APPENDIX I

Hydrology and Water Quality Technical Report

DRAFT

Hydrology and Water Quality Technical Report for the SDSU New Student Housing Project

Prepared for:

San Diego State University
Facilities Planning, Design, and Construction
5500 Campanile Drive
San Diego, California 92182-1624
Contact: Laura Shinn, Director

Prepared by:

DUDEK
605 Third Street
Encinitas, California 92024
Contact: Dylan Duvergé, PG

MARCH 2017

Printed on 30% post-consumer recycled material.

TABLE OF CONTENTS

Section **Page No.**

APPENDICES

FIGURES

TABLE OF CONTENTS (CONTINUED)

Section **Page No.**

TABLES

TABLE OF CONTENTS (CONTINUED)

Section **Page No.**

SUMMARY OF FINDINGS

The San Diego State University (SDSU) New Student Housing Project (proposed project) would be designed, constructed, and operated in compliance with the requirements of the State Water Resources Control Board's (SWRCB's) Construction General Permit (Order No. 2009-0009-DWQ, as amended) and the Small Municipal Separate Storm Sewer System (MS4) Permit (Order No. 2013-0001-DWQ, as amended). Considering the proposed project design, along with the application of performance standards contained within these permits, the proposed project would result in less-than-significant impacts with regard to hydrology and water quality.

Specific findings associated with each main issue are as follows:

- **Water Quality**: The combination of source control, structural treatment control, and biofiltration features to be incorporated into the proposed project would be adequate to avoid or substantially reduce to the maximum extent practicable (MEP)[1] potential impacts associated with increases in the rate, volume, and/or pollutant load of surface runoff. The main stormwater quality control features proposed consist of green roofs and biofiltration best management practices (BMPs) (i.e., Modular Wetlands, Contech Filterra Biofiltration systems). The biofiltration BMPs would be located and sized to ensure compliance with MS4 Permit standards for new development and redevelopment.
- **Hydromodification**[2]: The proposed project's receiving waters are not sensitive to hydromodification impacts because they consist of concrete/engineered structures. Nevertheless, the inclusion of biofiltration BMPs and detention vaults/cisterns (i.e., Brentwood StormTank, Oldcastle Precast Storm Capture) into the proposed project design would result in a decrease in peak flows received by off-site drainages, thereby avoiding effects with regard to downstream erosion and scour. The project would result in a modification to the location of on-site stormwater discharges; however, project design would ensure that pre-development drainage patterns within off-site drainages would be replicated as part of the project.

---

[1] The MEP standard involves applying BMPs that are effective in reducing the discharge of pollutants in stormwater runoff. The MEP requires permittees to choose effective BMPs, and to reject applicable BMPs only where other effective BMPs will serve the same purpose; the BMPs would not be technically feasible; or the cost would be prohibitive.

[2] Hydromodification is defined as changes in channel form associated with alterations in flow and sediment due to past or proposed future land use alterations that affect watershed processes.

TABLE OF CONTENTS (CONTINUED)

- **Groundwater**: The proposed project would be supplied by municipal water, would not require a groundwater well, and is not currently located in an area amenable to groundwater recharge. Therefore, the proposed project would not substantially deplete groundwater supplies nor would it interfere substantially with groundwater recharge.
- **Flooding/Flood Hazards**: The proposed project would not be located within a special flood hazard area identified by the Federal Emergency Management Agency or any other flood zone identified in local planning documents. Furthermore, the proposed project would include detention features to ensure the project does not exacerbate the depth or extent of flooding within Alvarado Creek or other downstream waters.

Compliance with applicable permits and development standards also would eliminate unlawful discharge quantities or poor water quality on a cumulatively considerable scale. Other projects in progress or proposed in the future also would be required to adhere to regional and other applicable water quality protection measures, thereby avoiding or further exacerbating cumulative water quality conditions. Therefore, the proposed project would not result in significant cumulative impacts to hydrology and water quality.

1 INTRODUCTION

The purpose of this report is to analyze the potential hydrology- and water quality-related impacts under the California Environmental Quality Act (CEQA) of the proposed California State University (CSU), San Diego State University (SDSU) New Student Housing Project (proposed project).

1.1 Regional and Local Setting

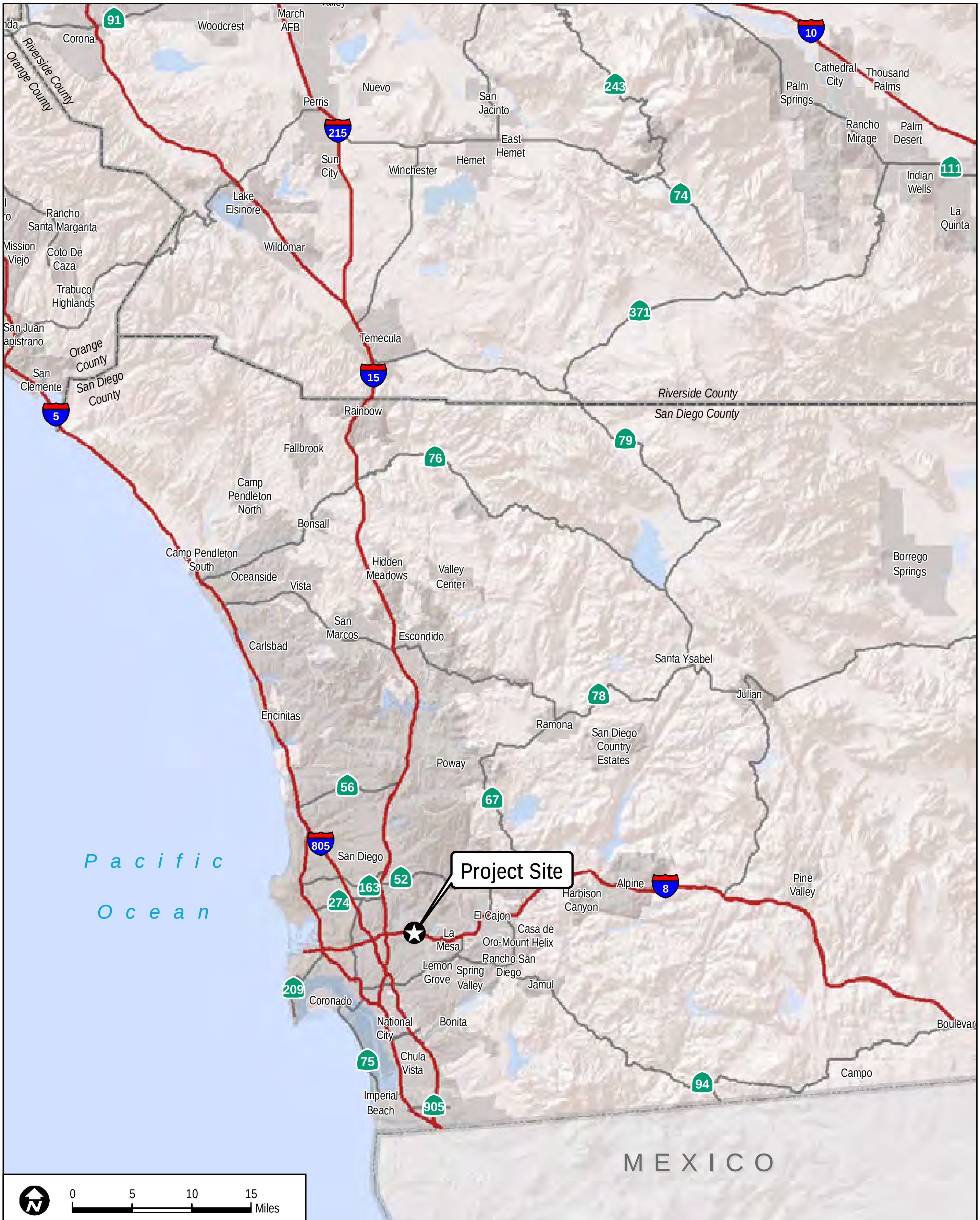
The SDSU campus is situated along Interstate 8 (I-8) about 8 to 10 miles east of downtown San Diego (see Figure 1, Regional Map, and Figure 2, Vicinity Map). The proposed project would be located on a 7.84-acre site at the northwest corner of the main SDSU campus (see Figure 3, Project Area Map). The campus is located within the College Area Community of the City of San Diego.

The proposed project would be developed west of SDSU academic buildings and north of the campus athletic fields. The site is defined by Remington Road to the south, 55th Street to the east, and private properties to the north and west. The land on which the proposed project would be developed is owned by SDSU and is located within the existing campus boundary.

1.2 Project Description

The proposed project is the expansion of on-campus student housing facilities to be located adjacent to the existing Chapultepec Hall. Specifically, the proposed project would consist of the development of facilities to accommodate up to 2,566 student housing beds in a series of residential towers to be located on the existing Parking Lot 9 (formerly “U” Parking Lot) and centered around the existing Chapultepec Hall. See Figure 2, Vicinity Map. The proposed project would be developed in three successive phases, and the analyses presented here will address, where applicable, the environmental impacts that could arise in each phase. In particular, Phase I would include construction of dormitory facilities to house up to 850 student housing beds on the existing Parking Lot 9, east of the existing Chapultepec Hall. Phase II would include construction of facilities to house up to an additional 850 beds in the area located to the west of the existing Chapultepec Hall. Phase III would include construction of facilities to house up to an additional 866 beds in buildings that would cantilever over the canyon behind Chapultepec Hall. The proposed project would consist of up to 8 new buildings. One building would serve as a dining hall (2 stories), while the remainder of the buildings would consist of 4- to 14-story buildings of single-, double-, and triple-occupancy student housing units. The complex would include outdoor gathering spaces and green space. The proposed project would entail permanent removal of the existing Parking Lot 9; these parking spaces would not be replaced.

Construction staging and storage areas for the three phases of the proposed project would be located northeast of the project site in part of Parking Lot 11 (see Project Description Figure 2.0-17, Project Construction Staging Areas). In the event that additional space is needed for construction equipment storage and letdown, one-third to one-half of Parking Lot 17C may be used.



Document Path: Z:\Projects\j821101\MAPDOC\MAPS\EIR Figs\Section 1 PD\Fig1_0_01_Regional.mxd

SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 1
Regional Map

INTENTIONALLY LEFT BLANK

SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

San Diego State University

Figure 2
Vicinity Map

INTENTIONALLY LEFT BLANK

SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 3
Project Area Map

INTENTIONALLY LEFT BLANK

2 METHODOLOGY

Potential impacts related to water quality and hydrology are evaluated based on the anticipated changes in topography, land cover, drainage infrastructure, and water pollutant sources associated with the proposed project. The assessment considers the sensitivity of the surrounding environment and downstream waters to project-related impacts, as well as the effectiveness of standard industry practice with regard to hydrology and hydraulics, including required compliance with applicable permits, laws, and regulations. Accordingly, this report provides a review of the proposed project's regulatory context, development standards pertaining to water quality, and their applicability to campus improvements. Drainage designs, stormwater runoff calculations, and the selection/sizing of low impact design features included herein is based on the Preliminary Drainage Study for West Campus Housing prepared by Snipes-Dye Associates (Appendix A). The assessment also is supported by data, publications, and resources provided by public agencies such as the U.S. Geological Survey (USGS), the State Water Resources Control Board (SWRCB), the San Diego Regional Water Quality Control Board (RWQCB), and the City of San Diego (City) Stormwater Division.

The analysis contained in this report is based on preliminary design information. As the engineering and design of the proposed project proceed to final stages for each phase of the proposed project, the project engineer will perform the calculations necessary to refine the location, design, and size of stormwater and water quality features, if necessary, to remain compliant with applicable stormwater standards. While exact details regarding the stormwater drainage design may be further refined as the design process moves forward, the project's proposed uses, overall footprint, and stormwater discharge locations will not change and, therefore, the conclusions reached in this report would be unaffected by any changes in stormwater drainage design specifics.

INTENTIONALLY LEFT BLANK

3 EXISTING CONDITIONS

This section describes the existing conditions in the proposed project area and identifies the applicable regulatory setting.

3.1 Existing Environmental Setting

The SDSU campus is located atop a mesa terrace intersected by canyon drainages on its east and west sides, each of which drains into the Alvarado Creek Canyon that makes up the northern border of the campus. Alvarado Creek is a tributary to the San Diego River, which eventually discharges into the Pacific Ocean immediately south of Mission Bay. The surrounding region is a broad urbanized coastal plain bounded by the Pacific Ocean to the west and by foothills and mountains to the east. Prior to development of the campus and surrounding area, the topography was characterized by deeply incised drainage canyons dissecting the relatively level mesa, which is commonly called “Montezuma Mesa,” at the location of the main SDSU campus. Chapultepec Hall and the adjacent Parking Lot 9 (formerly “U” Parking Lot) were constructed at the head of an unnamed canyon, where a wedge of fill soil[3] was placed to accommodate construction. Fill soils appear to extend to an estimated maximum depth of approximately 15 feet beneath the north-central edge of Parking Lot 9 (URS 2013).

The canyon to the north of the site splits into two “arms” that extend along the western and eastern sides of the existing residence hall and parking lot. Existing drainage from the project site, a portion of the Sport Complex and Remington Road, and off-campus development around the rim of the canyon is directed to these two arms, which are referred to in this report as the western creek and eastern creek. Both are unnamed ephemeral[4] drainages that meet near the northern tip of the campus property boundary, and convey storm flows further to the north-northeast to a culvert that undercrosses I-8 for delivery into Alvarado Creek. Alvarado Creek is the closest USGS “blue line” stream to the project site. In this location, Alvarado Creek consists of a concrete trapezoidal channel and flows in an easterly direction along the north side of I-8. There are no natural water bodies within the construction footprint of the proposed project. Please see Figure 4, Lower San Diego River Watershed, Figure 5, Local Hydrology Map, and Figure 6, Existing Drainage Patterns.

---

[3] Fill soils are placed over natural terrain to create level sites for roads, structures, and parking lots. In the project area, they consist of lean to fat clays, gravels, silty sand, and clayey sand.

[4] Flowing only briefly during and following a period of rainfall.

3.1.1 Climate

The climate of San Diego County (County) is characterized by warm, dry summers and mild, wet winters. The average rainfall is about 10–13 inches per year, most of which falls between November and March. The average mean temperature for the area is approximately 65 degrees Fahrenheit (°F) in the coastal zone and 57°F in the surrounding foothills (San Diego RWQCB 2016).

3.1.2 Watershed Hydrology

Regional Watersheds

The USGS Watershed Boundary Dataset delineates watersheds according to hydrologic units, which are nested within one another according to the scale of interest. USGS identifies hydrologic units by name and by hydrologic unit code (HUC). For example, at a statewide scale, hydrologic units consist of large regions and sub-regions draining to a common outlet. At a statewide scale, the proposed project is within the 11,100-square-mile "Southern California Coastal" subregion (HUC 1807), which identifies areas that eventually drain to the Pacific Ocean versus those that drain to the interior deserts of California. At the highest level of detail for the Watershed Boundary Dataset, the proposed project would be located within the Murray Reservoir sub-watershed of the Lower San Diego River watershed. Table 1, Watershed Designations by Agency/Source, lists the agency/source, HUC number, name, and size. (See also Figure 4, Lower San Diego River Watershed.)

In managing water resources, the SWRCB and the local "co-permittees"[5] classify watersheds in a hierarchical system similar to the USGS Watershed Boundary Dataset, but with somewhat different watershed names and boundaries. These geographic boundaries are likewise watershed based, but are typically referred to as hydrologic basins. These basins generally constitute the geographic basis around which many surface water quality problems and goals/objectives are defined. The proposed project would be located within the Mission San Diego hydrologic sub-area (Basin No. 9.07.1.1), one of the many sub-areas within the San Diego RWQCB (**Table 1**).

Table 1
Watershed Designations by Agency/Source

Agency/Source	HUC/Basin No.	Watershed Name	Size (Sq. Miles)
USGS Watershed	180703	Laguna–San Diego Coastal accounting unit	8,787

5 The stormwater co-permittees are the owners of municipal separate storm sewer systems (MS4s) through which urban runoff discharges into waters of the United States within the San Diego region. Together, the 18 cities, the County of San Diego (County), the Port of San Diego, and the Regional Airport Authority implement the National Pollutant Discharge Elimination System (NPDES) Permit.

Table 1
Watershed Designations by Agency/Source

Agency/Source	HUC/Basin No.	Watershed Name	Size (Sq. Miles)
Boundary Dataset	18070304	San Diego cataloguing unit	2,499
	1807030407	Lower San Diego River watershed	260
	180703040704	Murray Reservoir sub-watershed	27
San Diego RWQCB Basin Plan	9	San Diego region	6,277
	9.07	San Diego hydrologic unit	708
	9.07.1	Lower San Diego hydrologic area	279
	9.07.1.1	Mission San Diego hydrologic sub-area	93

Sources: USGS 2017; San Diego RWQCB 2016.
Notes: HUC = hydrologic unit code; sq miles = square miles

Local Watersheds

All stormwater runoff in the drainage area of the proposed project site presently is collected and eventually discharged to Alvarado Creek through a 42-inch reinforced concrete pipe (RCP) owned and maintained by the California Department of Transportation (Caltrans) underneath I-8 (Caltrans 1981). I-8 is built on a substantial fill slope that crosses the natural canyon, thereby requiring conveyance of water under I-8 through a pipe culvert. Figure 5, Local Hydrology Map, shows the approximate location of the Caltrans RCP, the approximate area that drains to the RCP, and how it connects to Alvarado Creek.

Basin characteristics and flow statistics for Alvarado Creek and the unnamed drainage were determined using the USGS web application “StreamStats” (Appendix B). StreamStats is a web-based geographic information system (GIS) that provides an assortment of analytical tools that are useful for water resources planning and management and for preliminary engineering design applications. StreamStats allows users to obtain streamflow statistics, drainage basin characteristics, and peak-flow characteristics for user-selected sites on streams. Basin characteristics for Alvarado Creek at the Caltrans RCP outlet and for the ephemeral drainage at the Caltrans RCP inlet are provided in Table 2, Selected Basin Characteristics for Alvarado Creek and Unnamed Ephemeral Drainage. Because there are no stream gauges at either location, flow estimates are based on regional regression equations that allow the extrapolation of streamflow statistics based on computed watershed characteristics. Knowledge of the watershed size and flow characteristics of downstream receiving waters is useful in determining the degree of influence the proposed project would have on existing flow patterns.

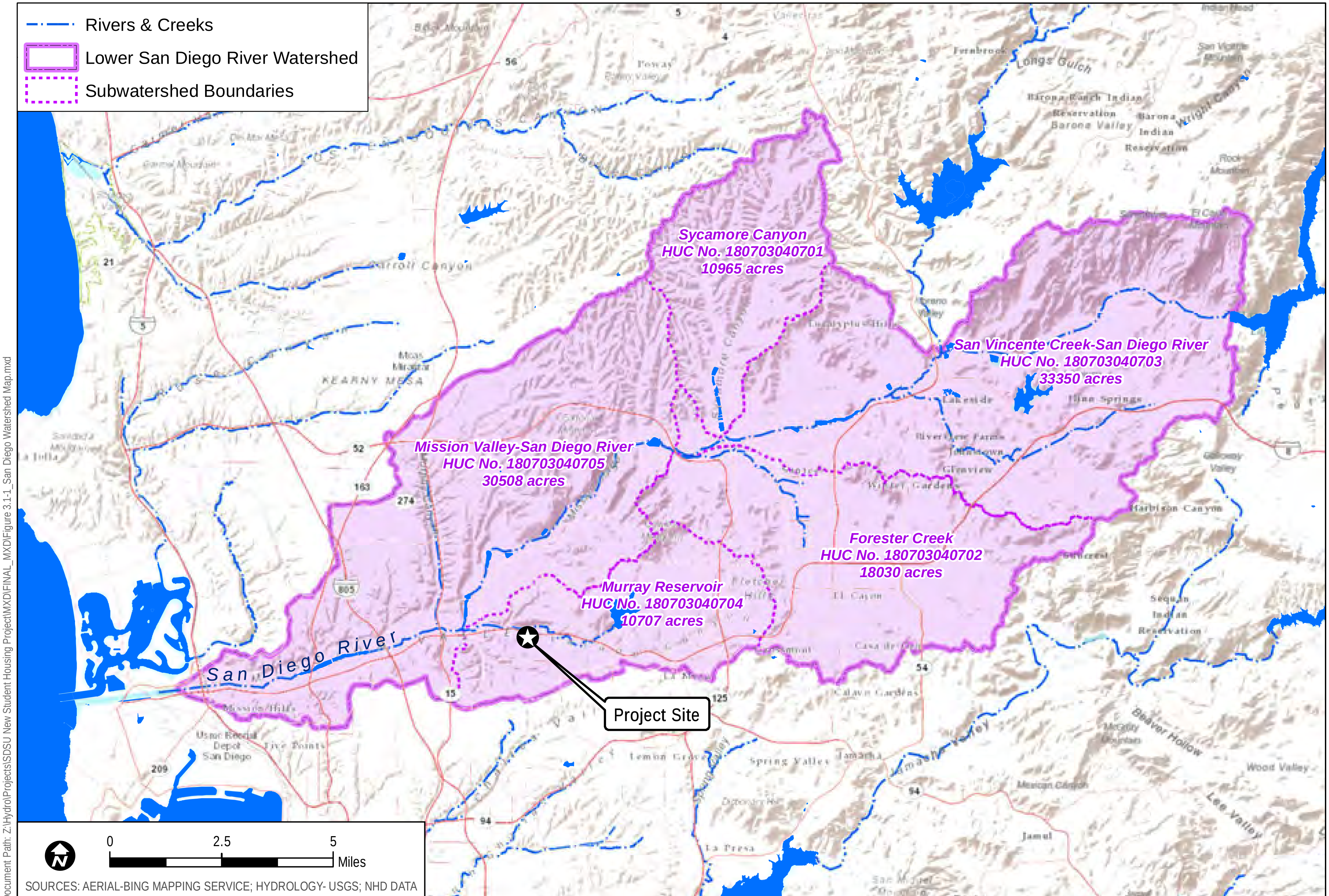
Table 2
Selected Basin Characteristics for Alvarado Creek and Unnamed Ephemeral Drainage

Parameter	Alvarado Creek at Caltrans RCP Outlet	Unnamed Ephemeral Drainage at Caltrans RCP Inlet
Basin Characteristics		
Watershed Area (acres, approximate)	7,488 acres	64 acres
Mean annual precipitation (inches)	13.6 inches	12.4 inches
Elevation at outlet	153 feet amsl	193 feet amsl
Average basin elevation (minimum – maximum) (feet NAVD88)	602 (137–1,530)	371 (208–444)
Mean basin slope computed from 30-meter Digital Elevation Model	9.0%	20.7%
Impervious area determined from NLCD 2011 imperviousness dataset	50.4%	33.5%
Length of the longest flow path	7 miles	<1 mile
Flow Estimates (90% Prediction Interval)		
2-year Peak Flow (cubic feet/second)	134 (24.2 – 745)	5.1 (<1 – 31.8)
10-Year Peak Flow (cubic feet/second)	735 (272 – 1,980)	16.0 (5.5 – 46.9)
25-year Peak Flow (cubic feet/second)	1,140 (500 – 2,610)	19.2 (7.8 – 47.7)
100-Year Peak Flow (cubic feet/second)	1,860 (863 – 4,020)	23.1 (9.8 – 54.4)

Source: Appendix B.
Notes: amsl = above mean sea level

3.1.3 Site Topography and Drainage

The site topography consists of natural vegetated slope land, sloping northerly descending toward I-8, excepting the areas occupied by buildings and the parking lots. The elevation of the property boundary of the proposed project varies from about 280 feet above mean sea level (amsl) at the northernmost corner where the eastern and western drainages meet, to about 440 feet amsl at the southern boundary along Remington Road (SanGIS 2003). The developed portion of the site occurs on flattened pads separated by retaining walls, with elevations in the range of 410 to 440 feet amsl.

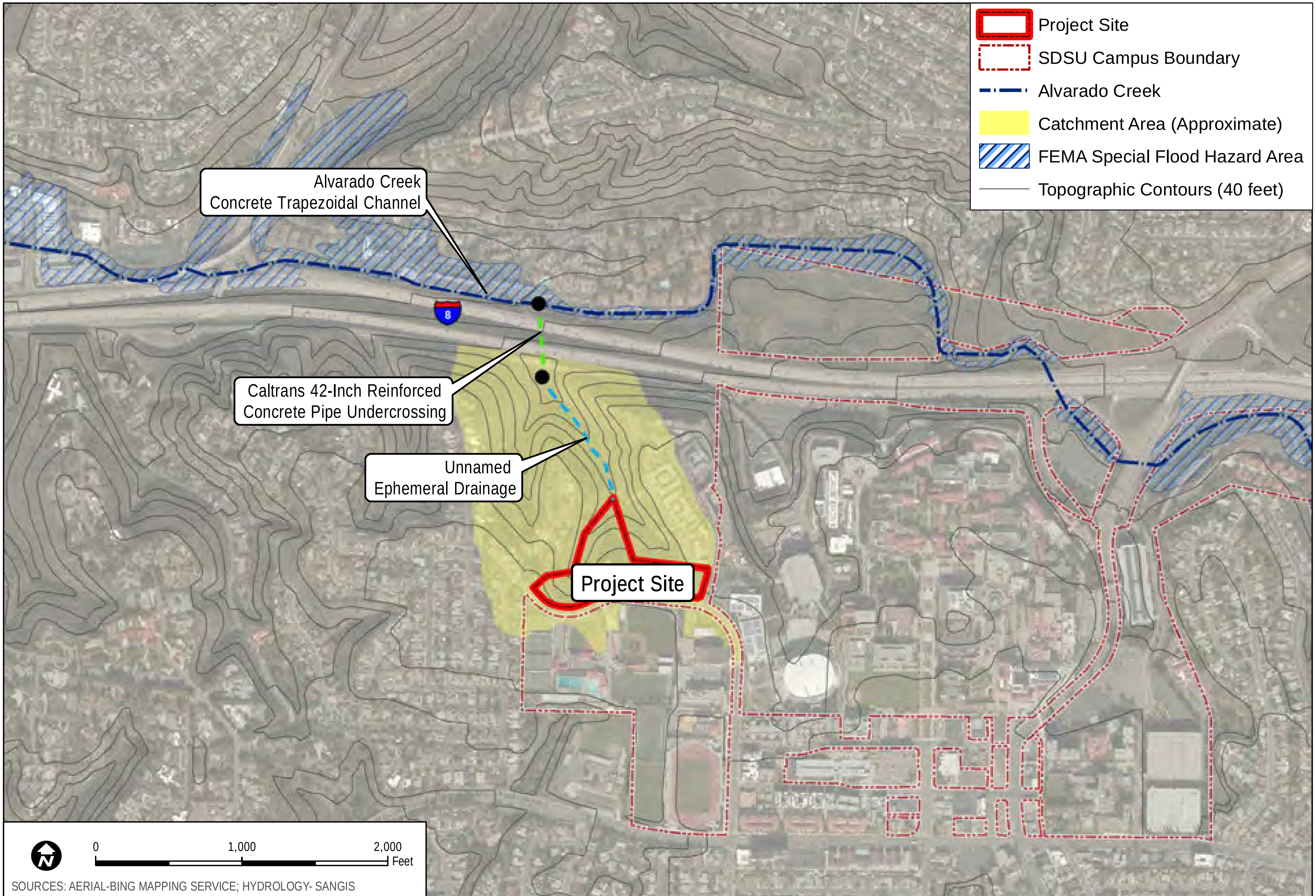


SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 4
Lower San Diego River Watershed

INTENTIONALLY LEFT BLANK



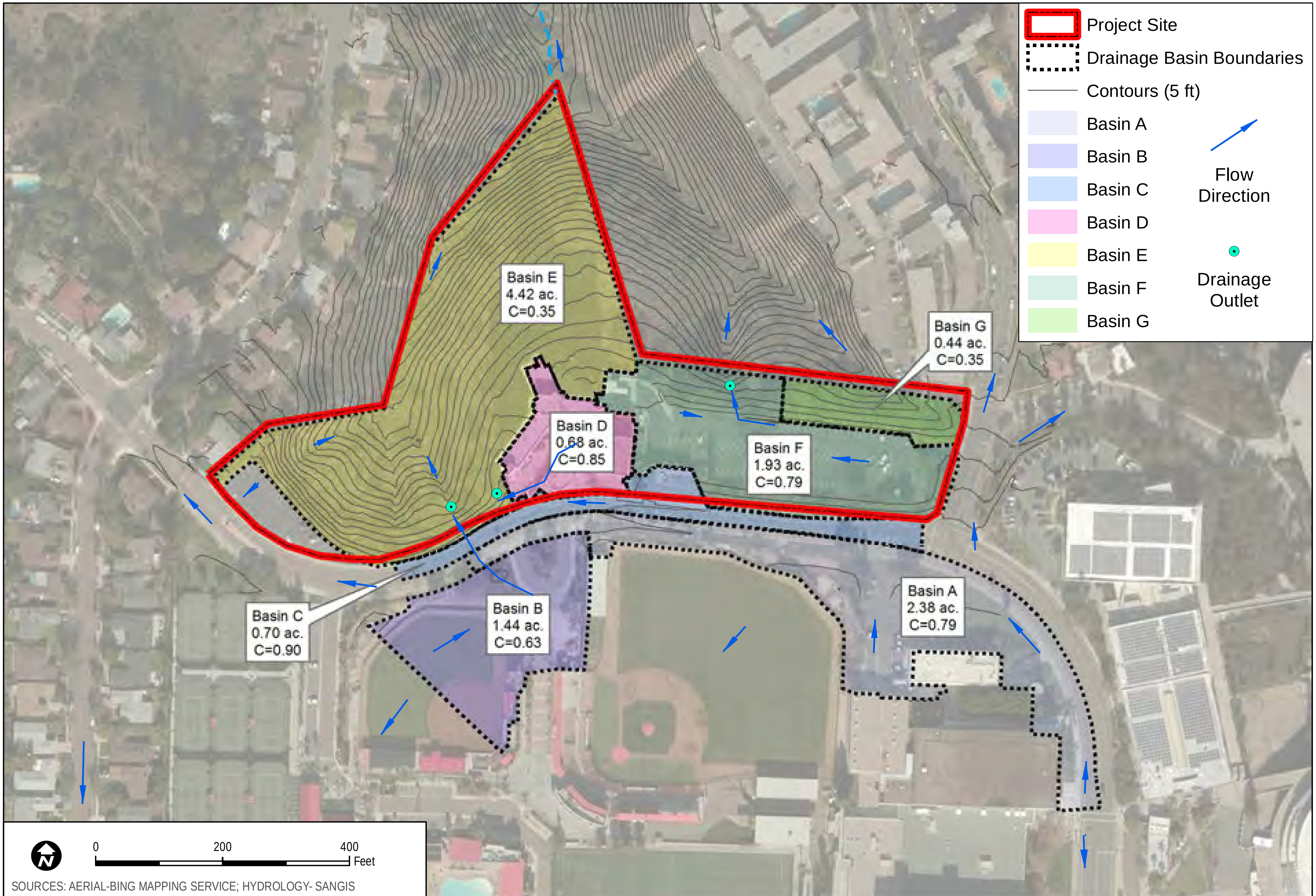
Document Path: Z:\Hydro\Projects\SDSU New Student Housing Project\MXD\FINAL_MXD\Figure 3.1-2_Local Hydrology Map.mxd

SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 5
Local Hydrology Map

INTENTIONALLY LEFT BLANK



Document Path: Z:\Hydro\Projects\SDSU New Student Housing Project\MXD\FINAL_MXD\Figure 3.1-3_Existing Drainage Patterns.mxd

SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

San Diego State University

Figure 6
Existing Drainage Patterns

INTENTIONALLY LEFT BLANK

The project site and off-site areas of the SDSU campus that contribute drainage to the canyon were identified in the drainage study prepared by Snipes-Dye Associates, which is included as Appendix A. Existing stormwater drainage is discharged directly to both arms of the canyon, i.e., the eastern drainage and western drainage, without treatment. Figure 6, Existing Drainage Patterns, and Table 3, Existing Drainage Basins, describe the drainage basins and how stormwater is handled and discharged from each. The runoff coefficient ("C" value in Figure 6 and Table 3) considers factors such as evaporation, absorption, transpiration, and surface storage to determine the amount of precipitation that becomes runoff. It is determined based on the imperviousness of the drainage basin and the character of soils. The soils within the study area are Hydrologic Group D soils, indicating high runoff potential. The higher the curve number value, the higher the runoff potential.

Table 3
Existing Drainage Basins

Basin Name	Area (Acres)	Runoff Coefficient (C)	Description
Basin A	2.39	0.79	Basins A through C cover a portion of the Sport Complex and Remington Road. Runoff from these areas is collected in curb-inlet and catch basins then discharged to the natural vegetated slope on the northern side of Remington Road through a 24-inch corrugated metal pipe and a 12-inch corrugated metal pipe, both located west of Chapultepec Hall.
Basin B	1.44	0.63	
Basin C	0.70	0.9	
Basin D	0.68	0.85	Basin D consists of Chapultepec Hall, the retail building, and the multipurpose building. Runoff from rooftops and courtyard areas is collected and discharged over the same natural vegetated slope, north of Chapultepec Hall through a 12-inch PVC pipe.
Basin E	4.42	0.35	Portion of property boundary within the western drainage and canyon.
Basin F	1.93	0.79	Basins G and F consist of Parking Lot 9 (formerly "U" Parking Lot) and the vegetated fill slope immediately bordering the lot to the north. The runoff from this area is discharged over the natural vegetated slope and outfalls into the eastern drainage located on the neighboring property to the north.
Basin G	0.44	0.35	

Source: Appendix A.

Appendix A includes a hydrology analysis, based upon the 100-year, 6-hour storm event of the existing flows using the Advanced Engineering Software and InteliSolve Hydroflow programs. In the pre-development conditions, the peak runoff discharges at the outfalls to the westerly creek (Basins A, B, C, D, and E) and the easterly creek (Basins F and G) were calculated to be 15 cubic feet per second (cfs) and 8 cfs, respectively. In the pre-project condition, the project site and the off-site contributing basins to the south together discharge a total of 23 cfs in the 100-year storm at the point where the eastern drainage and western drainage meet (Appendix A).

3.1.4 Flood Hazards

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps identify flood zones and areas that are susceptible to 100-year and 500-year floods. Based on a review of the Flood Insurance Rate Maps for San Diego County, the site of the proposed project is not located within a 100- or 500-year floodplain (SanGIS 2015) (see **Figure 5**). The FEMA flood zones in the vicinity are limited to areas on either side of Alvarado Creek, north of I-8. Furthermore, the site of the proposed project, due to its elevation of over 400 feet amsl on the Montezuma Mesa and its inland location, is not subject to dam inundation or tsunami hazards.

3.1.5 Water Quality

Runoff conveyed and discharged by municipal stormwater systems has been identified by local, regional, and national research programs as one of the principal causes of water quality problems in urban areas, such as the City of San Diego. This runoff potentially contains a host of pollutants including trash, debris, bacteria, viruses, oil, grease, sediments, nutrients, metals, and toxic chemicals. These contaminants can adversely affect the beneficial uses of receiving creeks, coastal waters, associated wildlife habitat, and public health. Urban runoff pollution is a problem during rainy seasons and throughout the year due to urban water uses that discharge non-stormwater runoff via dry weather flows to the stormwater conveyance system (City of San Diego 2016a).

Land development and construction activities introduce the following water quality concerns:

- Contribution of pollutants to receiving waters based on the creation of new impervious surfaces and the permanent "use" of the project site
- Contribution of pollutants to receiving waters based on the removal or change of vegetation during construction
- Contribution of pollutant-based sediment transport caused by increased impervious cover and the resultant increased erosive force
- Significant alteration of drainage patterns

When residential, industrial, office, or recreational areas are developed, new impervious areas are created (roads, parking lots, structures, etc.). Since the natural landscape's ability to infiltrate and cleanse urban runoff is "capped" by the impervious surfaces, rainfall that would have normally percolated into the soil is instead converted to runoff that flows directly to downstream creeks, bays, and beaches. This phenomenon is especially pronounced at low-intensity rainfall events. Historic increases in impervious cover have increased the frequency and intensity of stormwater flows that occur within the region's watercourses (City of San Diego 2016a).

As described in detail in **Section 3.2.1**, Clean Water Act (CWA) Section 303(d) requires states to develop a list of waters that do not meet water quality standards. These waters are called "water quality limited segments." The list in this case classifies seven segments within the San Diego hydrologic unit as impaired water bodies. Three of these are located in areas that runoff water from the proposed project potentially could reach. The three impaired bodies are Alvarado Creek, the San Diego River (Lower), and the Pacific Ocean Shoreline (San Diego River Mouth at Dog Beach). The pollutant/stressors and potential sources for these impaired water bodies are identified in Table 4, Section 303(d) List of Water Quality Limited Segments.

Table 4
Section 303(d) List of Water Quality Limited Segments

Location	Pollutant/ Stressor	Potential Source	Proposed TMDL Completion	Estimated Size Affected
Alvarado Creek	Selenium	Other urban runoff	2021	6 miles
San Diego River (Lower)	Enterococcus	Nonpoint source, point source, urban runoff/storm sewers	2021	16 miles
	Fecal coliform	Nonpoint source, point source, urban runoff/storm sewers, wastewater	2009	16 miles
	Low dissolved oxygen	Unknown nonpoint source, unknown point source, urban runoff/storm sewers	2019	16 miles
	Manganese	Source unknown	2021	16 miles
	Nitrogen	Nonpoint source, point source, urban runoff/storm sewers	2021	16 miles
	Phosphorus	Unknown nonpoint source, unknown point source, urban runoff/storm sewers	2019	16 miles
	Total dissolved solids	Flow regulation/modification, natural sources, unknown nonpoint source, unknown point source, urban runoff/storm sewers	2019	16 miles
	Toxicity	Nonpoint sources, other urban runoff, unknown point source	2021	16 miles
Pacific Ocean Shoreline, San Diego Hydrologic Unit (San Diego River Mouth, aka Dog Beach)	Enterococcus	Sources unknown	2021	0.03 mile
	Total coliform	Unknown nonpoint source, unknown point source, urban runoff/storm sewers	2010	0.03 mile

Source: SWRCB 2012.
Notes: TMDL = total maximum daily load.

Urban runoff/storm sewers are a potential source of fecal coliform, low dissolved oxygen, phosphorus, and total dissolved solids in the San Diego River (Lower). Nonpoint/point sources are a potential source of indicator bacteria at the Pacific Shoreline, San Diego hydrologic unit. Table 5, Probable Pollutants Causing Section 303(d) Impairment Listing, is excerpted from the City's Stormwater Standards Manual and presents the probable pollutants causing CWA Section 303(d) impairment listing for the three impaired water bodies located downstream of the site of the proposed project.

Table 5
Probable Pollutants Causing Section 303(d) Impairment Listing

Probable Pollutants	Eutrophic	Benthic Community Degradation	Sediment Toxicity	Toxicity (in Stormwater Runoff)	Low Dissolved Oxygen
Sediments	—	—	—	—	—
Nutrients	X	—	—	—	X
Heavy Metals	—	X	X	—	—
Organic Compounds	—	X	X	—	X
Trash and Debris	—	—	—	—	X
Oxygen-Demanding Substances	X	—	—	—	X
Oil and Grease	—	—	—	—	—
Bacteria and Viruses	—	—	—	—	—
Pesticides	—	—	—	X	—

Source: City of San Diego 2016a.

3.1.6 Groundwater

A groundwater basin is defined as a hydrogeologic unit containing one large aquifer, as well as several connected and interrelated aquifers. All major watersheds in the San Diego region contain groundwater basins. The proposed project site is outside of the groundwater basin as defined by the San Diego County Water Authority footprint and is over 1 mile east of the Mission Valley Groundwater Basin (Figure 7, Mission Valley Groundwater Basin). Drained by the San Diego River, this basin underlies an east–west trending valley and is bounded by lower-permeability San Diego, Poway, and Lindavista Formations (DWR 2004). The principal water-bearing deposit is alluvium consisting of medium to coarse-grained sand and gravel. This alluvium has an average thickness of 80 feet and a maximum thickness of about 100 feet (DWR 2004). The Mission Valley groundwater aquifer is described in Table 6.

Table 6
Mission Valley Groundwater Aquifer

Aquifer	Description	Thickness
Shallow Alluvium	Quaternary age medium to coarse-grained sand and gravel	Approximately 80–100 feet
San Diego Formation	Thick accumulation of older, semi-consolidated alluvial sediments	Generally less than 100 feet

Source: DWR 2004.

No groundwater, seeps, or springs were observed during site investigations at the project site; however, the occurrence of groundwater can fluctuate seasonally and with changes in land use (URS 2013).

3.2 Regulatory Setting

This section describes the applicable regulatory plans, policies, and ordinances relevant to the proposed project.

3.2.1 Federal

Clean Water Act

The CWA, as amended by the Water Quality Act of 1987, is the major federal legislation governing water quality (33 U.S.C. 1251 et seq.). The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The CWA establishes basic guidelines for regulating discharges of both point and nonpoint sources[6] of pollutants into the waters of the United States. The CWA requires that states adopt water quality standards to protect public health, enhance the quality of water resources, and ensure implementation of the CWA. Relevant sections of the CWA are as follows:

- **Sections 303 and 304** provide for water quality standards, criteria, and guidelines. Under Section 303(d) of the CWA, the State of California is required to develop a list of impaired water bodies that do not meet water quality standards and objectives. California is required to establish total maximum daily loads (TMDLs) for each pollutant/stressor. A TMDL defines how much of a specific pollutant/stressor a given water body can tolerate and still meet relevant water quality standards. Once a water body is placed on the Section 303(d) List of Water Quality Limited Segments, it remains on the list until a TMDL is adopted and the water quality standards are attained, or there is sufficient data

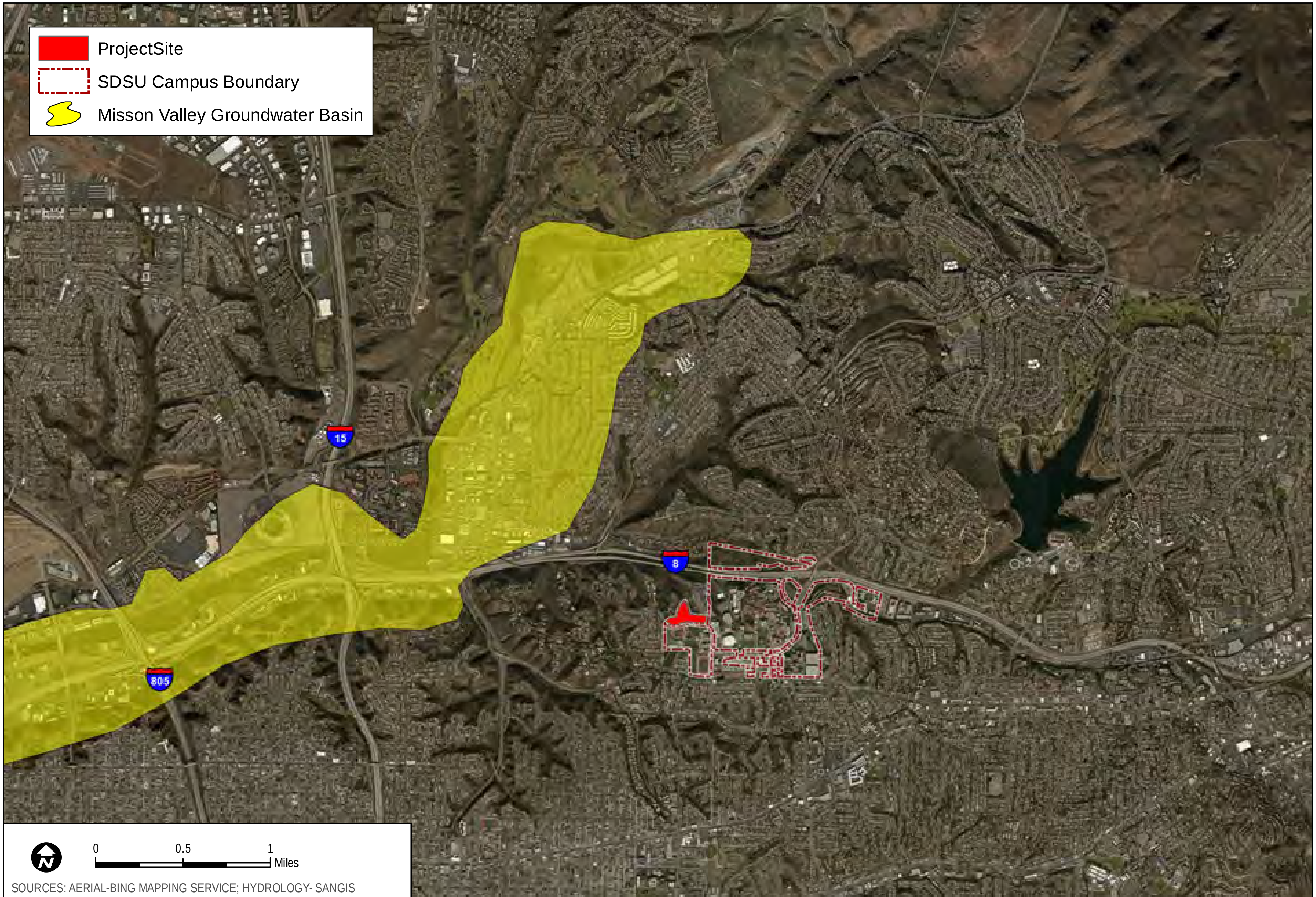
6 Point source discharges are those emanating from a pipe or discrete location/process, such as an industrial processes or wastewater discharge. Nonpoint source pollutants are those that originate from numerous diffuse sources and land uses, and which can accumulate in stormwater runoff or in groundwater.

to demonstrate that water quality standards have been met, and delisting from the Section 303(d) list should take place. The water quality impairments relevant to the proposed project are shown in Table 4, and the basin planning process that establishes beneficial uses and associated water quality objectives are further described in **Section 3.2.2**.

- **Section 401 (Water Quality Certification)** requires an applicant for any federal permit that proposes an activity that may result in a discharge to waters of the United States to obtain certification from the state that the discharge will comply with other provisions of the CWA. This process is known as the Water Quality Certification/Waste Discharge Requirements process.
- **Section 402 (National Pollutant Discharge Elimination System)** establishes the National Pollutant Discharge Elimination System (NPDES), a permitting system for the discharge of any pollutant (except for dredged or fill material) into waters of the United States. This permit program is administered by the SWRCB and the nine RWQCBs, which have several programs that implement individual and general permits related to construction activities, stormwater runoff quality, and various kinds of non-stormwater discharges.
- **Section 404 (Discharge of Dredged or Fill Material into Waters of the United States)** establishes a permit program for the discharge of dredged or fill material into waters of the United States. This permit program is jointly administered by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (EPA).

Numerous agencies have responsibilities for administration and enforcement of the CWA. At the federal level this includes the EPA, the U.S. Army Corps of Engineers, the Bureau of Reclamation, and the major federal land management agencies such as the U.S. Forest Service and the Bureau of Land Management. At the state level, with the exception of tribal lands, the California EPA and its sub-agencies, including the SWRCB, have been delegated primary responsibility for administering and enforcing the certain provisions of the CWA in California. At the local level, the San Diego RWQCB, municipalities, and special districts (including CSU) have implementation and enforcement responsibilities under the CWA.

Document Path: Z:\Hydro\Projects\SDSU New Student Housing Project\MXD\FINAL_MXD\Figure 3.1-4_Mission Valley Groundwater Basin.mxd



SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

SAN DIEGO STATE UNIVERSITY

Figure 7
Mission Valley Groundwater Basin

INTENTIONALLY LEFT BLANK

Federal Antidegradation Policy

The federal antidegradation policy (40 CFR Section 131.12) is designed to protect water quality and water resources. The policy requires states to develop statewide antidegradation policies and identify methods for implementing them. State antidegradation policies and implementation measures must include the following provisions: (1) existing instream uses and the water quality necessary to protect those uses shall be maintained and protected; (2) where existing water quality is better than necessary to support fishing and swimming conditions, that quality shall be maintained and protected unless the state finds that allowing lower water quality is necessary for important local economic or social development; and (3) where high-quality waters constitute an outstanding national resource, such as waters of national and state parks, wildlife refuges, and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected. State permitting actions must be consistent with the federal Antidegradation Policy.

3.2.2 State

Porter–Cologne Water Quality Control Act

The Porter–Cologne Water Quality Control Act (codified in the California Water Code, Section 13000 et seq.) is the primary water quality control law for California. Whereas the CWA applies to all waters of the United States, the Porter–Cologne Act applies to waters of the state[7], which includes isolated wetlands and groundwater in addition to federal waters. The Porter–Cologne Act grants the SWRCB and the nine RWQCBs power to protect water quality and is the primary vehicle for implementation of California's responsibilities under the federal CWA. The Porter–Cologne Act also grants the SWRCB and the nine RWQCBs authority and responsibility to adopt plans and policies, to regulate discharges of waste to surface and groundwater, to regulate waste disposal sites, and to require cleanup of discharges of hazardous materials and other pollutants. Further, the Porter–Cologne Act establishes reporting requirements for unintended discharges of any hazardous substance, sewage, or oil or petroleum product.

The act requires a "Report of Waste Discharge" for any discharge of waste (liquid, solid, or otherwise) to land or surface waters that may impair a beneficial use of surface or groundwater of the state. California Water Code Section 13260 subdivision (a) requires that any person discharging waste or proposing to discharge waste, other than to a community sewer system, that could affect the quality of the waters of the state, to file a Report of Waste Discharge with the applicable RWQCB. For discharges directly to surface water (waters of the United States), an

[7] "Waters of the state" are defined in the Porter–Cologne Act as "any surface water or groundwater, including saline waters, within the boundaries of the state" (California Water Code, Section 13050(e)).

NPDES permit is required, which is issued under both state and federal law; for other types of discharges, such as waste discharges to land (e.g., spoils disposal and storage), erosion from soil disturbance, or discharges to waters of the state (such as groundwater and isolated wetlands), Waste Discharge Requirements (WDRs) are required and are issued exclusively under state law. WDRs typically require many of the same BMPs and pollution control technologies as required by NPDES-derived permits.

California Antidegradation Policy

The California Antidegradation Policy, otherwise known as the Statement of Policy with Respect to Maintaining High Quality Water in California, was adopted by the SWRCB (State Board Resolution No. 68-16) in 1968. Unlike the Federal Antidegradation Policy, the California Anti-Degradation Policy applies to all waters of the state, not just surface waters. The policy requires that, with limited exceptions, whenever the existing quality of a water body is better than the quality established in individual Basin Plans (see description below), such high quality must be maintained, and discharges to that water body must not unreasonably affect any present or anticipated beneficial use of the water resource.

Water Quality Control Plan for the San Diego Basin

The California legislature has assigned the primary responsibility to administer and enforce statutes for the protection and enhancement of water quality, including the Porter–Cologne Act and portions of the CWA, to the SWRCB and its nine RWQCBs. The San Diego RWQCB implements the Water Quality Control Plan for the San Diego Basin (Basin Plan), which designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan (California Water Code Sections 13240–13247). The Porter–Cologne Act also provides the RWQCBs with authority to include within their Basin Plan water discharge prohibitions applicable to particular conditions, areas, or types of waste. The Basin Plan is continually updated to include amendments related to implementation of TMDLs, revisions of programs and policies within the San Diego RWQCB region, and changes to beneficial use designations and associated water quality objectives. The Basin Plan is the guiding document that establishes water quality standards for the region.

The Basin Plan for each region provides quantitative and narrative criteria for a range of water quality constituents applicable to certain receiving water bodies and groundwater basins within the San Diego Basin. Specific criteria are provided for the larger, designated water bodies within the region, as well as general criteria or guidelines for ocean waters, bays and estuaries, inland surface waters, and ground waters. In general, the narrative criteria require that degradation of water quality not occur due to increases in pollutant loads that will adversely impact the designated beneficial uses of a water body. The beneficial uses that have the potential to be affected by the proposed project are shown in **Table 7**, **Summary of Beneficial Uses of Inland Surface Water: San Diego River, Unnamed Tributary, and Alvarado Creek.** Definitions are provided in **Table 8, Basin Plan List of Beneficial Uses**. The Basin Plan also lists groundwater quality objectives for bacteria, chemical constituents, pesticides, radioactivity, salinity, tastes and odors, and toxicity.

Table 7
Summary of Beneficial Uses of Inland Surface Water: San Diego River, Unnamed Tributary, and Alvarado Creek

	Basin Number	Beneficial Uses[1]									
		MUN	*AGR*	*IND*	*PROC*	*REC 1*	*REC 2*	*BIOL*	*WARM*	*WILD*	*RARE*
Inland Surface Waters											
San Diego River	907.11	+	X	X	—	X	X	X	X	X	X
Unnamed Tributaries	907.11	+	X	X	—	X	X	—	X	X	X
Alvarado Creek	907.11	+	X	X	—	X	X	—	X	X	—
Groundwater											
Mission San Diego HSA[2]	907.11	P	X	X	X	—	—	—	—	—	—

Source: San Diego RWQCB 2016.
Notes: + = excepted from MUN (State Board Resolution No. 88-63, Sources of Drinking Water Policy); X = existing beneficial use; HSA = hydrologic sub-area; P = potential beneficial use.
1 See Table 8 for definitions.
2 These beneficial uses do not apply west of the eastern boundary of the right-of-way of I-5 and this area is excerpted from the sources of drinking water policy.

Table 8
Basin Plan List of Beneficial Uses

Beneficial Use	Description
MUN – Municipal and Domestic Supply	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
AGR – Agricultural Supply	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
IND – Industrial Services Supply	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
PROC – Industrial Process Supply	Uses of water for industrial activities that depend primarily on water quality.
FRSH – Freshwater Replenishment	Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g. salinity).
GWR – Groundwater	Uses of water for artificial recharge of groundwater for purpose of future extraction, maintenance of

Table 8
Basin Plan List of Beneficial Uses

Beneficial Use	Description
Recharge	water quality, or halting of saltwater intrusion into freshwater aquifers.
REC I – Contact Water Recreation	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and scuba diving, surfing, whitewater activities, fishing, and use of natural hot springs.
REC II – Non-Contact Water Recreation	Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where ingestion is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
WARM – Warm Freshwater Habitat	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.
COLD – Cold Freshwater Habitat	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
WILD – Wildlife Habitat	Uses of water that support terrestrial ecosystems including, but not limited to, the preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
RARE – Threatened or Endangered Species	Uses if water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
NAV – Navigation	Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
COMM – Commercial and Sport Fishing	Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended to human consumption or bait process.
BIOL – Preservation of Biological Habitats of Special Significance	Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.
EST – Estuarine Habitat	Uses of water that support estuarine habitat ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).
MAR – Marine Habitat	Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates or wildlife water and food sources.
AQUA – Aquaculture	Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption and bait.
MIGR – Migration of Aquatic Organisms	Uses of water that support habitats necessary for migration, acclimatization between fresh and salt water.
SPWN – Spawning, Reproduction, and/or Early Development	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. This use is applicable only for the protection of anadromous fish.
SHELL – Shellfish Harvesting	Uses of water that support habitats suitable for collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes.

Source: San Diego RWQCB 2016.

General NPDES Permits and WDRs

To enable efficient permitting under both the CWA and the Porter–Cologne Act, the SWRCB and the RWQCBs administer permit programs that group similar types of activities with similar threats to water quality. These “general permit” programs include the Phase II Small Municipal Separate Storm Sewer System (MS4)[8] Permit, the construction general permit, and other general permits for low-threat discharges. The construction stormwater program and the Small MS4 Permit are administered by the SWRCB, while other general WDRs are administered by the San Diego RWQCB. Point source discharges or other activities that threaten water quality that are not covered under a general permit must seek individual NPDES permits and/or WDRs, depending on the type, location, and destination of the discharge. For these type of discharges, the initial step in the process is to submit a “Report of Waste Discharge” to the San Diego RWQCB, which then determines the appropriate permitting pathway.

Table 9, State and Regional Water Quality-Related Permits and Approvals, lists the water-quality-related permits that would apply to certain actions conducted under the proposed project, each of which is further described below.

Table 9
State- and Regional Water Quality-Related Permits and Approvals

Program/Activity	Order Number/ NPDES Number	Permit Name	Affected Area/ Applicable Activity
Construction Stormwater Program	SWRCB Water Quality Order 2009-0009-DWQ/CAS000002, as amended	NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit)	Statewide/Construction-related land disturbance of > 1 acre.
Phase II Small MS4 Program	SWRCB Water Quality Order 2013-0001-DWQ/CAS000004, as amended	Waste Discharge Requirements for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (Small MS4 Permit)	All Regulated Small MS4 systems; New Development and Redevelopment Projects within the Small MS4 service area.
“Low Threat” Discharges to Land and/or Groundwater	R9-2014-0041	Conditional Waivers of Waste Discharge Requirements for Low Threat Discharges in the San Diego Region (including construction dewatering discharges)	San Diego region

8 A Small MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that serve populations of less than 100,000 persons.

Construction General Permit (SWRCB Order 2009-0009-DWQ, as amended)

For stormwater discharges associated with construction activity in the State of California, the SWRCB has adopted the General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) to avoid and minimize water quality impacts attributable to such activities. The Construction General Permit applies to all projects in which construction activity disturbs 1 acre or more of soil. Construction activity subject to this permit includes clearing, grading, and disturbances to the ground, such as stockpiling and excavation. The Construction General Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP), which would specify water quality BMPs designed to reduce or eliminate pollutants in stormwater discharges and authorized non-stormwater discharges from the construction site. Routine inspection of all BMPs is required under the provisions of the Construction General Permit, and the SWPPP must be prepared and implemented by qualified individuals as defined by the SWRCB.

To receive coverage under the Construction General Permit, the project applicant must submit a Notice of Intent and permit registration documents to the SWRCB. Permit registration documents include completing a construction site risk assessment to determine appropriate coverage level; detailed site maps showing disturbance area, drainage area, and BMP types/locations; the SWPPP; and where applicable, post-construction water balance calculations and active treatment systems design documentation.

Small MS4 Permit (SWRCB Order 2013-0001-DWQ, as amended)

For stormwater discharges from Small MS4s, the SWRCB has adopted Waste Discharge Requirements for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (Small MS4 Permit) (Water Quality Order 2013-0001-DWQ). MS4 Permits were issued in two phases. Under Phase I, which started in 1990, the RWQCBs adopted NPDES stormwater permits for medium (serving between 100,000 and 250,000 people) and large (serving 250,000 people) municipalities. As part of Phase II, the SWRCB adopted a general permit for the discharge of storm water from Small MS4s (Water Quality Order No. 2003-0005-DWQ) to provide permit coverage for smaller municipalities serving less than 100,000 people. SWRCB updated and revised the Small MS4 Permit under Water Quality Order 2013-0001-DWQ on February 5, 2013, which became effective on July 1, 2013, for a 5-year permit term. SDSU is identified as a permittee subject to the Small MS4 Permit. The surrounding municipalities (i.e., the City of San Diego) and Caltrans are subject to a separate Phase I MS4 Permits (Order No. R9-2013-0001, as amended, and Water Quality Order No. 2012-0011-DWQ, as amended, respectively).

The Small MS4 Permit consists of several program elements: Program Management, Public Involvement/Participation, Illicit Discharge Detection and Elimination, Construction Site Storm Water Runoff Control, Pollution Prevention/Good Housekeeping for Permittee Operations, Post Construction Storm Water Management for New Development and Re-development, Water Quality Monitoring Requirements, Program Effectiveness Assessment, and Annual Reporting. Besides requiring implementation of construction site BMPs and performance criteria and design guidelines for development within the Small MS4s service area, the Small MS4 Permit also requires operators to map their outfalls, properly maintain the storm drain system, educate the public on pollution prevention, and monitor and report on the quality of MS4 discharges to receiving waters so that the effectiveness of the program can be evaluated. Collectively, the program elements are designed to ensure discharges from the storm drain system do not contain pollutant loads at levels that violate water quality standards and Basin Plan objectives and policies (such as a TMDL for a CWA Section 303(d) impaired water body). Implementation of the program elements are the responsibility of the Small MS4 operator, in this case, SDSU.

Of particular relevance to the proposed project is that the Small MS4 Permit requires Regulated Projects[9] to implement post-construction measures in the form of site design, source control, stormwater treatment measures, and baseline hydromodification management measures to reduce the discharge of pollutants in stormwater to the MEP. These include:

- **Source Control Measures**: Source control measures seek to avoid introduction of water quality pollution/degradation in the first instance. Source control strategies include things like covering refuse/trash areas, properly managing outdoor storage of equipment/materials, minimizing use of pesticides and fertilizers in landscaping, using sumps or special area drains to send non-stormwater discharges to the sewer, ensuring regular grounds maintenance, etc.
- **Site Design Measures**: Site design measures require early assessment and evaluation of how site conditions, such as soils, vegetation, and flow paths will influence the placement of buildings and paved surfaces. The evaluation is used to meet the goals of capturing and treating runoff and maximizing opportunities to mimic natural hydrology. Options for site design measures include preserving trees, buffering natural water features, disconnecting impervious surfaces, and using green roofs or porous pavement.

[9] Regulated Projects are defined in Section E.12.c of Water Quality Order 2013-0001-DWQ and include all projects that create and/or replace 5,000 square feet or more of impervious surface, not including detached single-family home projects that are not part of a larger plan of development; interior remodels; routine maintenance or repair within the existing footprint; or linear underground/overhead projects.

- **Treatment Control Measures**: Treatment control measures retain, treat, and/or infiltrate the site runoff produced under normal circumstances, controlling both the quality and quantity of stormwater released to the stormwater conveyance system and natural receiving waters. In most situations, this means implementing structural BMPs (e.g., infiltration, bioretention and/or rainfall harvest and re-use) to address the volume and rate of runoff produced by 85th percentile storm[10] (i.e., design capture volume). The Small MS4 permit requires regulated projects to prioritize stormwater capture (e.g., infiltration and/or harvest and re-use) unless site conditions (e.g., low-permeability soils) make it infeasible.
- **Hydromodification Measures**: Hydromodification measures are required for projects that create or replace 1 or more acres of impervious surfacing so that post-project runoff shall not exceed the estimated pre-project flow rate for the 2-year, 24-hour storm. If the project creates or replaces less than 1 acre of impervious surfaces and the project demonstrates that post-project flows from the site are less than pre-project flows, then no hydromodification measures from Section E.12.e.(ii)(f) from the Phase II Small MS4 General Permit are required.
- **Operation and Maintenance Requirements**: The Small MS4 Permit requires that maintenance agreements stay in place with each property to ensure permanent treatment control measures developed on site are properly maintained and/or repaired in accordance with the stormwater quality control plan.

The aforementioned site design, treatment control, and hydromodification measures are often collectively referred to as "Low Impact Development" standards (or LID design). The proposed project meets the criteria as a Regulated Project and, thus, is required to comply with the stormwater management requirements of the Small MS4 Permit.

Conditional Waivers of Waste Discharge Requirements for Low-Threat Discharges in the San Diego Region.

This order (Order No. R9-2014-0041) authorizes several categories of discharges within the San Diego region that have a low threat to water quality, provided certain conditions are met to ensure compliance with water quality standards and Basin Plan objectives. Included among waiver categories is short-term construction dewatering operations (Waiver No. 3). Construction dewatering is generally authorized so long as the discharge is made to land and not directly (or indirectly) to a receiving water body, including an MS4, and it does not adversely affect the quality or the beneficial uses of the waters of the state. If the construction dewatering discharge

[10] The 85th percentile storm represents a value of rainfall, in inches, such that 85% of the observed 24-hour rainfall totals within the historical record will be less than that value.

would exceed 5,000 gallons/day for any continuous 180-day period, or if it is in or near an area with a soil and/or groundwater contamination, investigation or corrective action in effect, the discharger must submit to the San Diego RWQCB a Notice of Intent, applicable fees, monitoring data, and BMPs, as required, to demonstrate that adequate measures will be taken to prevent adverse effects on water quality.

3.2.3 Local

The City of San Diego Storm Water Runoff Control and Drainage Regulations are enforced through issuance of permits for projects under its jurisdictional control. Section 1.2 of the City's Storm Water Standards manual—titled "When to Apply These Standards"—states that the standards contained therein are applicable to any of the following:

- private project processed through the Development Services Department,
- public capital improvement project processed through the Engineering and Capital Projects Department, and
- ongoing maintenance efforts coordinated by the Operation and Maintenance Department (City of San Diego 2016a).

As a state agency, CSU/SDSU is not subject to local planning regulations, including those issued by the city of San Diego. Additionally, because the City will not be processing approvals related to the proposed project, and SDSU would not need to obtain building or grading permits from the City, the guidance is not legally applicable to the proposed project. However, as CSU/SDSU seeks to conform with local regulations whenever it is feasible to do so, compliance with the water quality and stormwater standards for state-sponsored projects, such as those on the SDSU campus—particularly with respect to the general permit for small MS4s described above—achieve a similar result to compliance with local development standards.

INTENTIONALLY LEFT BLANK

4 THRESHOLDS OF SIGNIFICANCE

The following significance criteria included in Appendix G of the CEQA Guidelines (14 CCR 15000 et seq.) assist in determining the significance of a hydrologic or water quality impact. Significant impacts would result if the proposed project would:

1. Violate any water quality standards or waste discharge requirements.
2. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
3. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river in a manner which would result in substantial erosion or siltation on or off site.
4. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on or off site.
5. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
6. Otherwise substantially degrade water quality.
7. Place housing within a 100-year flood hazard areas as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.
8. Place within a 100-year flood hazard area structures which would impede or redirect flood flows.
9. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.
10. Result in inundation by seiche, tsunami, or mudflow.
11. Result in a cumulative impact relative to hydrology and/or water quality when considered with other present and probable future projects in the region.

INTENTIONALLY LEFT BLANK

5 IMPACT ANALYSIS

Would the project violate any water quality standards or waste discharge requirements?

Overview

Water quality standards and WDRs are intended to protect the quality of waters of the state—generally wetlands, lakes, creeks, rivers and their tributaries, and groundwater. Because there are no natural water features (i.e., lakes, rivers, creeks, or springs) within the footprint of the proposed project, all impacts with respect to water quality standards or WDRs would be indirect in nature, removed in space and/or time from the impact-causing activity.

Impacts to water quality through exceedance of water quality standards, non-conformance with WDRs, or other means, potentially can result from the short-term effects of construction activity (e.g., erosion and sedimentation due to land disturbances, uncontained material and equipment storage areas, improper handling of hazardous materials), as well as long-term effects of landscaping, circulation improvements, utility infrastructure, and structural design (e.g., alteration of drainage patterns and/or increases in impervious surfaces). This discussion focuses on the potential water quality impacts associated with construction activities and the post-construction changes in land uses. Long-term hydrologic effects to the ephemeral drainages associated with changes in topography and impervious surfaces, e.g., hydromodification impacts, are addressed under the third and fourth thresholds below.

The potential to degrade water quality in downstream receiving waters is partly a function of the proposed project area as compared to the total watershed area at that location. As discussed in **Section 3.1.3**, all stormwater runoff in the proposed project's drainage area is collected and eventually discharged to Alvarado Creek through a 42-inch RCP underneath I-8. The proposed project site is comprised of 7.84 acres, with a development footprint of approximately 4.94 acres (Appendix A). Additionally, construction of the project may utilize laydown areas consisting of existing developed locations on campus including part of Lot 11 and Lot 17C. **Table 2** illustrates the watershed area for the unnamed ephemeral drainage at the Caltran 42-inch RCP inlet, and for Alvarado Creek at the Caltrans 42-inch RCP outlet, is approximately 64 acres and 7,488 acres, respectively. Therefore, the development footprint constitutes approximately 0.07% of the total watershed contributing to Alvarado Creek at the RCP outlet, and approximately 7.7% of the total watershed contributing to the unnamed ephemeral drainage at the RCP inlet. As the project involves no non-stormwater discharges to the storm drain system (which are prohibited without prior authorization from the RWQCB), contributions to flow would occur only during and immediately after rainfall events, when Alvarado Creek would be collecting runoff from the entire watershed.

In the context of the watershed as a whole, the off-site receiving waters are not highly sensitive to the water quality-related effects of the proposed project. Based on the size of the proposed project site compared to the overall watershed size, it is unlikely that project-related effects would be measurable in Alvarado Creek. Furthermore, Alvarado Creek consists of a hardened conveyance along the north side of I-8 (i.e., a concrete trapezoidal channel), is bounded by urban development to the north, and does not currently support a natural riparian corridor. The unnamed ephemeral drainage north of the proposed project would have the greatest sensitivity to potential project impacts, since the project would constitute approximately 7.7% of its watershed; however, as described below, project design features and BMPs will substantially reduce flows to the drainage. Because water quality degradation is by nature a cumulative issue, the prevailing stormwater management standards require developers to reduce pollutant contributions to the maximum extent practicable, regardless of how minor the project-related influence on receiving water quality may be.

Stormwater Runoff During Construction

Phases I, II, and III

Construction activities such as demolition of existing structures (e.g., existing Parking Lot 9) and grading, excavation, and trenching for construction of proposed facilities would expose soils, slopes, and construction equipment/materials to stormwater runoff. Construction site runoff can contain soil particles and sediments from these activities. Dust from construction sites also can be transported to other nearby locations where the dust can enter runoff or water bodies. Spills or leaks from heavy equipment and machinery, staging areas, or building sites also can enter runoff. Typical pollutants could include petroleum products and heavy metals from equipment, as well as products such as paints, solvents, and cleaning agents, which could contain hazardous constituents. Sediment from erosion of graded or excavated surface materials, leaks or spills from equipment, or inadvertent releases of construction materials could result in water quality degradation if runoff containing the sediment entered receiving waters in sufficient quantities to exceed Basin Plan water quality objectives.

Because of the significant amount of hillside grading that would be required, increased sediment and turbidity are the primary constituents of concern with regard to construction of the proposed project. The potential impacts from construction-related activities would be temporary, generally limited to the initial demolition and site-preparation phases of construction. Following construction, disturbed areas would be paved or covered by structures. Disturbed areas on the periphery of the development would be revegetated with California native species and selectively thinned and replanted to meet City of San Diego fuel modification and steep hillside landscape guidance.

Because the proposed project collectively would result in land disturbance of more than 1 acre, it is subject to the Construction General Permit, which pertains to potential pollutant discharges resulting from grading and other construction activities (SWRCB Order No. 2009-0009-DWQ, as amended). Compliance with the permit requires SDSU and/or its contractor to file a Notice of Intent with the SWRCB and submit permit registration documents prior to construction, including a SWPPP. The SWPPP will be prepared by a qualified individual and contain site maps that show the construction site perimeter, existing and proposed buildings, lots, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the project site. The SWPPP will include a risk determination and list the appropriate water quality BMPs that will be used to protect stormwater quality throughout the construction phase. Additionally, the SWPPP must contain a visual monitoring program and a chemical monitoring program for "non-visible" pollutants to monitor the effectiveness of the selected BMPs.

The SWPPP will be required to demonstrate that the construction activities will not violate discharge prohibitions, effluent limitations, and water quality standards as outlined in the Construction General Permit. The following are examples of effective BMPs that are standard in a SWPPP:

- Silt fences installed along limits of work and/or the project construction site
- Stockpile containment (e.g., Visqueen, fiber rolls, gravel bags)
- Exposed soil stabilization structures (e.g., fiber matrix on slopes and construction access stabilization mechanisms)
- Street sweeping
- Tire washes for equipment
- Runoff control devices (e.g., drainage swales, gravel bag barriers/chevrons, velocity check dams) during construction phases conducted during the rainy season
- Storm drain inlet protection
- Wind erosion (dust) controls
- Tracking controls
- Prevention of fluid leaks (inspections and drip pans) from vehicles
- Dewatering operations best practices (e.g., discharge to landscaped, vegetated, or soil area or into an infiltration basin, so long as the water contains only sediment and no other pollutants; use of vacuum truck to haul the water to an authorized discharge location; or implementation of various methods of treatment on site prior to discharging the water)

- Materials pollution management
- Proper waste management
- Regular inspections and maintenance of BMPs

The SWPPP also must incorporate the hazardous materials spill prevention measures. If a cleanup action were required in the vicinity of the proposed project, any discharge of accumulated groundwater or stormwater would need to be made in coordination with the San Diego RWQCB and in accordance with applicable WDRs. SDSU shall implement all guidelines contained in the SWPPP throughout project construction (see **Section 3.2.2**). A copy of the applicable SWPPP is to be kept at the construction site. As the closest receiving water, the unnamed ephemeral drainage north of the project site would be most sensitive to potential water quality impacts of construction. This would be considered in the SWPPP and the type, design, and location of BMPs would be selected in a manner that adequately protects the drainage from significant water quality impacts.

Required compliance with the Construction General Permit (SWRCB Order No. 2009-0009-DWQ, as amended) is adequate to ensure that impacts related to stormwater runoff during construction would be **less than significant**.

Stormwater Runoff During Operations and Maintenance

Phases I, II, and III

Changes in impervious areas created and nonpoint source pollutants associated with proposed land uses could alter the types and levels of pollutants that could be present in project site runoff. Runoff from building rooftops, driveways, and landscaped areas can contain nonpoint source pollutants such as sediment, trash, oil, grease, heavy metals, pesticides, herbicides, and/or fertilizers. Concentrations of pollutants carried in urban runoff are extremely variable, depending on factors such as the following:

- Volume of runoff reaching the storm drains
- Time since the last rainfall
- Relative mix of land uses and densities
- Degree to which street cleaning occurs

Table 10 lists the potential pollutants of concern identified by the City of San Diego as typically associated with proposed project uses.

Table 10
Potential Pollutants Generated by Proposed Project Land Use Types

	General Pollutant Categories								
General Project Category	*Sediments*	*Nutrients*	*Heavy Metals*	*Organic Compounds*	*Trash & Debris*	*Oxygen Demanding Substances*	*Oil & Grease*	*Bacteria & Viruses*	*Pesticides*
Attached Residential Development	X	X	—	—	X	—	—	P	X
Restaurants	—	—	—	—	X	X	X	X	
Steep Hillside Development	X	X	—	—	X	X	X	—	X

Notes: X = anticipated; P = potential

Under existing conditions, stormwater that is not infiltrated into landscaped areas and bare ground moves as sheet flow toward street gutters, swales, and the inlets of underground storm drains. The storm drains direct runoff to the natural slopes above the eastern and western drainages on both sides of Chapultepec Hall and Parking Lot 9. Under existing conditions, these storm flows, which originate from about 5 acres of developed campus land, are not treated prior to discharge. Furthermore, Parking Lot 9 is an uncovered parking lot and therefore a potential source of nonpoint source pollutants in stormwater runoff (i.e., should parked vehicles leak fuels or fluid).

Under proposed project conditions, the developed area north of Remington Road would increase significantly with the addition of four residence halls and a food service building. Parking Lot 9 would be removed, and proposed parking would be located below grade, thereby removing exposure of vehicles to stormwater runoff as a potential pollutant source. Without design features to capture and treat stormwater runoff, such an increase in developed area could have water quality impacts on the unnamed ephemeral drainage in the canyon to the north, such as increased erosive power and/or delivery of nonpoint source pollutants such as trash. **Appendix A** details the proposed drainage plan and provides the necessary modeling support to demonstrate that runoff would be captured and treated to the standards required under the Small MS4 Permit (described in **Section 3.2.2**).

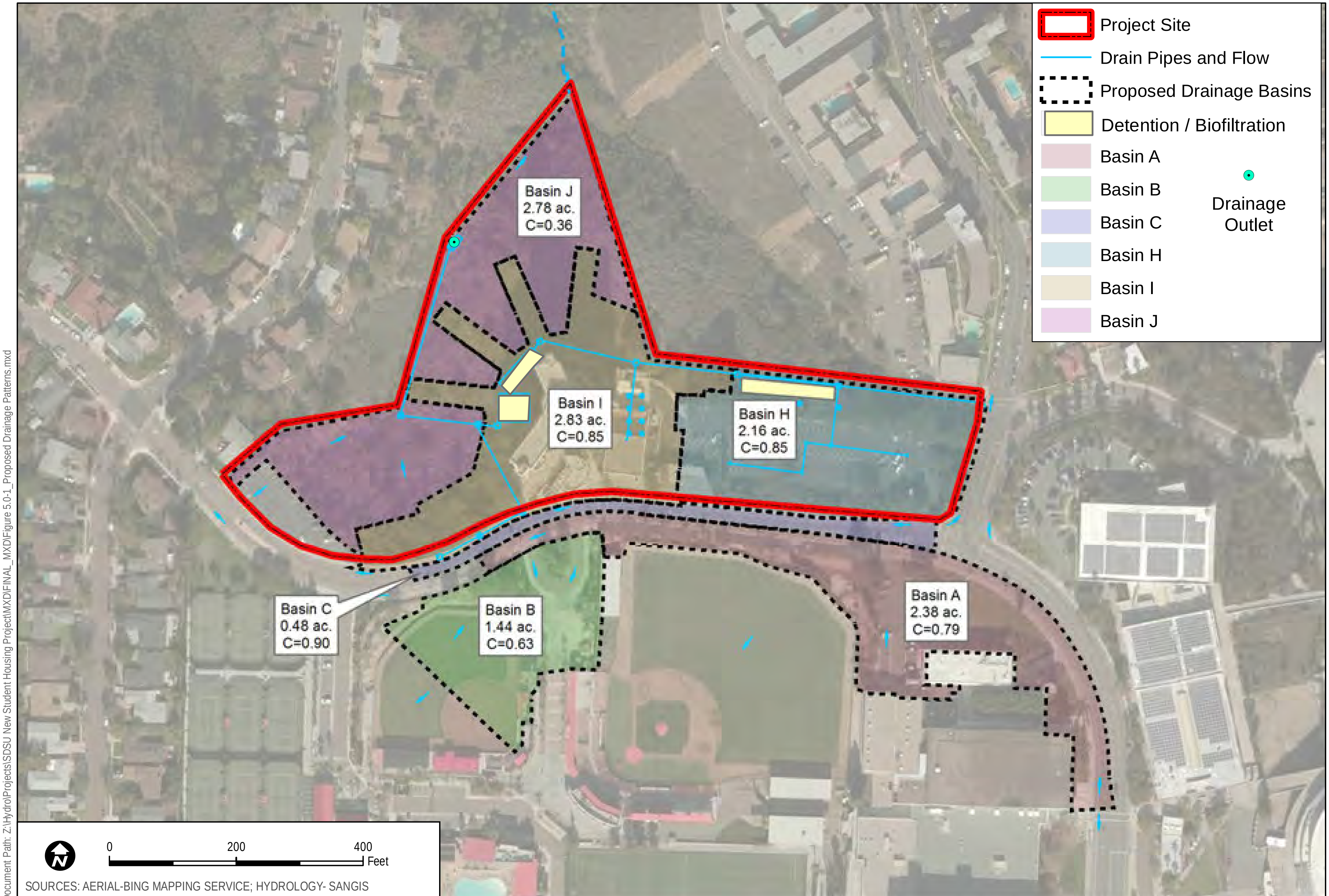
In the post-development stage, the new storm drain system would replace the existing corrugated metal pipes that currently deliver untreated storm flows from campus development to the slopes above the eastern and western arms of the canyon. The new storm drain system will convey the on-site and off-site runoff for discharge to the western ephemeral drainage creek, where it outfalls downstream at the most northerly corner of the site (**Appendix A**). This discharge location would include velocity dissipation, and would be located in an area less likely to cause erosion or rilling compared to existing conditions. The existing discharge locations are on steep slopes, whereas the proposed discharge location is on flatter ground along the existing drainage. The proposed drainage basins, discharge location, and the locations of biofiltration BMPs are shown in **Figure 8, Proposed Drainage Patterns**. **Table 11, Proposed Drainage Basins,** provides the size, runoff coefficient, and description of the proposed drainage basins. All runoff from the proposed project, as well as off-site areas to the south (i.e., a portion of the Sport Complex and Remington Road) would be passed through water quality treatment prior to discharge.

Table 11
Proposed Drainage Basins

Basin Name	Area (Acres)	Runoff Coefficient (C)	Description
Basin A	2.39	0.79	Basins A through C cover a portion of the Sport Complex and Remington Road, and are off-site areas that would not change with the project. However, storm runoff from these areas would be collected and conveyed along with storm flows from the project site prior to discharge to the western drainage.
Basin B	1.44	0.63	
Basin C	0.56	0.9	
Basin H	2.11	0.85	Basin H would include proposed development within the existing footprint of Parking Lot 9 and the vegetated fill slope immediately bordering the lot to the north.
Basin I	2.83	0.85	Basin I would include proposed development within the existing footprint of Chapultepec Hall and the hillslopes to the north and west.
Basin J	2.67	0.36	Basin J consists of the remaining portion of the property boundary within the western drainage and canyon.

Source: Appendix A.

In compliance with the SWRCB MS4 Permit, the development must implement stormwater quality control and flow control facilities. Due to the site constraints and conditions, stormwater infiltration, and bioretention facilities are not feasible for the proposed project. The BMPs selected for stormwater quality control are proprietary biofiltration BMPs (i.e., Modular Wetlands, Contech Filterra Biofiltration systems). These water quality BMPs meet the MEP standard because geotechnical data and site size constraints make vegetated swales, infiltration facilities, biorentention basins and other similar BMPs infeasible. As shown in **Figure 6**, the water quality BMPs would be located beneath the fire access lane and would be connected to the proposed underground storm drain system.



SDSU New Student Housing Project
Hydrology and Water Quality Technical Report

San Diego State University

Figure 8
Proposed Drainage Patterns

INTENTIONALLY LEFT BLANK

The proposed detention facilities for stormwater hydromodification flow control are detention vaults/cisterns (i.e., Brentwood StormTank, Oldcastle Precast Storm Capture), which must be traffic rated. The selected detention facilities for the proposed project are the Brentwood StormTank systems composed of module double stacks units and will be designed to detain the required runoff (minimum 10-year event volume) and metered discharge at the lower flow rate (10% of the peak 2-year discharge). These systems serve both water quality and flood control functions. The aforementioned stormwater quality control and hydromodification flow control BMPs are standard in the industry for sites with soil and/or space constraints, and have a demonstrated track record of performing adequately for the intended uses and conditions.

In addition to the stormwater drainage system, the proposed project would include landscape and site design BMPs that would further reduce the potential for adverse water quality impacts, including the following:

- The proposed project would consist of up to six green roofs: Two on Phase I east building, two on Phase I west building, one on the food service building, and one on the Phase II building.
- The proposed project would consist of three residential courtyards interspersed amongst the two buildings that comprise Phase I. These outdoor living spaces would incorporate movable outdoor furniture, planting beds, and turf.
- The proposed project would incorporate one residential park that would be located north of Chapultepec Hall and east of Residence Hall 3 Building D. The park would provide a lawn area, fire pit, outdoor furniture, and shade trees.
- Where the proposed project boundary meets the canyon on the north side of the site, the canyon slopes would be revegetated with California native species and selectively thinned and replanted to meet City of San Diego fuel modification and steep hillside landscape guidance.

With the proposed water quality BMPs and detention basins, peak discharge in the 100-year event from the post-development site is calculated to be about 12 cfs which is less than the pre-development conditions. See Appendix A for hydrology calculations.

Thus, even though the proposed project would increase the coverage of impervious surfaces relative to existing conditions, it would not result in adverse impacts on water quality when considering required compliance with the Small MS4 Permit and the associated design features that have been incorporated into the proposed project. The undergrounding of existing uncovered parking, the capture of off-site drainage areas into the proposed drainage system, and the relocation of stormwater outfalls to the canyon bottom with a lower slope are positive changes with regard to avoiding excessive erosion/scour. The proposed biofiltration BMPs would filter out any pollutants present within stormwater flows prior to discharge into the canyon bottom. Considering these design features, the post-construction impacts on stormwater quality, including to the closest receiving water (i.e., the unnamed ephemeral drainage north of the project site), would be less than significant.

Non-Stormwater Discharges

Phases I, II, and III

Non-stormwater discharges include activities such as groundwater dewatering during construction or permanent process related discharges, usually associated with industrial and/or service commercial sites. The proposed project would not include any permanent non-stormwater discharges. All sanitary sewage would be directed to the municipal sewer system. Furthermore, construction related groundwater dewatering is not anticipated based on the location of the proposed project atop a mesa, and the lack of observed groundwater seeps or springs. However, groundwater conditions fluctuate seasonally and thus there is the slight possibility that foundation excavations or utility trenches would require groundwater dewatering to support construction. The dewatering operations best practices required under the SWPPP would ensure that if groundwater is suspected to be contaminated, that it be appropriately treated prior to discharge. For these reasons, the impacts from non-stormwater discharge relative to groundwater would be **less than significant**.

Summary

In summary, the combination of source control, site design features (e.g., landscaping and green rooftops), and biofiltration BMPs to be incorporated into the proposed project are adequate to avoid or substantially reduce potential impacts associated with increases in the rate, volume, and/or pollutant load of surface runoff to the MEP. Project impacts with regard to water quality standards or WDRs would be less than significant.

Would the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

Perched groundwater seeps have been reported in some of the previous excavations on the SDSU campus, likely a result of infiltrating landscape irrigation water and precipitation meeting natural geologic formations beneath site fills; however, no groundwater seeps or springs have been observed on site (Southland Geotechnical Consultants 2015, URS 2013). While not anticipated, it is possible that construction contractors may need to pump groundwater seepage out of excavations during construction of sub-grade foundations and facilities (i.e., groundwater dewatering). If this activity is required, its effects on shallow groundwater levels would be temporary and highly localized. Any impacts would be limited to the perched groundwater and, therefore, would not affect static water levels in the underlying regional aquifer; the campus is not underlain by a DWR-designated groundwater basin (see Figure 7). Furthermore, the campus (and the City of San Diego as a whole) is reliant on municipal water supplies, which means there are no existing or proposed groundwater wells in or adjacent to the proposed project that could be adversely affected by construction-related dewatering activities.

Following construction, changes in land cover (e.g., impervious surfaces) ultimately could affect the amount of stormwater that percolates into the ground versus the amount that runs off into the downstream ephemeral drainages or Alvarado Creek. To the extent the proposed project changes the ratio of pervious to impervious surfaces, it also could increase or decrease recharge of the underlying groundwater aquifer. However, due to the soil characteristics and slope, the area is not amenable to recharge of groundwater and instead promotes runoff. Recharge areas in the region generally are limited to ponds, wetlands, stream corridors, and flatter areas underlain by permeable soils and sediment. The proposed project is underlain by clayey soils within Hydrologic Group D, which indicates soils that have a high runoff (URS 2013; Appendix A). Therefore, the project-related changes in land use would not have appreciable (i.e., measurable) effects on groundwater recharge. As such, direct impacts of the proposed project on aquifer volumes, the local groundwater table, and the production rate of pre-existing nearby wells would be **less than significant**.

Indirect Impacts

Phases I, II, and III

To the extent the proposed project would generate additional demand for water, it also could indirectly result in a small, incremental increase in demand on the City's groundwater supply. However, water service for the project site is and will continue to be provided through the purchase of municipal water from the City—no on-site groundwater wells are proposed. The City currently derives its water supply almost exclusively from surface water sources (both local and imported), with only a small pilot program in place to use local groundwater (City of San Diego 2016b). Less than 1% of the City's supply is from groundwater (City of San Diego 2016b). Therefore, the project-related increase in water demand would be served by surface water and would have a negligible, if any, effect with regard to groundwater depletion. Thus, indirect impacts of the project relative to groundwater supplies would be **less than significant.**

Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river in a manner which would result in substantial erosion or siltation on- or off-site?

Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

Phases I, II, and III

As discussed under the first threshold and in Appendix A, the proposed project would include detention facilities to ensure there is no increase in peak flow volumes. The project would reduce the peak discharge volume in the 100-year, 6-hour storm event (which is the storm event which typically produces the highest flow). See Appendix A. With the proposed detention basins, peak discharge in the 100-year event from the post-development site is calculated to be about 12 cfs, which is less than the pre-development conditions. The proposed drainage plan would shift a small portion of flow that currently drains to the eastern arm of the canyon to the western arm. However, this shift would not increase the flow received by any off-site receiving waters, thereby avoiding hydromodification impacts such as flooding and streambed scour. Therefore, any impacts associated with alteration of existing drainage patterns with respect to both erosion and flooding, would be **less than significant**.

Would the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Phases I, II, and III

Because the proposed project would reduce the peak flow rate from the area of the campus that drains to the canyon and the unnamed ephemeral drainage, the project would not create or contribute runoff water that would exceed the capacity of Caltrans' 42-inch RCP culvert or the concrete trapezoidal channel along Alvarado Creek, each of which has adequate capacity to carry existing runoff. As to polluted runoff, as discussed under the first criterion, the proposed stormwater treatment devices would be sufficient to avoid substantial polluted runoff from the site. Furthermore, any pollutant sources would be limited to nonpoint sources such as trash/debris and sediment. For these reasons, the impacts relative to this criterion would be **less than significant**.

Would the project otherwise substantially degrade water quality?

Phases I, II, and III

The ways in which the proposed project could degrade water quality have been analyzed under the above criteria. The project would not involve any non-stormwater discharges other than sanitary sewer discharges, and would not degrade water quality for any reason other than those already discussed. Therefore, the proposed project would not otherwise substantially degrade water quality and impacts would be **less than significant**.

Would the project place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

Phases I, II, and III

The site of the proposed project is not located within a 100-year flood hazard area as mapped by FEMA. Therefore, the proposed project would have no impact relative to flood hazard areas, and impacts would be **less than significant**. (See Figure 5.)

Would the project place within a 100-year flood hazard area structures which would impede or redirect flood flows?

Phases I, II, and III

The site of the proposed project is not located within a 100-year flood hazard area as mapped by FEMA. Therefore, the proposed project would not place structures within a 100-year flood hazard area, and impacts would be **less than significant**. (See Figure 5.)

Would the project expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

Phases I, II, and III

Flood inundation of the proposed project site is not likely due to its elevation (i.e., higher than approximately 400 feet amsl) and distance from natural drainage channels susceptible to flooding during precipitation events (i.e., Alvarado Creek). For the same reasons, the proposed project site also is not located in an area susceptible to inundation by a dam failure (such as Lake Murray). Therefore, the proposed project would not expose people or structures to a significant risk of loss, injury, or death involving flooding, and impacts with respect to this criterion would be **less than significant**.

Would the project result in inundation by seiche, tsunami, or mudflow?

Phases I, II, and III

Seiches are periodic oscillations of a body of water. Due to the project site's elevation and its distance from bodies of water, the possibility of its inundation from a seiche is considered very low. Similarly, as to inundation by tsunami, due to the distance from the coastline and the elevation of the project site, the possibility of inundation of the site by a tsunami is considered very low. Mudflow is a flowing mass of soil with a high fluidity during movement. The project site is located on a relatively level to gently sloping mesa area in an urbanized campus area with minimally exposed soil surfaces. The proposed project would include retaining walls and remedial grading necessary to ensure the hillside development does not destabilize the hillslope. Even if a mudflow occurred on the slopes adjacent to the site of the proposed project, the mudflow would affect the open space only in the canyon bottom and would not have consequences with regard to public safety. As such, the possibility of inundation of the project site by mudflows is considered very low. Therefore, the proposed project would not result in inundation by seiche, tsunami, and/or mudflow hazards, and impacts would be **less than significant**.

Would the project result in a cumulative impact relative to hydrology and/or water quality when considered with other present and probable future projects in the region?

Due to the existing developed nature of the area proposed to be redeveloped by the proposed project, in combination with the water quality and stormwater BMPs that would be incorporated into the project design, the proposed project would not contribute to a cumulative increase in stormwater discharge rates. With respect to water quality, the proposed project's adherence to applicable BMPs for water quality management would be consistent with the overall regional objective of improving water quality. All cumulative projects, including future campus projects, would be required to be planned, constructed, and managed in accordance with regional BMPs and discharge requirements. Adherence to regional standards would eliminate unlawful discharges and poor water quality management practices from occurring on a cumulatively considerable scale. Further, other projects in process or proposed in the future would be required to adhere to regional and other applicable water quality protection measures to eliminate adverse cumulative water quality conditions. Therefore, the proposed project would not result in significant cumulative impacts related to hydrology and/or water quality, and impacts would be **less than significant**.

6 MITIGATION MEASURES

Because all potential impacts of the proposed project would be less than significant as a result of compliance with applicable laws and regulations and the implementation of corresponding project design features, no mitigation measures are required.

INTENTIONALLY LEFT BLANK

7 REFERENCES CITED

Caltrans (California Department of Transportation). 1981. "As-Built Plans, Interstate 8, Post Mile 4.9/8.2." Sheet 70/246. Prepared September 20, 1979, authorized August 3, 1981.

City of San Diego. 2016a. *Storm Water Standards*. January 2016. https://www.sandiego.gov/sites/default/files/storm-water-standards-manual-2016-1.pdf.

City of San Diego. 2016b. "Figure 6-1." In *2015 Final Urban Water Management Plan*. https://wuedata.water.ca.gov/public/uwmp_attachments/3881681144/2015%20UWMP%20Report.pdf. June 2016.

DWR (Department of Water Resources). 2004. *California's Groundwater*. Groundwater Basin Description for the Mission Valley Groundwater Basin (Basin No. 9-14). DWR Bulletin 118. February 2004.

San Diego RWQCB (Regional Water Quality Control Board). 2016. *Water Quality Control Plan for the San Diego Basin (Region 9)*. September 1994, with amendments effective on or before May 17, 2016.

SanGIS. 2003. "TOPO_1999_2." Two-Foot Topographic Contours based on 1999 Orthophotos. Created by City of San Diego IT&C. Last updated April 2003.

SanGIS. 2015. "Floodplains." FEMA Flood Insurance Rate Map, San Diego County, California and Unincorporated Areas. Accessed February 2, 2015. http://sdgis.sandag.org/.

Southland Geotechnical Consultants. 2015. *Geotechnical Input for Environmental Impact Report, Engineering and Interdisciplinary Sciences Building, San Diego State University, San Diego, California*. El Cajon, California: Southland Geotechnical Consultants. January 19, 2015.

SWRCB (State Water Resources Control Board). 2012. *Final 2012 California Integrated Report (Clean Water Act Section 303(d) List/305(b) Report.* Accessed January 27, 2017. http://www.swrcb.ca.gov/water_issues/programs/tmdl/integrated2012.shtml.

URS. 2013. *Factual Geotechnical Report, West Campus Housing, San Diego State University, Remington Road and 55th Street, San Diego, California 92182*. URS Project No. 27661317.10000. Prepared for San Diego University, Facilities Planning Design and Construction. December 13, 2013.

USGS (U.S. Geological Survey). 2017. *The National Map*, Version 2.0. Web-based Geographic Information System (GIS) viewer. Accessed January 5, 2017. http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd.

APPENDIX A

Preliminary Drainage Study for West Campus Housing

Snipes-Dye associates

PRELIMINARY DRAINAGE STUDY

For

WEST CAMPUS HOUSING

SAN DIEGO STATE UNIVERSITY

Prepared by:
Snipes-Dye Associates
8348 Center Drive, Suite G
La Mesa, CA 91942-2910
(619)697-9234
Job No. SD2916

Dated: January 23, 2017

REGISTERED PROFESSIONAL ENGINEER
MATTHEW P. KURTZ
No. 79546
Exp. 9/30/18
CIVIL
STATE OF CALIFORNIA

Preliminary Hydraulic/Hydrology Calculations

The site is located at the northwesterly portion of San Diego State University, along the northerly side of Remington Road, between Hewlett Drive and 55th Street. The proposed development of the student housing complex consists of the construction of additional four residence halls, multi-story buildings with parking levels over a 7.8-acre site which currently occupied by Chapultepec Hall, a retail building, a multi-purpose building and couple parking lots. Parking Lot T and Chapultepec Hall will remain. The existing buildings located adjacent to Chapultepec Hall and the parking lot will get demolished for the construction of new residence halls and fire-truck access lane. The site topography consists of natural vegetated slope land, sloping northerly descending toward Interstate 8, excepting the areas occupied by buildings and the parking lots.

The upstream basin, tributary to the site runoff consists of approximately 2.5 acres of developed area, including a portion of the Sport Complex and Remington Road. The runoff from these areas is collected in curb-inlet and catch basins then discharge to the natural vegetated slope on the northerly side of Remington Road through a 24-inch CMP and a 12-inch CMP which located west of Chapultepec Hall. Runoff from Chapultepec Hall, retail building, multi-purpose building rooftops and their courtyard area is collected and discharged over the same natural vegetated slope, north of Chapultepec Hall through a 12-inch PVC pipe. The runoff then flows northerly in the westerly creek located along the westerly site boundary then outfalls at the most northerly corner of the site. The runoff from portion of the site which is occupied by Parking Lot U is discharged over the natural vegetated slope and outfalls into the easterly creek located on the neighbor property to the north. See attached pre-development drainage map. A hydrology analysis, based upon the 100-year, 6-hour storm event of the existing flows has been calculated, using the Advanced Engineering Software (AES) and InteliSolve Hydroflow programs. The runoff coefficients were calculated based on the percentage of impervious area within each basin. In the pre-development conditions, the peak runoff discharges at the outfalls to the westerly creek and the easterly creek were calculated to be 15 cubic feet per second (cfs) and 8 cfs, respectively. The pre-development site discharges a total of 23 cfs in the 100-year storm.

In the post-development site, a new storm drain system is proposed including the replacement of the existing 24-inch and 12-inch CMPs. The new storm drain system will convey the onsite and offsite runoff and discharge to the downstream drainage creek located along the northwesterly site boundary where it outfalls to the downstream at the most northerly corner of the site.

In compliance with the State Water Resources Control Board MS4 Permit, the development would have to implement the stormwater quality control and flow control facilities. Due to the site constrains and conditions, stormwater infiltration, bioretention and biofiltration facilities are not feasible for this development. The proposed BMPs selected for stormwater quality control are the proprietary biofiltration BMPs (i.e. Modular Wetlands, Contech Filterra Biofiltration sytems) which must be certified by the Washington Technology Acceptance Protocol-Ecology program. The proposed detention facilities for stormwater hydromodification flow control are detention vaults/cisterns (i.e. Brentwood StormTank, Oldcastle Precast Storm Capture) which must be traffic rated. The selected detention facilities for this project are the Brentwood StormTank systems composed of module double stacks units. Detention Basin No.1 located in the fire lane adjacent to the proposed Residence Hall 1, has storage capacity of approximate 19,800 cubic feet (required 13,550 cubic feet) which will detain the required runoff (minimum 10-year event volume) from areas of the Residence Hall 1 and Residence Hall 2 and metered discharge at the lower flow rate (10% of the peak 2-year discharge). Detention Basin No. 2 located in the fire lane turnaround cul-de-sac, has storage capacity of approximate 22,500 cubic feet (required 18,200 cubic feet). It will be designed similarly to the Detention Basin No. 1 to control the runoff flow from the areas of the Residence Hall 3, Residence Hall 4 and Food Service building.

With the proposed detention basins, peak discharge in the 100-year event from the post-development site is calculated to be about 12 cfs which is less than the pre-development conditions. See the attached hydrology calculations and post-development drainage map.

CONCLUSION:

- The outfall in the post-development condition is at the same location as in the pre-development condition.

- Site design includes detention basins which have the capacity to retain the on-site runoff to mitigate the increase runoff in the post-development site for 100-year storm event.

- The peak 100-year discharge from the post-development site will be less than the discharge in the pre-development after mitigation.

- There will be no impact to downstream and adjacent properties due to the grading of the site.

ATTACHMENTS

ATTACHMENT A – HYDROLOGY/HYDRAULIC CALCULATIONS FOR PRE-DEVELOPMENT AND POST-DEVELOPMENT BEFORE MITIGATION

ATTACHMENT B – HYDROLOGY/HYDRAULIC CALCULATIONS FOR POST-DEVELOPMENT AFTER MITIGATION

ATTACHMENT C – ISOPLUVIAL, RAINFALL BASIN, SOIL HYDROLOGIC GROUP, TIME OF CONCETRATION AND RAINFALL INTENSITY CALCULATIONS

ATTACHMENT D –DETENTION BASINS CALCULATIONS AND DETAILS

ATTACHMENT E – PRE-DEVELOPMENT AND POST-DEVELOPMENT DRAINAGE MAPS

ATTACHMENT A:

HYDROLOGY/HYDRAULIC CALCULATIONS FOR PRE-DEVELOPMENT AND POST-DEVELOPMENT BEFORE MITIGATION

```
****************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                     2003,1985,1981 HYDROLOGY MANUAL
       (c) Copyright 1982-2013 Advanced Engineering Software (aes)
           Ver. 20.0 Release Date: 06/01/2013  License ID 1305

                        Analysis prepared by:
```

Snipes-Dye associates

civil engineers & land surveyors

8348 Center Drive, Suite G, La Mesa, CA 91942
(619) 697-9234 (619) 460-2033 fax
www.snipesdye.com

```
 ************************** DESCRIPTION OF STUDY **************************
* SDSU WEST CAMPUS HOUSING                                                 *
* PRE-DEVELOPMENT WITH MITIGATION                                          *
* HYDROLOGY STUDY- 100YEAR FREQUENCY                                       *
 **************************************************************************

  FILE NAME: SD2912.DAT
  TIME/DATE OF STUDY: 15:22 01/18/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================= ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020  0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
```

```
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =   20.500
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.863
  SUBAREA RUNOFF(CFS) =      5.41
  TOTAL AREA(ACRES) =      2.39   TOTAL RUNOFF(CFS) =      5.41

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.50
  RAINFALL INTENSITY(INCH/HR) =   2.86
  TOTAL STREAM AREA(ACRES) =     2.39
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.41

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6300
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =   12.500
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.939
  SUBAREA RUNOFF(CFS) =      3.57
  TOTAL AREA(ACRES) =      1.44   TOTAL RUNOFF(CFS) =      3.57

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE      2.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0200
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  16.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.83
  GIVEN PIPE DIAMETER(INCH) =  16.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       3.57
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   12.57
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      2.00 =      30.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.57
  RAINFALL INTENSITY(INCH/HR) =   3.92
  TOTAL STREAM AREA(ACRES) =     1.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.57

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.41    20.50        2.863          2.39
      2        3.57    12.57        3.925          1.44

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        6.89    12.57       3.925
      2        8.01    20.50       2.863

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.01   Tc(MIN.) =   20.50
  TOTAL AREA(ACRES) =        3.8
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE      2.00 =      30.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE     31.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0500
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.55
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.01
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   20.57
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     31.00 =      80.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     31.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.57
  RAINFALL INTENSITY(INCH/HR) =   2.86
  TOTAL STREAM AREA(ACRES) =     3.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.01

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =   12.000
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.044
  SUBAREA RUNOFF(CFS) =      2.55
  TOTAL AREA(ACRES) =      0.70   TOTAL RUNOFF(CFS) =      2.55

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     31.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.00
  RAINFALL INTENSITY(INCH/HR) =   4.04
  TOTAL STREAM AREA(ACRES) =     0.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.55

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     31.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =    5.600
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.612
  SUBAREA RUNOFF(CFS) =      3.82
  TOTAL AREA(ACRES) =      0.68   TOTAL RUNOFF(CFS) =      3.82
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     31.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.60
  RAINFALL INTENSITY(INCH/HR) =   6.61
  TOTAL STREAM AREA(ACRES) =     0.68
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.82

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        8.01    20.57        2.857          3.83
      2        2.55    12.00        4.044          0.70
      3        3.82     5.60        6.612          0.68

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        8.47     5.60       6.612
      2       10.55    12.00       4.044
      3       11.46    20.57       2.857

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      11.46   Tc(MIN.) =   20.57
  TOTAL AREA(ACRES) =        5.2
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     31.00 =     800.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  CHANNEL LENGTH THRU SUBAREA(FEET) =   800.00
  REPRESENTATIVE CHANNEL SLOPE =  0.1750
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.692
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.55
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.74
```

```
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   1.98
  Tc(MIN.) =   22.55
  SUBAREA AREA(ACRES) =     4.42       SUBAREA RUNOFF(CFS) =    4.17
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.576
  TOTAL AREA(ACRES) =         9.6         PEAK FLOW RATE(CFS) =      14.94

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOW VELOCITY(FEET/SEC.) =   7.07
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     32.00 =    1600.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =   10.900
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.303
  SUBAREA RUNOFF(CFS) =      6.56
  TOTAL AREA(ACRES) =      1.93   TOTAL RUNOFF(CFS) =      6.56

****************************************************************************
  FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =    5.200
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.936
  SUBAREA RUNOFF(CFS) =      1.07
  TOTAL AREA(ACRES) =      0.44   TOTAL RUNOFF(CFS) =      1.07
```

```
****************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                      2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2013 Advanced Engineering Software (aes)
           Ver. 20.0 Release Date: 06/01/2013  License ID 1305

                       Analysis prepared by:
```


Snipes-Dye associates
civil engineers & land surveyors
8348 Center Drive, Suite G, La Mesa, CA 91942
(619) 697-9234 (619) 460-2033 fax
www.snipesdye.com


```
 ************************** DESCRIPTION OF STUDY **************************
 * SDSU WEST CAMPUS HOUSING                                                *
 * POST-DEVELOPMENT                                                        *
 * HYDROLOGY STUDY- 100YEAR FREQUENCY                                      *
 **************************************************************************
```

****

FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 22

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

==

*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7900
S.C.S. CURVE NUMBER (AMC II) = 0
USER SPECIFIED Tc(MIN.) = 20.500
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.863
SUBAREA RUNOFF(CFS) = 5.41
TOTAL AREA(ACRES) = 2.39 TOTAL RUNOFF(CFS) = 5.41

****

FLOW PROCESS FROM NODE 101.00 TO NODE 101.00 IS CODE = 1

>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

==

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 20.50
RAINFALL INTENSITY(INCH/HR) = 2.86
TOTAL STREAM AREA(ACRES) = 2.39

```
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     5.41

****************************************************************************
 FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  22
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .6300
 S.C.S. CURVE NUMBER (AMC II) =   0
 USER SPECIFIED Tc(MIN.) =   12.500
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.939
 SUBAREA RUNOFF(CFS) =     3.57
 TOTAL AREA(ACRES) =     1.44   TOTAL RUNOFF(CFS) =     3.57

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    101.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0200
 FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  16.0 INCH PIPE IS   6.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.83
 GIVEN PIPE DIAMETER(INCH) =  16.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      3.57
 PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   12.62
 LONGEST FLOWPATH FROM NODE    201.00 TO NODE    101.00 = ********** FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   12.62
 RAINFALL INTENSITY(INCH/HR) =   3.91
 TOTAL STREAM AREA(ACRES) =     1.44
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     3.57

 ** CONFLUENCE DATA **
 STREAM    RUNOFF      Tc      INTENSITY      AREA
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       5.41    20.50       2.863         2.39
    2       3.57    12.62       3.915         1.44
```

```
RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM    RUNOFF     Tc     INTENSITY
NUMBER     (CFS)   (MIN.)   (INCH/HOUR)
   1      6.90   12.62     3.915
   2      8.02   20.50     2.863

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      8.02   Tc(MIN.) =   20.50
TOTAL AREA(ACRES) =       3.8
LONGEST FLOWPATH FROM NODE    201.00 TO NODE    201.00 = ********** FEET.

****************************************************************************
FLOW PROCESS FROM NODE    201.00 TO NODE    301.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
REPRESENTATIVE SLOPE =  0.0500
FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS   6.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  11.55
GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      8.02
PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   20.57
LONGEST FLOWPATH FROM NODE    201.00 TO NODE    301.00 = ********** FEET.

****************************************************************************
FLOW PROCESS FROM NODE    301.00 TO NODE    301.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   20.57
RAINFALL INTENSITY(INCH/HR) =   2.86
TOTAL STREAM AREA(ACRES) =    3.83
PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.02

****************************************************************************
FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  22
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
*USER SPECIFIED(SUBAREA):
```

USER-SPECIFIED RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) = 0
USER SPECIFIED Tc(MIN.) = 12.000
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.044
SUBAREA RUNOFF(CFS) = 2.04
TOTAL AREA(ACRES) = 0.56 TOTAL RUNOFF(CFS) = 2.04

****
FLOW PROCESS FROM NODE 301.00 TO NODE 301.00 IS CODE = 1

>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 12.00
RAINFALL INTENSITY(INCH/HR) = 4.04
TOTAL STREAM AREA(ACRES) = 0.56
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.04

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	8.02	20.57	2.857	3.83
2	2.04	12.00	4.044	0.56

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	7.70	12.00	4.044
2	9.46	20.57	2.857

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 9.46 Tc(MIN.) = 20.57
TOTAL AREA(ACRES) = 4.4
LONGEST FLOWPATH FROM NODE 201.00 TO NODE 301.00 = FEET.

****
FLOW PROCESS FROM NODE 301.00 TO NODE 302.00 IS CODE = 41

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==
REPRESENTATIVE SLOPE = 0.3000
FLOW LENGTH(FEET) = 150.00 MANNING'S N = 0.013

DEPTH OF FLOW IN 24.0 INCH PIPE IS 4.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 22.88
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 9.46
PIPE TRAVEL TIME(MIN.) = 0.11 Tc(MIN.) = 20.68
LONGEST FLOWPATH FROM NODE 201.00 TO NODE 302.00 = FEET.

****
FLOW PROCESS FROM NODE 10.00 TO NODE 10.00 IS CODE = 10

>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==

****
FLOW PROCESS FROM NODE 400.00 TO NODE 401.00 IS CODE = 22

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .8500
S.C.S. CURVE NUMBER (AMC II) = 0
USER SPECIFIED Tc(MIN.) = 7.300
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.573
SUBAREA RUNOFF(CFS) = 10.00
TOTAL AREA(ACRES) = 2.11 TOTAL RUNOFF(CFS) = 10.00

```
****************************************************************************
 FLOW PROCESS FROM NODE    401.00 TO NODE    501.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 REPRESENTATIVE SLOPE =  0.0700
 FLOW LENGTH(FEET) =   500.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  14.19
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      10.00
 PIPE TRAVEL TIME(MIN.) =   0.59    Tc(MIN.) =    7.89
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    501.00 =     650.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    501.00 TO NODE    501.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.89
 RAINFALL INTENSITY(INCH/HR) =   5.30
 TOTAL STREAM AREA(ACRES) =     2.11
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.00

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  22
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 USER-SPECIFIED RUNOFF COEFFICIENT = .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 USER SPECIFIED Tc(MIN.) =    6.200
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.192
 SUBAREA RUNOFF(CFS) =     14.90
 TOTAL AREA(ACRES) =      2.83   TOTAL RUNOFF(CFS) =     14.90

****************************************************************************
 FLOW PROCESS FROM NODE    501.00 TO NODE    501.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
 TIME OF CONCENTRATION(MIN.) =    6.20
 RAINFALL INTENSITY(INCH/HR) =   6.19
 TOTAL STREAM AREA(ACRES) =     2.83
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.90

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       10.00     7.89       5.302         2.11
    2       14.90     6.20       6.192         2.83

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       22.75     6.20      6.192
    2       22.75     7.89      5.302

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      22.75   Tc(MIN.) =    6.20
 TOTAL AREA(ACRES) =       4.9
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE    501.00 =     650.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    501.00 TO NODE     10.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1       22.75     6.20      6.192       4.94
 LONGEST FLOWPATH FROM NODE    400.00 TO NODE     10.00 =     650.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1        9.46    20.68      2.847       4.39
 LONGEST FLOWPATH FROM NODE    201.00 TO NODE     10.00 =   FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
    1      25.59      6.20       6.192
    2      19.92      20.68       2.847
```

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 25.59 Tc(MIN.) = 6.20
TOTAL AREA(ACRES) = 9.3

****
FLOW PROCESS FROM NODE 10.00 TO NODE 600.00 IS CODE = 51

>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==
CHANNEL LENGTH THRU SUBAREA(FEET) = 720.00
REPRESENTATIVE CHANNEL SLOPE = 0.1750
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 2.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 20.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.451
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .3600
S.C.S. CURVE NUMBER (AMC II) = 0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 28.21
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 8.86
AVERAGE FLOW DEPTH(FEET) = 0.30 TRAVEL TIME(MIN.) = 1.35
Tc(MIN.) = 7.55
SUBAREA AREA(ACRES) = 2.67 SUBAREA RUNOFF(CFS) = 5.24
AREA-AVERAGE RUNOFF COEFFICIENT = 0.705
TOTAL AREA(ACRES) = 12.0 PEAK FLOW RATE(CFS) = 46.11

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.40 FLOW VELOCITY(FEET/SEC.) = 10.63
LONGEST FLOWPATH FROM NODE 201.00 TO NODE 600.00 = FEET.
==
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 12.0 TC(MIN.) = 7.55
PEAK FLOW RATE(CFS) = 46.11 OUTFALL FROM THE WESTERLY CREEK
==
==
END OF RATIONAL METHOD ANALYSIS

ATTACHMENT B:

HYDROLOGY/HYDRAULIC CALCULATIONS FOR POST-DEVELOPMENT AFTER MITIGATION

****

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
2003,1985,1981 HYDROLOGY MANUAL

Ver. 20.0 Release Date: 06/01/2013 License ID 1305

Analysis prepared by:

Snipes-Dye associates
civil engineers & land surveyors
8348 Center Drive, Suite G, La Mesa, CA 91942
(619) 697-9234 (619) 460-2033 fax
www.snipesdye.com

************************* DESCRIPTION OF STUDY *************************
* **SDSU WEST CAMPUS HOUSING** *
* **POST-DEVELOPMENT WITH MITIGATION** *
* HYDROLOGY STUDY- 100YEAR FREQUENCY *
****

FILE NAME: SD2912.DAT
TIME/DATE OF STUDY: 15:22 01/18/2017

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.700
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK-SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

```
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =   20.500
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.863
  SUBAREA RUNOFF(CFS) =      5.41
  TOTAL AREA(ACRES) =      2.39   TOTAL RUNOFF(CFS) =      5.41

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    101.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.50
  RAINFALL INTENSITY(INCH/HR) =   2.86
  TOTAL STREAM AREA(ACRES) =     2.39
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.41

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6300
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =   12.500
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.939
  SUBAREA RUNOFF(CFS) =      3.57
  TOTAL AREA(ACRES) =      1.44   TOTAL RUNOFF(CFS) =      3.57

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    101.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0200
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  16.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.83
  GIVEN PIPE DIAMETER(INCH) =  16.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.57
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   12.62
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    101.00 = ********** FEET.
****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.62
  RAINFALL INTENSITY(INCH/HR) =   3.91
  TOTAL STREAM AREA(ACRES) =     1.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.57

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.41    20.50        2.863          2.39
      2        3.57    12.62        3.915          1.44

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        6.90    12.62       3.915
      2        8.02    20.50       2.863

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.02   Tc(MIN.) =   20.50
  TOTAL AREA(ACRES) =        3.8
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    201.00 = ********** FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    301.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0500
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.55
```

```
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.02
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   20.57
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    301.00 = ********** FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    301.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.57
  RAINFALL INTENSITY(INCH/HR) =   2.86
  TOTAL STREAM AREA(ACRES) =     3.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.02

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  USER SPECIFIED Tc(MIN.) =   12.000
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.044
  SUBAREA RUNOFF(CFS) =      2.04
  TOTAL AREA(ACRES) =      0.56   TOTAL RUNOFF(CFS) =      2.04

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    301.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.00
  RAINFALL INTENSITY(INCH/HR) =   4.04
  TOTAL STREAM AREA(ACRES) =     0.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.04

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        8.02    20.57        2.857          3.83
      2        2.04    12.00        4.044          0.56
```

```
  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        7.70    12.00       4.044
      2        9.46    20.57       2.857

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       9.46   Tc(MIN.) =   20.57
  TOTAL AREA(ACRES) =        4.4
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    301.00 = ********** FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.3000
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   4.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.88
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.46
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   20.68
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    302.00 = ********** FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   7.30   RAIN INTENSITY(INCH/HOUR) =  5.57
  TOTAL AREA(ACRES) =     2.11   TOTAL RUNOFF(CFS) =      0.10

+--------------------------------------------------------------------------+
| BMP#1                                                                    |
| MITIGATED OUTFLOW = 0.02 CFS (PER HYDRAFLOW SOFTWARE)                    |
| USED Q=0.10 CFS (MIN. ALLOWABLE PIPE FLOW PER AES SOFTWARE
+--------------------------------------------------------------------------+
```

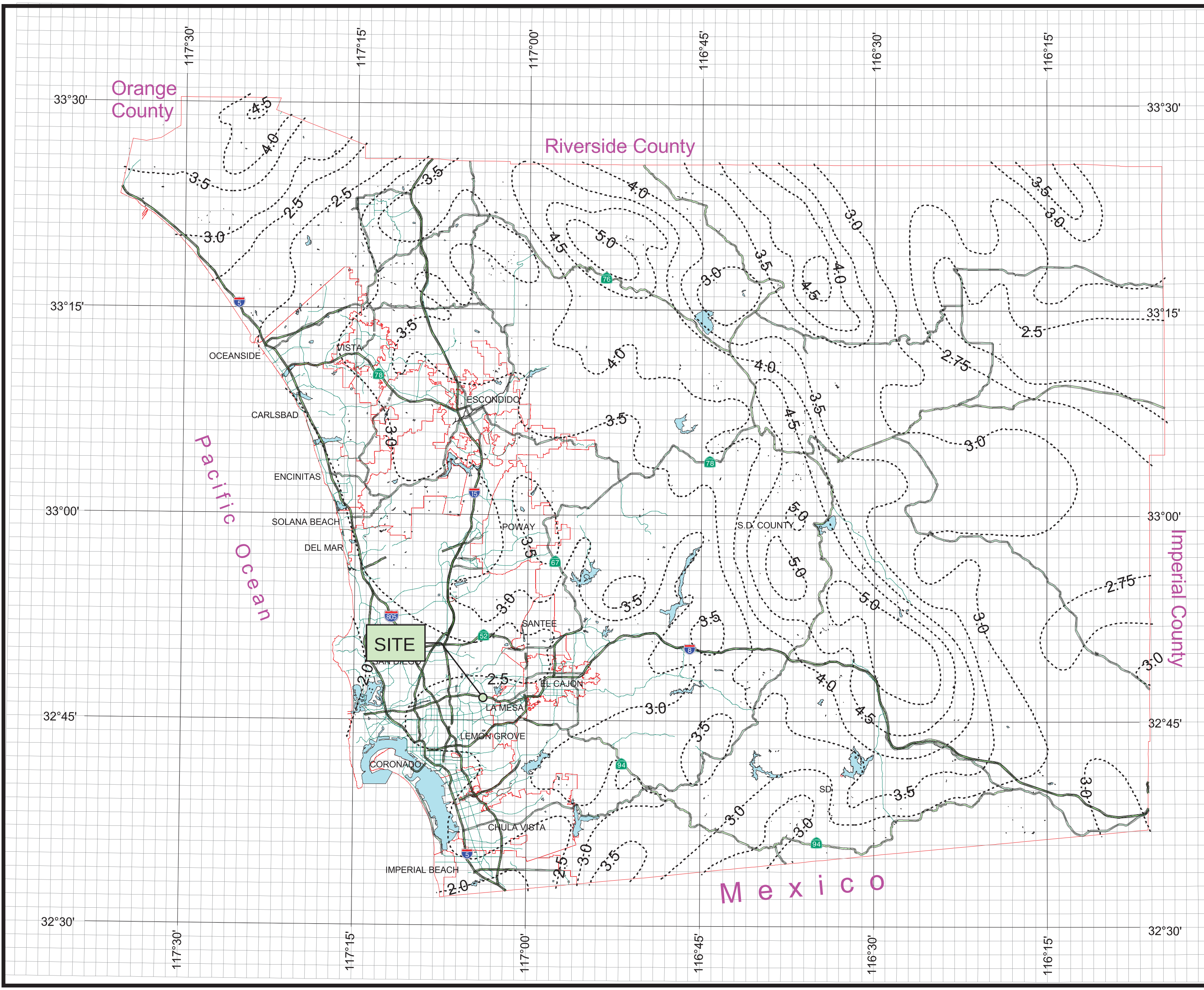
```
****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    501.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  REPRESENTATIVE SLOPE =  0.0700
  FLOW LENGTH(FEET) =   500.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   0.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.86
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.10
  PIPE TRAVEL TIME(MIN.) =   2.16    Tc(MIN.) =    9.46
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    501.00 = ********** FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    501.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.46
  RAINFALL INTENSITY(INCH/HR) =   4.72
  TOTAL STREAM AREA(ACRES) =     2.11
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.10

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  12.00   RAIN INTENSITY(INCH/HOUR) =  4.04
  TOTAL AREA(ACRES) =     2.83   TOTAL RUNOFF(CFS) =      0.09

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    501.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.00
  RAINFALL INTENSITY(INCH/HR) =   4.04
  TOTAL STREAM AREA(ACRES) =     2.83
```

```
PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.09

** CONFLUENCE DATA **
STREAM     RUNOFF       Tc      INTENSITY      AREA
NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1        0.10     9.46        4.716          2.11
    2        0.09    12.00        4.044          2.83

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1        0.17     9.46       4.716
    2        0.18    12.00       4.044

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       0.18   Tc(MIN.) =   12.00
TOTAL AREA(ACRES) =        4.9
LONGEST FLOWPATH FROM NODE    201.00 TO NODE    501.00 = ********** FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    302.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

** MAIN STREAM CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY     AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1        0.18    12.00       4.044        4.94
LONGEST FLOWPATH FROM NODE    201.00 TO NODE    302.00 = ********** FEET.

** MEMORY BANK #  1 CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY     AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1        9.46    20.68       2.847        4.39
LONGEST FLOWPATH FROM NODE    201.00 TO NODE    302.00 = ********** FEET.

** PEAK FLOW RATE TABLE **
STREAM    RUNOFF       Tc      INTENSITY
NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
    1       5.66      12.00        4.044
    2       9.58      20.68        2.847

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       9.58   Tc(MIN.) =   20.68
TOTAL AREA(ACRES) =        9.3
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    600.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  CHANNEL LENGTH THRU SUBAREA(FEET) =   720.00
  REPRESENTATIVE CHANNEL SLOPE =  0.1750
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  20.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.686
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3600
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.88
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.16
  AVERAGE FLOW DEPTH(FEET) =   0.17   TRAVEL TIME(MIN.) =   1.95
  Tc(MIN.) =   22.63
  SUBAREA AREA(ACRES) =     2.67       SUBAREA RUNOFF(CFS) =    2.58
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.358
  TOTAL AREA(ACRES) =       12.0         PEAK FLOW RATE(CFS) =      11.55

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.18   FLOW VELOCITY(FEET/SEC.) =   6.26
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    600.00 = ********** FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       12.0  TC(MIN.) =     22.63
  PEAK FLOW RATE(CFS)   =      11.55
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

ATTACHMENT C:

ISOPLUVIAL, RAINFALL BASIN, SOIL HYDROLOGIC GROUP, TIME OF CONCETRATION AND RAINFALL INTENSITY CALCULATIONS



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

2.7	Isopluvial (inches)

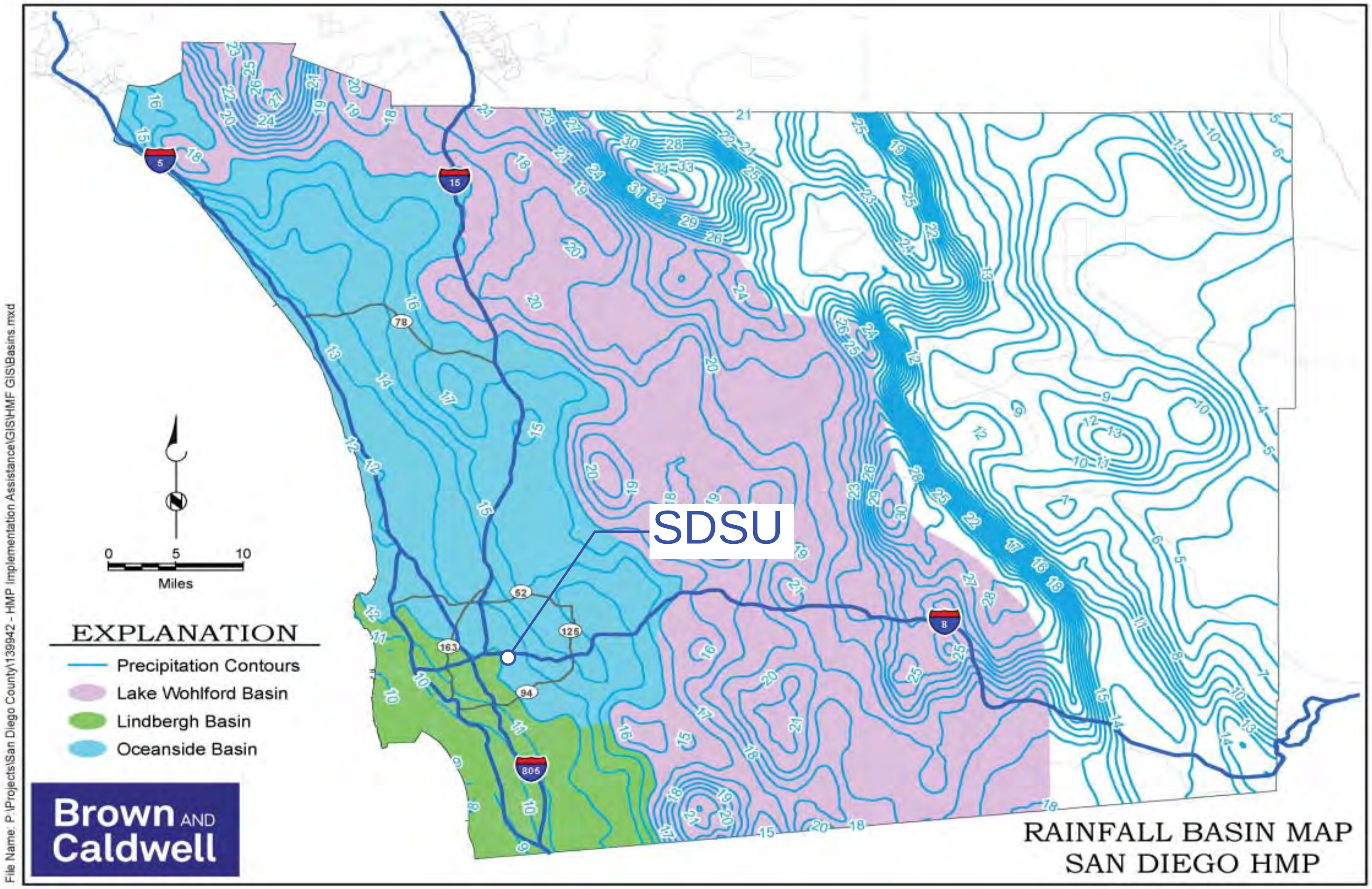
SDSU West Campus Housing

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles


SDSU
EXPLANATION
Precipitation Contours
Lake Wohlford Basin
Lindbergh Basin
Oceanside Basin
Miles
Brown AND Caldwell
RAINFALL BASIN MAP
SAN DIEGO HMP
File Name: P:\Projects\San Diego County\139942 - HMP Implementation Assistance\GIS\HMF GIS\Basins.mxd

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 7, Nov 15, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 3, 2010—Jun 7, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes	D	3.3	53.5%
OkC	Olivenhain-Urban land complex, 2 to 9 percent slopes	D	2.8	46.5%
Totals for Area of Interest			**6.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

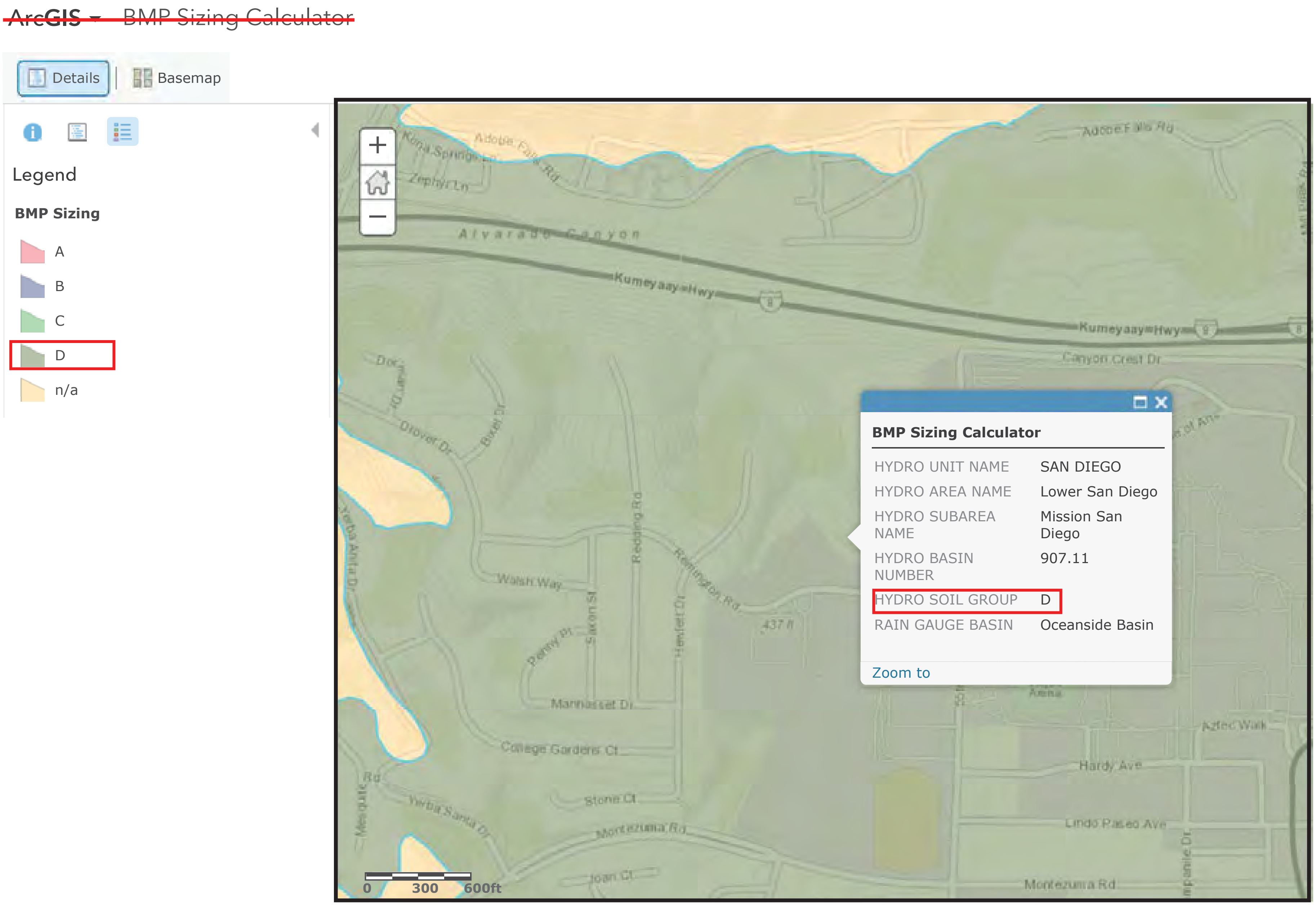
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SOIL TYPE

SDSU- WEST CAMPUS HOUSING



Hydrologic Soil Group—San Diego County Area, California
(SDSU)

Map Scale: 1:1,590 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

DETERMINE T_C FOR URBAN AREAS

% IMP = Percent of impervious surface

C_p = Pervious runoff coefficient

Soil Group D for Undisturbed Natural Terrain in Table 3-1

C =0.90(% IMP) + Cp(1 - % IMP)

C = Runoff Coefficient

s = Slope of the surface (%)

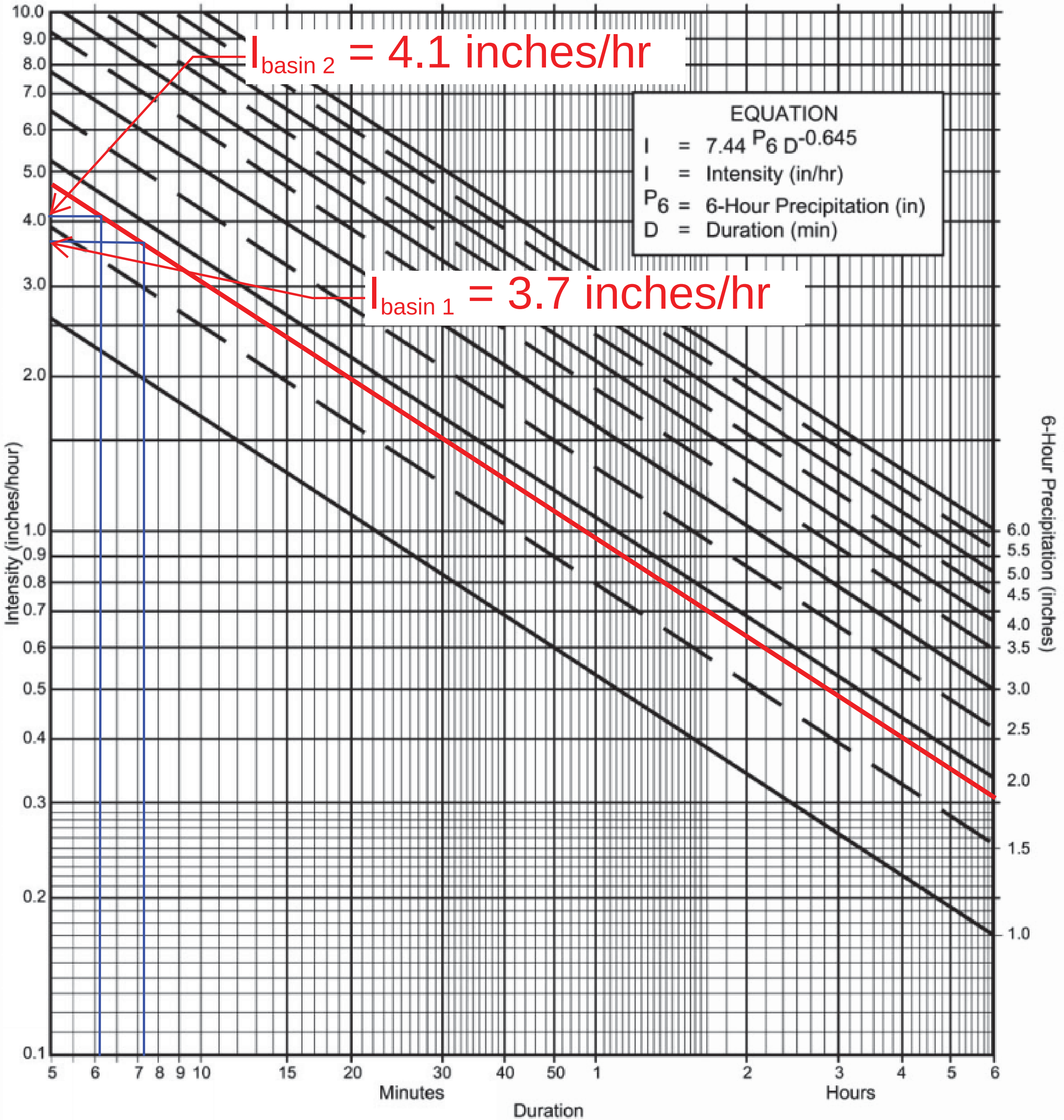
D = Length of the flowline

T_c = Time of flow overland

FAA Rational Formula - County Hydrology Manual Figure 3-3

$$T_c = [(1.8(1.1 - C) D^{1/2}]/s^{1/3}$$

SUB-BASINS	% IMP	Cp	C	s (%)	D (Feet)	Tc (Minutes)
A	80%	0.35	0.79	0.86	1227	20.5
B	50%	0.35	0.63	1.50	280	12.5
C	100%	0.35	0.90	0.62	804	12.0
D	90%	0.35	0.85	1.00	150	5.6
E	0%	0.35	0.35	17.50	800	14.8
F	80%	0.35	0.79	0.87	345	10.9
G	0%	0.35	0.35	25.60	125	5.2
H	90%	0.35	0.85	2.00	400	7.3
I	90%	0.35	0.85	5.00	520	6.2
J	2%	0.35	0.36	25.60	720	12.2



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 10 year

(b) P_6 = 1.8 in., P_{24} = ______, $\frac{P_6}{P_{24}}$ = ______ %(2)

(c) Adjusted P_6(2) = ______ in.

(d) t_x = ______ min.

(e) I = ______ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

ATTACHMENT D:

DETENTION BASINS CALCULATIONS AND DETAILS.

Hydrograph Plot

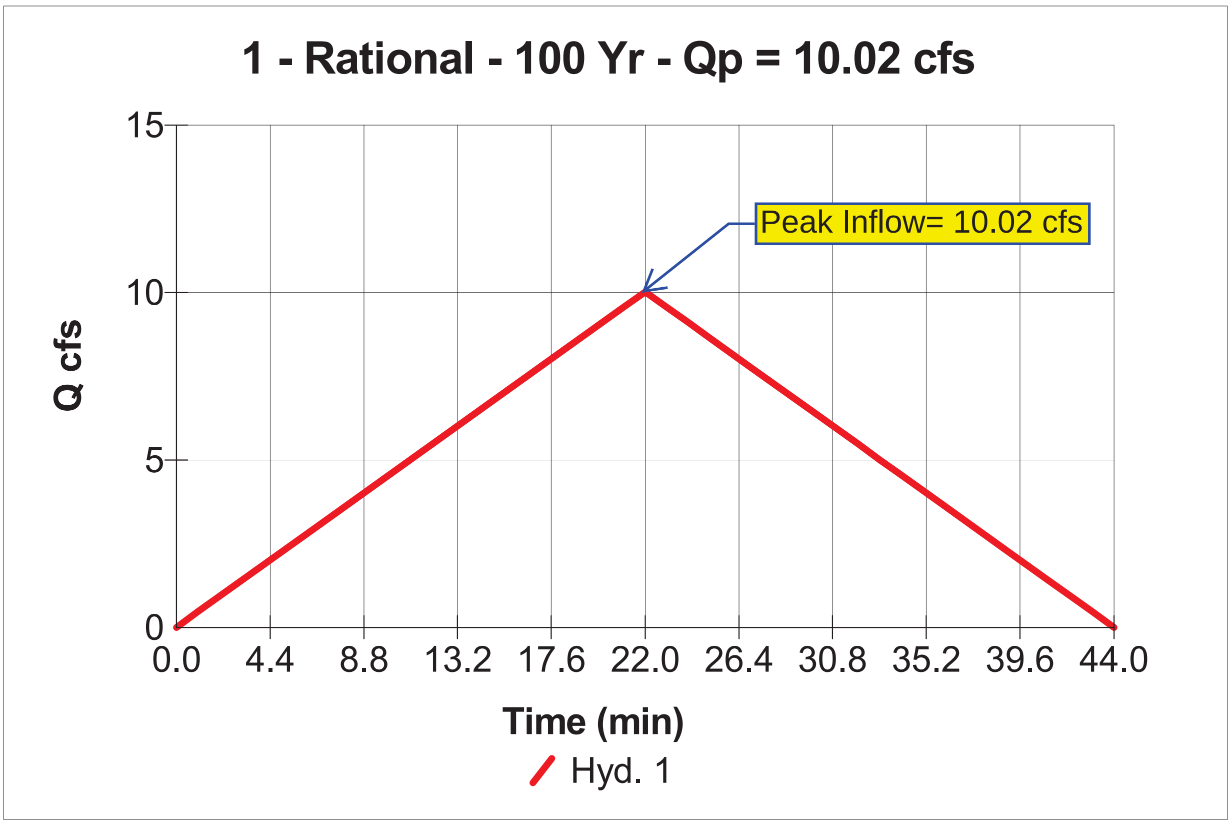
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

Basin H

Hydrograph type	= Rational	Peak discharge	= 10.02 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 3.8 ac	Runoff coeff.	= 0.99
Intensity	= 2.692 in/hr	Time of conc. (Tc)	= 22 min
IDF Curve	= IDF-SDSU.idf	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 13,225 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

Basin H

Hydrograph type	= Rational	Peak discharge	= 10.02 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 3.8 ac	Runoff coeff.	= 0.99
Intensity	= 2.692 in/hr	Time of conc. (Tc)	= 22 min
IDF Curve	= IDF-SDSU.idf	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 13,225 cuft

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
0.02	0.46	0.58	4.10
0.03	0.91	0.60	3.64
0.05	1.37	0.62	3.19
0.07	1.82	0.63	2.73
0.08	2.28	0.65	2.28
0.10	2.73	0.67	1.82
0.12	3.19	0.68	1.37
0.13	3.64	0.70	0.91
0.15	4.10	0.72	0.46
0.17	4.55		
0.18	5.01		
0.20	5.46	*...End*	
0.22	5.92		
0.23	6.38		
0.25	6.83		
0.27	7.29		
0.28	7.74		
0.30	8.20		
0.32	8.65		
0.33	9.11		
0.35	9.56		
0.37	10.02 <<	Peak Inflow	
0.38	9.56		
0.40	9.11		
0.42	8.65		
0.43	8.20		
0.45	7.74		
0.47	7.29		
0.48	6.83		
0.50	6.38		
0.52	5.92		
0.53	5.46		
0.55	5.01		
0.57	4.55		

Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 1 - BMP#1

Pond Data

Bottom LxW = 148.0 x 23.0 ft   Side slope = 0.0:1   Bottom elev. = 412.00 ft   Depth = 6.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	412.00	3,404	0	0
0.30	412.30	3,404	1,021	1,021
0.60	412.60	3,404	1,021	2,042
0.90	412.90	3,404	1,021	3,064
1.20	413.20	3,404	1,021	4,085
1.50	413.50	3,404	1,021	5,106
1.80	413.80	3,404	1,021	6,127
2.10	414.10	3,404	1,021	7,148
2.40	414.40	3,404	1,021	8,170
2.70	414.70	3,404	1,021	9,191
3.00	415.00	3,404	1,021	10,212
3.30	415.30	3,404	1,021	11,233
3.60	415.60	3,404	1,021	12,254
3.90	415.90	3,404	1,021	13,276
4.20	416.20	3,404	1,021	14,297
4.50	416.50	3,404	1,021	15,318
4.80	416.80	3,404	1,021	16,339
5.10	417.10	3,404	1,021	17,360
5.40	417.40	3,404	1,021	18,382
5.70	417.70	3,404	1,021	19,403
6.00	418.00	3,404	1,021	20,424

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 1.4	0.0	0.0	0.0
Span in	= 1.4	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 412.25	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 6.00	0.00	0.00	0.00
Crest El. ft	= 415.88	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	412.00	0.00	---	---	---	0.00	---	---	---	---	0.00
0.30	1,021	412.30	0.00	---	---	---	0.00	---	---	---	---	0.00
0.60	2,042	412.60	0.00	---	---	---	0.00	---	---	---	---	0.00
0.90	3,064	412.90	0.00	---	---	---	0.00	---	---	---	---	0.00
1.20	4,085	413.20	0.00	---	---	---	0.00	---	---	---	---	0.00
1.50	5,106	413.50	0.00	---	---	---	0.00	---	---	---	---	0.00
1.80	6,127	413.80	0.00	---	---	---	0.00	---	---	---	---	0.00
2.10	7,148	414.10	0.00	---	---	---	0.00	---	---	---	---	0.00
2.40	8,170	414.40	0.00	---	---	---	0.00	---	---	---	---	0.00
2.70	9,191	414.70	0.00	---	---	---	0.00	---	---	---	---	0.00
3.00	10,212	415.00	0.00	---	---	---	0.00	---	---	---	---	0.00
3.30	11,233	415.30	0.00	---	---	---	0.00	---	---	---	---	0.00
3.60	12,254	415.60	0.00	---	---	---	0.00	---	---	---	---	0.00
3.90	13,276	415.90	0.00	---	---	---	0.00	---	---	---	---	0.00
4.20	14,297	416.20	0.00	---	---	---	3.28	---	---	---	---	3.28
4.50	15,318	416.50	0.00	---	---	---	9.29	---	---	---	---	9.29
4.80	16,339	416.80	0.00	---	---	---	17.06	---	---	---	---	17.06
5.10	17,360	417.10	0.00	---	---	---	26.26	---	---	---	---	26.26
5.40	18,382	417.40	0.00	---	---	---	36.71	---	---	---	---	36.71
5.70	19,403	417.70	0.00	---	---	---	48.25	---	---	---	---	48.25
6.00	20,424	418.00	0.00	---	---	---	60.80	---	---	---	---	60.80

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

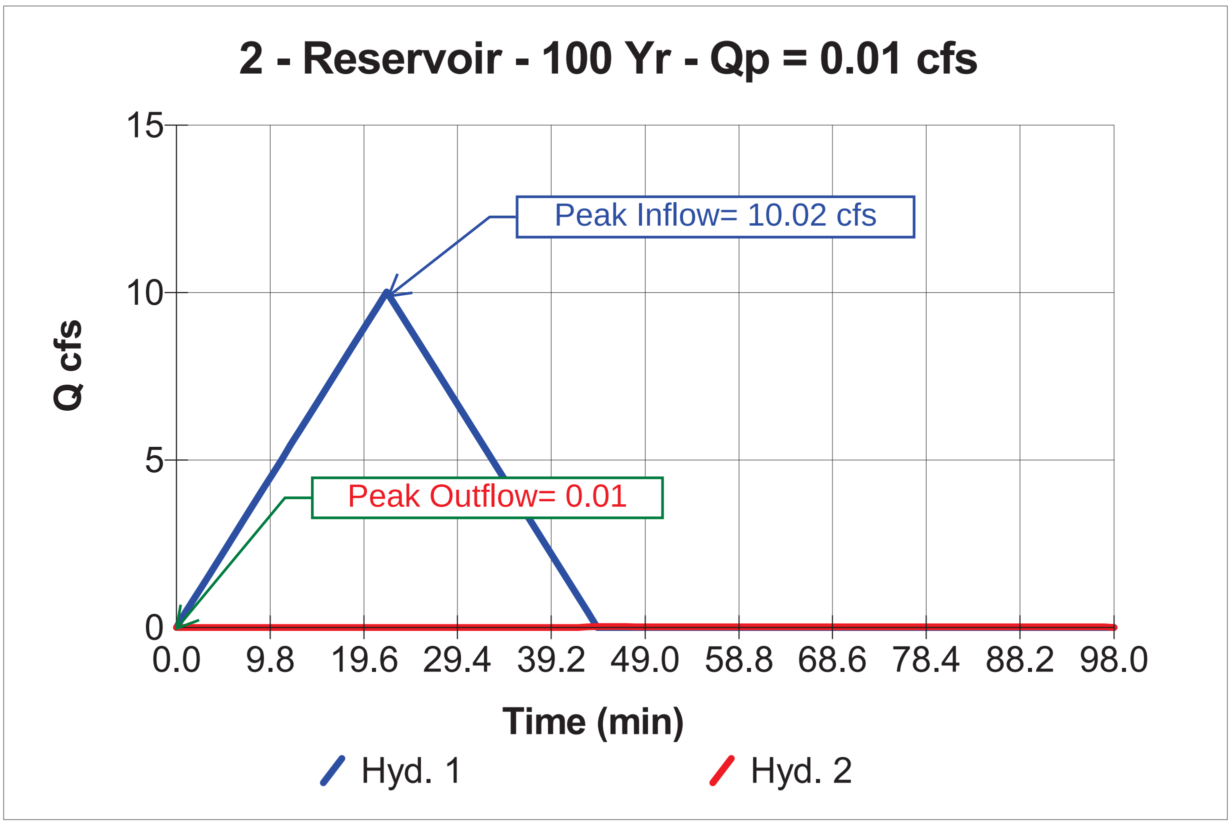
Hyd. No. 2

BMP #1

Hydrograph type	= Reservoir	Peak discharge	= 0.01 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 1	Reservoir name	= BMP#1
Max. Elevation	= 415.88 ft	Max. Storage	= 13,224 cuft

Storage Indication method used.

Hydrograph Volume = 16 cuft



Hydrograph Report

Hyd. No. 2

BMP #1

Hydrograph type	=	Reservoir	Peak discharge	=	0.01 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Inflow hyd. No.	=	1	Reservoir name	=	BMP#1
Max. Elevation	=	415.88 ft	Max. Storage	=	13,224 cuft

Storage Indication method used.

Outflow hydrograph volume = 16 cuft

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
0	0.00	412.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
1	0.46	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
2	0.91	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
3	1.37	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
4	1.82	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
5	2.28	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
6	2.73	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
7	3.19	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
8	3.64	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
9	4.10	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
10	4.55	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
11	5.01	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
12	5.46	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
13	5.92	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
14	6.38	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
15	6.83	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
16	7.29	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
17	7.74	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
18	8.20	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
19	8.65	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
20	9.11	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
21	9.56	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
22	10.02 <<	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
23	9.56	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
24	9.11	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
25	8.65	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
26	8.20	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
27	7.74	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
28	7.29	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
29	6.83	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
30	6.38	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
31	5.92	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
32	5.46	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
33	5.01	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
34	4.55	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
35	4.10	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
36	3.64	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
37	3.19	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00

Peak Inflow= 10.02 cfs

Continues on next page...

Hydrograph Discharge Table

Peak Outflow= 0.01 cfs

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
38	2.73	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
39	2.28	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
40	1.82	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
41	1.37	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
42	0.91	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
43	0.46	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
44	0.00	415.88 <<	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01 <<
45	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
46	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
47	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
48	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
49	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
50	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
51	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
52	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
53	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
54	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
55	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
56	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
57	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
58	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
59	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
60	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
61	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
62	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
63	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
64	0.00	415.88	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
65	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
66	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
67	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
68	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
69	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
70	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
71	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
72	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
73	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
74	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
75	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
76	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
77	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
78	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
79	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
80	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
81	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
82	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
83	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
84	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
85	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
86	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
87	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
88	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

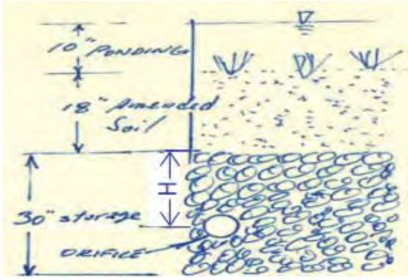
Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
89	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
90	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
91	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
92	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
93	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
94	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
95	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
96	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
97	0.00	415.88	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
98	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00

...End

Sizing Low Flow Orifice

(1) $Q = C_d \times A \times (2gH)^{0.5}$ Orifice Discharge Equation



C_d = Orifice Coefficient = 0.60 (sharp, clean edge)

H = Water Head above orifice

g = Gravitational Acceleration = 32.2 ft/s^2

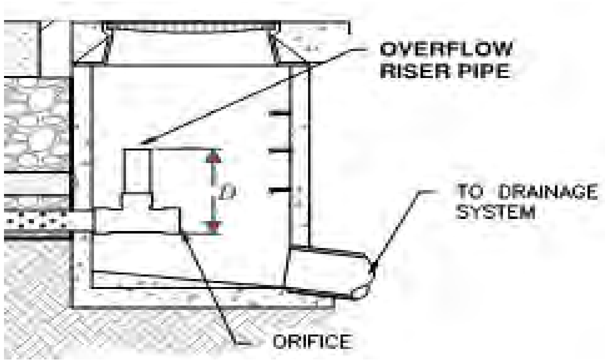
A = Area of the Orifice

(2) $A = [0.1Q_2 \times A_{DMA}]/C_d \times (2gH)^{0.5}$

Q_2 = 2-year Storm Unit Runoff (Per Table G.2-2 of City of San Diego BMP Design Manual, January. 2016)

A_{DMA} = Area of the Drainage Management Area (DMA)

Basin	Rain Gauge	Soil Type	Cover	Slope	H (ft)	Q_2 Unit Runoff	A_{DMA} (SF)	A_{DMA} (Acres)	$0.1Q_2$	Max. Orifice Area (inch^2)	Orifice Diameter (inches)	Q_{10} Unit Runoff (cfs/acre)	Q_{10} (cfs)
1	Oceanside	D	Scrub	Steep	1.00	0.244	91,790	2.11	0.0514	1.54	**1.40**	0.228	0.4804



FLOW CONTROL FOR BMP NO. 2		
Lower Flow Threshold =	**0.0514**	**cfs**
Peak Q_{10} =	**0.4804**	**cfs**
Max Orifice Diameter Allowed =	**1.400**	**inch**
Proposed Orifice Diameter =	**0.21**	**inch**

Prepared by:
Snipes-Dye Associates

Updated: 1/23/2017

G.2.1 Unit Runoff Ratios

Table G.2-2 presents unit runoff ratios for calculating pre-development Q_2, to be used when applicable to determine the lower flow threshold for low flow orifice sizing for biofiltration with partial retention, biofiltration, biofiltration with impermeable liner, or cistern BMPs. There is no low flow orifice in the infiltration BMP or bioretention BMP. The unit runoff ratios are re-printed from the BMP Sizing Calculator methodology. Unit runoff ratios for "urban" and "impervious" cover categories were not transferred to this manual due to the requirement to control runoff to pre-development condition (see Chapter 6.3.3).

How to use the unit runoff ratios:

Obtain unit runoff ratio from Table G.2-2 based on the project's rainfall basin, hydrologic soil group, and pre-development slope (for redevelopment projects, pre-development slope may be considered if historic topographic information is available, otherwise use pre-project slope). Multiply the area tributary to the structural BMP (A, acres) by the unit runoff ratio (Q2, cfs/acre) to determine the pre-development Q2 to determine the lower flow threshold, to use for low flow orifice sizing.

Table G.2-2: Unit Runoff Ratios for Sizing Factor Method

Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lake Wohlford	A	Scrub	Low	0.136	0.369
Lake Wohlford	A	Scrub	Moderate	0.207	0.416
Lake Wohlford	A	Scrub	Steep	0.244	0.47
Lake Wohlford	B	Scrub	Low	0.208	0.414
Lake Wohlford	B	Scrub	Moderate	0.227	0.448
Lake Wohlford	B	Scrub	Steep	0.253	0.482
Lake Wohlford	C	Scrub	Low	0.245	0.458
Lake Wohlford	C	Scrub	Moderate	0.253	0.481
Lake Wohlford	C	Scrub	Steep	0.302	0.517
Lake Wohlford	D	Scrub	Low	0.253	0.48
Lake Wohlford	D	Scrub	Moderate	0.292	0.516

Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lake Wohlford	D	Scrub	Steep	0.351	0.538
Oceanside	A	Scrub	Low	0.035	0.32
Oceanside	A	Scrub	Moderate	0.093	0.367
Oceanside	A	Scrub	Steep	0.163	0.42
Oceanside	B	Scrub	Low	0.08	0.365
Oceanside	B	Scrub	Moderate	0.134	0.4
Oceanside	B	Scrub	Steep	0.181	0.433
Oceanside	C	Scrub	Low	0.146	0.411
Oceanside	C	Scrub	Moderate	0.185	0.433
Oceanside	C	Scrub	Steep	0.217	0.458
Oceanside	D	Scrub	Low	0.175	0.434
Oceanside	D	Scrub	Moderate	0.212	0.455
Oceanside	D	Scrub	Steep	0.244	0.571
Lindbergh	A	Scrub	Low	0.003	0.081
Lindbergh	A	Scrub	Moderate	0.018	0.137
Lindbergh	A	Scrub	Steep	0.061	0.211
Lindbergh	B	Scrub	Low	0.011	0.134
Lindbergh	B	Scrub	Moderate	0.033	0.174
Lindbergh	B	Scrub	Steep	0.077	0.23
Lindbergh	C	Scrub	Low	0.028	0.19
Lindbergh	C	Scrub	Moderate	0.075	0.232
Lindbergh	C	Scrub	Steep	0.108	0.274
Lindbergh	D	Scrub	Low	0.05	0.228
Lindbergh	D	Scrub	Moderate	0.104	0.266
Lindbergh	D	Scrub	Steep	0.143	0.319

SDSU West Campus Housing

1/17/2017

DMA name	DMA Area (acres)	DMA Area (sf)	Pos-project surface type	DMA runoff factor	DMA area x runoff factor	Hydrologic Soil Group D			Oceanside Rain Gauge Basin					
DMA 1	1.90	82,610	roof top, concrete walks and ac drive areas	0.90	74,349	IMP Name: Cistern (Sizing Factors Per Table G.2-7)								
	0.00		pervious pavement	0.10	0	No Channel Assessment, Lower Flow Threshold = $0.1Q_2$								
	0.21	9,180	landscape	0.10	918	IMP Area Sizing Factor (Table G.2-7)	Min. IMP Area (sf)	**Proposed Area (sf)**	IMP Surface Volume Sizing Factor (Table G.2-7)	Min. IMP Volume (cf)	**Proposed IMP Capacity (cf)**	IMP Subsurface Volume Sizing Factor (Table G.2-7)	Min. IMP Subsurface Volume (cf)	**Proposed IMP Subsurface Volume (cf)**
				TOTAL	**75,267**	**N/A**	**N/A**	**N/A**	**0.1800**	**13,548**	19,800	**N/A**	**N/A**	

Prepared by:
Snipes-Dye Associates

which a cistern provides temporary storage for runoff to be either used onsite (harvest and use), infiltrated, or biofiltered, project-specific continuous simulation modeling is recommended. Refer to Sections 5.6 and 6.3.6.

Table G.2-7: Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	0.3900	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	0.2000	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.5Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	B	Flat	Oceanside	N/A	0.1900	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Moderate	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	0.1000	N/A
$0.5Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	0.2100	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	0.2000	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Steep	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	0.5900	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	0.3600	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	0.2200	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	0.1800	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Steep	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	B	Flat	L Wohlford	N/A	0.2600	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	0.2400	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	0.1000	N/A
$0.1Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	0.5400	N/A
$0.1Q_2$	B	Moderate	Lindbergh	N/A	0.7800	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	0.3400	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	0.2400	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	0.1600	N/A
$0.1Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	0.5100	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	0.3400	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	0.2400	N/A
$0.1Q_2$	C	Flat	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	0.1800	N/A
$0.1Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	0.4400	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	0.4000	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Flat	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	0.2200	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	0.1800	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Bioretention surface area sizing factor (not applicable under this manual standards – use methods presented in Chapter 5 and Appendix B or Appendix F to size bioretention or biofiltration facility for pollutant control)
V_1 = Cistern volume sizing factor

Definitions for "N/A"

≠ Column V2: N/A in column V2 means there is no V2 element in the cistern BMP

≠ Column A: N/A in column A means there is no A element in the cistern BMP. Note sizing factors previously created for sizing a bioretention or biofiltration facility downstream of a cistern under the 2007 MS4 Permit are not applicable under the MS4 Permit.

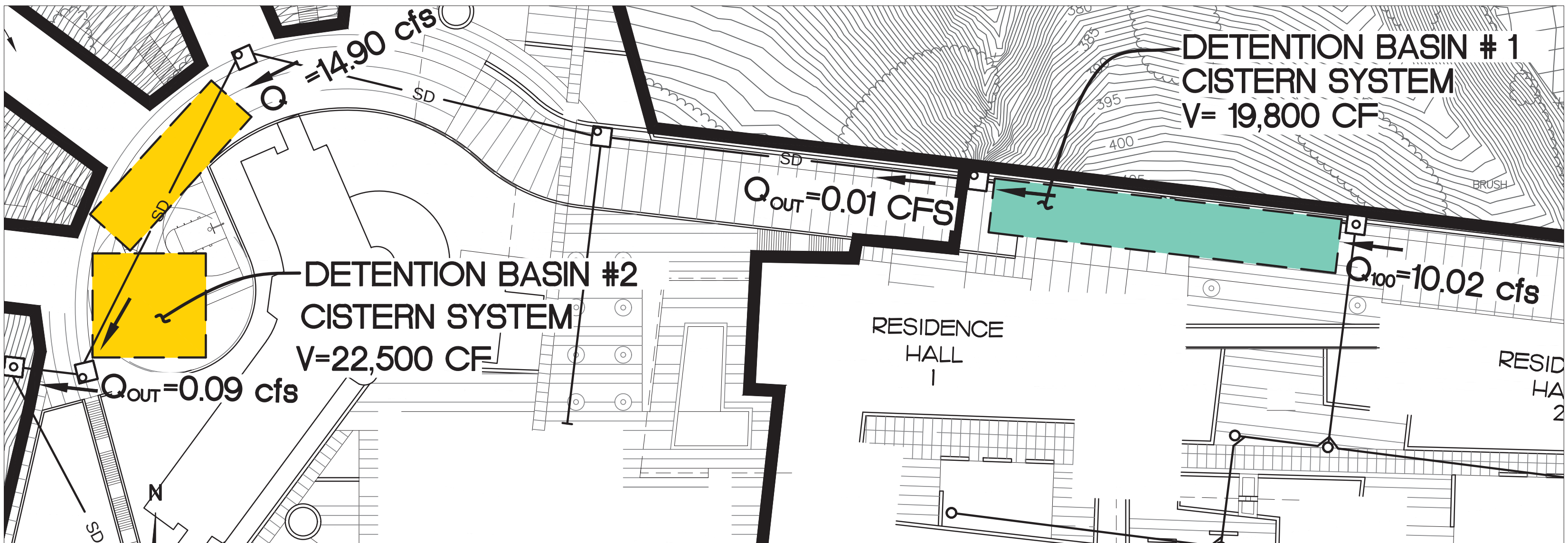
.

LEGEND

ITEM	SYMBOL
DRAINAGE BASIN BOUNDARY	
FLOW	
DETENTION BASIN #1 (CISTERN) AREA: 3,404 SF	
DETENTION BASIN #2 (CISTERN) AREA: 3,872 SF	

FLOW CONTROL - DETENTION BASIN 1		
	REQUIRED	PROPOSED
VOLUME	13,548 CF	19,800 CF
ORIFICE SIZE	1.4 INCH	1.4 INCH

FLOW CONTROL - DETENTION BASIN 2		
	REQUIRED	PROPOSED
VOLUME	18,197 CF	22,500 CF
ORIFICE SIZE	1.62 INCH	1.62 INCH



DETENTION BASINS EXHIBIT

50 25 0 50 100 150

SCALE: 1"=50'

SHEET TITLE: DETENTION BASINS EXHIBIT

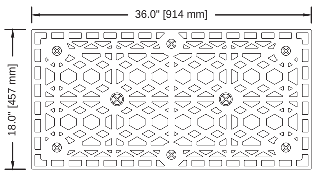
JOB NAME: SAN DIEGO STATE UNIVERSITY WEST CAMPUS HOUSING

SNIPES-DYE ASSOCIATES
8348 CENTER DRIVE, STE. G, LA MESA, CA 91942 TELEPHONE (619) 697-9234 FAX (619) 460-2033

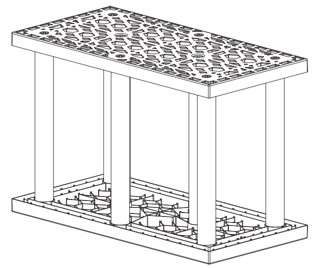
DESIGNER: DCP
DRAWN: DCP
CHECKED: SPN
DATE: 1-24-17

SHEET 1 OF 1 SHEETS

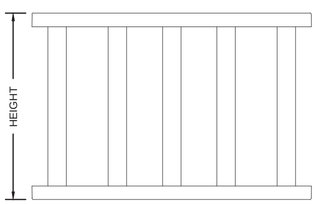
JOB NO. SD2916



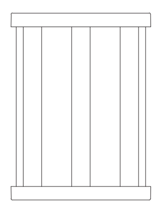
TOP



ISOMETRIC VIEW

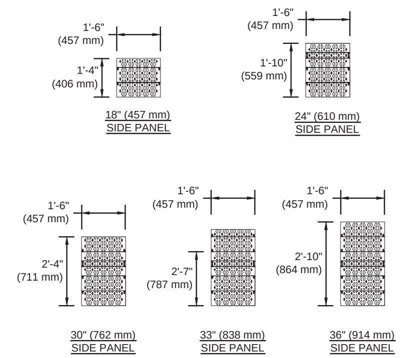


FRONT



SIDE

MODULE DETAIL



NOTES:
1. SIDE PANELS TO BE INSTALLED ALONG SYSTEM PERIMETER, UNLESS OTHERWISE SPECIFIED.
2. ALL HEIGHTS TO BE CUT FROM A 36" (914 mm) SIDE PANEL AT PRE-SCRIBED LOCATIONS, EXCEPT 33" (838 mm) SIDE PANEL.

SIDE PANEL DETAIL

STORMTANK® MODULE				
NAME	HEIGHT (mm)	CAPACITY (m^3)	VOID RATIO	NOMINAL WEIGHT (kg)
ST-18	18" (457)	6.44 cf (0.18)	95.50%	22.70 lbs. (10)
ST-24	24" (610)	8.66 cf (0.25)	96.00%	26.30 lbs. (12)
ST-30	30" (762)	10.88 cf (0.31)	96.50%	29.50 lbs. (13)
ST-33	33" (838)	11.99 cf (0.34)	96.90%	29.82 lbs. (13.5)
ST-36	36" (914)	13.10 cf (0.37)	97.00%	33.10 lbs. (15)

NOTES:

a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.

b. SIDE PANELS REQUIRED AROUND THE PERIMETER OF THE INSTALLATION ONLY, UNLESS OTHERWISE NOTED.

c. SIDE PANELS ARE TO BE CUT FROM A 36" PANEL AT THE PRE-SCRIBED LOCATIONS.

REV.	DATE	RECORD OF CHANGES	BY	APPRV.
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

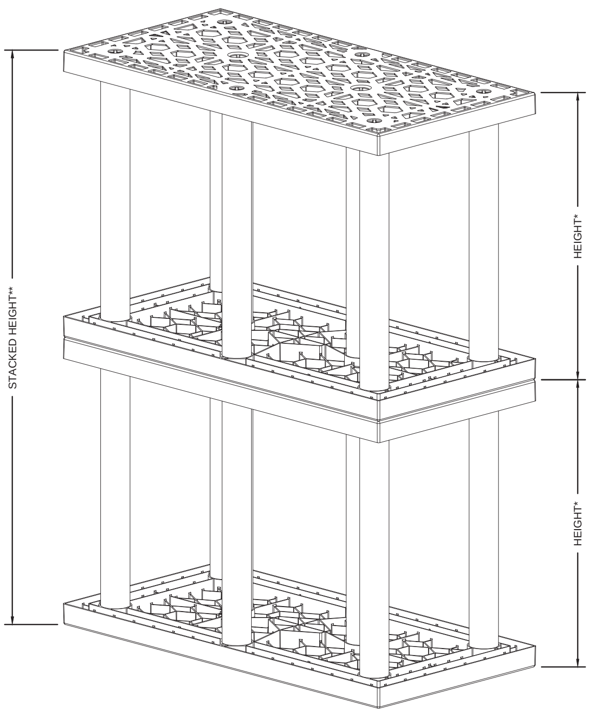
BRENTWOOD®
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

Project Name: MODULE DETAIL

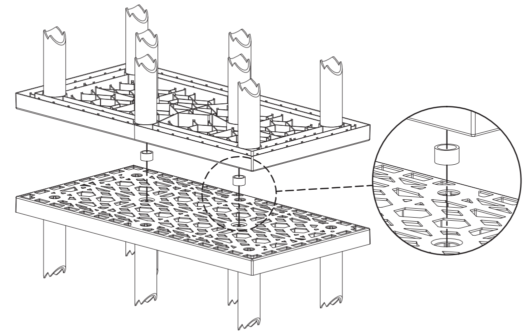
Title: STORMTANK® MODULE

Drawn By	Date
B.LINE	4/5/12

Drawing No.	Sheet	Scale
STM-000-00	1 of 2	NTS



MODULE DOUBLE STACK DETAIL



STACKING PIN DETAIL

DOUBLE STACK CONFIGURATIONS:						
SYSTEM HEIGHT (mm)	ST-18	ST-24	ST-30	ST-33	ST-36	CAPACITY (m^3)
42" (1,067)	1	1	-	-	-	15.08 cf (0.42)
48" (1,219)	1	-	1	-	-	17.30 cf (0.48)
51" (1,295)	1	-	-	1	-	18.42 cf (0.52)
54" (1,372)	1	-	-	-	1	19.50 cf (0.54)
57" (1,448)	-	1	-	1	-	20.64 cf (0.58)
60" (1,524)	-	1	-	-	1	21.75 cf (0.62)
63" (1,600)	-	-	1	1	-	22.86 cf (0.65)
66" (1,676)	-	-	-	2	-	23.97 cf (0.68)
69" (1,753)	-	-	-	1	1	25.08 cf (0.71)
72" (1,829)	-	-	-	-	2	26.20 cf (0.73)

NOTES:

a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.

b. STACKING PINS REQUIRED BETWEEN MODULE LAYERS, FOR ALL STACKED SYSTEMS (SEE DETAIL).

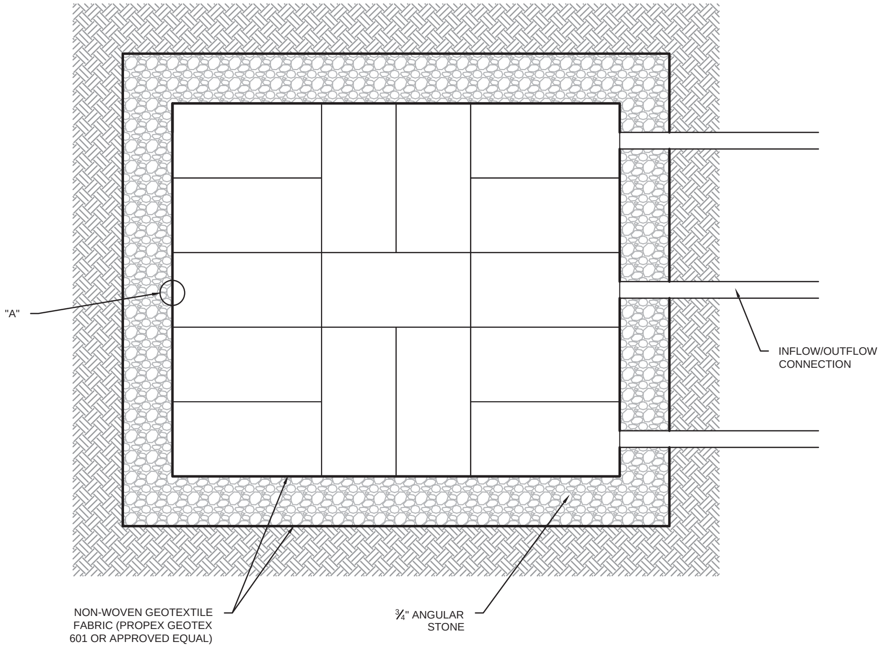
REV.	DATE	RECORD OF CHANGES	BY	APPRV.
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

BRENTWOOD®
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

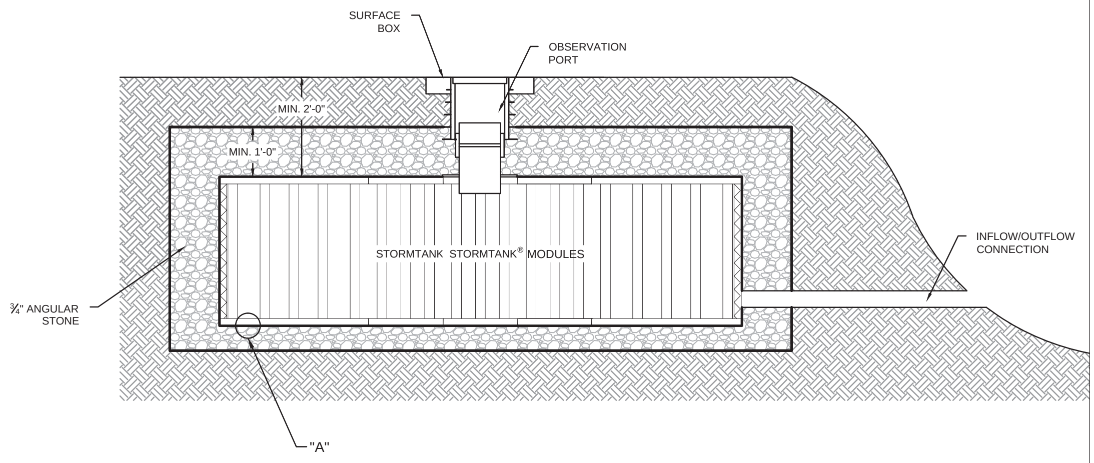
Project Name
MODULE DOUBLE STACK DETAIL

Title
STORMTANK®
MODULE

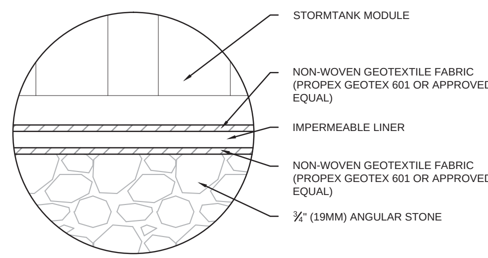
Drawn By	Date	
B.LINE	4/5/12	
Drawing No. STM-000-00	Sheet 2 of 2	Scale NTS



LAYOUT VIEW



CROSS-SECTION



DETAIL "A"

NOTES:

a. **REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER INSTALLATION PRACTICES.**

b. **THIS DRAWINGS IS FOR ILLUSTRATION PURPOSES ONLY AND DOES NOT SUPERSEDE ENGINEERING DESIGN OR CALCULATIONS. THIS DRAWINGS REPRESENT THE INTEGRATION OF STORMTANK MODULES INTO A FLOOD PLAIN MITIGATION APPLICATION AND SHALL NOT BE CONSTRUED AS PROPER DESIGN. PLEASE REFERENCE ALL LOCAL REGULATIONS AND DESIGN MANUALS DURING THE DESIGN OF THESE APPLICATIONS.**

B	11/7/14	GEOTEXTILE PRODUCT SPECIFIED	CGB	
A.	11/13/13	INITIAL RELEASE	CAT	
REV.	DATE	RECORD OF CHANGES	BY	APPRV.

BRENTWOOD®
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

Project Name
CONCEPTUAL FLOODPLAIN MITIGATION DESIGN

Title
STORMTANK®
MODULE

Drawn By	Date
C.TORRES	11/11/13

Drawing No.	Sheet	Scale
APP-002-00	1 of 1	NTS

Hydrograph Plot

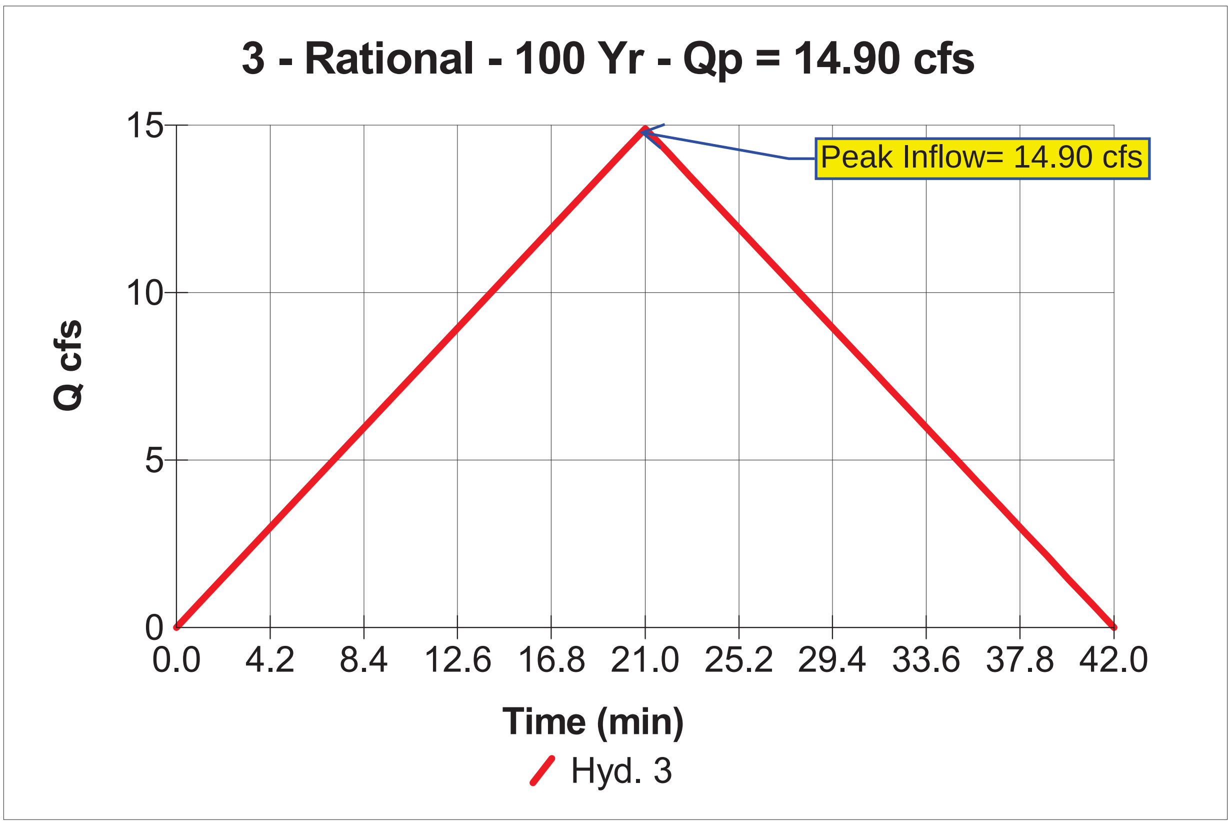
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

BASIN I

Hydrograph type	= Rational	Peak discharge	= 14.90 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 5.4 ac	Runoff coeff.	= 0.99
Intensity	= 2.774 in/hr	Time of conc. (Tc)	= 21 min
IDF Curve	= IDF-SDSU.idf	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 18,769 cuft



Hydrograph Report

Hyd. No. 3

BASIN I

Hydrograph type	= Rational	Peak discharge	= 14.90 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 5.4 ac	Runoff coeff.	= 0.99
Intensity	= 2.774 in/hr	Time of conc. (Tc)	= 21 min
IDF Curve	= IDF-SDSU.idf	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 18,769 cuft

Hydrograph Discharge Table

Time -- (min	Outflow cfs)	Time -- (min	Outflow cfs)
1	0.71	35	4.97
2	1.42	36	4.26
3	2.13	37	3.55
4	2.84	38	2.84
5	3.55	39	2.13
6	4.26	40	1.42
7	4.97	41	0.71
8	5.67		
9	6.38		
10	7.09	*...End*	
11	7.80		
12	8.51		
13	9.22		
14	9.93		
15	10.64		
16	11.35		
17	12.06		
18	12.77		
19	13.48		
20	14.19		
21	14.90 <	Peak Inflow	
22	14.19		
23	13.48		
24	12.77		
25	12.06		
26	11.35		
27	10.64		
28	9.93		
29	9.22		
30	8.51		
31	7.80		
32	7.09		
33	6.38		
34	5.67		

Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 2 - BMP#2

Pond Data

Bottom LxW = 124.0 x 32.0 ft   Side slope = 0.0:1   Bottom elev. = 395.00 ft   Depth = 6.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	395.00	3,968	0	0
0.30	395.30	3,968	1,190	1,190
0.60	395.60	3,968	1,190	2,381
0.90	395.90	3,968	1,190	3,571
1.20	396.20	3,968	1,190	4,762
1.50	396.50	3,968	1,190	5,952
1.80	396.80	3,968	1,190	7,142
2.10	397.10	3,968	1,190	8,333
2.40	397.40	3,968	1,190	9,523
2.70	397.70	3,968	1,190	10,714
3.00	398.00	3,968	1,190	11,904
3.30	398.30	3,968	1,190	13,094
3.60	398.60	3,968	1,190	14,285
3.90	398.90	3,968	1,190	15,475
4.20	399.20	3,968	1,190	16,666
4.50	399.50	3,968	1,190	17,856
4.80	399.80	3,968	1,190	19,046
5.10	400.10	3,968	1,190	20,237
5.40	400.40	3,968	1,190	21,427
5.70	400.70	3,968	1,190	22,618
6.00	401.00	3,968	1,190	23,808

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 1.6	0.0	0.0	0.0
Span in	= 1.6	0.0	0.0	0.0
No. Barrels	= 1	0	0	0
Invert El. ft	= 395.25	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 6.00	0.00	0.00	0.00
Crest El. ft	= 399.73	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	395.00	0.00	---	---	---	0.00	---	---	---	---	0.00
0.30	1,190	395.30	0.00	---	---	---	0.00	---	---	---	---	0.00
0.60	2,381	395.60	0.03	---	---	---	0.00	---	---	---	---	0.03
0.90	3,571	395.90	0.04	---	---	---	0.00	---	---	---	---	0.04
1.20	4,762	396.20	0.06	---	---	---	0.00	---	---	---	---	0.06
1.50	5,952	396.50	0.07	---	---	---	0.00	---	---	---	---	0.07
1.80	7,142	396.80	0.07	---	---	---	0.00	---	---	---	---	0.07
2.10	8,333	397.10	0.08	---	---	---	0.00	---	---	---	---	0.08
2.40	9,523	397.40	0.09	---	---	---	0.00	---	---	---	---	0.09
2.70	10,714	397.70	0.09	---	---	---	0.00	---	---	---	---	0.09
3.00	11,904	398.00	0.10	---	---	---	0.00	---	---	---	---	0.10
3.30	13,094	398.30	0.11	---	---	---	0.00	---	---	---	---	0.11
3.60	14,285	398.60	0.11	---	---	---	0.00	---	---	---	---	0.11
3.90	15,475	398.90	0.12	---	---	---	0.00	---	---	---	---	0.12
4.20	16,666	399.20	0.12	---	---	---	0.00	---	---	---	---	0.12
4.50	17,856	399.50	0.13	---	---	---	0.00	---	---	---	---	0.13
4.80	19,046	399.80	0.13	---	---	---	0.00	---	---	---	---	0.13
5.10	20,237	400.10	0.13	---	---	---	0.00	---	---	---	---	0.13
5.40	21,427	400.40	0.14	---	---	---	0.00	---	---	---	---	0.14
5.70	22,618	400.70	0.14	---	---	---	0.00	---	---	---	---	0.14
6.00	23,808	401.00	0.15	---	---	---	0.22	---	---	---	---	0.37

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

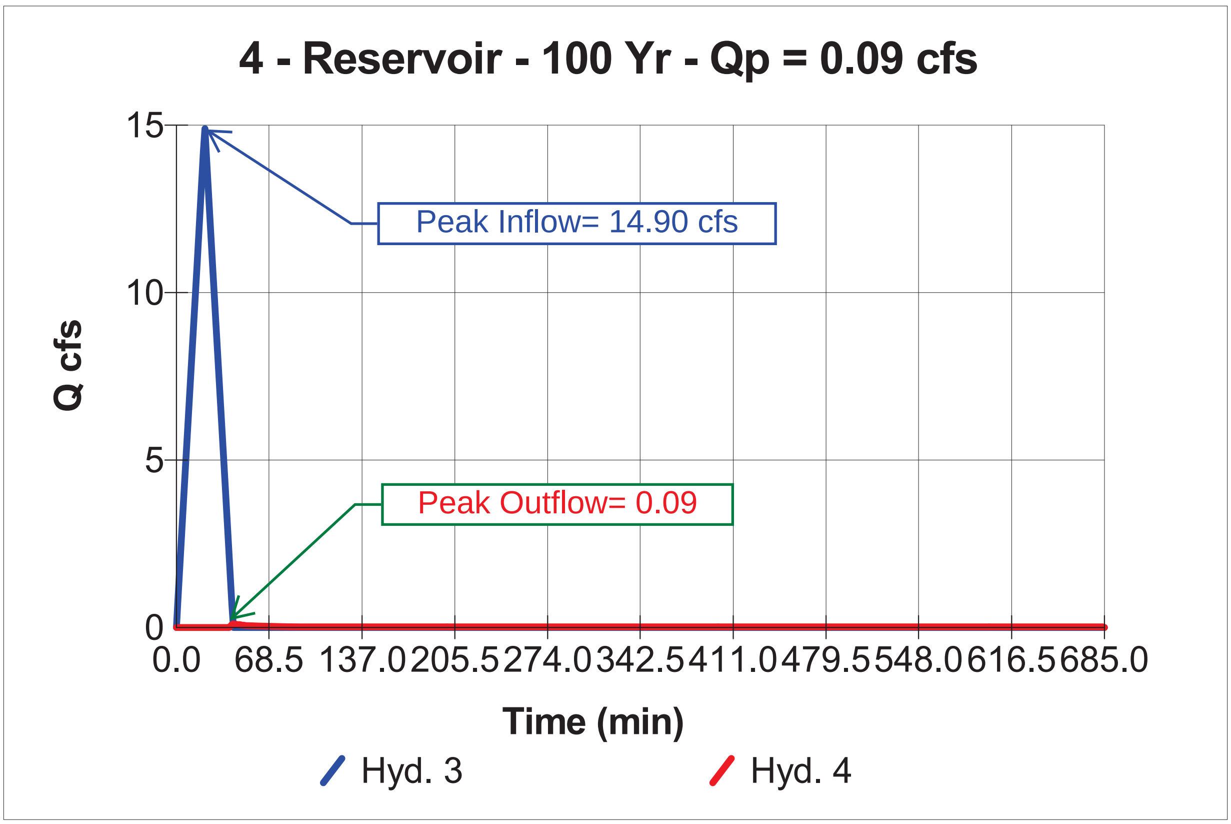
Hyd. No. 4

BMP#2

Hydrograph type = Reservoir		Peak discharge	= 0.09 cfs
Storm frequency = 100 yrs		Time interval	= 1 min
Inflow hyd. No. = 3		Reservoir name	= BMP#2
Max. Elevation = 399.73 ft		Max. Storage	= 18,760 cuft

Storage Indication method used.

Hydrograph Volume = 164 cuft



Hyd. No. 4

BMP#2

Hydrograph type	= Reservoir	Peak discharge	= 0.09 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 3	Reservoir name	= BMP#2
Max. Elevation	= 399.73 ft	Max. Storage	= 18,760 cuft

Storage Indication method used.

Outflow hydrograph volume = 164 cuft

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
0	0.00	395.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
1	0.71	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
2	1.42	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
3	2.13	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
4	2.84	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
5	3.55	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
6	4.26	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
7	4.97	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
8	5.67	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
9	6.38	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
10	7.09	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
11	7.80	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
12	8.51	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
13	9.22	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
14	9.93	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
15	10.64	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
16	11.35	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
17	12.06	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
18	12.77	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
19	13.48	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
20	14.19	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
21	14.90 <<	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
22	14.19	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
23	13.48	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
24	12.77	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
25	12.06	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
26	11.35	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
27	10.64	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
28	9.93	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
29	9.22	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
30	8.51	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
31	7.80	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
32	7.09	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
33	6.38	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
34	5.67	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
35	4.97	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
36	4.26	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
37	3.55	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00

Peak Inflow= 14.90 cfs

Continues on next page...

Hydrograph Discharge Table

Peak Outflow= 0.09 cfs

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
38	2.84	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
39	2.13	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00
40	1.42	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
41	0.71	399.72	-----	-----	-----	-----	0.08	-----	-----	-----	-----	0.08
42	0.00	399.73 <<	-----	-----	-----	-----	0.09	-----	-----	-----	-----	0.09 <<
43	0.00	399.73	-----	-----	-----	-----	0.09	-----	-----	-----	-----	0.09
44	0.00	399.73	-----	-----	-----	-----	0.08	-----	-----	-----	-----	0.08
45	0.00	399.72	-----	-----	-----	-----	0.08	-----	-----	-----	-----	0.08
46	0.00	399.72	-----	-----	-----	-----	0.07	-----	-----	-----	-----	0.07
47	0.00	399.72	-----	-----	-----	-----	0.07	-----	-----	-----	-----	0.07
48	0.00	399.72	-----	-----	-----	-----	0.07	-----	-----	-----	-----	0.07
49	0.00	399.72	-----	-----	-----	-----	0.06	-----	-----	-----	-----	0.06
50	0.00	399.72	-----	-----	-----	-----	0.06	-----	-----	-----	-----	0.06
51	0.00	399.72	-----	-----	-----	-----	0.06	-----	-----	-----	-----	0.06
52	0.00	399.72	-----	-----	-----	-----	0.05	-----	-----	-----	-----	0.05
53	0.00	399.72	-----	-----	-----	-----	0.05	-----	-----	-----	-----	0.05
54	0.00	399.72	-----	-----	-----	-----	0.05	-----	-----	-----	-----	0.05
55	0.00	399.71	-----	-----	-----	-----	0.05	-----	-----	-----	-----	0.05
56	0.00	399.71	-----	-----	-----	-----	0.04	-----	-----	-----	-----	0.04
57	0.00	399.71	-----	-----	-----	-----	0.04	-----	-----	-----	-----	0.04
58	0.00	399.71	-----	-----	-----	-----	0.04	-----	-----	-----	-----	0.04
59	0.00	399.71	-----	-----	-----	-----	0.04	-----	-----	-----	-----	0.04
60	0.00	399.71	-----	-----	-----	-----	0.04	-----	-----	-----	-----	0.04
61	0.00	399.71	-----	-----	-----	-----	0.03	-----	-----	-----	-----	0.03
62	0.00	399.71	-----	-----	-----	-----	0.03	-----	-----	-----	-----	0.03
63	0.00	399.71	-----	-----	-----	-----	0.03	-----	-----	-----	-----	0.03
64	0.00	399.71	-----	-----	-----	-----	0.03	-----	-----	-----	-----	0.03
65	0.00	399.71	-----	-----	-----	-----	0.03	-----	-----	-----	-----	0.03
66	0.00	399.71	-----	-----	-----	-----	0.03	-----	-----	-----	-----	0.03
67	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
68	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
69	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
70	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
71	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
72	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
73	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
74	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
75	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
76	0.00	399.71	-----	-----	-----	-----	0.02	-----	-----	-----	-----	0.02
77	0.00	399.71	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
78	0.00	399.71	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
79	0.00	399.71	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
80	0.00	399.71	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
81	0.00	399.71	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
82	0.00	399.71	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
83	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
84	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
85	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
86	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
87	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
88	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
89	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
90	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
91	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
92	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
93	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
94	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
95	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
96	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
97	0.00	399.70	-----	-----	-----	-----	0.01	-----	-----	-----	-----	0.01
98	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
99	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
100	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
101	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
102	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
103	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
104	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
105	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
106	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
107	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
108	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
109	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
110	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
111	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
112	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
113	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
114	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
115	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
116	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
117	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
118	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
119	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
120	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
121	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
122	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
123	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
124	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
125	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
126	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
127	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
128	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
129	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
130	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
131	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
132	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
133	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
134	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
135	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
136	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
137	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
138	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
139	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
140	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
141	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
142	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
143	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
144	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
145	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
146	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
147	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
148	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
149	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
150	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
151	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
152	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
153	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
154	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
155	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
156	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
157	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
158	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
159	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
160	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
161	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
162	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
163	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
164	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
165	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
166	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
167	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
168	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
169	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
170	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
171	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
172	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
173	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
174	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
175	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
176	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
177	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
178	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
179	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
180	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
181	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
182	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
183	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
184	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
185	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
186	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
187	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
188	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
189	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
190	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
191	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
192	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
193	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
194	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
195	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
196	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
197	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
198	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
199	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
200	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
201	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
202	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
203	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
204	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
205	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
206	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
207	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
208	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
209	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
210	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
211	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
212	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
213	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
214	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
215	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
216	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
217	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
218	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
219	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
220	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
221	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
222	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
223	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
224	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
225	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
226	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
227	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
228	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
229	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
230	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
231	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
232	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
233	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
234	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
235	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
236	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
237	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
238	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
239	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
240	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
241	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
242	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
243	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
244	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
245	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
246	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
247	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
248	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
249	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
250	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
251	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
252	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
253	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
254	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
255	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
256	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
257	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
258	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
259	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
260	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
261	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
262	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
263	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
264	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
265	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
266	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
267	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
268	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
269	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
270	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
271	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
272	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
273	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
274	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
275	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
276	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
277	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
278	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
279	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
280	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
281	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
282	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
283	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
284	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
285	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
286	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
287	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
288	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
289	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
290	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
291	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
292	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
293	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
294	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
295	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
296	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
297	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
298	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
299	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
300	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
301	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
302	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
303	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
304	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
305	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
306	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
307	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
308	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
309	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
310	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
311	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
312	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
313	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
314	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
315	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
316	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
317	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
318	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
319	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
320	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
321	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
322	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
323	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
324	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
325	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
326	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
327	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
328	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
329	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
330	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
331	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
332	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
333	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
334	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
335	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
336	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
337	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
338	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
339	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
340	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
341	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
342	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
343	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
344	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
345	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
346	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
347	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
348	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
349	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
350	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
351	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
352	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
353	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
354	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
355	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
356	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
357	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
358	0.00	399.70	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
359	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
360	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
361	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
362	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
363	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
364	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
365	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
366	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
367	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
368	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
369	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
370	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
371	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
372	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
373	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
374	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
375	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
376	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
377	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
378	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
379	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
380	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
381	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
382	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
383	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
384	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
385	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
386	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
387	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
388	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
389	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
390	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
391	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
392	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
393	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
394	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
395	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
396	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
397	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
398	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
399	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
400	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
401	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
402	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
403	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
404	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
405	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
406	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
407	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
408	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
409	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
410	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
411	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
412	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
413	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
414	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
415	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
416	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
417	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
418	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
419	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
420	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
421	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
422	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
423	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
424	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
425	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
426	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
427	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
428	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
429	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
430	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
431	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
432	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
433	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
434	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
435	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
436	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
437	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
438	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
439	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
440	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
441	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
442	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
443	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
444	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
445	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
446	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
447	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
448	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
449	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
450	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
451	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
452	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
453	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
454	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
455	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
456	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
457	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
458	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
459	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
460	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
461	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
462	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
463	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
464	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
465	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
466	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
467	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
468	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
469	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
470	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
471	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
472	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
473	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
474	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
475	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
476	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
477	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
478	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
479	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
480	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
481	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
482	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
483	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
484	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
485	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
486	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
487	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
488	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
489	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
490	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
491	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
492	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
493	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
494	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
495	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
496	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
497	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
498	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
499	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
500	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
501	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
502	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
503	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
504	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
505	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
506	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
507	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
508	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
509	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
510	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
511	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
512	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
513	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
514	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
515	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
516	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
517	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
518	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
519	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
520	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
521	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
522	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
523	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
524	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
525	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
526	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
527	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
528	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
529	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
530	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
531	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
532	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
533	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
534	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
535	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
536	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
537	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
538	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
539	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
540	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
541	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
542	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
543	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
544	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
545	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
546	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
547	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
548	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
549	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
550	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
551	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
552	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
553	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
554	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
555	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
556	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
557	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
558	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
559	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
560	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
561	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
562	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
563	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
564	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
565	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
566	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
567	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
568	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
569	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
570	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
571	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
572	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
573	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
574	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
575	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
576	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
577	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
578	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
579	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
580	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
581	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
582	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
583	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
584	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
585	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
586	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
587	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
588	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
589	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
590	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
591	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
592	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
593	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
594	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
595	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
596	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
597	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
598	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
599	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
600	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
601	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
602	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
603	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
604	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
605	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
606	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
607	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
608	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
609	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
610	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
611	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
612	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
613	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
614	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
615	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
616	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
617	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
618	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
619	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
620	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
621	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
622	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
623	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
624	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
625	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
626	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
627	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
628	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
629	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
630	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
631	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
632	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
633	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
634	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
635	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
636	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
637	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
638	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
639	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
640	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
641	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
642	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
643	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
644	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
645	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
646	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
647	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
648	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
649	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
650	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
651	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
652	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
653	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
654	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
655	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
656	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
657	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
658	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
659	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
660	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
661	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
662	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
663	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
664	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
665	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
666	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
667	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
668	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
669	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
670	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
671	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
672	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
673	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
674	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
675	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
676	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
677	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
678	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
679	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
680	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
681	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
682	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
683	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
684	0.00	399.69	-----	-----	-----	-----	0.00	-----	-----	-----	-----	0.00
685	0.00	0.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.00

...End

SDSU West Campus Housing
BMP-2 (Basin I)

Sizing Low Flow Orifice

(1) $Q = C_d \times A \times (2gH)^{0.5}$ Orifice Discharge Equation

C_d = Orifice Coefficient = 0.60 (sharp, clean edge)

H = Water Head above orifice

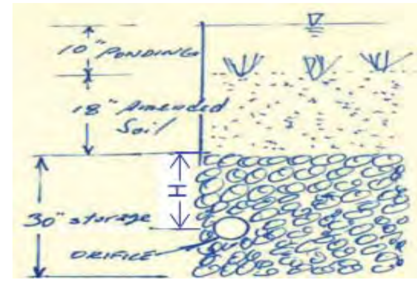
g = Gravitational Acceleration = 32.2 ft/s^2

A = Area of the Orifice

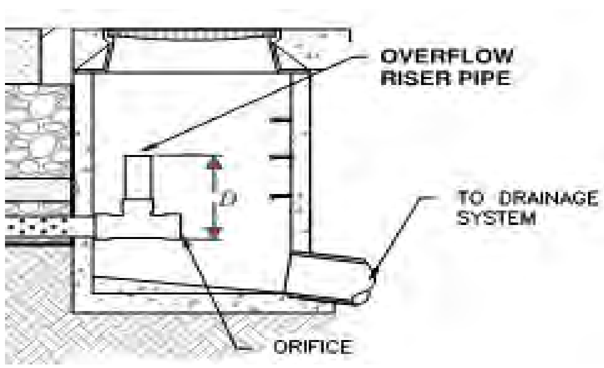
(2) $A = [0.1Q_2 \times A_{DMA}]/C_d \times (2gH)^{0.5}$

Q_2 = 2-year Storm Unit Runoff (Per Table G.2-2 of City of San Diego BMP Design Manual, January. 2016)

A_{DMA} = Area of the Drainage Management Area (DMA)



Basin	Rain Gauge	Soil Type	Cover	Slope	H (ft)	Q_2 Unit Runoff	A_{DMA} (SF)	A_{DMA} (Acres)	$0.1Q_2$	Max. Orifice Area (inch^2)	Orifice Diameter (inches)	Q_{10} Unit Runoff (cfs/acre)	Q_{10} (cfs)
1	Oceanside	D	Scrub	Steep	1.00	0.244	123,290	2.83	0.0691	2.07	**1.62**	0.228	0.6453



FLOW CONTROL FOR BMP NO. 2		
Lower Flow Threshold =	0.0691	cfs
Peak Q_{10} =	0.6453	cfs
Max Orifice Diameter Allowed =	1.622	inch
Proposed Orifice Diameter =	0.21	inch

Prepared by:
Snipes-Dye Associates

Updated: 1/23/2017

G.2.1 Unit Runoff Ratios

Table G.2-2 presents unit runoff ratios for calculating pre-development Q_2, to be used when applicable to determine the lower flow threshold for low flow orifice sizing for biofiltration with partial retention, biofiltration, biofiltration with impermeable liner, or cistern BMPs. There is no low flow orifice in the infiltration BMP or bioretention BMP. The unit runoff ratios are re-printed from the BMP Sizing Calculator methodology. Unit runoff ratios for "urban" and "impervious" cover categories were not transferred to this manual due to the requirement to control runoff to pre-development condition (see Chapter 6.3.3).

How to use the unit runoff ratios:

Obtain unit runoff ratio from Table G.2-2 based on the project's rainfall basin, hydrologic soil group, and pre-development slope (for redevelopment projects, pre-development slope may be considered if historic topographic information is available, otherwise use pre-project slope). Multiply the area tributary to the structural BMP (A, acres) by the unit runoff ratio (Q2, cfs/acre) to determine the pre-development Q2 to determine the lower flow threshold, to use for low flow orifice sizing.

Table G.2-2: Unit Runoff Ratios for Sizing Factor Method

Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lake Wohlford	A	Scrub	Low	0.136	0.369
Lake Wohlford	A	Scrub	Moderate	0.207	0.416
Lake Wohlford	A	Scrub	Steep	0.244	0.47
Lake Wohlford	B	Scrub	Low	0.208	0.414
Lake Wohlford	B	Scrub	Moderate	0.227	0.448
Lake Wohlford	B	Scrub	Steep	0.253	0.482
Lake Wohlford	C	Scrub	Low	0.245	0.458
Lake Wohlford	C	Scrub	Moderate	0.253	0.481
Lake Wohlford	C	Scrub	Steep	0.302	0.517
Lake Wohlford	D	Scrub	Low	0.253	0.48
Lake Wohlford	D	Scrub	Moderate	0.292	0.516

Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lake Wohlford	D	Scrub	Steep	0.351	0.538
Oceanside	A	Scrub	Low	0.035	0.32
Oceanside	A	Scrub	Moderate	0.093	0.367
Oceanside	A	Scrub	Steep	0.163	0.42
Oceanside	B	Scrub	Low	0.08	0.365
Oceanside	B	Scrub	Moderate	0.134	0.4
Oceanside	B	Scrub	Steep	0.181	0.433
Oceanside	C	Scrub	Low	0.146	0.411
Oceanside	C	Scrub	Moderate	0.185	0.433
Oceanside	C	Scrub	Steep	0.217	0.458
Oceanside	D	Scrub	Low	0.175	0.434
Oceanside	D	Scrub	Moderate	0.212	0.455
Oceanside	D	Scrub	Steep	0.244	0.571
Lindbergh	A	Scrub	Low	0.003	0.081
Lindbergh	A	Scrub	Moderate	0.018	0.137
Lindbergh	A	Scrub	Steep	0.061	0.211
Lindbergh	B	Scrub	Low	0.011	0.134
Lindbergh	B	Scrub	Moderate	0.033	0.174
Lindbergh	B	Scrub	Steep	0.077	0.23
Lindbergh	C	Scrub	Low	0.028	0.19
Lindbergh	C	Scrub	Moderate	0.075	0.232
Lindbergh	C	Scrub	Steep	0.108	0.274
Lindbergh	D	Scrub	Low	0.05	0.228
Lindbergh	D	Scrub	Moderate	0.104	0.266
Lindbergh	D	Scrub	Steep	0.143	0.319

SDSU West Campus Housing

1/17/2017

DMA name	DMA Area (acres)	DMA Area (sf)	Pos-project surface type	DMA runoff factor	DMA area x runoff factor	Hydrologic Soil Group D			Oceanside Rain Gauge Basin					
DMA 2	2.55	110,960	roof top, concrete walks and ac drive areas	0.90	99,864	IMP Name: Cistern (Sizing Factors Per Table G.2-7)								
	0.00		pervious pavement	0.10	0	No Channel Assessment, Lower Flow Threshold = $0.1Q_2$								
	0.28	12,330	landscape	0.10	1,233	IMP Area Sizing Factor (Table G.2-7)	Min. IMP Area (sf)	**Proposed Area (sf)**	IMP Surface Volume Sizing Factor (Table G.2-7)	Min. IMP Volume (cf)	**Proposed IMP Capacity (cf)**	IMP Subsurface Volume Sizing Factor (Table G.2-7)	Min. IMP Subsurface Volume (cf)	**Proposed IMP Subsurface Volume (cf)**
				TOTAL	**101,097**	**N/A**	**N/A**	**N/A**	**0.1800**	**18,197**	22,500	**N/A**	**N/A**	

Prepared by:
Snipes-Dye Associates

which a cistern provides temporary storage for runoff to be either used onsite (harvest and use), infiltrated, or biofiltered, project-specific continuous simulation modeling is recommended. Refer to Sections 5.6 and 6.3.6.

Table G.2-7: Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	0.3900	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	0.2000	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.5Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	B	Flat	Oceanside	N/A	0.1900	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Moderate	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	0.1000	N/A
$0.5Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	0.2100	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	0.2000	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Steep	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	0.5900	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	0.3600	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	0.2200	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	0.1800	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Steep	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	B	Flat	L Wohlford	N/A	0.2600	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	0.2400	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	0.1000	N/A
$0.1Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	0.5400	N/A
$0.1Q_2$	B	Moderate	Lindbergh	N/A	0.7800	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	0.3400	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	0.2400	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	0.1600	N/A
$0.1Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	0.5100	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	0.3400	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	0.2400	N/A
$0.1Q_2$	C	Flat	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	0.1800	N/A
$0.1Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	0.4400	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	0.4000	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Flat	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	0.2200	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	0.1800	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Bioretention surface area sizing factor (not applicable under this manual standards – use methods presented in Chapter 5 and Appendix B or Appendix F to size bioretention or biofiltration facility for pollutant control)
V_1 = Cistern volume sizing factor

Definitions for "N/A"

≠ Column V2: N/A in column V2 means there is no V2 element in the cistern BMP

≠ Column A: N/A in column A means there is no A element in the cistern BMP. Note sizing factors previously created for sizing a bioretention or biofiltration facility downstream of a cistern under the 2007 MS4 Permit are not applicable under the MS4 Permit.

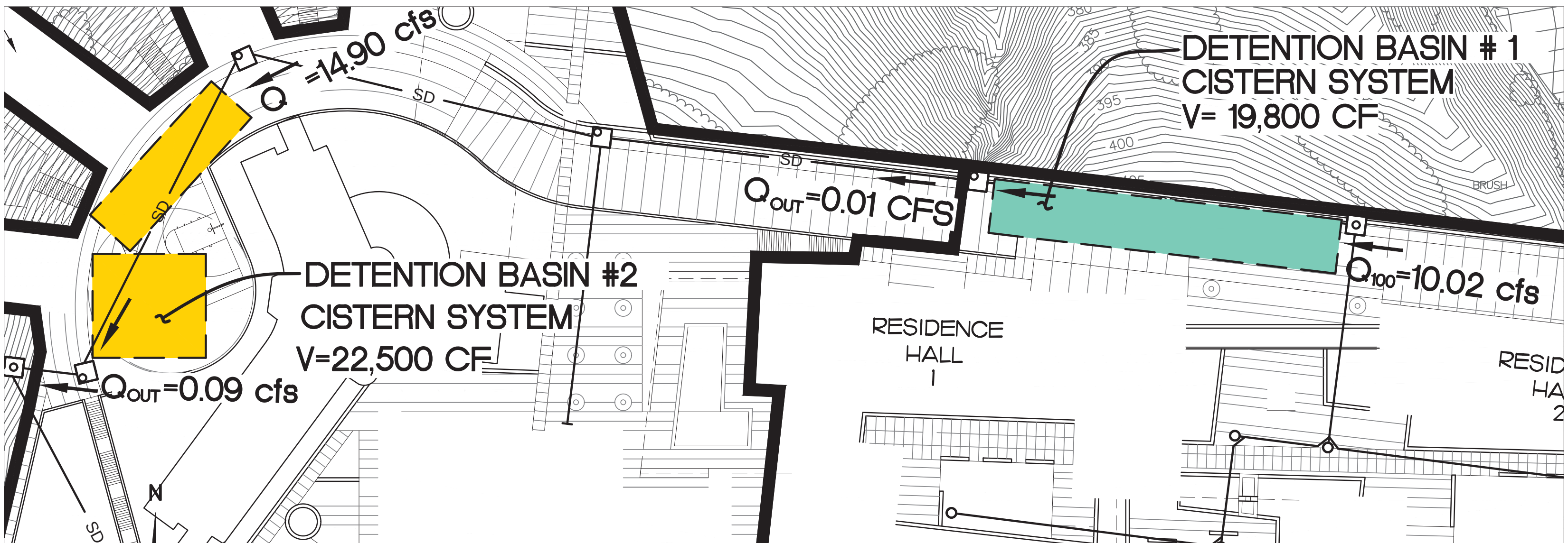
.

LEGEND

ITEM	SYMBOL
DRAINAGE BASIN BOUNDARY	
FLOW	
DETENTION BASIN #1 (CISTERN) AREA: 3,404 SF	
DETENTION BASIN #2 (CISTERN) AREA: 3,872 SF	

FLOW CONTROL - DETENTION BASIN 1		
	REQUIRED	PROPOSED
VOLUME	13,548 CF	19,800 CF
ORIFICE SIZE	1.4 INCH	1.4 INCH

FLOW CONTROL - DETENTION BASIN 2		
	REQUIRED	PROPOSED
VOLUME	18,197 CF	22,500 CF
ORIFICE SIZE	1.62 INCH	1.62 INCH



DETENTION BASINS EXHIBIT

50 25 0 50 100 150

SCALE: 1"=50'

SHEET TITLE: DETENTION BASINS EXHIBIT

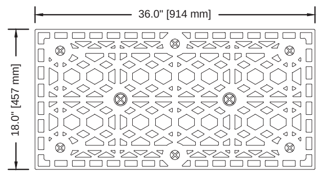
JOB NAME: SAN DIEGO STATE UNIVERSITY WEST CAMPUS HOUSING

SNIPES-DYE ASSOCIATES
8348 CENTER DRIVE, STE. G, LA MESA, CA 91942 TELEPHONE (619) 697-9234 FAX (619) 460-2033

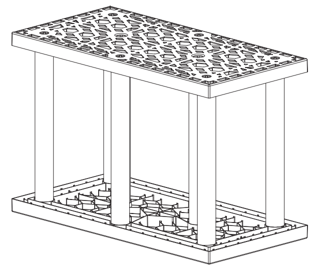
DESIGNER	DRAWN	CHECKED	DATE
DCP	DCP	SPN	1-24-17

SHEET 1 OF 1 SHEETS

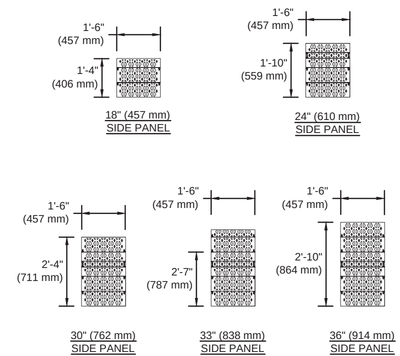
JOB NO. SD2916



TOP

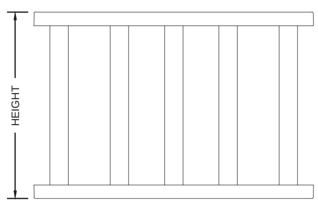


ISOMETRIC VIEW

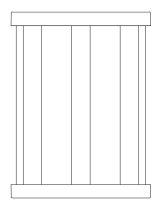


NOTES:
1. SIDE PANELS TO BE INSTALLED ALONG SYSTEM PERIMETER, UNLESS OTHERWISE SPECIFIED.
2. ALL HEIGHTS TO BE CUT FROM A 36" (914 mm) SIDE PANEL AT PRE-SCRIBED LOCATIONS, EXCEPT 33" (838 mm) SIDE PANEL.

SIDE PANEL DETAIL



FRONT



SIDE

MODULE DETAIL

STORMTANK® MODULE				
NAME	HEIGHT (mm)	CAPACITY (m^3)	VOID RATIO	NOMINAL WEIGHT (kg)
ST-18	18" (457)	6.44 cf (0.18)	95.50%	22.70 lbs. (10)
ST-24	24" (610)	8.66 cf (0.25)	96.00%	26.30 lbs. (12)
ST-30	30" (762)	10.88 cf (0.31)	96.50%	29.50 lbs. (13)
ST-33	33" (838)	11.99 cf (0.34)	96.90%	29.82 lbs. (13.5)
ST-36	36" (914)	13.10 cf (0.37)	97.00%	33.10 lbs. (15)

NOTES:
a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.
b. SIDE PANELS REQUIRED AROUND THE PERIMETER OF THE INSTALLATION ONLY, UNLESS OTHERWISE NOTED.
c. SIDE PANELS ARE TO BE CUT FROM A 36" PANEL AT THE PRE-SCRIBED LOCATIONS.

REV.	DATE	RECORD OF CHANGES	BY	APPRV.
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

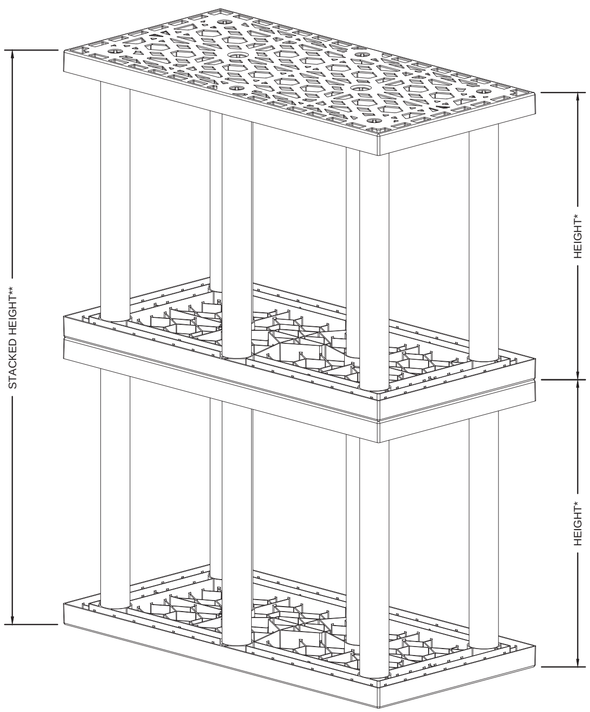
BRENTWOOD®
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

Project Name
MODULE DETAIL

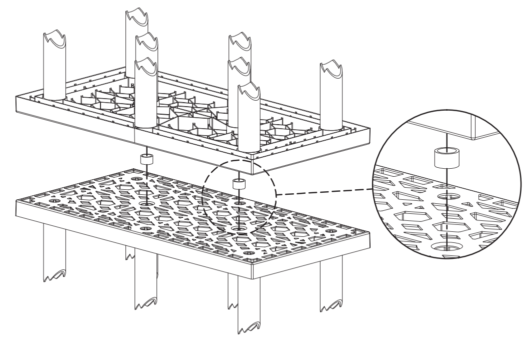
Title
STORMTANK®
MODULE

Drawn By	Date
B.LINE	4/5/12

Drawing No.	Sheet	Scale
STM-000-00	1 of 2	NTS



MODULE DOUBLE STACK DETAIL



STACKING PIN DETAIL

DOUBLE STACK CONFIGURATIONS:						
SYSTEM HEIGHT (mm)	ST-18	ST-24	ST-30	ST-33	ST-36	CAPACITY (m^3)
42" (1,067)	1	1	-	-	-	15.08 cf (0.42)
48" (1,219)	1	-	1	-	-	17.30 cf (0.48)
51" (1,295)	1	-	-	1	-	18.42 cf (0.52)
54" (1,372)	1	-	-	-	1	19.50 cf (0.54)
57" (1,448)	-	1	-	1	-	20.64 cf (0.58)
60" (1,524)	-	1	-	-	1	21.75 cf (0.62)
63" (1,600)	-	-	1	1	-	22.86 cf (0.65)
66" (1,676)	-	-	-	2	-	23.97 cf (0.68)
69" (1,753)	-	-	-	1	1	25.08 cf (0.71)
72" (1,829)	-	-	-	-	2	26.20 cf (0.73)

NOTES:

a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.

b. STACKING PINS REQUIRED BETWEEN MODULE LAYERS, FOR ALL STACKED SYSTEMS (SEE DETAIL).

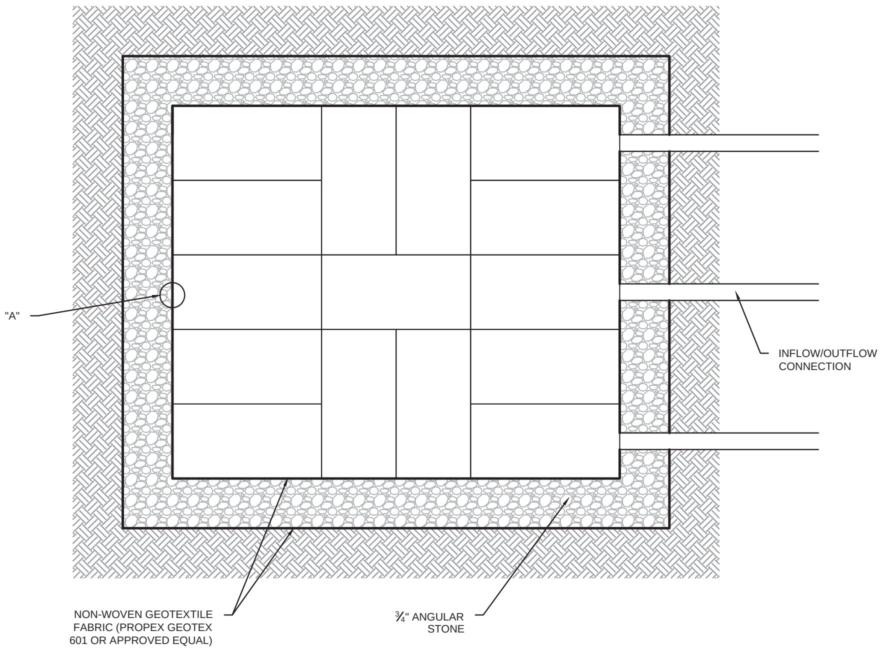
REV.	DATE	RECORD OF CHANGES	BY	APPRV.
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

BRENTWOOD®
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

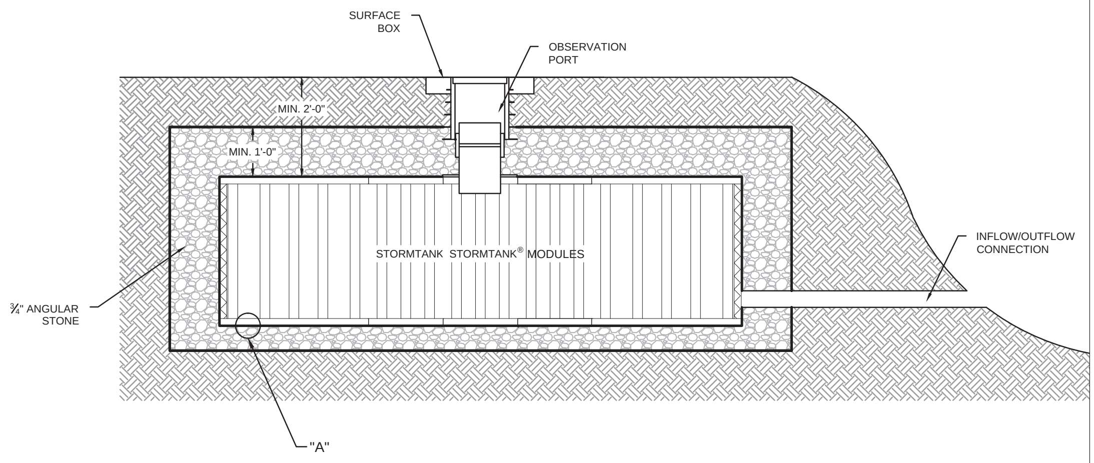
Project Name
MODULE DOUBLE STACK DETAIL

Title
STORMTANK®
MODULE

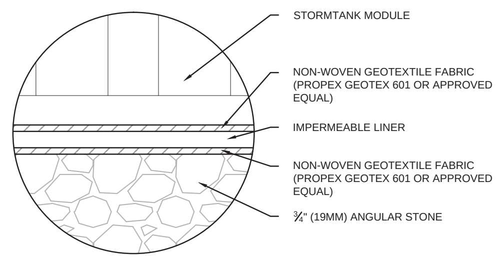
Drawn By		Date
B.LINE		4/5/12
Drawing No.	Sheet	Scale
STM-000-00	2 of 2	NTS



LAYOUT VIEW



CROSS-SECTION



DETAIL "A"

NOTES:

a. **REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER INSTALLATION PRACTICES.**
b. **THIS DRAWINGS IS FOR ILLUSTRATION PURPOSES ONLY AND DOES NOT SUPERSEDE ENGINEERING DESIGN OR CALCULATIONS. THIS DRAWINGS REPRESENT THE INTEGRATION OF STORMTANK MODULES INTO A FLOOD PLAIN MITIGATION APPLICATION AND SHALL NOT BE CONSTRUED AS PROPER DESIGN. PLEASE REFERENCE ALL LOCAL REGULATIONS AND DESIGN MANUALS DURING THE DESIGN OF THESE APPLICATIONS.**

REV.	DATE	RECORD OF CHANGES	BY	APPRV.
B	11/7/14	GEOTEXTILE PRODUCT SPECIFIED	CGB	
A.	11/13/13	INITIAL RELEASE	CAT	

BRENTWOOD®
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

Project Name
CONCEPTUAL FLOODPLAIN MITIGATION DESIGN

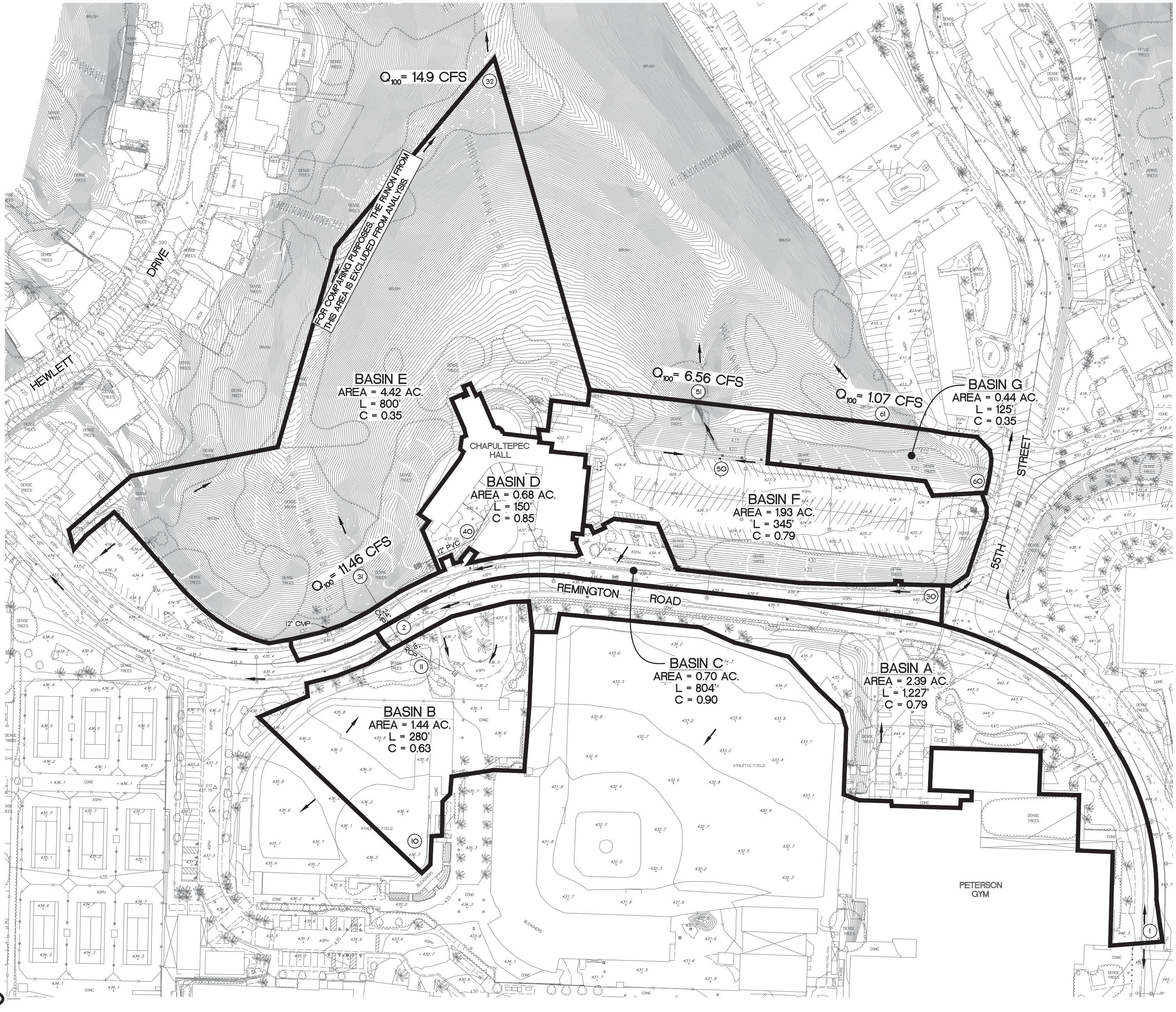
Title
STORMTANK®
MODULE

Drawn By		Date
C.TORRES		11/11/13
Drawing No.	Sheet	Scale
APP-002-00	1 of 1	NTS

ATTACHMENT E:

PRE-DEVELOPMENT AND POST-DEVELOPMENT DRAINAGE MAPS

SAN DIEGO STATE UNIVERSITY
WEST CAMPUS HOUSING EIR
PRE-DEVELOPMENT DRAINAGE MAP



LEGEND

ITEM	SYMBOL
DRAINAGE BASIN BOUNDARY	(heavy line)
NODE	(1)
FLOW	(arrow)
LENGTH OF FLOWLINE	L = 345'
RUNOFF COEFFICIENT	C = 0.35
PEAK DISCHARGE (100-YR STORM)	Q_{100}= 14.9 CFS

PRELIMINARY

PRE-DEVELOPMENT DRAINAGE MAP

SHEET TITLE: PRE-DEVELOPMENT DRAINAGE MAP

JOB NAME: SAN DIEGO STATE UNIVERSITY WEST CAMPUS HOUSING EIR

DESIGNER: SPN | DRAWN: JGF | CHECKED: MPK | DATE: 1-20-17

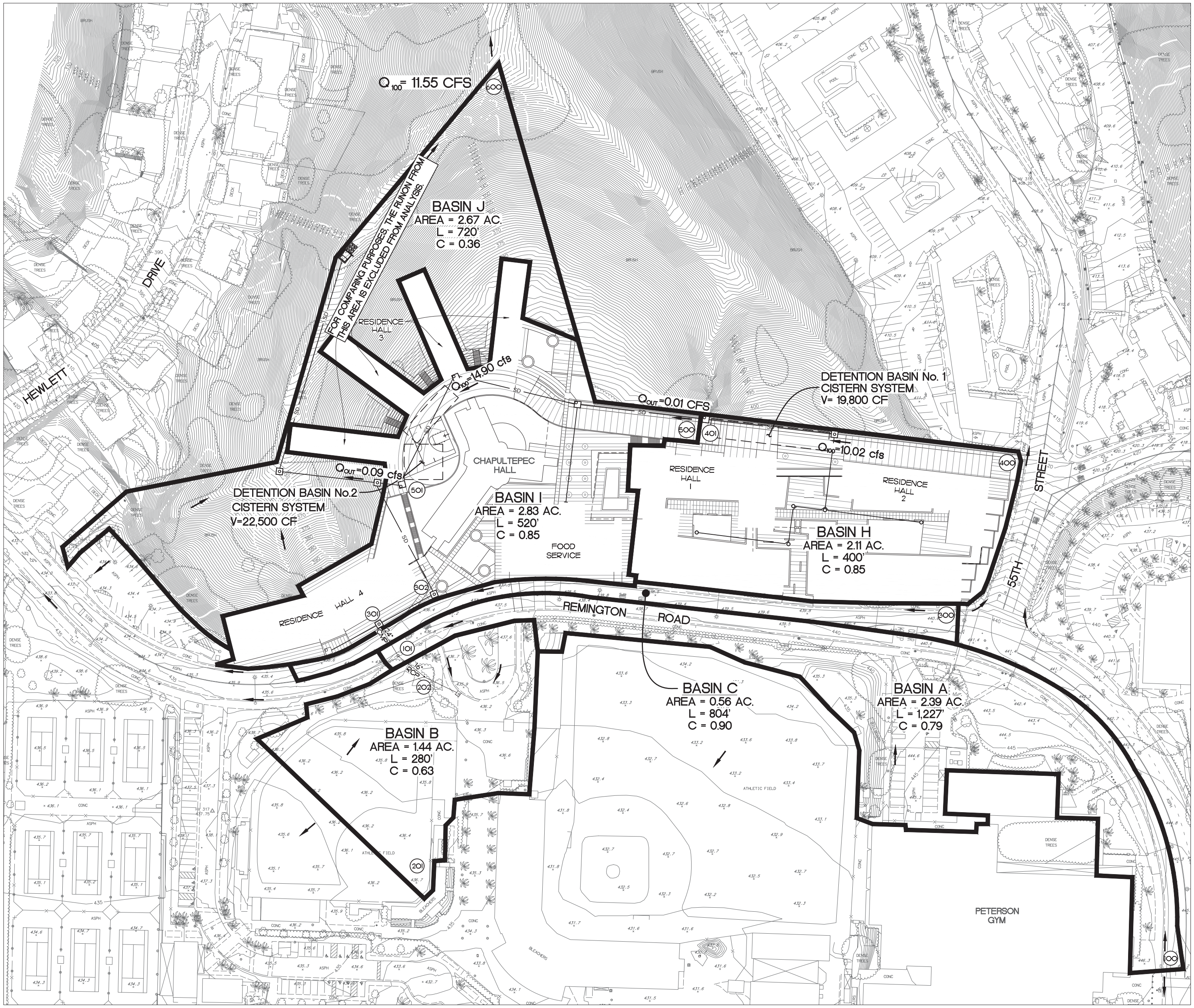
SNIPES-DYE ASSOCIATES

8348 CENTER DRIVE, SUITE G, LA MESA, CA 91942-2910 (619) 697-9234, FAX (619) 460-2033

SHEET 1 OF 1 SHEETS

JOB NO. SD2912

SAN DIEGO STATE UNIVERSITY
WEST CAMPUS HOUSING EIR
POST-DEVELOPMENT DRAINAGE MAP



N

50 25 0 50 100 150

SCALE: 1"=50'

LEGEND

ITEM	SYMBOL
DRAINAGE BASIN BOUNDARY	(heavy line)
NODE	1
FLOW	→
LENGTH OF FLOWLINE	L = 345'
RUNOFF COEFFICIENT	C = 0.35

PRELIMINARY

POST-DEVELOPMENT DRAINAGE MAP

SHEET TITLE: POST-DEVELOPMENT DRAINAGE MAP

JOB NAME: SAN DIEGO STATE UNIVERSITY WEST CAMPUS HOUSING EIR

DESIGNER: SPN DRAWN: JGP CHECKED: MPK DATE: 1-20-17

REVISION DESCRIPTION

SHEET 1 OF 1 SHEETS

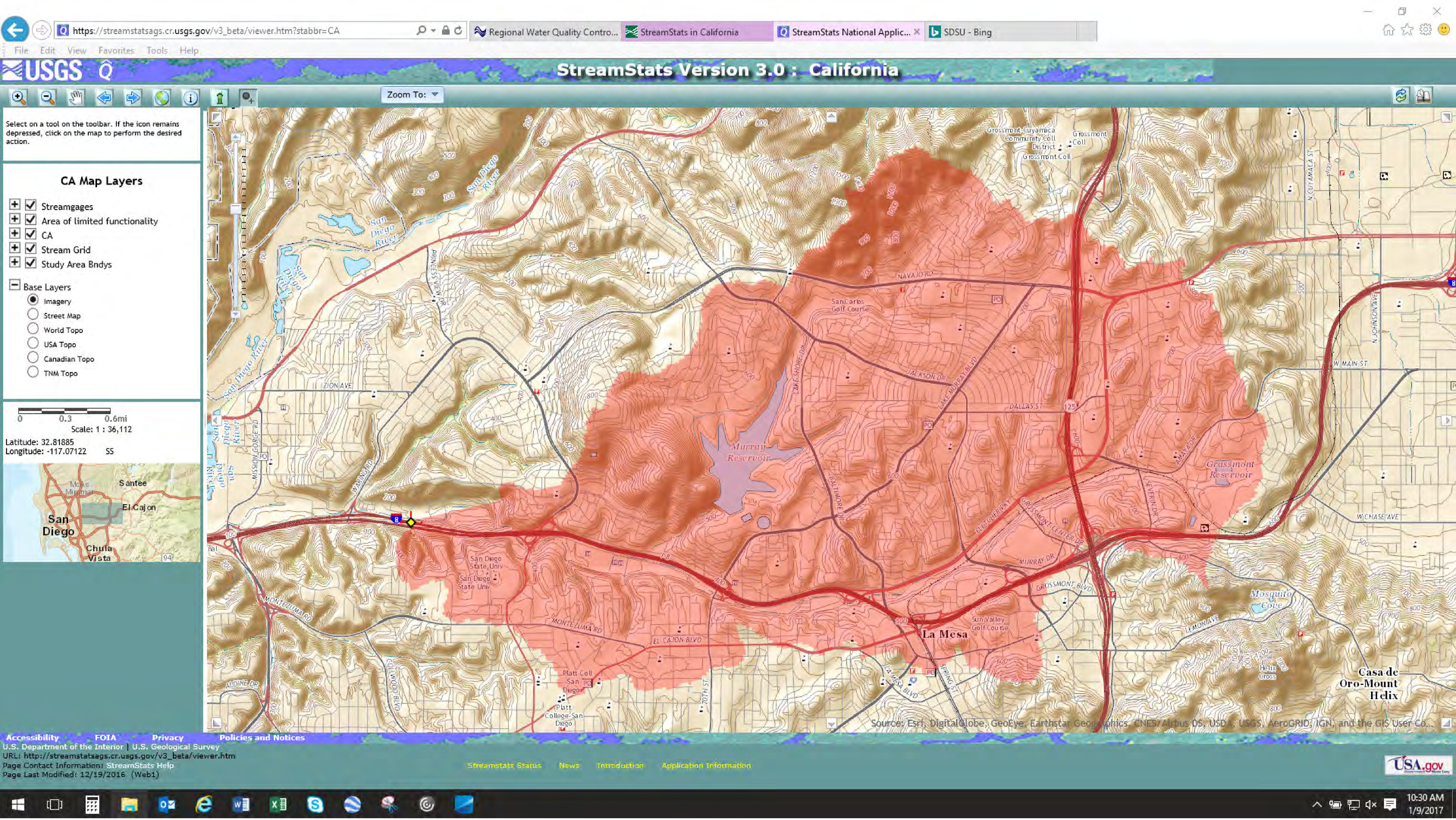
JOB NO. SD292

SNIPES-DYE ASSOCIATES

8348 CENTER DRIVE, SUITE G, LA MESA, CA 91942-2910 (619) 697-9234, FAX (619) 460-2033

APPENDIX B

U.S. Geological Survey "StreamStats" Application Basin Characteristics and Flow Estimates


https://streamstatsags.cr.usgs.gov/v3_beta/viewer.htm?stabbr=CA
Regional Water Quality Contro...
StreamStats in California
StreamStats National Applic...
SDSU - Bing
File Edit View Favorites Tools Help
USGS
StreamStats Version 3.0 : California
Zoom To:
Select on a tool on the toolbar. If the icon remains depressed, click on the map to perform the desired action.
CA Map Layers
Streamgages
Area of limited functionality
CA
Stream Grid
Study Area Bndys
Base Layers
Imagery
Street Map
World Topo
USA Topo
Canadian Topo
TNM Topo
0 0.3 0.6mi
Scale: 1 : 36,112
Latitude: 32.81885
Longitude: -117.07122
Santee
El Cajon
San Diego
Chula Vista
Murray Reservoir
Grossmont Reservoir
San Diego River
La Mesa
San Carlos Golf Course
San Diego State Univ
Sun Valley Golf Course
Mosquito Cove
Casa de Oro-Mount Helix
NAVAJO RD
JACKSON DR
LAKE MURRAY BLVD
DALLAS ST
MONTEZUMA RD
EL CAJON BLVD
ZION AVE
GROSSMONT BLVD
MURRAY DR
W MAIN ST
W CHASE AVE
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Co...
Accessibility FOIA Privacy Policies and Notices
U.S. Department of the Interior | U.S. Geological Survey
URL: http://streamstatsags.cr.usgs.gov/v3_beta/viewer.htm
Page Contact Information: StreamStats Help
Page Last Modified: 12/19/2016 (Web1)
Streamstats Status News Introduction Application Information
USA.gov
10:30 AM
1/9/2017

StreamStats Version 3.0

Basin Characteristics Ungaged Site Report

Date: Mon Jan 9, 2017 10:34:10 AM GMT-8
Study Area: California
NAD 1983 Latitude: 32.7803 (32 46 49)
NAD 1983 Longitude: -117.0809 (-117 04 52)

Label	Value	Units	Definition
DRNAREA	11.7	square miles	Area that drains to a point on a stream
RELIEF	1392	feet	Maximum - minimum elevation
ELEVMAX	1530	feet	Maximum basin elevation
MINBELEV	137	feet	Minimum basin elevation
LAKEAREA	1.71	percent	Percentage of Lakes and Ponds
EL6000	0	percent	Percent of area above 6000 ft
CENTROIDX	-1942213.3	State plane coordinates	Basin centroid horizontal (x) location in state plane coordinates
CENTROIDY	1295284.5	State plane coordinates	Basin centroid vertical (y) location in state plane units
OUTLETELEV	153	feet	Elevation of the stream outlet in feet above NAVD88.
BASINPERIM	23	miles	Perimeter of the drainage basin as defined in SIR 2004-5262
RELRELF	60.6	feet per mi	Basin relief divided by basin perimeter
ELEV	602	feet	Mean Basin Elevation
BSLDEM30M	8.99	percent	Mean basin slope computed from 30 m DEM
FOREST	1.44	percent	Percentage of area covered by forest
LC11IMP	50.4	percent	Average percentage of impervious area determined from NLCD 2011 impervious dataset
PRECIP	13.6	inches	Mean Annual Precipitation
JANMAXTMP	66.67	degrees F	Mean Maximum January Temperature
JANMINTMP	42.29	degrees F	Mean Minimum January Temperature
ALTIND	0.5	thousand feet	Altitude Index
LC11DEV	94.3	percent	Percentage of developed (urban) land from NLCD 2011 classes 21-24
LFPLENGTH	7	miles	Length of longest flow path

StreamStats Version 3.0

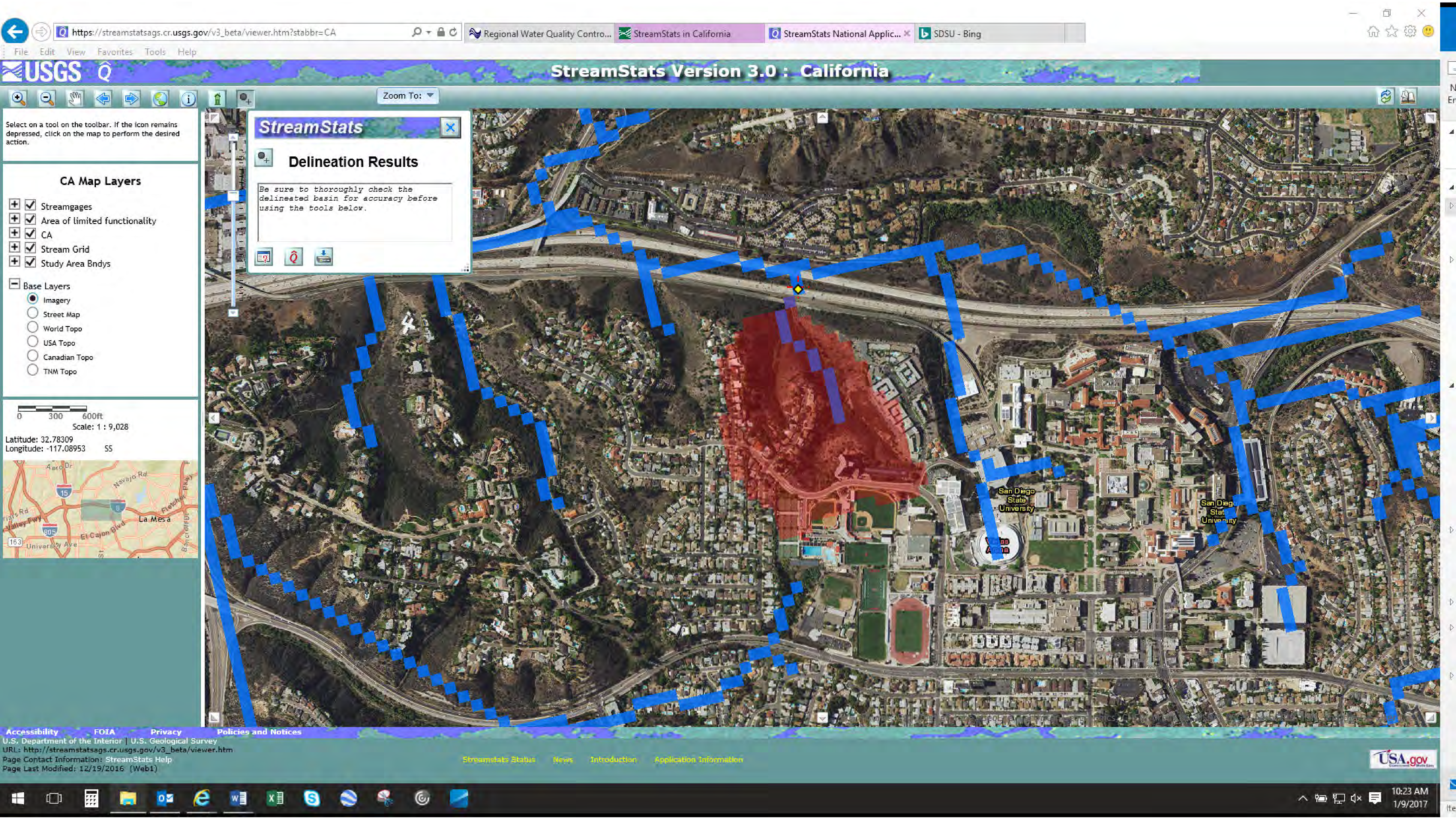
Flow Statistics Ungaged Site Report

Date: Mon Jan 9, 2017 10:40:16 AM GMT-8
Study Area: California
NAD 1983 Latitude: 32.7803 (32 46 49)
NAD 1983 Longitude: -117.0839 (-117 05 02)
Drainage Area: 11.7 mi2

Peak-Flow Basin Characteristics			
100% 2012 5113 Region 5 South Coast (11.7 mi2)			
Parameter	**Value**	**Regression Equation Valid Range**	
		Min	**Max**
Drainage Area (square miles)	11.7	0.04	850
Mean Annual Precipitation (inches)	13.6	10	45

Peak-Flow Statistics						
Statistic	**Value**	**Unit**	**Prediction Error (percent)**	**Equivalent years of record**	**90-Percent Prediction Interval**	
					Min	**Max**
PK2	134	ft3/s	130		24.2	745
PK5	445	ft3/s	83		131	1510
PK10	735	ft3/s	64		272	1980
PK25	1140	ft3/s	52		500	2610
PK50	1490	ft3/s	48		693	3210
PK100	1860	ft3/s	47		863	4020
PK200	2280	ft3/s	48		1040	4970
PK500	2790	ft3/s	52		1210	6400

#http://pubs.usgs.gov/sir/2012/5113/#
Gotvald_ A.J._ Barth_ N.A._ Veilleux_ A.G._ and Parrett_ Charles_ 2012_ Methods for determining magnitude and frequency of floods in California_ based on data through water year 2006: U.S. Geological Survey Scientific Investigations Report 2012-5113_ 38 p._ 1 pl.


https://streamstatsags.cr.usgs.gov/v3_beta/viewer.htm?stabbr=CA
Regional Water Quality Contro...
StreamStats in California
StreamStats National Applic...
SDSU - Bing
File Edit View Favorites Tools Help
USGS
StreamStats Version 3.0 : California
Zoom To:
Select on a tool on the toolbar. If the icon remains depressed, click on the map to perform the desired action.
CA Map Layers
Streamgages
Area of limited functionality
CA
Stream Grid
Study Area Bndys
Base Layers
Imagery
Street Map
World Topo
USA Topo
Canadian Topo
TNM Topo
0 300 600ft
Scale: 1 : 9,028
Latitude: 32.78309
Longitude: -117.08953
StreamStats
Delineation Results
Be sure to thoroughly check the delineated basin for accuracy before using the tools below.
San Diego State University
Accessibility FOIA Privacy Policies and Notices
U.S. Department of the Interior | U.S. Geological Survey
URL: http://streamstatsags.cr.usgs.gov/v3_beta/viewer.htm
Page Contact Information: StreamStats Help
Page Last Modified: 12/19/2016 (Web1)
Streamstats Status News Introduction Application Information
USA.gov
10:23 AM
1/9/2017

StreamStats Version 3.0

Basin Characteristics Ungaged Site Report

Date: Mon Jan 9, 2017 10:24:38 AM GMT-8
Study Area: California
NAD 1983 Latitude: 32.7799 (32 46 48)
NAD 1983 Longitude: -117.0802 (-117 04 49)

Label	Value	Units	Definition
DRNAREA	0.1	square miles	Area that drains to a point on a stream
RELIEF	236	feet	Maximum - minimum elevation
ELEVMAX	444	feet	Maximum basin elevation
MINBELEV	208	feet	Minimum basin elevation
LAKEAREA	0	percent	Percentage of Lakes and Ponds
EL6000	0	percent	Percent of area above 6000 ft
CENTROIDX	-1947139.5	State plane coordinates	Basin centroid horizontal (x) location in state plane coordinates
CENTROIDY	1295220.6	State plane coordinates	Basin centroid vertical (y) location in state plane units
OUTLETELEV	193	feet	Elevation of the stream outlet in feet above NAVD88.
BASINPERIM	1.45	miles	Perimeter of the drainage basin as defined in SIR 2004-5262
RELRELF	162	feet per mi	Basin relief divided by basin perimeter
ELEV	371	feet	Mean Basin Elevation
BSLDEM30M	20.7	percent	Mean basin slope computed from 30 m DEM
FOREST	13.4	percent	Percentage of area covered by forest
LC11IMP	33.5	percent	Average percentage of impervious area determined from NLCD 2011 impervious dataset
PRECIP	12.4	inches	Mean Annual Precipitation
JANMAXTMP	66.28	degrees F	Mean Maximum January Temperature
JANMINTMP	43.1	degrees F	Mean Minimum January Temperature
ALTIND	0.31	thousand feet	Altitude Index
LC11DEV	72.3	percent	Percentage of developed (urban) land from NLCD 2011 classes 21-24
LFPLENGTH	0	miles	Length of longest flow path

StreamStats Version 3.0

Flow Statistics Ungaged Site Report

Date: Mon Jan 9, 2017 10:25:57 AM GMT-8
Study Area: California
NAD 1983 Latitude: 32.7799 (32 46 48)
NAD 1983 Longitude: -117.0801 (-117 04 49)
Drainage Area: 0.1 mi2

Peak-Flow Basin Characteristics			
100% 2012 5113 Region 5 South Coast (0.1 mi2)			
Parameter	**Value**	**Regression Equation Valid Range**	
		Min	**Max**
Drainage Area (square miles)	0.1	0.04	850
Mean Annual Precipitation (inches)	12.4	10	45

Peak-Flow Statistics						
Statistic	**Value**	**Unit**	**Prediction Error (percent)**	**Equivalent years of record**	**90-Percent Prediction Interval**	
					Min	**Max**
PK2	5.1	ft3/s	130		0.82	31.8
PK5	12.2	ft3/s	83		3.28	45.2
PK10	16	ft3/s	64		5.45	46.9
PK25	19.2	ft3/s	52		7.76	47.7
PK50	21.3	ft3/s	48		9.08	49.8
PK100	23.1	ft3/s	47		9.8	54.4
PK200	25	ft3/s	48		10.4	59.7
PK500	26.4	ft3/s	52		10.4	67

#http://pubs.usgs.gov/sir/2012/5113/#
Gotvald_ A.J._ Barth_ N.A._ Veilleux_ A.G._ and Parrett_ Charles_ 2012_ Methods for determining magnitude and frequency of floods in California_ based on data through water year 2006: U.S. Geological Survey Scientific Investigations Report 2012-5113_ 38 p._ 1 pl.