
c    mawdfglnd   if = 1 atmosperic wet deposition varies monthly on land (card
276)
c
c       vqofg  qsowfg  vsqcfg  qifwfg  viqcfg  qagwfg  vaqcfg  adfglnd
maddfglnd  mawdfglnd
        0       1       0       1       0       1       0       1       0
        0
c-------------------------------------------------------------------------------
------------------------------
C260  qual-input
c    storage on surface and nonseasonal parameters
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    sqo     initial storage of QUALOF on surface (lb or #)
c    potfw   washoff potency factor if qsdfg > 0, card 250 (lb or #)/ton-
sediment
c    potfs   scour potency pactor if qsdfg > 0, card 250 (lb or #)/ton-
sediment
c    potfc   background concentration potency pactor if qsdfg > 0, card 250
(lb or #)/ton-sediment
c    acqop   accumulation rate of QUALOF on surface (lb or #)/acre/day
c    sqolim  maximum storage of QUALOF on surface (lb or #)/acre
c    wsqop   rate of surface runoff that removes 90% of stored QUALOF per hour
(in/hr)
c    soqc    concentration of constituent in surface outflow (mg/l), (ug/l),
or (#/100ml)
c    ioqc    concentration of constituent in interflow outflow (mg/l), (ug/l),
or (#/100ml)
c    aoqc    concentration of constituent in groundwater outflow (mg/l),
(ug/l), or (#/100ml)
c    addc    atmospheric dry deposition flux (lb/acre/day or #/acre/day)
c    awdc    atmospheric wet deposition concentration (mg/l), (ug/l), or
```

```
(#/100ml)
c
c       the units of the following parameters are as follow:
c       if in card 250, the unit is mg/l or ug/l, then M is lbs
c       if in card 250, the unit is #/100ml, then M is #, in this case the
unit for
c       soqc, ioqc and aoqc should be #/100ml instead of mg/l
c
c       defid  dwqid  deluid  sqo     potfw     potfs   potfc   acqop   sqolim
wsqop       soqc   ioqc   aoqc   addc  awdc
        1       3       1       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       2       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       3       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       4       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       5       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       6       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       7       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       8       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       9       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       10      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       11      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       12      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       13      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
        2.000000        2.000000        0.000000        0.000000
        0.000000
        1       3       14      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
```

```
2.000000        2.000000        0.000000        0.000000
0.000000
1       3       15      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
2.000000        2.000000        0.000000        0.000000
0.000000
1       3       16      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
2.000000        2.000000        0.000000        0.000000
0.000000
1       3       17      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
2.000000        2.000000        0.000000        0.000000
0.000000
1       3       18      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
2.000000        2.000000        0.000000        0.000000
0.000000
1       3       19      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
2.000000        2.000000        0.000000        0.000000
0.000000
1       3       20      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
2.000000        2.000000        0.000000        0.000000
0.000000
1       3       21      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
2.000000        2.000000        0.000000        0.000000
0.000000
1       7       1       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.900000        1.900000        0.000000        0.000000
0.000000
1       7       2       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.080000        1.080000        0.000000        0.000000
0.000000
1       7       3       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.080000        1.080000        0.000000        0.000000
0.000000
1       7       4       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.900000        1.900000        0.000000        0.000000
0.000000
1       7       5       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
3.000000        3.000000        0.000000        0.000000
0.000000
1       7       6       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.260000        1.260000        0.000000        0.000000
0.000000
1       7       7       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.260000        1.260000        0.000000        0.000000
0.000000
1       7       8       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       9       0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
```

```
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       10      0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.080000        1.080000        0.000000        0.000000
0.000000
1       7       11      0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.080000        1.080000        0.000000        0.000000
0.000000
1       7       12      0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.760000        1.760000        0.000000        0.000000
0.000000
1       7       13      0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.760000        1.760000        0.000000        0.000000
0.000000
1       7       14      0.000000        0.001000        0.001000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       15      0.000000        0.001000        0.001000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       16      0.000000        0.001000        0.001000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       17      0.000000        0.001000        0.001000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       18      0.000000        0.001000        0.001000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       19      0.000000        0.001000        0.001000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       7       20      0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       7       21      0.000000        0.010000        0.010000
0.000000        0.000000        0.000001        1.640000
1.000000        1.000000        0.000000        0.000000
0.000000
1       11      1       0.000000        0.800000        0.800000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       11      2       0.000000        0.600000        0.600000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       11      3       0.000000        0.600000        0.600000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       11      4       0.000000        0.800000        0.800000
0.000000        0.000000        0.000001        1.640000
```

```
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      5       0.000000        1.140000        1.140000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      6       0.000000        0.400000        0.400000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      7       0.000000        0.400000        0.400000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      8       0.000000        0.800000        0.800000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      9       0.000000        0.800000        0.800000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      10      0.000000        0.600000        0.600000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      11      0.000000        0.600000        0.600000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      12      0.000000        0.300000        0.300000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      13      0.000000        0.300000        0.300000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      14      0.000000        0.012000        0.012000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      15      0.000000        0.012000        0.012000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      16      0.000000        0.012000        0.012000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      17      0.000000        0.012000        0.012000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      18      0.000000        0.012000        0.012000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      19      0.000000        0.012000        0.012000
        0.000000        0.000000        0.000001        1.640000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        1       11      20      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000001        1.640000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000
1       11      21      0.000000        0.600000        0.600000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      1       0.000000        0.800000        0.800000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      2       0.000000        0.200000        0.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      3       0.000000        0.200000        0.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      4       0.000000        0.800000        0.800000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      5       0.000000        1.000000        1.000000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      6       0.000000        0.180000        0.180000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      7       0.000000        0.180000        0.180000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      8       0.000000        0.800000        0.800000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      9       0.000000        0.800000        0.800000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      10      0.000000        0.200000        0.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      11      0.000000        0.200000        0.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      12      0.000000        0.100000        0.100000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      13      0.000000        0.100000        0.100000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      14      0.000000        0.002000        0.002000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      15      0.000000        0.002000        0.002000
0.000000        0.000000        0.000001        1.640000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      16      0.000000        0.002000        0.002000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      17      0.000000        0.002000        0.002000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      18      0.000000        0.002000        0.002000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      19      0.000000        0.002000        0.002000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      20      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       12      21      0.000000        0.200000        0.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      1       0.000000        7.500000        7.500000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      2       0.000000        1.200000        1.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      3       0.000000        1.200000        1.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      4       0.000000        7.500000        7.500000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      5       0.000000        10.200000       10.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      6       0.000000        5.080000        5.080000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      7       0.000000        5.080000        5.080000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      8       0.000000        7.500000        7.500000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      9       0.000000        7.500000        7.500000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      10      0.000000        1.200000        1.200000
0.000000        0.000000        0.000001        1.640000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      11      0.000000        1.200000        1.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      12      0.000000        2.500000        2.500000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      13      0.000000        2.500000        2.500000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      14      0.000000        0.050000        0.050000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      15      0.000000        0.050000        0.050000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      16      0.000000        0.050000        0.050000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      17      0.000000        0.050000        0.050000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      18      0.000000        0.050000        0.050000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      19      0.000000        0.050000        0.050000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      20      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       14      21      0.000000        1.200000        1.200000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       16      1       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.470000        0.470000        0.000000        0.000000
0.000000
1       16      2       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.470000        0.470000        0.000000        0.000000
0.000000
1       16      3       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.470000        0.470000        0.000000        0.000000
0.000000
1       16      4       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.470000        0.470000        0.000000        0.000000
0.000000
1       16      5       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
```

```
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      6       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      7       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       16      8       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       16      9       0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       16      10      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      11      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      12      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
1.860000        1.860000        0.000000        0.000000
0.000000
1       16      13      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
1.860000        1.860000        0.000000        0.000000
0.000000
1       16      14      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      15      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      16      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      17      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      18      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      19      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.350000        0.350000        0.000000        0.000000
0.000000
1       16      20      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
0.000000        0.000000        0.000000        0.000000
0.000000
1       16      21      0.000000        0.000000        0.000000
0.000000        0.000000        0.000001        1.640000
```

```
        0.000000        0.000000        0.000000        0.000000
        0.000000
c-------------------------------------------------------------------------------
---------------
c270 mon-accumulation rate (monaccum)
c    only required if vqofg =1 (see card 255)
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    jan-dec accumulation rate at start of each month (lb/acre/day)
c       if in card 250, the unit is #/100ml, the above unit should be
#/acre/day
c
c       defid dwqid   deluid   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c-------------------------------------------------------------------------------
----------
c271 mon-storage limit of quality constituent (monsqolim)
c    only required if vqofg = 1 (see card 255)
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    jan-dec maximum storage at start of each month (lb/acre)
c       if in card 250, the unit is #/100ml, the above unit should be #/acre
c
c       defid dwqid   deluid   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c-------------------------------------------------------------------------------
----------
c272 mon-surfaceflow concentration (monsuroconc)
c    only required if vsqcfg = 1 (see card 255)
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    jan-dec concentration of constituent in surface flow at start of each
month (mg/l), (ug/l), or (#/100ml)
c       if in card 250, the unit is #/100ml, the above unit should be #/100ml
c
c       defid dwqid   deluid   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c-------------------------------------------------------------------------------
----------
c273 mon-interflow concentration (moninterconc)
c    only required if viqcfg = 1 (see card 255)
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    jan-dec concentration of constituent in interflow at start of each month
(mg/l), (ug/l), or (#/100ml)
c       if in card 250, the unit is #/100ml, the above unit should be #/100ml
c
c       defid dwqid   deluid   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c-------------------------------------------------------------------------------
----------
c274 mon-groundwater concentration (mongrndconc)
c    only required if vaqcfg = 1 (see card 255)
c
c    defid   parameter group id
c    dwqid   general quality id
```

```
c    deluid  landuse id
c    jan-dec concentration of constituent in groundwater at start of each
month (mg/l), (ug/l), or (#/100ml)
c       if in card 250, the unit is #/100ml, the above unit should be #/100ml
c
c       defid dwqid   deluid   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c------------------------------------------------------------------------------
---------------
c275 mon-atmospheric dry deposition flux
c    only required if maddfglnd = 1 (see card 255)
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    jan-dec flux of constituent in dry deposition at start of each month
(lb/acre/day or #/acre/day)
c
c       defid dwqid   deluid   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c------------------------------------------------------------------------------
---------------
c276 mon-atmospheric wet deposition concentration
c    only required if mawdfglnd = 1 (see card 255)
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    jan-dec concentration of constituent in atmospheric wet deposition at
start of each month (mg/l), (ug/l), or (#/100ml)
c
c       defid dwqid   deluid   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c------------------------------------------------------------------------------
---------------
C280 stream water quality control
c
c    adfgrch     if = 1 atmosperic deposition on reach (0 for no atmospheric
deposition)
c    maddfgrch   if = 1 atmosperic dry deposition varies monthly on reach
(card 282)
c    mawdfgrch   if = 1 atmosperic wet deposition varies monthly on reach
(card 283)
c
c       adfgrch  maddfgrch  mawdfgrch
        0       0       0
c------------------------------------------------------------------------------
------------------------------
c281 general quality constituent control
c
c    rgid     stream parameter group id
c    dwqid    general quality id
c    qsdfg    if = 0 no sediment associated qual
c                    if = 1 sediment associated in stream,
adsorption/desorption of qual is simulated
c    iniCond  initial instream concentration at start of simulation by group
(mg/l), (ug/l), or (#/100ml)
c    decay    general first-order instream loss rate of qual by reach group
(1/day)
c    tcdecay  temperature correction coefficient for first-order decay of qual
(min=1, max=2)
c    addc     atmospheric dry deposition flux (lb/acre/day or #/acre/day)
c    awdc     atmospheric wet deposition concentration (mg/l), (ug/l), or
(#/100ml)
```

```
c    potber   scour potency pactor for stream bank erosion if qsdfg > 0, (lb
or #)/ton-sediment
c
c       rgid  dwqid   qsdfg   iniCond  decay  tcdecay   addc   awdc   potber
        1       3       0       0.000000        0.100000        1.000000
        0.000000        0.000000        0.000000
        1       7       0       0.000000        0.100000        1.000000
        0.000000        0.000000        0.000000
        1       11      0       0.000000        0.200000        1.000000
        0.000000        0.000000        0.000000
        1       12      0       0.000000        0.200000        1.000000
        0.000000        0.000000        0.000000
        1       14      0       0.000000        0.200000        1.000000
        0.000000        0.000000        0.000000
        1       16      0       0.000000        0.200000        1.000000
        0.000000        0.000000        0.000000
c------------------------------------------------------------------------------
------------------------------
c282 mon-atmospheric dry deposition flux
c    only required if maddfgrch = 1 (see card 280)
c
c    rgid    reach group id
c    dwqid   general quality id
c    jan-dec flux of constituent in dry deposition at start of each month
(lb/acre/day or #/acre/day)
c
c       rgid dwqid   jan   feb   mar   apr   may   jun   jul   aug   sep   oct
nov   dec
c------------------------------------------------------------------------------
---------------
c283 mon-atmospheric wet deposition concentration
c    only required if mawdfgrch = 1 (see card 280)
c
c    rgid    reach group id
c    dwqid   general quality id
c    jan-dec concentration of constituent in atmospheric wet deposition at
start of each month (mg/l), (ug/l), or (#/100ml)
c
c       rgid dwqid   jan   feb   mar   apr   may   jun   jul   aug   sep   oct
nov   dec
c------------------------------------------------------------------------------
---------------
c285 parameters for decay of contaminant adsorbed to sediment
c    only required if qsdfg > 0 (see card 281)
c
c    rgid      reach group id
c    dwqid     general quality id
c    addcpm1   decay rate for qual adsorbed to suspended sediment (/day)
c    addcpm2   temperature correction coefficient for decay of qual on
suspended sediment (range from 1.0 to 2.0)
c    addcpm3   decay rate for qual adsorbed to bed sediment (/day)
c    addcpm4   temperature correction coefficient for decay of qual on bed
sediment (range from 1.0 to 2.0)
c
c   rgid  dwqid   addcpm1   addcpm2   addcpm3   addcpm4
        1       3       0.000000        1.070000        0.000000
        1.070000
        1       7       0.000000        1.070000        0.000000
        1.070000
        1       11      0.000000        1.070000        0.000000
        1.070000
        1       12      0.000000        1.070000        0.000000
        1.070000
        1       14      0.000000        1.070000        0.000000
```

```
        1.070000
        1       16      0.000000        1.070000        0.000000
        1.070000
c-------------------------------------------------------------------------------
---------------
c286 adsorption coefficients of qual
c    only required if qsdfg > 0 (see card 281)
c
c    rgid      reach group id
c    dwqid     general quality id
c    adpm1     distribution coefficients for qual with suspended sand (l/mg)
c    adpm2     distribution coefficients for qual with suspended silt (l/mg)
c    adpm3     distribution coefficients for qual with suspended clay (l/mg)
c    adpm4     distribution coefficients for qual with bed sand (l/mg)
c    adpm5     distribution coefficients for qual with bed silt (l/mg)
c    adpm6     distribution coefficients for qual with bed clay (l/mg)
c
c   rgid  dwqid   adpm1   adpm2   adpm3   adpm4   adpm5   adpm6
        1       3       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       7       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       11      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       12      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       14      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       16      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
c-------------------------------------------------------------------------------
---------------
c287 adsorption/desorption rate parameters
c    only required if qsdfg > 0 (see card 281)
c
c    rgid      reach group id
c    dwqid     general quality id
c    adpm1     transfer rates between adsorbed and desorbed states of qual
with suspended sand (/day)
c    adpm2     transfer rates between adsorbed and desorbed states of qual
with suspended silt (/day)
c    adpm3     transfer rates between adsorbed and desorbed states of qual
with suspended clay (/day)
c    adpm4     transfer rates between adsorbed and desorbed states of qual
with bed sand (/day)
c    adpm5     transfer rates between adsorbed and desorbed states of qual
with bed silt (/day)
c    adpm6     transfer rates between adsorbed and desorbed states of qual
with bed clay (/day)
c
c   rgid  dwqid   adpm1   adpm2   adpm3   adpm4   adpm5   adpm6
        1       3       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       7       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       11      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       12      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       14      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       16      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
c-------------------------------------------------------------------------------
```

```
---------------
c288 adsorption/desorption temperature correction parameters
c    only required if qsdfg > 0 (see card 281)
c
c    rgid      reach group id
c    dwqid     general quality id
c    adpm1     temperature correction coefficients for adsorption/desorption
on suspended sand (range from 1.0 to 2.0)
c    adpm2     temperature correction coefficients for adsorption/desorption
on suspended silt (range from 1.0 to 2.0)
c    adpm3     temperature correction coefficients for adsorption/desorption
on suspended clay (range from 1.0 to 2.0)
c    adpm4     temperature correction coefficients for adsorption/desorption
on bed sand (range from 1.0 to 2.0)
c    adpm5     temperature correction coefficients for adsorption/desorption
on bed silt (range from 1.0 to 2.0)
c    adpm6     temperature correction coefficients for adsorption/desorption
on bed clay (range from 1.0 to 2.0)
c
c   rgid  dwqid   adpm1   adpm2   adpm3   adpm4   adpm5   adpm6
        1       3       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       7       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       11      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       12      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       14      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       16      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
c-------------------------------------------------------------------------------
---------------
c289 initial concentrations on sediment
c    only required if qsdfg > 0 (see card 281)
c
c    rgid      reach group id
c    dwqid     general quality id
c    sqal1     initial concentrations of qual on suspended sand (concu/mg)
c    sqal2     initial concentrations of qual on suspended silt (concu/mg)
c    sqal3     initial concentrations of qual on suspended clay (concu/mg)
c    sqal4     initial concentrations of qual on bed sand (concu/mg)
c    sqal5     initial concentrations of qual on bed silt (concu/mg)
c    sqal6     initial concentrations of qual on bed clay (concu/mg)
c
c   rgid  dwqid   sqal1   sqal2   sqal3   sqal4   sqal5   sqal6
        1       3       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       7       0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       11      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       12      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       14      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        1       16      0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
c-------------------------------------------------------------------------------
---------------
C310 soil-data
c    only required if nitrfg = 1 or phosfg = 1 (see card 0)
c    soil layer depths, bulk densities, and wilting point
```

```
c
c    defid     parameter group id
c    deluid    landuse id
c    dep_sl    depth of surface layer (in)
c    dep_ul    depth of upper layer (in)
c    dep_ll    depth of lower layer (in)
c    dep_gwl   depth of groundwater layer (in)
c    bd_sl     bulkdensity of surface layer (lb/ft3)
c    bd_ul     bulkdensity of upper layer (lb/ft3)
c    bd_ll     bulkdensity of lower layer (lb/ft3)
c    bd_gwl    bulkdensity of groundwater layer (lb/ft3)
c    wp_sl     wiltingpoint of surface layer (fraction)
c    wp_ul     wiltingpoint of upper layer (fraction)
c    wp_ll     wiltingpoint of lower layer (fraction)
c    wp_gwl    wiltingpoint of groundwater layer (fraction)
c
c   defid deluid  depth_sl   depth_ul   depth_ll   depth_gwl    bd_sl    bd_ul
bd_ll    bd_gwl    wp_sl    wp_ul    wp_ll    wp_gwl
c------------------------------------------------------------------------------
---------------
C311  mstlay-parm
c    factors used to adjust solute leaching rates
c
c    defid   parameter group id
c    deluid  landuse id
c    slmpf   factor used to adjust solute percolation rate from the surface
layer storage to the upper layer principal storage
c    ulpf    factor used to adjust solute percolation rate from the upper
layer principal storage to the lower layer storage
c    llpf    factor used to adjust solute percolation rate from the lower
layer storage to the active and inactive groundwater
c
c   defid   deluid  slmpf     ulpf     llpf
c------------------------------------------------------------------------------
---------------
C312  mst-topstor
c    initial moisture storage in each topsoil layer
c
c    defid   parameter group id
c    deluid  landuse id
c    smstm   initial moisture content in the surface storage (lb/ac)
c    umstm   initial moisture content in the upper principal storage (lb/ac)
c    imstm   initial moisture content in the upper transitory (interflow)
storages (lb/ac)
c
c   defid   deluid  smstm     umstm     imstm
c------------------------------------------------------------------------------
---------------
C313  mst-topflx
c    initial fractional fluxes in each topsoil layer
c
c    defid   parameter group id
c    deluid  landuse id
c    fso     initial values of the fractional fluxes of soluble chemicals
through the topsoil layers of a PLS (/ivl)
c    fsp     initial values of the fractional fluxes of soluble chemicals
through the topsoil layers of a PLS (/ivl)
c    fii     initial values of the fractional fluxes of soluble chemicals
through the topsoil layers of a PLS (/ivl)
c    fup     initial values of the fractional fluxes of soluble chemicals
through the topsoil layers of a PLS (/ivl)
c    fio     initial values of the fractional fluxes of soluble chemicals
through the topsoil layers of a PLS (/ivl)
c
```

```
c   defid   deluid  fso     fsp     fii    fup     fio
c-------------------------------------------------------------------------------
---------------
C314  mst-substor
c    initial moisture storage in each topsoil layer
c
c    defid   parameter group id
c    deluid  landuse id
c    lmstm   initial moisture storages in the lower layer (lb/ac)
c    amstm   initial moisture content in the active groundwater layers (lb/ac)
c
c   defid   deluid  lmstm     amstm
c-------------------------------------------------------------------------------
---------------
C315  mst-subflx
c    initial fractional fluxes in each topsoil layer
c
c    defid   parameter group id
c    deluid  landuse id
c    flp     initial fractional fluxes of soluble chemicals through the
subsoil layers (/ivl)
c    fldp    initial fractional fluxes of soluble chemicals through the
subsoil layers (/ivl)
c    fao     initial fractional fluxes of soluble chemicals through the
subsoil layers (/ivl)
c
c   defid   deluid  flp     fldp     fao
c-------------------------------------------------------------------------------
---------------
C341 initial storage of nitrogen in the surface layer
c    only required if nitrfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    lorgn   initial storage of labile organic nitrogen (lb/acre)
c    amad    initial storage of adsorbed ammonium (lb/acre)
c    amsu    initial storage of solution ammonium (lb/acre)
c    no3     initial storage of nitrate (lb/acre)
c    pltn    initial storage of nitrogen stored in plants (lb/acre)
c    rorgn   initial storage of refractory organic nitrogen (lb/acre)
c
c   defid  deluid lorgn   amad    amsu    no3    pltn   rorgn
c-------------------------------------------------------------------------------
---------------
C342 initial storage of nitrogen in the upper layer
c    only required if nitrfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    lorgn   initial storage of labile organic nitrogen (lb/acre)
c    amad    initial storage of adsorbed ammonium (lb/acre)
c    amsu    initial storage of solution ammonium (lb/acre)
c    no3     initial storage of nitrate (lb/acre)
c    pltn    initial storage of nitrogen stored in plants (lb/acre)
c    rorgn   initial storage of refractory organic nitrogen (lb/acre)
c
c   defid  deluid lorgn   amad    amsu    no3    pltn   rorgn
c-------------------------------------------------------------------------------
---------------
C343 initial storage of nitrogen in the transitory layer
c    only required if nitrfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
```

```
c    iamsu   initial storage of solution ammonium (lb/acre)
c    ino3    initial storage of nitrate (lb/acre)
c    islon   initial storage of solution labile organic nitrogen  (lb/acre)
c    isron   initial storage of solution refractory organic nitrogen (lb/acre)
c    agpltn  initial storage of above-ground plant nitrogen (lb/acre)
c    littrn  initial storage of litter nitrogen (lb/acre)
c
c   defid  deluid iamsu   ino3    islon    isron    agpltn   littrn
c-------------------------------------------------------------------------------
---------------
C344 initial storage of nitrogen in the lower layer
c    only required if nitrfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    lorgn   initial storage of labile organic nitrogen (lb/acre)
c    amad    initial storage of adsorbed ammonium (lb/acre)
c    amsu    initial storage of solution ammonium (lb/acre)
c    no3     initial storage of nitrate (lb/acre)
c    pltn    initial storage of nitrogen stored in plants (lb/acre)
c    rorgn   initial storage of refractory organic nitrogen (lb/acre)
c
c   defid  deluid lorgn   amad    amsu    no3    pltn   rorgn
c-------------------------------------------------------------------------------
---------------
C345 initial storage of nitrogen in the groundwater layer
c    only required if nitrfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    lorgn   initial storage of labile organic nitrogen (lb/acre)
c    amad    initial storage of adsorbed ammonium (lb/acre)
c    amsu    initial storage of solution ammonium (lb/acre)
c    no3     initial storage of nitrate (lb/acre)
c    pltn    initial storage of nitrogen stored in plants (lb/acre)
c    rorgn   initial storage of refractory organic nitrogen (lb/acre)
c
c   defid  deluid lorgn   amad    amsu    no3    pltn   rorgn
c-------------------------------------------------------------------------------
---------------
C361 initial phosphorus storage in the surface layer
c    only required if phosfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    orgp    initial storage of organic phosphorus (lb/acre)
c    p4ad    initial storage of adsorbed phosphate (lb/acre)
c    p4su    initial storage of solution phosphate (lb/acre)
c    pltp    initial storage of phosphorus stored in plants (lb/acre)
c
c   defid  deluid orgp   p4ad    p4su    pltp
c-------------------------------------------------------------------------------
---------------
C362 initial phosphorus storage in the upper layer
c    only required if phosfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    orgp    initial storage of organic phosphorus (lb/acre)
c    p4ad    initial storage of adsorbed phosphate (lb/acre)
c    p4su    initial storage of solution phosphate (lb/acre)
c    pltp    initial storage of phosphorus stored in plants (lb/acre)
c
c   defid  deluid orgp   p4ad    p4su    pltp
```

```
c-------------------------------------------------------------------------------
---------------
C363 initial phosphorus storage in the transitory layer
c    only required if phosfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    ip4su   initial storage of solution phosphate (lb/acre)
c
c   defid  deluid ip4su
c-------------------------------------------------------------------------------
---------------
C364 initial phosphorus storage in the lower layer
c    only required if phosfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    orgp    initial storage of organic phosphorus (lb/acre)
c    p4ad    initial storage of adsorbed phosphate (lb/acre)
c    p4su    initial storage of solution phosphate (lb/acre)
c    pltp    initial storage of phosphorus stored in plants (lb/acre)
c
c   defid  deluid orgp   p4ad    p4su    pltp
c-------------------------------------------------------------------------------
---------------
C365 initial phosphorus storage in the groundwater layer
c    only required if phosfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    orgp    initial storage of organic phosphorus (lb/acre)
c    p4ad    initial storage of adsorbed phosphate (lb/acre)
c    p4su    initial storage of solution phosphate (lb/acre)
c    pltp    initial storage of phosphorus stored in plants (lb/acre)
c
c   defid  deluid orgp   p4ad    p4su    pltp
c-------------------------------------------------------------------------------
---------------
c390 atmosphere to stream mapping (read if mdasfg = 1 and adfgrch = 1)
c
c    rgid    reach parameter group id
c    dwqid   general quality id
c    OrgN    organic nitrogen fraction in pqual
c    NH4S    ammonium solution fraction in pqual
c    NH4E    ammonium exchange fraction in  pqual
c    NO3     nitrate fraction in pqual
c    NO2     nitrite fraction in pqual
c    SO4     sulfate fraction in pqual
c
c       defid dwqid   OrgN   NH4S   NH4E   NO3   NO2   SO4
c-------------------------------------------------------------------------------
---------------
c391 land surface to land sub-surface mapping (read if mdasfg =1)
c
c    defid   parameter group id
c    dwqid   general quality id
c    deluid  landuse id
c    OrgN    organic nitrogen fraction in pqual
c    NH4S    ammonium solution fraction in pqual
c    NH4E    ammonium exchange fraction in  pqual
c    NO3     nitrate fraction in pqual
c    NO2     nitrite fraction in pqual
c    SO4     sulfate fraction in pqual
c
```

```
c       defid dwqid   deluid   OrgN   NH4S   NH4E   NO3   NO2   SO4
c-------------------------------------------------------------------------------
---------------
c392 land to stream mapping (read if mdasfg=1)
c
c    rgid    stream parameters group id
c    dwqid   general quality id
c    lutype  landuse type flow id (1 = impervious surfaceflow,
c            2 = pervious surfaceflow, 3 = pervious interflow, 4 = pervious
groundflow)
c    PFe     Particulate iron fraction in pqual
c    DFe     Dissolved iron fraction in pqual
c    PAl     Particulate aluminum fraction in pqual
c    DAl     Dissolved aluminum fraction in pqual
c    CO3     CO3(2-) fraction in pqual
c    SO4     SO4 fraction in pqual
c
c       rgid   dwqid    lutype   PFe   DFe   PAl   DAl   CO3   SO4
c-------------------------------------------------------------------------------
---------------
C393 calibration parameters for the surfcae layer
c    only required if mdasfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    crfg    chemical reaction flag
c            0  = no chemical reaction
c            1  = only nitrogen transformation
c            2  = full chemical reactions
c    kes     nitrogen transformation (NH4E to NH4S) rate (per day)
c    kse     nitrogen transformation (NH4S to NH4E) rate (per day)
c    k1      nitrogen transformation (NH4S to NO2) rate (per day)
c    k2      nitrogen transformation (NO2 to NO3) rate (per day)
c    k3      nitrogen transformation (plant uptake NO3) rate (per day)
c    k4      nitrogen transformation (plant uptake NH4S) rate (per day)
c    k6      nitrogen transformation (OrgN to NH4S) rate (per day)
c    kk6     nitrogen transformation (NH4S to OrgN) rate (per day)
c    kk8     nitrogen transformation (NO3 to OrgN) rate (per day)
c    K_Al    Aluminum solubility constant
c    Ks      selectivity coefficient
c    CaX     base saturation percentage (fraction)
c    THETA   temperature correction coefficient for nitrogen transformation
for surface layer (range from 1.0 to 2.0)
c    OrgA    Organic acid input to the surface layer (mg/l)
c
c   defid deluid  crfg  kes   kse   k1   k2   k3   k4   k6   kk6   kk8  K_Al
Ks  CaX  theta  OrgA
c-------------------------------------------------------------------------------
---------------
C394 calibration parameters for the upper layer
c    only required if mdasfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    crfg    chemical reaction flag
c            0  = no chemical reaction
c            1  = only nitrogen transformation and sulfate adsorption
c            2  = full chemical reactions
c    kes     nitrogen transformation (NH4E to NH4S) rate (per day)
c    kse     nitrogen transformation (NH4S to NH4E) rate (per day)
c    k1      nitrogen transformation (NH4S to NO2) rate (per day)
c    k2      nitrogen transformation (NO2 to NO3) rate (per day)
c    k3      nitrogen transformation (plant uptake NO3) rate (per day)
c    k4      nitrogen transformation (plant uptake NH4S) rate (per day)
```

```
c    k6      nitrogen transformation (OrgN to NH4S) rate (per day)
c    kk6     nitrogen transformation (NH4S to OrgN) rate (per day)
c    kk8     nitrogen transformation (NO3 to OrgN) rate (per day)
c    Km      maximum adsorbable amount of sulfate(mol/kg)
c    OneH    value to use to determine a half saturation
c    DESORP  desorption rate (per day)
c    K_Al    Aluminum solubility constant (log K_Al)
c    Ks      selectivity coefficient (Log Ks)
c    CaX     base saturation percentage (fraction)
c    PeakMon growing season peak month
c    THETA   temperature correction coefficient for nitrogen transformation
for upper layer (range from 1.0 to 2.0)
c    OrgA    Organic acid input to the upper layer (mg/l)
c
c   defid deluid  crfg  kes   kse   k1   k2   k3   k4   k6   kk6   kk8   Km
OneH   DESORP  K_Al  Ks  CaX  PeakMon  theta  OrgA
c-------------------------------------------------------------------------------
---------------
C395 calibration parameters for the groundwater layer
c    only required if mdasfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    crfg    chemical reaction flag
c            0  = no chemical reaction
c            1  = only nitrogen transformation and sulfate adsorption
c            2  = full chemical reactions
c    kes     nitrogen transformation (NH4E to NH4S) rate (per day)
c    kse     nitrogen transformation (NH4S to NH4E) rate (per day)
c    k1      nitrogen transformation (NH4S to NO2) rate (per day)
c    k2      nitrogen transformation (NO2 to NO3) rate (per day)
c    k3      nitrogen transformation (plant uptake NO3) rate (per day)
c    k4      nitrogen transformation (plant uptake NH4S) rate (per day)
c    k6      nitrogen transformation (OrgN to NH4S) rate (per day)
c    kk6     nitrogen transformation (NH4S to OrgN) rate (per day)
c    kk8     nitrogen transformation (NO3 to OrgN) rate (per day)
c    Km      maximum adsorbable amount of sulfate(mol/kg)
c    OneH    value to use to determine a half saturation
c    DESORP  desorption rate (per day)
c    K_Al    Aluminum solubility constant (Log K_Al)
c    Ks      selectivity coefficient (Log Ks)
c    CaX     base saturation percentage (fraction)
c    PeakMon growing season peak month
c    THETA   temperature correction coefficient for nitrogen transformation
for groundwater layer (range from 1.0 to 2.0)
c    OrgA    Organic acid input to the groundwater layer (mg/l)
c
c   defid deluid  crfg  kes   kse   k1   k2   k3   k4   k6   kk6   kk8   Km
OneH   DESORP  K_Al  Ks  CaX  PeakMon  theta  OrgA
c-------------------------------------------------------------------------------
---------------
C396 calibration parameters for the reach
c    only required if mdasfg = 1 (see card 0)
c
c    rgid    reach group id
c            0  = no chemical reaction
c            1  = only nitrogen transformation and sulfate adsorption
c            2  = full chemical reactions
c    k1      nitrogen transformation (NH4S to NO2) rate (per day)
c    k2      nitrogen transformation (NO2 to NO3) rate (per day)
c    k3      nitrogen transformation (NO3 to ?) rate (per day)
c    k6      nitrogen transformation (OrgN to NH4S) rate (per day)
c    kk1     sulfate transformation rate (per day)
c    FEK     metal (iron) dissolution constants
```

```
c    AlK     metal (alluminium) dissolution constants
c    PCO     co2 value (per day)
c    FR_3    precipitation rate for Ca(2+) (per day)
c    FR_4    precipitation rate for CO3(2-) (per day)
c    FR_5    precipitation rate for dissolved iron (per day)
c    FRP_5   precipitation rate for particulate iron (per day)
c    FR_8    precipitation rate for dissolved alluminium (per day)
c    FRP_8   precipitation rate for particulate alluminium (per day)
c    FR_9    precipitation rate for Org (per day)
c    THETA   temperature correction coefficient for nitrogen transformation
for the stream (range from 1.0 to 2.0)
c    FR_Al   Al load (from soil chemical reaction) reduction factor in the
base flow
c            during the dry days (0 - no reduction,1 - 100% reduction)
c
c   rgid   crfg  k1   k2   k3   k6   kk1  FEK   AlK  PCO   FR_3   FR_4   FR_5
FRP_5   FR_8   FRP_8   FR_9  theta  FR_Al
c------------------------------------------------------------------------------
---------------
C397 initial storage in the top layer
c    only required if mdasfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    OrgN_S  initial storage of organic nitrogen in the surface layer
(lb/acre)
c    OrgN_U  initial storage of organic nitrogen in the upper layer (lb/acre)
c    OrgN_I  initial storage of organic nitrogen in the transitory layer
(lb/acre)
c    NH4S_S  initial storage of solution ammonium in the surface layer
(lb/acre)
c    NH4S_U  initial storage of solution ammonium in the upper layer (lb/acre)
c    NH4S_I  initial storage of solution ammonium in the transitory layer
(lb/acre)
c    NH4E_S  initial storage of exchange ammonium in the surface layer
(lb/acre)
c    NH4E_U  initial storage of exchange ammonium in the upper layer (lb/acre)
c    NH4E_I  initial storage of exchange ammonium in the transitory layer
(lb/acre)
c    NO3_S   initial storage of nitrate in the surface layer (lb/acre)
c    NO3_U   initial storage of nitrate in the upper layer (lb/acre)
c    NO3_I   initial storage of nitrate in the transitory layer (lb/acre)
c    NO2_S   initial storage of nitrite in the surface layer (lb/acre)
c    NO2_U   initial storage of nitrite in the upper layer (lb/acre)
c    NO2_I   initial storage of nitrite in the transitory layer (lb/acre)
c    SO4_S   initial storage of sulfate in the surface layer (lb/acre)
c    SO4_U   initial storage of sulfate in the upper layer (lb/acre)
c    SO4_I   initial storage of sulfate in the transitory layer (lb/acre)
c
c   defid  deluid OrgN_S   OrgN_U   OrgN_I   NH4S_S    NH4S_U    NH4S_I
NH4E_S    NH4E_U    NH4E_I    NO3_S    NO3_U    NO3_I    NO2_S   NO2_U   NO2_I
SO4_S   SO4_U   SO4_I
c------------------------------------------------------------------------------
---------------
C398 initial storage in the sub layer
c    only required if mdasfg = 1 (see card 0)
c
c    defid   parameter group id
c    deluid  landuse id
c    OrgN_L  initial storage of organic nitrogen in the lower layer (lb/acre)
c    OrgN_A  initial storage of organic nitrogen in the groundwater layer
(lb/acre)
c    NH4S_L  initial storage of solution ammonium in the lower layer (lb/acre)
c    NH4S_A  initial storage of solution ammonium in the groundwater layer
```

```
(lb/acre)
c    NH4E_L  initial storage of exchange ammonium in the lower layer (lb/acre)
c    NH4E_A  initial storage of exchange ammonium in the groundwater layer
(lb/acre)
c    NO3_L   initial storage of nitrate in the lower layer (lb/acre)
c    NO3_A   initial storage of nitrate in the groundwater layer (lb/acre)
c    NO2_L   initial storage of nitrite in the lower layer (lb/acre)
c    NO2_A   initial storage of nitrite in the groundwater layer (lb/acre)
c    SO4_L   initial storage of sulfate in the lower layer (lb/acre)
c    SO4_A   initial storage of sulfate in the groundwater layer (lb/acre)
c
c   defid  deluid OrgN_L   OrgN_A   NH4S_L    NH4S_A    NH4E_L    NH4E_A
NO3_L    NO3_A    NO2_L   NO2_A   SO4_L   SO4_A
c-----------------------------------------------------------------------------
---------------
C399 initial concentration in the stream
c    only required if mdasfg = 1 (see card 0)
c
c    defid parameter group id
c    OrgN  initial conc of organic nitrogen in the stream (mg/l)
c    H2O   initial conc of H2O in the stream (mg/l)
c    H     initial conc of H(+) in the stream (mg/l)
c    Ca    initial conc of Ca(2+) in the stream (mg/l)
c    CO3   initial conc of CO3(2-) in the stream (mg/l)
c    Fe    initial conc of Fe(3+) in the stream (mg/l)
c    NO3   initial conc of nitrate in the stream (mg/l)
c    NH4   initial conc of ammonium in the stream (mg/l)
c    Al    initial conc of aluminum in the stream (mg/l)
c    Org   initial conc of Torg in the stream (mg/l)
c    SO4   initial conc of sulfate in the stream (mg/l)
c    PF    initial conc of ParF in the stream (mg/l)
c    PA    initial conc of ParA in the stream (mg/l)
c    NO2   initial conc of nitrite in the stream (mg/l)
c
c   defid  OrgN   H2O   H    Ca    CO3    Fe    NO3   NH4   Al    Org   SO4
PF   PA   NO2
c-----------------------------------------------------------------------------
---------------
c400 general channel information
c
c    admod   advection method (1 for dynamic mixing same as in HSPF and 2 for
static mixing)
c    kc      crop factor associated with PEVT (used to back-calculate EVAP;
EVAP = PEVT/kc)
c    sedber  stream bank erosion sediment (1 for on and 0 for off)
c    vconfg  a value of 1 for vconfg means that F(vol) (volume-dependent)
outflow demand components are multiplied by a factor which is allowed to vary
through the year.
c            These monthly adjustment factors are input in Table-type MON-
CONVF in this section (card 401)
c
c       admod    kc   sedber   vconfg
        1       2.000000000000e+000     0       0
c-----------------------------------------------------------------------------
---------------
c401 monthly F(vol) adjustment factors
c    only required if vconfg = 1 (see card 400)
c
c    rgid     stream parameter group id
c    jan-dec  F(vol) adjustment factors at the start of each month
c
c  rgid jan   feb   mar   apr   may   jun   jul   aug   sep   oct   nov   dec
c-----------------------------------------------------------------------------
---------------
```

```
c405 channel routing network
c
c    rchid   reach id (same as subbasin id)
c    control output control switch for the corresponding reach
c            0 = will not write general output
c            1 = will write general output
c    NumOutlets number of downstream outlets
c    DSn     downstream outlets  DS1   Ds2  ....  DSn
c
c    rchid   control   NumOutlets   DS1   DS2  .......   DSn
        5046    1       1       5045
        5065    1       1       5064
        5066    1       1       5065
        5079    1       1       5078
        5080    1       1       5078
        5083    1       1       5082
        5173    1       1       5172
        5175    1       1       5172
        5183    1       1       5181
        5189    1       1       5187
c------------------------------------------------------------------------------
---------------
c410 reach geometry information
c
c    rchid   reach/lake id (same as subbasin id)
c    rgid    reach/lake group id
c    trgid   threshold reach/lake group id
c    lkfg    reach/lake flag (0 for reach otherwise lake)
c            lake flag = 1 (rectangular weir for internal option)
c            lake flag = 2 (triangular weir for internal option)
c            lake flag = 11 (BMP with rectangular weir for internal option)
c            lake flag = 12 (BMP with triangular weir for internal option)
c    idepth  reach/lake initial water depth (feet)
c    length  reach/lake length (miles)
c    depth   reach/lake bank full depth (feet)
c    width   reach/lake bankfull width (feet)
c    slope   reach longitudinal slope/lake infiltration rate (in/hr)
c    Mann    reach Manning's roughness coefficient/lake weir width (ft)
c    r1      reach ratio of bottom width to bank full width (bottom width = r1
* width)/lake orifice height (ft)
c    r2      reach side slope of flood plane/lake orifice diameter (ft)
c    w1      reach flood plane width factor (total width of flood plane =
w1*Width)/lake median particle size diameter, db50 (ft)
c    crat    ratio of maximum velocity to mean velocity in the RCHRES cross-
section under typical flow conditions (greater than or equal to 1)
c    ks     the weighting factor for hydraulic routing (calibration)
c
c       rchid   rgid  trgid   lkfg      idepth  length    depth  width
slope     mann    r1    r2    w1    crrat  ks
        5046    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5065    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5066    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5079    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
```

```
        0.000000
        5080    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5083    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5173    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5175    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5183    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
        5189    1       0       0       0.000000        0.000000
        0.000000        0.000000        0.000100        0.020000
        0.500000        0.500000        1.500000        1.500000
        0.000000
c-------------------------------------------------------------------------------
---------------
c413 reach cross-section information
c
c    rchid   x1 y1      x2      y2...
c    rchid   reach id (same as subbasin id)
c    x       distance from the left reach bank (ft)
c            it should not be greater than bank full width in card 410 (ft)
c    y       elevation from the reach bed (ft)
c            it should not be greater than bank full depth in card 410 (ft)
c
c-------------------------------------------------------------------------------
---------------
c415 reach discharge-volume relationship
c
c    rchid   reach id
c    depth   water depth (feet)
c    area    water surface area (acres)
c    vol     water volume (ac-ft)
c    disch(1, 2, 3, ....noutflows)  outflows (cfs)
c
c       rchid  depth   area    vol    disch1    disch2   .......   dischN
c-------------------------------------------------------------------------------
---------------
c420 general point source information
c
c    nPtSource   number of individual point sources
c    nPtQuals    number of point source quals
c
c  nPtSource  nPtQuals
        0       0
c-------------------------------------------------------------------------------
---------------
c425 point source
c    Qualindex  point source qual index
c    Qualname   point source qual name
c    Qualid        point source qual id
c    sqalfr        point source sediment associated qual fraction (0-1)
c
```

```
c  Qualindex  Qualname  qualid
c------------------------------------------------------------------------------
---------------
c430 point source withdrawal
c    subbasin  point source reach id
c    permit    point source permit
c    pipe      point source pipe
c    wd_target point source withdrawal target reach id
c
c  subbasin  permit  pipe   wd_target
c------------------------------------------------------------------------------
---------------
c440 sediment parameters controls
c
c    crvfg   if crvfg = 1, erosion-related cover may vary throughout the year.
c            values are supplied in Table-type MON-COVER (card 453)
c    vsivfg  if vsivfg = 1, the rate of net vertical sediment input may vary
throughout the year.
c            if vsivfg = 2, the vertical sediment input is added to the
detached sediment storage only on days when no rainfall occurred during the
previous day.
c            values are supplied in Table-type MON-NVSI (card 454)
c    sandfg  if sandfg = 0, the sand is not simulated.
c            if sandfg = 1, the sand transport capacity is calculated using
the Toffaleti method.
c            if sandfg = 2, the sand transport capacity is calculated using
the Colby method.
c            if sandfg = 3, the sand transport capacity is calculated using
the power function of velocity.
c    sweepfg if sweepfg = 0, the street sweeping is not simulated.
c
c       crvfg    vsivfg    sandfg    sweepfg
        0       0       3       0
c------------------------------------------------------------------------------
---------------
c445 street sweeping (read if sweepfg =1, see card 440)
c
c    defid         parameter group id
c    deluid        landuse id
c    deluname      landuse name
c    start_month   start month of street sweeping requirement
c    end_month     end month of street sweeping requirement
c    frequency     days between street sweeping within the landuse (0 for no
sweeping)
c    percent_area  fraction of land surface which is available for street
sweeping (0 for no sweeping)
c    effic_sand    fraction of sand in solids storage that is available for
removal by sweeping (0-1)
c    effic_silt    fraction of silt in solids storage that is available for
removal by sweeping (0-1)
c    effic_clay    fraction of clay in solids storage that is available for
removal by sweeping (0-1)
c
c       defid   deluid   deluname   start_month   end_month   frequency
percent_area   effic_sand   effic_silt   effic_clay
c------------------------------------------------------------------------------
---------------
c450 sediment parameter group 1 (read if sedfg =1)
c
c    defid   parameter group id
c    deluid  landuse id
c    smpf    supporting management practice factor
c    krer    coefficient in the soil detachment equation
c    jrer    exponent in the soil detachment equation
```

```
c    affix   fraction by which detached sediment storage decreases each day as
a result of
c            soil compaction. (/day)
c    cover   fraction of land surface which is shielded from rainfall erosion
c    nvsi    rate at which sediment enters detached storage from the
atmosphere (lb/ac/day)
c            negative value may be used to simulate removal by human activity
or wind
c    kser    coefficient in the detached sediment washoff equation
c    jser    exponent in the detached sediment washoff equation
c    kger    coefficient in the matrix soil scour equation, which simulates
gully erosion
c    jger    exponent in the matrix soil scour equation, which simulates gully
erosion
c    accsdp  rate at which solids accumulate on the land surface (used in
impervious land)
c    remsdp  fraction of solids storage which is removed each day when there
is no runoff,
c            for example, because of street sweeping (used in impervious land)
c
c       defid deluid  smpf   krer   jrer  affix  cover    nvsi  kser   jser
kger  jger   accsdp remsdp
        1      1      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.035000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      2      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.030000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      3      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.030000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      4      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.035000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      5      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.070000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      6      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.065000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      7      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.065000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      8      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.085000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      9      1.000000        0.000000        0.000000
        0.000000      0.000000        0.000000        0.085000
        2.000000      0.000000        2.000000        0.001000
        0.025000
        1      10     1.000000        0.100000        1.810000
        0.003000      0.270000        0.000000        0.001000
        2.000000      0.000000        2.000000        0.000000
        0.000000
        1      11     1.000000        0.100000        1.810000
        0.003000      0.270000        0.000000        0.100000
```

```
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       12      1.000000        0.100000        1.810000
        0.003000        0.270000        0.000000        0.100000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       13      1.000000        0.100000        1.810000
        0.003000        0.270000        0.000000        0.100000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       14      1.000000        0.100000        1.810000
        0.003000        0.270000        0.000000        0.100000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       15      1.000000        0.100000        1.810000
        0.003000        0.270000        0.000000        0.100000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       16      1.000000        0.350000        1.810000
        0.003000        0.270000        0.000000        0.150000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       17      1.000000        0.350000        1.810000
        0.003000        0.270000        0.000000        0.150000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       18      1.000000        0.350000        1.810000
        0.003000        0.270000        0.000000        0.150000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       19      1.000000        0.350000        1.810000
        0.003000        0.270000        0.000000        0.150000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       20      1.000000        0.000000        1.810000
        0.003000        0.000000        0.000000        0.000000
        2.000000        0.000000        2.000000        0.000000
        0.000000
        1       21      1.000000        0.100000        1.810000
        0.003000        0.000000        0.000000        0.100000
        2.000000        0.000000        2.000000        0.000000
        0.000000
c------------------------------------------------------------------------------
---------------
c451 sediment parameter group 2 (read if sedfg =1)
c
c    defid     parameter group id
c    deluid    landuse id
c    sed-suro  background concentration associated with surface flow (mg/l)
c    sed-ifwo  background concentration associated with interflow outflow
(mg/l)
c    sed-agwo  background concentration associated with groundwater outflow
(mg/l)
c    sed_i     fraction of sediment class_i (sand, silt, and clay)
c
c    (sand + silt + clay = 1)
c    Background sediment load is added to total sediment from LAND prior to
applying fractions
c
c       defid   deluid    sed_suro   sed_ifwo   sed_agwo   sed_1   sed_2
sed_3 ........sed_n
        1       1       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       2       0.000000        0.000000        0.000000
```

```
        0.050000        0.550000        0.400000
        1       3       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       4       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       5       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       6       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       7       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       8       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       9       0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       10      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       11      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       12      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       13      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       14      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       15      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       16      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       17      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       18      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       19      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       20      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
        1       21      0.000000        0.000000        0.000000
        0.050000        0.550000        0.400000
c-------------------------------------------------------------------------------
---------------
c452 GQUAL-sediment to stream mapping (read if sediment as gqual)
c
c    defid   parameter group id
c    dwqid   general quality id
c    lutype  landuse type flow id (1 = impervious surfaceflow,
c            2 = pervious surfaceflow, 3 = pervious interflow, 4 = pervious
groundflow)
c    sed_i   fraction of sediment class_i (sand, silt, and clay)
c
c       defid dwqid    lutype   sed_1   sed_2   sed_3 ........sed_n
c-------------------------------------------------------------------------------
---------------
c453 monthly erosion-related cover values
c    only required if crvfg = 1 (see card 440)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec erosion-related cover values at start of each month
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-------------------------------------------------------------------------------
-------
```

```
c454 monthly net vertical sediment input
c    only required if vsivfg = 1 (see card 440)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec net vertical sediment input at start of each month (lb/acre/day)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-------------------------------------------------------------------------------
-------
c455 sediment general parameters group 3 (read if sedfg = 1)
c    general sediment related parameters for instream transport
c
c    rgid     stream parameter group id
c    bedwid   bed width (ft) - this is constant for the entire simulation
period
c    beddep   initial bed depth (ft)
c    por      porosity
c    burial   burial rate of aggregated sediment layer (in/day)
c             if burial = 0 then burial rate in card 456 is used
c
c
c       rgid  bedwid  beddep  por  burial
        1      1.000000        0.000000        0.300000        0.000000
c-------------------------------------------------------------------------------
---------------
c456 sediment parameters group 4 (read if sedfg = 1)
c    cohesive suspended sediment variables for instream transport
c
c    rgid           stream parameter group id
c    sed_id         sediment class id
c    sedflg         sediment flag indicating sediment class (0 for sand, 1 for
silt, and 2 for clay)
c    sedo           initial sediment conc in fluid phase (mg/liter)
c    sedfrac        initial sediment fractions (by weight) in the bed material
c    db50/d         median diameter of the non-cohesive sediment (sand) (in)
(sandfg = 1 or 2)
c                   / effective diameter of the cohesive particles (silt and
clay) (in)
c    w              corresponding fall velocity of the particle in still water
(in/s)
c    rho            density of the particles (gm/cm^3)
c    ksand/taucd    coefficient in the sandload power function formula (sandfg
= 3)
c                   / critical bed shear stress for deposition of the cohesive
particle - generally taucd <= taucs (lb/ft^2)
c                   if tau > taucd then no deposition
c                   if tau < taucd then deposition rate approaches settling
velocity, w
c    expsnd/taucs   exponent in the sandload power function formula (sandfg =
3)
c                   / critical bed shear stress for scour of the cohesive
particle (lb/ft^2)
c                   if tau < taucs then no scour
c                   if tau > taucs then scour steadily increases
c    m              erodibility coefficient of the cohesive particle
(lb/ft^2/day)
c    burial         burial rate of the sediment particle (in/day)
c                   it is used if burial rate in card 455 is zero
c
c
c       rgid  sed_id  sedflg    sedo  sedfrac  db50/d   w  rho  ksand/taucd
expsnd/taucs  m   burial
```

```
       1       1       0       0.000000        0.100000        0.005000
       0.020000        2.500000        0.350000        3.200000
       0.000000        0.000000
       1       2       1       0.000000        0.450000        0.000600
       0.010000        2.200000        0.150000        0.900000
       3.000000        0.000000
       1       3       2       0.000000        0.450000        0.000060
       0.000100        2.000000        0.080000        0.800000
       5.000000        0.000000
c------------------------------------------------------------------------------
---------------
c457 Streambank erosion sediment parameters (read if sedfg = 1 and sedber = 1)
c
c    rchid   reach id
c    kber    coefficient for scour of the bank matrix soil (calibration)
c    jber    exponent for scour of the bank matrix soil (calibration)
c    qber    bank erosion flow threshold causing channel bank soil erosion
(cfs)
c            if = negative then threshold flow is at the bank full depth (cfs)
c    sed_i   fraction of sediment class_i (sand, silt, and clay)
c
c       rchid    kber    jber    qber   sed_1   sed_2   sed_3 ....sed_n
c------------------------------------------------------------------------------
---------------
c460 soil temperature control   (read if tempfg = 1)
c
c    msltfg  if = 1 monthly vary aslt and bslt parameters in surface flow
temperature calculation
c    miftfg  if = 1 monthly vary aift and bift parameters in interflow
temperature calculation
c    mgwtfg  if = 1 monthly vary agwt and bgwt parameters in ground water
temperature calculation
c
c       msltfg     miftfg      mgwtfg
c------------------------------------------------------------------------------
---------------
c461 Soil Temperature   (read if tempfg =1)
c
c    defid   parameter group id
c    deluid  landuse id
c    tsopfg  if = 0 compute subsurface temperatures using a mean departure
from air temperature plus a smoothing factor
c            if = 1 compute subsurface temperature using regression
c            if = 2 the lower/gw layer temperature is a function of upper
layer temperature instead of air temperature
c    aslt    surface layer temperature when the air temperature 0 degrees C
c    bslt    slope of the surface layer temperature regression equation
c    aift    mean difference between interflow temperature and air temperature
(C)
c    bift    smoothing factor in the interflow temperature calculation
c    agwt    mean difference between groundwater temperature and air
temperature (C)
c    bgwt    smoothing factor in the groundwater temperature calculation
c    islt    initial surface flow temperature (C)
c    iift    initial interflow temperature (C)
c    igwt    initial groundwater temperature (C)
c
c            y = a + b * x
c       defid deluid   tsopfg    aslt     bslt     aift     bift     agwt
bgwt  islt   iift   igwt
c------------------------------------------------------------------------------
---------------
c462 mon-aslt
c    only required if tempfg = 1 and msltfg = 1 (see card 460)
```

```
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec surface layer temperature when the air temperature 0 degrees C at
start of each month (C)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-----------------------------------------------------------------------------
-------
c463 mon-bslt
c    only required if tempfg = 1 and msltfg = 1 (see card 460)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec slope of the surface layer temperature regression equation at
start of each month
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-----------------------------------------------------------------------------
-------
c464 mon-aift
c    only required if tempfg = 1 and miftfg = 1 (see card 460)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec mean difference between interflow temperature and air temperature
at start of each month (C)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-----------------------------------------------------------------------------
-------
c465 mon-bift
c    only required if tempfg = 1 and miftfg = 1 (see card 460)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec smoothing factor in the interflow temperature calculation at
start of each month
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-----------------------------------------------------------------------------
-------
c466 mon-agwt
c    only required if tempfg = 1 and mgwtfg = 1 (see card 460)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec mean difference between groundwater temperature and air
temperature at start of each month (C)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-----------------------------------------------------------------------------
-------
c467 mon-bgwt
c    only required if tempfg = 1 and mgwtfg = 1 (see card 460)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec smoothing factor in the groundwater temperature calculation at
```

```
start of each month
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-----------------------------------------------------------------------------
-------
c470 Temperature Parameters for Land Groups  (read if tempfg =1)
c
c    subbasin    subbasin id
c    melev          the mean watershed elevation (ft)
c    eldat       difference in elevation between watershed and the air
temperature gage (ft)
c    rmelev      the mean RCHRES elevation (ft)
c    reldat      difference in elevation between the RCHRES and the air
temperature gage (ft)
c                (positive if RCHRES is higher than the gage).
c
c       subbasin   melev     eldat   rmelev     reldat
c-----------------------------------------------------------------------------
---------------
c475 Temperature Parameters for Stream Groups  (read if tempfg =1)
c
c    rgid    stream parameters group id
c    cfsaex  correction factor for solar radiation; fraction of RCHRES surface
exposed to radiation
c    katrad  longwave radiation coefficient
c    kcond   conduction-convection heat transport coefficient
c    kevap   evaporation coefficient
c
c       rgid   cfsaex    katrad     kcond     kevap
c-----------------------------------------------------------------------------
---------------
c480 Bed Heat Conduction Parameters for Stream Groups  (read if tempfg=1)
c
c    rgid    stream parameters group id
c    preflg  flag for heat transfer rates for water surface (0 = off)
c    bedflg  bed conduction flag
c            0 - bed conduction is not simulated
c            1 - single interface (water-mud) heat transfer method
c            2 - two-interface (water-mud and mud-ground) heat transfer method
c            3 - Jobson method (not supported)
c    tgflg   source of the ground temperature for the bed conduction (used
when bedflg is 1 or 2)
c            1 - time series (not supported)
c            2 - single value
c            3 - monthly values (card 485)
c    muddep  depth of the mud layer in the two-interface model (bedflg = 2)
(m)
c    tgrnd   constant (tgflg = 2) ground temperature (bedflg = 1 or 2) (degree
C)
c    kmud    heat conduction coefficient between water and the mud/ground
(bedflg = 1 or 2) (kcal/m2/degC/hr)
c    kgrnd   heat conduction coefficient between ground and mud in the two-
interface model (bedflg = 2) (kcal/m2/degC/hr)
c
c       rgid   preflg   bedflg   tgflg   muddep   tgrnd   kmud   kgrnd
c-----------------------------------------------------------------------------
---------------
c485 monthly ground temperatures for bed heat conduction algorithms
c    only required if tgflg = 3 (see card 480)
c
c    rgid     stream parameter group id
c    jan-dec  tgrndm - monthly ground temperatures for use in the bed heat
conduction models (degree C)
```

```
c
c  rgid jan   feb   mar   apr   may   jun   jul   aug   sep   oct   nov   dec
c-------------------------------------------------------------------------------
---------------
c500 land to stream mapping (read if oxfg =1)
c
c    rgid    stream parameters group id
c    dwqid   general quality id
c    lutype  landuse type flow id (1 = impervious surfaceflow,
c            2 = pervious surfaceflow, 3 = pervious interflow, 4 = pervious
groundflow)
c    bod     bod fraction in pqual
c    nox     nitrate fraction in pqual
c    tam     total ammonia fraction in  pqual
c    snh4    particulate NH4-N fraction in pqual
c    po4     ortho-phosphorus fraction in pqual
c    spo4    particulate PO4-P fraction in pqual
c    orn     organic-nitrogen fraction in pqual
c    orp     organic-phosphorus fraction in pqual
c    orc     organic-carbon fraction in pqual
c
c       rgid   dwqid    lutype   bod   nox   tam   snh4   po4   spo4   orn
orp   orc
c-------------------------------------------------------------------------------
---------------
c502 gases control   (read if oxfg =1)
c
c    midofg  if = 1 monthly very DO concentration in interflow
c    mico2fg if = 1 monthly very CO2 concentration in interflow
c    madofg  if = 1 monthly very DO concentration in ground water
c    maco2fg if = 1 monthly very CO2 concentration in ground water
c
c       midofg     mico2fg      madofg      maco2fg
c-------------------------------------------------------------------------------
---------------
c503   DO-CO2 Control constant values (read if oxfg =1)
c
c    defid   parameter group id
c    deluid  landuse id
c    sdoxp   concentration of dissolved oxygen in surface flow (mg/l)
c    sco2p   concentration of dissolved CO2 in surface flow (mg/l)
c    idoxp   concentration of dissolved oxygen in interflow outflow (mg/l)
c    ico2p   concentration of dissolved CO2 in interflow outflow (mg/l)
c    adoxp   concentration of dissolved oxygen in active groundwater outflow
(mg/l)
c    aco2p   concentration of dissolved CO2 in active groundwater outflow
(mg/l)
c
c       defid deluid   sdoxp    sco2p     idoxp    ico2p     adoxp    aco2p
c-------------------------------------------------------------------------------
---------------
c504 mon-DO (interflow)  mg C/l
c    only required if oxfg = 1 and midofg = 1 (see card 502)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec interflow dissolved oxygen concentration at start of each month
(mg/l)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-------------------------------------------------------------------------------
-------
c505 mon-DO (groundwater)
```

```
c    only required if oxfg = 1 and madofg = 1 (see card 502)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec groundwater dissolved oxygen concentration at start of each month
(mg/l)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-------------------------------------------------------------------------------
-------
c506 mon-CO2 (interflow)  mg C/l
c    only required if oxfg = 1 and mico2fg = 1 (see card 502)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec interflow carbon dioxide concentration at start of each month
(mg/l)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-------------------------------------------------------------------------------
---------------
c507 mon-CO2 (groundwater)
c    only required if oxfg = 1 and maco2fg = 1 (see card 502)
c
c    defid   parameter group id
c    deluid  landuse id
c    jan-dec groundwater carbon dioxide concentration at start of each month
(mg/l)
c
c       defid deluid   jan   feb   mar   apr   may   jun   jul   aug   sep
oct   nov   dec
c-------------------------------------------------------------------------------
---------------
c510 DO/BOD control
c
c    benrfg   benthic release flag (for benthic related parameters)
c    reamfg reaeration flag (indicates the method used to calculate the
reaeration coefficient for free-flowing streams)
c    if = 1 then Tsivoglou method is used
c    if = 2 then Owens, Churchill, or O'Connor-Dobbins method is used
depending on velocity and depth of water
c    if = 3 then Coefficient is calculated as a power function of velocity
and/or depth
c
c       benrfg     reamfg
c-------------------------------------------------------------------------------
---------------
c511 ox-parm1
c
c    rgid    stream parameter group id
c    kbod20  bod decay rate at 20oC (1/hr)
c    tcbod   temperature adjustment coefficient for bod decay
c    kodset  bod settling rate (m/hr)
c    supsat  maximum allowable dissolved oxygen supersaturation (expressed as
a multiple of the dissolved oxygen saturation concentration)
c    tcginv  temperature correction coefficient for surface gas invasion
c    reak    empirical constant in the equation
c            if reamfg = 1 then it is an escape coefficient (1/ft)
c            if reamfg = 3 then it is used to calculate the reaeration
coefficient (1/hr)
c    expred  exponent to depth in the reaeration coefficient equation (for
reamfg = 3)
```

```
c    exprev  exponent to velocity in the reaeration coefficient equation (for
reamfg = 3)
c    cforea  correction factor in the lake reaeration equation; it accounts
for good or poor circulation characteristics
c
c       rgid   kbod20   tcbod   kodset   supsat   tcginv   reak   expred
exprev   cforea
c-----------------------------------------------------------------------------
---------------
c512 ox-parm2
c
c    rgid       stream parameter group id
c    benod      benthal oxygen demand at 20 degrees C (with unlimited DO
concentration) (mg/m2/hr)
c    tcben      temperature correction coefficient for benthal oxygen demand
c    expod      exponential factor in the dissolved oxygen term of the benthal
oxygen demand equation
c    brbod      benthal release rate of BOD under aerobic
conditions.(mg/m2/hr)
c    brbod_inc  increment to benthal release of BOD under anaerobic
conditions. (mg/m2/hr)
c    exprel     the exponent in the DO term of the benthal BOD release
equation
c
c       rgid   benod   tcben   expod   brbod   brbod_inc   exprel
c-----------------------------------------------------------------------------
-------
c513 oxrx-initial conditions
c
c    rgid   stream parameter group id
c    dox    DO initial condition. (mg/l)
c    bod    BOD initial condition in water column. (mg/l)
c    satdo  Initial DO saturation concentration. (mg/l)
c
c       rgid   dox   bod   satdo
c-----------------------------------------------------------------------------
-------
c514 ox-scour parms
c
c    rgid   stream parameter group id
c    scrvel threshold velocity above which the effect of scouring on benthal
release rates is considered. (m/s)
c    scrmul multiplier by which benthal releases are increased during
scouring.
c
c       rgid   scrvel   scrmul
c-----------------------------------------------------------------------------
-------
c520 nutrients control
c
c    tamfg    total ammonia flag
c    no2fg    nitrite flag
c    po4fg    ortho-phosphorus flag
c    amvfg    ammonia volatilization flag
c    denfg    denitrification flag
c    adnhfg   NH4 adsorption flag
c    adpofg   PO4 adsorption flag
c    mphfg    monthly pH flag (not supported in this version)
c
c       tamfg   no2fg   po4fg   amvfg   denfg   adnhfg   adpofg   mphfg
c-----------------------------------------------------------------------------
---------------
c521 nut-parm1
c
```

```
c    rgid    stream parameter group id
c    cvbo    conversion from milligrams biomass to milligrams oxygen (mg/mg)
c    cvbpc   conversion from biomass expressed as phosphorus to carbon
(mols/mol)
c    cvbpn   conversion from biomass expressed as phosphorus to nitrogen
(mols/mol)
c    bpcntc  percentage of biomass which is carbon (by weight)
c    ktam20  nitrification rate of ammonia at 20 degrees C (1/hr)
c    kno220  nitrification rate of nitrite at 20 degrees C (1/hr)
c    tcnit   temperature correction coefficient for nitrification
c    kno320  nitrate denitrification rate at 20 degrees C (1/hr)
c    tcden   temperature correction coefficient for denitrification
c    denoxt  dissolved oxygen concentration threshold for denitrification
(mg/l)
c
c       rgid   cvbo   cvbpc   cvbpn  bpcntc   ktam20  kno220  tcnit  kno320
tcden  denoxt
c-----------------------------------------------------------------------------
---------------
c522 nut-parm2
c
c    rgid         stream parameter group id
c    brtam_1      benthal release rate of ammonia under aerobic condition
(mg/m2/hr)
c    brtam_2      benthal release rates of ammonia under anaerobic conditions
(mg/m2/hr)
c    brpo4_1      benthal release rate of ortho-phosphorus under aerobic
condition (mg/m2/hr)
c    brpo4_2      benthal release rate of ortho-phosphorus under anaerobic
condition (mg/m2/hr)
c    bnh4(1-3)    constant bed concentrations of ammonia-N adsorbed to sand,
silt, and clay (mg/kg)
c    bpo4(1-3)    constant bed concentrations of ortho-phosphorus-P adsorbed
to sand, silt, and clay (mg/kg)
c
c       rgid   brtam_1   brtam_2   brpo4_1   brpo4_2   bnh4_1   bnh4_2
bnh4_3    bpo4_1   bpo4_2   bpo4_3
c-----------------------------------------------------------------------------
-------
c523 nut-parm3
c
c    rgid         stream parameter group id
c    anaer        concentration of dissolved oxygen below which anaerobic
conditions are assumed to exist (mg/l)
c    adnhpm(1-3)  adsorption coefficients (Kd) for ammonia-N adsorbed to sand,
silt, and clay (cm3/g)
c    adpopm(1-3)  adsorption coefficients for ortho-phosphorus-P adsorbed to
sand, silt, and clay (cm3/g)
c    expnvg       exponent in the gas layer mass transfer coefficient equation
for NH3 volatilization
c    expnvl       exponent in the liquid layer mass transfer coefficient
equation for NH3 volatilization
c
c       rgid  anaer    adnhpm_1   adnhpm_2   adnhpm_3   adpopm_1   adpopm_2
adpopm_3   expnvg   expnvl
c-----------------------------------------------------------------------------
-------
c524 nut-initial conditions
c
c    rgid       stream parameter group id
c    no3        initial concentration of nitrate (mg/l)
c    tam        initial concentration of total ammonia (mg/l)
c    no2        initial concentration of nitrite (as N) (mg/l)
c    po4        initial concentration of ortho-phosphorus (as P) (mg/l)
```

```
c    snh4(1-3)  initial suspended concentrations of ammonia-N adsorbed to
sand, silt, and clay (mg/kg)
c    spo4(1-3)  initial suspended concentrations of ortho-phosphorus-P
adsorbed to sand, silt, and clay (mg/kg)
c
c       rgid   no3   tam   no2   po4   snh4_1   snh4_2   snh4_3   spo4_1
spo4_2   spo4_3
c------------------------------------------------------------------------------
-------
c530 plank flags
c
c    phyfg    phytoplankton flag
c    zoofg    zooplankton flag
c    balfg    benthic algae flag
c    sdltfg   influence of sediment washload on light extinction flag
c    amrfg    ammonia retardation of nitrogen-limited growth flag
c    decfg    linkage between carbon dioxide and phytoplankton growth flag (if
on, the linkage is decoupled)
c    nsfg     ammonia is included as part of available nitrogen supply in
nitrogen limited growth calculations
c    orefg    indicates the oref parameter in card 534 as a flowrate (if = 0)
otherwise velocity
c
c       phyfg   zoofg   balfg   sdltfg   amrfg   decfg   nsfg   orefg
c------------------------------------------------------------------------------
---------------
c531 plank-parm1
c
c    rgid    stream parameter group id
c    ratclp  ratio of chlorophyll A content of biomass to phosphorus content
c    nonref  non-refractory fraction of algae and zooplankton biomass
c    litsed  multiplication factor to total sediment concentration to
determine sediment contribution to light extinction (l/mg/ft)
c    alnpr   fraction of nitrogen requirements for phytoplankton growth that
is satisfied by nitrate
c    extb    base extinction coefficient for light (1/m)
c    malgr   maximum unit algal growth rate (1/hr)
c
c       rgid    ratclp   nonref   litsed   alnpr   extb    malgr
c------------------------------------------------------------------------------
---------------
c532 plank-parm2
c
c    rgid    stream parameter group id
c    cmmlt   Michaelis-Menten constant for light limited growth (lay/min)
c    cmmn    nitrate Michaelis-Menten constant for nitrogen limited growth
(mg/l)
c    cmmnp   nitrate Michaelis-Menten constant for phosphorus limited growth
(mg/l)
c    cmmp    phosphate Michaelis-Menten constant for phosphorus limited growth
(mg/l)
c    talgrh  temperature above which algal growth ceases (C)
c    talgrl  temperature below which algal growth ceases (C)
c    talgrm  temperature below which algal growth is retarded (C)
c
c       rgid    cmmlt    cmmn    cmmnp    cmmp    talgrh   talgrl   talgrm
c------------------------------------------------------------------------------
-------
c533 plank-parm3
c
c    rgid   stream parameter group id
c    alr20  algal unit respiration rate at 20 degrees C (1/hr)
c    aldh   high algal unit death rate (1/hr)
c    aldl   low algal unit death rate (1/hr)
```

```
c    oxald  increment to phytoplankton unit death rate due to anaerobic
conditions (1/hr)
c    naldh  inorganic nitrogen concentration below which high algal death rate
occurs (as nitrogen) (mg/l)
c    paldh  inorganic phosphorus concentration below which high algal death
rate occurs (as phosphorus) (mg/l)
c
c       rgid     alr20      aldh      aldl     oxald     naldh     paldh
c--------------------------------------------------------------------------------
-------
c534 plank-parm4
c
c    rgid    stream parameter group id
c    phycon  constant inflow concentration of plankton from land to reach
(mg/l)
c    seed    minimum concentration of plankton not subject to advection (i.e.,
at high flow) (mg/l)
c    mxstay  concentration of plankton not subject to advection at very low
flow (mg/l)
c    oref    velocity/outflow at which the concentration of plankton not
subject to advection is midway between SEED and MXSTAY, see card 530 (m/s or
m3/s)
c    claldh  chlorophyll a concentration above which high algal death rate
occurs (ug/l)
c    physet  phytoplankton settling rate (m/hr)
c    refset  settling rate for dead refractory organics (m/hr)
c    cfsaex  This factor is used to adjust the input solar radiation to make
it applicable to the RCHRES;
c            for example, to account for shading of the surface by trees or
buildings
c    mbal    maximum benthic algae density (as biomass) (mg/m2)
c    cfbalr  ratio of benthic algal to phytoplankton respiration rate
c    cfbalg  ratio of benthic algal to phytoplankton growth rate
c
c       rgid   phycon   seed   mxstay   oref   claldh   physet   refset
cfsaex  mbal   cfbalr   cfbalg
c--------------------------------------------------------------------------------
-------
c535 plank-initial conditions
c
c    rgid   stream parameter group id
c    phyto  initial phytoplankton concentration, as biomass (mg/l)
c    benal  initial benthic algae density, as biomass (mg/m2)
c    orn    initial dead refractory organic nitrogen concentration (mg/l)
c    orp    initial dead refractory organic phosphorus concentration (mg/l)
c    orc    initial dead refractory organic carbon concentration (mg/l)
c
c       rgid    phyto    benal   orn    orp    orc
c--------------------------------------------------------------------------------
-------
c540 pH controls
c
c    phffg1   value of 0 indicates that the removal factor for total inorganic
carbon is constant, given as phfrc1
c                        a value of 1 indicates the monthly removal factors
c    phffg2   value of 0 indicates that the removal factor for dissolved
carbon dioxide is constant, given as phfrc2
c             a value of 1 indicates the monthly removal factors
c    phfrc1   removal fraction for total inorganic carbon
c    phfrc2   removal fraction for dissolved carbon dioxide
c
c       phffg1   phffg2   phfrc1   phfrc2
c--------------------------------------------------------------------------------
---------------
```

```
c541 pH-parm
c
c    rgid    stream parameter group id
c    phcnt      maximum number of iterations used to solve for the pH
c    alkcon     number of the conservative substance which is used to simulate
alkalinity
c            Alkalinity must be simulated in order to obtain valid results
c    cfcinv     ratio of the carbon dioxide invasion rate to the oxygen
reaeration rate
c    brco2_1    benthal release rate of CO2 (as carbon) for aerobic conditions
(mg/m2/hr)
c    brco2_2 benthal release rate of CO2 (as carbon) for anaerobic conditions
(mg/m2/hr)
c
c       rgid    phcnt   alkcon   cfcinv   brco2_1   brco2_2
c------------------------------------------------------------------------------
---------------
c542 pH-initial conditions
c
c    rgid       stream parameter group id
c    tic                initial total inorganic carbon (mg/l)
c    co2                initial carbon dioxide (as carbon) (mg/l)
c    ph         initial pH
c
c       rgid    tic    co2   ph
c------------------------------------------------------------------------------
-------
c543 mon-tic (monthly removal fraction for total inorganic carbon)
c    only required if phfg = 1 and phffg1 = 1 (see card 502 and card 540)
c
c    rgid    stream parameter group id
c    jan-dec total inorganic carbon removal fraction at the start of each
month
c
c  rgid jan   feb   mar   apr   may   jun   jul   aug   sep   oct   nov   dec
c------------------------------------------------------------------------------
---------------
c544 mon-co2 (monthly removal fraction for dissolved carbon dioxide)
c    only required if phfg = 1 and phffg2 = 1 (see card 502 and card 540)
c
c    rgid    stream parameter group id
c    jan-dec dissolved carbon dioxide removal fraction at the start of each
month
c
c  rgid jan   feb   mar   apr   may   jun   jul   aug   sep   oct   nov   dec
c------------------------------------------------------------------------------
---------------
c600 TMDL control flags
c
c    ncpt        if > 0 then use point sources control card 660
c    ncland      if > 0 then use landuse control card 670
c                if = 1 then apply reduction to only surface output
c                if = 2 then apply reduction to total land output
c    ncrch       if > 0 then use reach control card 685 and 690
c    ntrgp       number of threshold groups in Card 410 and 610
c    ntnum       number of defined thresholds for analysis
c                if > 0 then use threshold control cards 605 and 610
c
c   ncpt  ncland  ncrch  ntrgp  ntnum
        0       2       0       0       0
c------------------------------------------------------------------------------
---------------
c605 TMDL threshold mapping (used if ntnum > 0 in card 600)
c
```

```
c    tnum       threshold ordinal number
c    tqsd       threshold qual (1 for dissolved only and 2 for total)
c    tcount     number of water quality constituent to aggregate
c    tqid       list of tqid to aggregate - number of tqid in list = tcount
(GQUAL/RQUAL IDs)
c
c    tnum   tqsd    tcount   tqid1   tqid2   .......   tqidn
c-------------------------------------------------------------------------------
---------------
c610 TMDL threshold definitions (used if ntnum > 0 in card 600)
c
c    trgid      threshold reach group ID (corresponds to trgid on Card 410)
c    tnum       threshold number (corresponds to tnum on Card 605)
c    ttype      threshold type (possible values: 0, 1, 2, 3 or -1, -2, -3)
c                0 = no standard to be applied for the trgid
c                1 = instantaneous values > threshold
c                2 = arithmetic mean > threshold
c                3 = geometric mean > threshold
c               -1 = instantaneous values < threshold
c               -2 = arithmetic mean < threshold
c               -3 = geometric mean < threshold
c    tdays      number of days over model output is aggregated and/or is
compared
c               if tdays = 0 then threshold becomes percent of time
c    jan-dec    twelve monthly values for threshold (for constant, use same
value 12 times)
c               (units are same as in card 250)
c
c    examples: ttype  tdays  description/interpretation
c                 1      1  at least one instantaneous value within a 1-day
running period > threshold
c                -1      1  at least one instantaneous value within a 1-day
running period < threshold
c                 1      0  percent of time that instantaneous value >
threshold
c                 2      4  4-day running arithmetic mean > threshold
c                 3     30  30-day running geometric mean > threshold (for
previous 30-days)
c
c  trgid  tnum   ttype  tdays   jan   feb   mar   apr   may   jun   jul   aug
sep   oct   nov   dec
c-------------------------------------------------------------------------------
----------
c660 TMDL point source control (used if ncpt > 0 on card 600)
c
c    rchid         reach id
c    permit        point source index (level1)
c    pipe          point source index qualifier (level2)
c    reduction     reduction of pollutant from point source (in fraction)
c
c   rchid   permit   pipe
reduction_flow...reduction_qual1...reduction_qual2...reduction_qualn
c-------------------------------------------------------------------------------
---------------
c670 TMDL land-based control (used if ncland > 0 on card 600)
c
c    subbasin   subwatershed id
c    deluid     land use id
c    luname     land use name
c    reduction  reduction of pollutant from corresponding landuse and
subwatershed
c
c       subbasin  deluid pluname  reduction
        5046    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    2       LD_SF_Res_Moderate      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    3       LD_SF_Res_Steep 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    4       MF_Res  0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5046    5       Commercial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    6       Institutional   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    7       Industrial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    8       Transportation  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    9       Secondary_Roads 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    10      Urban_Grass_Irrigated   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    11      Urban_Grass_NonIrrigated        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000
5046    12      Agriculture_Moderate_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    13      Agriculture_Moderate_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    14      Vacant_Moderate_B       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    15      Vacant_Moderate_D       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    16      Vacant_Steep_A  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    17      Vacant_Steep_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    18      Vacant_Steep_C  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    19      Vacant_Steep_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5046    20      Water   0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5046    21      Water_Reuse     0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5065    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	2	LD_SF_Res_Moderate	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	3	LD_SF_Res_Steep	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	4	MF_Res	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000
5065	5	Commercial	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	6	Institutional	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	7	Industrial	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	8	Transportation	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	9	Secondary_Roads	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	10	Urban_Grass_Irrigated	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	11	Urban_Grass_NonIrrigated	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000
5065	12	Agriculture_Moderate_B	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	13	Agriculture_Moderate_D	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	14	Vacant_Moderate_B	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	15	Vacant_Moderate_D	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	16	Vacant_Steep_A	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	17	Vacant_Steep_B	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	18	Vacant_Steep_C	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	19	Vacant_Steep_D	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5065	20	Water	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000
5065	21	Water_Reuse	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5066	1	HD_SF_Residential	0.000000	0.000000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    2       LD_SF_Res_Moderate      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    3       LD_SF_Res_Steep 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    4       MF_Res  0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5066    5       Commercial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    6       Institutional   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    7       Industrial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    8       Transportation  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    9       Secondary_Roads 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    10      Urban_Grass_Irrigated   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    11      Urban_Grass_NonIrrigated        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000
5066    12      Agriculture_Moderate_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    13      Agriculture_Moderate_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    14      Vacant_Moderate_B       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    15      Vacant_Moderate_D       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    16      Vacant_Steep_A  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    17      Vacant_Steep_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    18      Vacant_Steep_C  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    19      Vacant_Steep_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5066    20      Water   0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5066    21      Water_Reuse     0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    2       LD_SF_Res_Moderate      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    3       LD_SF_Res_Steep 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    4       MF_Res  0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5079    5       Commercial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    6       Institutional   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    7       Industrial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    8       Transportation  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    9       Secondary_Roads 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    10      Urban_Grass_Irrigated   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    11      Urban_Grass_NonIrrigated        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000
5079    12      Agriculture_Moderate_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    13      Agriculture_Moderate_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    14      Vacant_Moderate_B       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    15      Vacant_Moderate_D       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    16      Vacant_Steep_A  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    17      Vacant_Steep_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    18      Vacant_Steep_C  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    19      Vacant_Steep_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5079    20      Water   0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5079    21      Water_Reuse     0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    2       LD_SF_Res_Moderate      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    3       LD_SF_Res_Steep 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    4       MF_Res  0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5080    5       Commercial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    6       Institutional   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    7       Industrial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    8       Transportation  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    9       Secondary_Roads 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    10      Urban_Grass_Irrigated   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    11      Urban_Grass_NonIrrigated        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000
5080    12      Agriculture_Moderate_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    13      Agriculture_Moderate_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    14      Vacant_Moderate_B       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    15      Vacant_Moderate_D       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    16      Vacant_Steep_A  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    17      Vacant_Steep_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    18      Vacant_Steep_C  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    19      Vacant_Steep_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5080    20      Water   0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5080    21      Water_Reuse     0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    2       LD_SF_Res_Moderate      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    3       LD_SF_Res_Steep 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    4       MF_Res  0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5083    5       Commercial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    6       Institutional   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    7       Industrial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    8       Transportation  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    9       Secondary_Roads 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    10      Urban_Grass_Irrigated   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    11      Urban_Grass_NonIrrigated        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000
5083    12      Agriculture_Moderate_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    13      Agriculture_Moderate_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    14      Vacant_Moderate_B       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    15      Vacant_Moderate_D       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    16      Vacant_Steep_A  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    17      Vacant_Steep_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    18      Vacant_Steep_C  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    19      Vacant_Steep_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5083    20      Water   0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5083    21      Water_Reuse     0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    2       LD_SF_Res_Moderate      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    3       LD_SF_Res_Steep 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    4       MF_Res  0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5173    5       Commercial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    6       Institutional   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    7       Industrial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    8       Transportation  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    9       Secondary_Roads 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    10      Urban_Grass_Irrigated   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    11      Urban_Grass_NonIrrigated        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000
5173    12      Agriculture_Moderate_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    13      Agriculture_Moderate_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    14      Vacant_Moderate_B       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    15      Vacant_Moderate_D       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    16      Vacant_Steep_A  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    17      Vacant_Steep_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    18      Vacant_Steep_C  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    19      Vacant_Steep_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5173    20      Water   0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5173    21      Water_Reuse     0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    2       LD_SF_Res_Moderate      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    3       LD_SF_Res_Steep 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    4       MF_Res  0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5175    5       Commercial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    6       Institutional   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    7       Industrial      0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    8       Transportation  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    9       Secondary_Roads 0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    10      Urban_Grass_Irrigated   0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    11      Urban_Grass_NonIrrigated        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000
5175    12      Agriculture_Moderate_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    13      Agriculture_Moderate_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    14      Vacant_Moderate_B       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    15      Vacant_Moderate_D       0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    16      Vacant_Steep_A  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    17      Vacant_Steep_B  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    18      Vacant_Steep_C  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    19      Vacant_Steep_D  0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5175    20      Water   0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000
5175    21      Water_Reuse     0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
0.000000        0.000000        0.000000        0.000000
5183    1       HD_SF_Residential       0.000000        0.000000
```

```
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	2	LD_SF_Res_Moderate	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	3	LD_SF_Res_Steep	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	4	MF_Res	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000
5183	5	Commercial	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	6	Institutional	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	7	Industrial	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	8	Transportation	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	9	Secondary_Roads	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	10	Urban_Grass_Irrigated	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	11	Urban_Grass_NonIrrigated	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000
5183	12	Agriculture_Moderate_B	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	13	Agriculture_Moderate_D	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	14	Vacant_Moderate_B	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	15	Vacant_Moderate_D	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	16	Vacant_Steep_A	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	17	Vacant_Steep_B	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	18	Vacant_Steep_C	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	19	Vacant_Steep_D	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5183	20	Water	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000
5183	21	Water_Reuse	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000
5189	1	HD_SF_Residential	0.000000	0.000000
```

```
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    2       LD_SF_Res_Moderate      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    3       LD_SF_Res_Steep 0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    4       MF_Res  0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        5189    5       Commercial      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    6       Institutional   0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    7       Industrial      0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    8       Transportation  0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    9       Secondary_Roads 0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    10      Urban_Grass_Irrigated   0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    11      Urban_Grass_NonIrrigated        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000
        5189    12      Agriculture_Moderate_B  0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    13      Agriculture_Moderate_D  0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    14      Vacant_Moderate_B       0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    15      Vacant_Moderate_D       0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    16      Vacant_Steep_A  0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    17      Vacant_Steep_B  0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    18      Vacant_Steep_C  0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    19      Vacant_Steep_D  0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        5189    20      Water   0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000
        5189    21      Water_Reuse     0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
        0.000000        0.000000        0.000000        0.000000
c-----------------------------------------------------------------------
```

```
---------------
c680 TMDL reach control (used if ncrch > 0 on card 600)
c
c    rchid          controlled reach id
c    outlet         controlled reach outlet id
c    switch_mon     monthly switch to control conc limit or reduction of
pollutant from the corresponding reach (0-off, 1-on)
c
c   rchid   outlet   switch_1   switch_2......switch_12
c------------------------------------------------------------------------------
---------------
c685 TMDL reach control (used if ncrch > 0 on card 600)
c
c    rchid          controlled reach id
c    outlet         controlled reach outlet id
c    limit-flow     flow limit from the corresponding reach (cfs)
c    limit_pol      concentration limit of pollutant from the corresponding
reach (mg/l or ug/l or #/100ml)
c
c   rchid   outlet   limit_flow   limit_qual1...limit_qual2...limit_qualn
c------------------------------------------------------------------------------
---------------
c690 TMDL reach control (used if ncrch > 0 on card 600)
c
c    rchid          controlled reach id
c    outlet         controlled reach outlet id
c    reduction      reduction of pollutant from the corresponding reach
(fraction)
c                   reduction in outflow will also reduce the pollutant mass
from the outflow and
c                   any defined reduction to pollutant will be the additional
c
c   rchid   outlet
reduction_flow...reduction_qual1...reduction_qual2...reduction_qualn
c------------------------------------------------------------------------------
---------------
```