2014000387

THE CITY OF SAN DIEGO

MEMORANDUM

DATE: June 6, 2014

TO: Elizabeth Shearer-Nguyen, Associate Planner, Development Services Department

FROM: Seevani Bista, Senior Water Resources Specialist, Public Utilities Department

SUBJECT: Water Supply Assessment Report (WSA) for the Glen at Scripps Ranch Project

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In response to your request, please find attached WSA for the Glen at Scripps Ranch Project approved by Deputy Director of the Long-Range Planning and Water Resources Division, Public Utilities.

The Public Utilities Department (Department) prepared this WSA to assess whether sufficient water supplies are or will be available to meet the projected water demands of the project. The findings verify that there is sufficient water supply to serve existing demands, projected demands of the project, and future water demands within the Department's service area in normal and dry year forecasts during a 20-year projection.

Should there be any comments on the WSA at the conclusion of the public review process for the Glen at Scripps Ranch EIR, please forward your comments for our review. Please provide us a copy of the EIR after the City Council approval.

If you have any questions, please call me at (619) 533-4222.

Seevani Bista for

SB/ak

Attachment: Water Supply Assessment Report

cc: Ray Palmucci, Deputy City Attorney, Office of the City Attorney
Marsi A. Steirer, Deputy Director, Public Utilities Department
George Adrian, P.E., Principal Water Resources Specialist, Public Utilities Department
Anna McPherson, Senior Planner, Development Services Department
Michael Prinz, Associate Planner, Planning, Neighborhoods & Economic Development Department
Anas Kaziha, Junior Engineer-Civil, Public Utilities Department
RMS 6.8.4

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

WATER SUPPLY ASSESSMENT REPORT

The Glen at Scripps Ranch Project

Prepared by:

City of San Diego Public Utilities Department

Reviewed by:

Marsi A Steirer June 5, 2014

Marsi A. Steirer, Deputy Director **Date**
Long-Range Planning & Water Resources Division

Prepared: June 2014

City of San Diego Public Utilities Department
Water Supply Assessment Report

The Glen at Scripps Ranch Project

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Section 1 - Purpose

On January 1, 2002, Senate Bill 610 (SB 610) and Senate Bill 221 (SB 221) took effect. The intent of SB 610 and SB 221 was to improve the link between information on water supply availability and certain land-use decisions made by cities and counties. Under SB 610 (codified in the Water Code beginning at Section 10910), a water supply assessment (WSA) must be furnished to cities and counties for inclusion in any environmental documentation of projects (defined in the Water Code) that propose to construct 500 or more residential units, or that will use an amount of water equivalent to what would be used by 500 residential units, and are subject to the California Environmental Quality Act (CEQA). Under SB 221, approval by a city or county of certain residential subdivisions requires an affirmative written verification of sufficient water supply or water supply verification (WSV).

Not every project that is subject to the requirements of SB 610 is also subject to the mandatory water verification of SB 221 (e.g., if subdivision map approval is not required). Conversely, not every project that is subject to the requirements of SB 221 must also obtain a SB 610 water supply assessment.

A foundational document for compliance for both SB 610 and SB 221 is the Urban Water Management Plan (UWMP) of the relevant water agency. Both of these statutes repeatedly identify the UWMP as a planning document that can be used by a water supplier to meet the standards set forth in both statutes. Thorough and complete UWMPs will allow water suppliers to use UWMPs as a foundation to fulfill the specific requirements of the two statutes. Cities, counties, water districts, property owners and developers utilize this document when planning for and proposing new projects. It is crucial that cities, counties and water suppliers work closely when developing and updating these planning documents. The City of San Diego's 2010 UWMP, which is used as the basis for this Report (WSA), was adopted by the San Diego City Council in June 2011.

Development Services Department (DSD) requested that the City of San Diego Public Utilities Department (Department) prepare this WSA as part of the environmental review for the Glen at Scripps Ranch Project (Project). A more detailed description of the Project is provided in Section 2 of this WSA. This WSA evaluates water supplies that are or will be available during normal, single-dry year, and multiple-dry water years during a 20-year projection to meet the projected demands of the Project, in addition to existing and planned future water demands of the Department. This WSA provides an assessment of the availability of sufficient water supplies for the Project only and does not constitute approval of the Project.

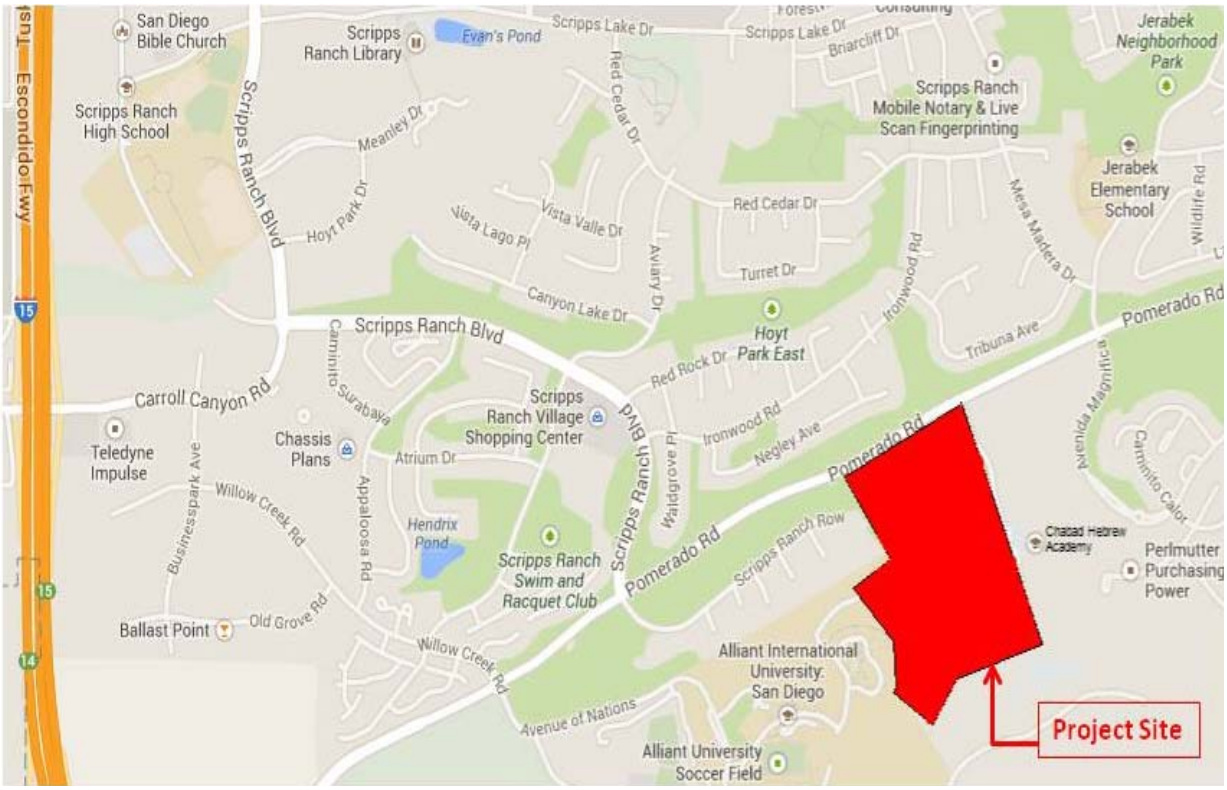
This WSA includes, among other information, identification of existing water supply entitlements, water rights, water service contracts, or agreements relevant to the identified water supply for the Project and quantities of water received in prior years pursuant to those entitlements, rights, contracts and agreements.

This Report has been prepared in compliance with the requirements under SB 610 by the Department in consultation with DSD, the San Diego County Water Authority (Water Authority) and the Metropolitan Water District of Southern California (MWD).

Section 2 - Project Description

The proposed senior living project is located east of Interstate 1-15 and south of Pomerado Road on an approximately 53-acre site. The project site is bounded on the south by Marine Corps Air Station (MCAS) Miramar, on the southwest by Alliant International University Campus, on the northwest by military housing complex (multi-family uses), on the north by Pomerado Road and on the east by Chabad of San Diego. The project site is located within the Scripps Miramar Ranch Community Plan (SMRCP) area in the north central portion of the City.

FIGURE 2-1
VICINITY MAP OF THE PROJECT



The project proposes the following developments:

<u>Assisted Living Units</u>

The project would construct 404 Assisted Living units of which there would be three different types: 64 Villas, 288 Independent Living units, 48 Garden Terrace units, and 4 Guest Suites (Studios). The Villas would range from two-bed/two-bath units to three- bed/two-bath units. The Independent Living units would range from one-bed/one-bath units to three-bed/two-bath units. The Garden Terrace units would range from two-bed/two-bath units to three-bed/two-bath units. The assisted living units would be occupied by two people per unit at the most.

The average water usage in the development was determined based on the information of an existing similar facility, University Village Thousand Oaks (UVTO), which is owned and operated by the same applicant. The applicant calculated the gallons per day (gpd) per unit based on the billing data of UVTO which was reviewed by City staff. The same gpd per unit was applied to the proposed number of units of the Glen at Scripps Ranch project to estimate the water usage of the assisted living units.

Health Center

The proposed Health Center would address the needs of the residents by providing 50 Acute Assisted Living units and 60 Skilled Nursing beds. The Health Center would provide care and skilled nursing services for residents, and 16 of the 50 Acute Assisted Living units would be for residents with Alzheimer's disease or other types of dementia.

Common/Recreation Building

The project would consist of an exhibit/conference, a billiard room, a card room, a beauty salon, fine dining area, a theater, a library lounge, a fitness center, a business center, and administrative offices on a 57,600 square feet site.

In addition, amenities for the project include a putting green, outdoor fire place, water feature/fountain, pond, croquet lawn, gardens, pool, bocce ball courts, pitch and putt golf course, two courtyard fountains, landscaped courtyard with fountain. Total square footage for landscaping (medium water use) is 975,084, which includes 4,187 for special landscape, also includes active turf and edible crops (low water use).

Facilities Building

Housekeeping, laundry, residential and grounds maintenance, janitorial services, a maintenance center, and storage would be based in the proposed Facilities Building (10,066 square feet).

Entry Kiosk

A small entry kiosk/guard station (205 square foot) is proposed at the entrance to the project off of Chabad Center Driveway.

Section 3 - Findings

Water Assessment

Project: This Report identifies that the water demand projections for the Project, as proposed, are included in the regional water resource planning documents of the Water Authority, MWD, and partially in the City's 2010 UWMP. Current and future water supplies, as well as actions necessary to develop the future water supplies, have been identified. This Report demonstrates that there will be sufficient water supplies available during normal, single-dry year, and multiple-dry water years during a 20-year projection to meet the unanticipated projected demands of the Project by utilizing the demand increment associated with the accelerated forecasted growth in the Water Authority's 2010 UWMP as described below, and in the City's 2010 UWMP.

The Water Authority's 2010 UWMP provides for a comprehensive planning analysis at a regional level and includes water use associated with accelerated forecasted residential development as part of its municipal and industrial sector demand projections. These housing units were identified by the San Diego Association of Government (SANDAG) land use plan in the course of its regional housing needs assessment, but are not yet included in existing general land use plans of local jurisdictions. The demand associated with accelerated forecasted residential development is intended to account for SANDAG's land-use development currently projected to occur between 2035 and 2050, but has the likely potential to occur on an accelerated schedule. SANDAG estimates that this accelerated forecasted residential development could occur within the planning horizon (2010 to 2035) of the 2010 UWMP. These units are not yet included in local jurisdictions' general plans, so their projected demands are incorporated at a regional level. When necessary, this additional demand increment, termed Accelerated Forecasted Growth, can be used by member agencies to meet the demands of development projects not identified in the general land use plans.

As demonstrated in Table 3-1 of this Report, prepared by the Public Utilities Department (Department) in compliance with the requirements of SB 610 using the City's and Water Authority's 2010 UWMP based upon SANDAG Series 12 Forecast land use, there is sufficient water planned to supply the Project's estimated annual average usage. The projected water demands of the Project are 92,350 gallons per day or 103 acre feet per year (AFY). Per the City's 2010 UWMP, the planned water demands of this project site are 13,800 gallons per day or 15 AFY. The remaining portion of the estimated 78,550 gallons per day or 88 AFY is accounted for through the Accelerated Forecasted Growth demand increment of the Water Authority's 2010 UWMP. As documented in the Water Authority's 2010 UWMP, the Water Authority is planning to meet future and existing demands which include the demand increment associated with the accelerated forecasted growth. The Water Authority will also assist its member agencies in tracking the certified Environmental Impact Reports (EIRs) provided by the agencies that include water supply assessments that utilize the accelerated forecasted growth demand increment, to demonstrate adequate supplies for the development. In addition, the next update of the demand forecast for the Water Authority's 2015 UWMP will be based on SANDAG's most recently updated forecast, which will include the Project.

Existing and Future Developments Planned to occur by 2035: The City's 2010 UWMP demonstrates there will be sufficient water supplies available to meet demands for existing and

planned future developments that are projected to occur by 2035. Based on a normal water supply year, the estimated water supply projected in five-year increments for a 20-year projection will meet the City's projected water demand of 240,472 acre-feet[A] (AF) in 2015 to 298,860 AF in 2035 (**Table 6-5**) for these developments. Similarly, based on a single-dry year forecast (**Table 6-7**), the estimated water supply will meet the projected water demand of 318,586 AF (2035). Based on a multiple-dry year, third year supply (**Table 6-8**), the estimated water supply will meet the projected demands of 281,466 AF (2015); 303,004 AF (2020); 322,166 AF (2025); 334,720 AF (2030); and 346,823 AF (2035).

Therefore, based on the findings from the City's 2010 UWMP and the Water Authority's 2010 UWMP, this project will result in no unanticipated demands.

TABLE 3-1
WATER DEMAND ANALYSIS

Planned Water Demands for the Project Site per the 2010 UWMP				
Category	**Quantity**		**Estimated Potable Water Use**	
			Gallons per Day (gpd)	**Acre-feet per Year (AFY)**
Employees[1]	*230*		***13,800***	***15.5***
Projected Water Demands for The Glen at Scripps Ranch Project				
Buildings	**Square Feet**	**Units/Beds/ Employee/meal**	**Gallons per Day (gpd)**	**Acre-feet per Year (AFY)**
Villas[2]	3,039	64	6,080	6.81
Garden Terrace[3]	4,182	48	2,880	3.23
Independent Living Units[4]	8,394	288	13,248	14.84
Guest Suites (studio)[4,5]	400	4	184	0.21
Total Assisted Living Units		**404**		**25.09**
Skilled Nursing Beds [6]	790	60	7,380	8.27
Acute Assisted Living [6]	1,875	50	6,150	6.89
Total Health Center Units		**110**		**15.1**
Common Dining Hall[7,8]	8,008	520	5,200	5.82
Central Plant[9]	10,066	-	2,374	2.66
Laundry[10]			2,537	2.84
Total Employee for the entire facilities[1,11]		198	11,880	13.31
Landscaping[12]	975,084	-	34,437	38.57
		Total	***92,350***	***103.4***
Net Water Demands			**Acre-Feet per Year (AFY)**	
Projected			103.4	
City of San Diego 2010 UWMP - Planned			15.5	
Planned from Water Authority's Accelerated Forecasted Growth			88.0	
Unanticipated Demands			0.0	

[A] An acre-foot of water equals 325,851 gallons, which is enough water for two average families of four for one year.

[B] Table Notes located on page 6 for the table above.

Conclusion

In summary, these findings substantiate that there is sufficient water supply planned to serve this Project's future water demands within the Department service area in normal, single-dry year, and multiple-dry water year forecasts.

Therefore, this Report concludes that the projected level of water use for this Project is within the regional water resource planning documents of the City, the Water Authority and MWD. Current and future water supplies, as well as the actions necessary to develop these supplies, have been identified in the water resources planning documents of the Department, the Water Authority, and MWD to serve the projected demands of the Project, in addition to existing and planned future water demands of the Department.

Table 3-1 Notes:

1. 60 gallons per person per day is based on City data for employment water use (includes nominal landscaping water use)
2. The average water usage for Villas (95 gallons per day per unit) was provided by the applicant and reviewed by City staff and is based on billing data for two different years from a similar facility
3. The average water usage for Garden Terrace (60 gallons per day per unit) was provided by the applicant and reviewed by City staff and is based on billing data for two different years from a similar facility
4. The average water usage Independent Living (46 gallons per day per unit) was provided by the applicant and reviewed by City staff and is based on billing data for two different years from a similar facility
5. Guest suites are assumed to have water usage equivalent to the Independent Living Units
6. 123 gpd per unit is the City's reviewed estimate for a hospital (skilled nursing and acute assisted) bed
7. Information on estimated number of meals per day based on the person per household in each assisted living unit (1.3 each) and assuming that the residents will have one meal a day every day
8. Restaurant water usage is estimated at 10 gallons per meal/customer per day (Restaurant water usage from using data from Amy Vickers – 'Water Use and Conservation')
9. Based on the estimated water usage at the similar facility (University Village Thousand Oaks)
10. Based on the model specification of the proposed washing machines'
11. Number of employee for the project per the information provided by the applicant

Landscaping water demands are based on the proposed landscape information provided by the applicant and the City's on-line landscaping watering calculator (http://apps.sandiego.gov/landcalc/start.do)

Section 4 - City of San Diego Public Utilities Department

The City of San Diego (City) purchased its initial water system in 1901 from the privately owned San Diego Water & Telephone Company. Since then, continual expansion of the water system has been required to meet the demands of the growing population of the City. To meet the demand, the Public Utilities Department (Department) purchased a number of reservoirs between 1913 and 1935 to supplement local water supplies. Despite low annual precipitation for the area (approximately 10 inches per year), these reservoirs supplied the City's growing demands until 1940.

The need to import water emerged with the increased demand generated by the presence of the United States Navy prior to and during World War II, and the ensuing population growth. As a result, the Department and other local retail water distributors formed the Water Authority in 1944 for the purpose of purchasing Colorado River water from MWD. The Department and other local retail water distributors began receiving imported water from the Colorado River in 1947.

Today, the Department treats and delivers more than 200,000 AFY of water to more than 1.3 million residents. The water system extends over 404 square miles, including 342 square miles in the City. The Department potable water system serves the City and certain surrounding areas, including both retail and wholesale customers. The Project is located within the Department service area.

In addition to delivering potable water, the City has a recycled water program. Its objectives are to optimize the use of local water supplies, lessen reliance on imported water and free up capacity in the potable system. Recycled water provides the City a dependable, year-round, locally produced and controlled water resource.

4.1 Overview of Potable System Facilities

The water system consists of nine raw water storage facilities with over 408,000 AF of storage capacity, three water treatment plants, 28 treated water storage facilities, and more than 3,212 miles of transmission and distribution lines.

The Department maintains and operates nine local surface raw water storage facilities, which are connected directly or indirectly to the City's water treatment operations. The Lower Otay, Barrett, and Morena Reservoirs (135,349 AF total capacity) service the Otay Water Treatment Plant in south San Diego; the El Capitan, San Vicente, Sutherland, and Lake Murray Reservoirs (236,311 AF total capacity) service the Alvarado Water Treatment Plant in central San Diego; and the Miramar Reservoir (6,682 AF total capacity) services the Miramar Water Treatment Plant in north San Diego. Lake Hodges Reservoir has a total capacity of 30,251 AF and is connected to Olivenhain Reservoir, which is owned by Water Authority. Olivenhain Reservoir is connected to the Water Authority's second aqueduct. Through this connection, Hodges water can be delivered to all City treatment plants. The City has the ability to access 50 percent of the local water available in Hodges Reservoir via the Water Authority's delivery system.

The Department maintains and operates three water treatment plants with a combined total rated capacity of 378.4 million gallons per day (MGD). The Miramar Water Treatment Plant (Miramar WTP), originally constructed in 1962, has a rated capacity of 144 MGD with the ability to increase to 215 MGD after the replacement of the two old clearwells in 2016. The Miramar WTP generally serves the City's geographical area north of the San Diego River (north San Diego). The Alvarado Water Treatment Plant (Alvarado WTP), operational since 1951, had an initial capacity rating of 120 MGD. Several hydraulic improvements and upgrades were completed in 2011 which increased the capacity of the plant to 200 MGD. The California Department of Public Health (CDPH) has approved this rating for the Alvarado WTP. The Alvarado WTP generally serves the geographical area from National City to the San Diego River (central San Diego). The Otay Water Treatment Plant (Otay WTP) was constructed in 1940, and has a current rated capacity of 34.4 MGD, which meets current and short-term forecasted demands. The Otay WTP has hydraulic capacity to increase to 40 MGD in the future. In order to do so, approval from CDPH is required, based upon a future high filtration rate study. The Otay WTP generally serves the geographical area bordering Mexico (south San Diego) and parts of the southeastern portion of central San Diego. All upgrade work was completed in 2012 including the construction of a third flocculation and sedimentation basin, filter piping and media improvements.

The Department maintains and operates 28 treated water storage facilities including steel tanks, standpipes, concrete tanks and rectangular concrete reservoirs, with capacities varying from less than one to 35 million gallons.

The water system consists of more than 3,212 miles of pipelines, including transmission lines up to 84 inches in diameter and distribution lines as small as four inches in diameter. Transmission lines are pipelines 16 inches and larger in diameter that convey raw water to the water treatment plants and convey treated water from the water treatment plants to the treated water storage facilities. Distribution lines are pipelines 16 inches and smaller in diameters that directly service the retail users connected to a meter. In addition, the Department maintains and operates 49 water pump stations that deliver treated water from the water treatment plants to approximately 279,557 metered service connections in 128 different pressure zones. The Department also maintains several emergency connections to and from neighboring water agencies, including the Santa Fe Irrigation District (Miramar WTP), the City of Poway (Miramar WTP), Olivenhain Municipal Water District (Miramar WTP), the Cal-American Water Company (Alvarado and Otay WTP's), Sweetwater Authority (Otay WTP), and the Otay Water District (Otay WTP).

4.2 Overview of Recycled System Facilities

The City's recycled water system consists primarily of two water reclamation plants with a combined total wastewater treatment capacity of 45 million gallons per day (MGD), three recycled water storage facilities with over a million gallons (12 MG) of storage capacity, and more than 93 miles of transmission and distribution lines.

Located in the Miramar area, the North City Water Reclamation (NCWRP) treats an average of 16.5 MGD of wastewater, although the plant has an ultimate treatment capability of 30 MGD. In CY 2013, 7.0 MGD of the wastewater flows were treated to a tertiary level and 7.1 MGD was beneficially reused. The Department maintains and operates the Northern Service Area

distribution system which consists of 91 miles of recycled water pipeline, two reservoirs, two pump stations, with service to 574 meters.

Located at the end of Dairymart Road, near the International Border with Mexico, the South Bay Water Reclamation Plant (SBWRP) treats an average of eight (8) MGD of wastewater, although the Plant has a treatment capability of 15 MGD. In CY 2013, an average of 3.9 MGD of the tertiary treated wastewater flows were beneficially reused. The Public Utilities Department maintains and operates the Southern Service Area distribution system which consists of three (3) miles recycled water pipeline, one storage tank, one pump station and seven (7) meters.

Section 5 - Existing and Projected Supplies

The Department relies on imported water as its major water supply source, and is a Water Authority member agency. The Water Authority is a member agency of MWD. The statutory relationships between the Water Authority and its member agencies, and MWD and its member agencies, respectively, establish the scope of the Department's entitlements to water from these two agencies. Due to the Department's reliance on these two agencies, this Report relies and includes information on the existing and projected supplies, supply programs, and related projects of the Water Authority and MWD.

The City relies on the long-term water resources planning documents of the Water Authority and MWD to support the work on this Report. These documents are available at the following websites and contacts:

San Diego County Water Authority

http://www.sdcwa.org/2010-urban-water-management-plan

Dana Friehauf, Principal Water Resources Specialist (858) 522-6749

Metropolitan Water District of Southern California

http://www.mwdh2o.com/mwdh2o/pages/yourwater/ywater01.html#RUWMP

MWD staff, (213) 217-6000

The Water Authority and MWD are actively pursuing programs and projects to diversify their water supply resources. A description of these efforts as well as the challenges facing the Water Authority and MWD can be found in the San Diego County Water Authority Official Statement, dated February 13, 2013, relating to Water Revenue Refunding Bonds 2013A, and MWD's Official Statement, dated March 13, 2014, relating to Water Revenue Refunding Bonds, 2014 Series A. These Official Statements are available at the following websites[1]:

http://www.sdcwa.org/sites/default/files/files/finance-investor/2013Bond.pdf

http://mwdh2o.com/mwdh2o/pages/finance/PDFs/2014-Ser.A-B-FOS.pdf

A brief overview of MWD and the Water Authority, including the Department relationship to these agencies, is included below.

A description of local surface and local recycled water supplies available to the Department can be found in Section 5.4 of this Report.

[A] This information is current at the time this document was prepared.

5.1 Metropolitan Water District of Southern California

MWD was created in 1928, under authority of the Metropolitan Water District Act (California Statutes 1927, Chapter 429, as reenacted in 1969 as Chapter 209, as amended) (the "MWD Act"). MWD's primary purpose is to provide a supplemental supply of wholesale water for domestic and municipal uses to its constituent agencies. The MWD service area comprises approximately 5,200 square miles and includes portions of the six counties of Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura. There are 26 member agencies of MWD, consisting of 14 cities, 11 municipal water districts and the Water Authority. A Board of Directors, currently numbering 37 members, governs MWD. Each constituent agency has at least one representative on the MWD Board. Representation and voting rights are based upon the assessed valuation of property within each constituent agency. The Water Authority has four members on the MWD Board and about 18 percent of the weighted vote. The total population of the MWD service area is currently estimated at approximately 19 million.

MWD's existing water supplies have been historically sufficient to meet demands within its service area during years of normal precipitation. Although MWD plans and manages reserve supplies to account for normal occurrences of drought conditions, regulatory restrictions, including but not limited to restrictions under the Federal and California Endangered Species Acts, have placed limitations on MWD's ability to provide water to its member agencies. In the future, population growth, regulatory restrictions, increased competition for low-cost water supplies, and other factors such as climate change could impact MWD's ability to supply its member agencies even in normal years.

MWD Water Supply

MWD's two major sources of water are from the Colorado River and the State Water Project (SWP).

Colorado River Water: The Colorado River was MWD's original source of water after its establishment in 1928. The Colorado River Aqueduct, which is owned and operated by MWD, is 242 miles long, starting at Lake Havasu and terminating at Lake Mathews in Riverside County. Under applicable laws, agreements and treaties governing the use of water from the Colorado River, California is entitled to 4.4 million acre-feet of Colorado River water annually, plus one-half of any surpluses that may be available for use collectively in Arizona, California and Nevada as declared on an annual basis by the United States Secretary of the Interior. Under the priority system that governs the distribution of Colorado River water made available to California, MWD holds the fourth priority right of 550,000 acre-feet per year and a fifth priority right of 662,000 acre-feet per year. MWD's fourth priority right is within California's basic annual apportionment of 4.4 million acre-feet; however, the fifth priority right is outside of this entitlement and therefore is not considered a firm supply of water. MWD also retains a "call" on 100,000 acre-feet per year on water transferred to the Coachella Valley Water District and the Desert Water Agency, if needed, so long as they pay for the financial obligations associated with the water during the call period.

Several fish species and other wildlife species either directly or indirectly have the potential to affect Colorado River operations, thus changing the amount of water deliveries to the Colorado River Aqueduct. A number of species that are on either "endangered" or "threatened" lists under the federal and/or California endangered species acts ("ESAs") are present in the area of the Lower Colorado River. MWD and other stakeholder agencies have developed a multi-species conservation program that allows MWD to obtain federal and state permits for any incidental take of protected species resulting from current and future water and power operations of its Colorado River facilities and to minimize any uncertainty from additional listings of endangered species.

State Water Project: The SWP is owned by the State of California and operated by the State Department of Water Resources (DWR). The SWP transports Feather River water stored in and released from Oroville Dam and unregulated flows diverted directly from the San Francisco Bay/Sacramento-San Joaquin Delta Estuary ("Bay-Delta") south via the California Aqueduct to four delivery points near the northern and eastern boundaries of MWD. The total length of the California Aqueduct is 444 miles. MWD is one of 29 agencies that have long-term contracts for water service from DWR, and is the largest agency in terms of the number of people it serves, the share of SWP water to which it is entitled, and the total amount of annual payments made to DWR. MWD's contract with DWR provides for the ultimate delivery of 1,911,400 acre-feet per year (46 percent of the total SWP entitlement). The SWP was originally intended to meet demands of 4.2 million acre-feet per year. Initial SWP facilities were completed in the early 1970s, and it was envisioned that additional facilities would be constructed as contractor demands increased. Several factors, including public opposition, increased costs, and increased non-SWP demands for limited water supplies, combined to delay the construction of additional facilities.

The quantity of SWP water available for delivery each year is controlled by hydrology, environmental and operational considerations. In addition to its importance to urban and agricultural water users, the Bay-Delta is of critical ecological importance. The Bay-Delta is the largest estuary on the west coast of the United States and provides habitat for more than 750 plant and animal species. One-hundred-fifty years of human activity have contributed to the destruction of habitat, the decline of several estuarine and anadromous fish species, and the deterioration of water quality. These activities include increasing water demands from urban and agricultural uses, the dredging and filling of tidal marshes, the construction of levees, urban runoff, agricultural drainage, runoff from abandoned mines, and the introduction of non-native species, thus affecting the supply and reliability of this source.

DWR has altered the operations of the SWP to accommodate species of fish listed under the ESAs. These changes in project operations have adversely affected SWP deliveries. The impact on total SWP operations attributable to the Delta smelt and salmon species biological opinions combined is estimated to be one million acre-feet in an average year, reducing SWP deliveries from approximately 3.3 million acre-feet to approximately 2.3 million acre-feet for the year under average hydrology, and are estimated to range from 0.3 million acre-feet during critically dry years to 1.3 million acre-feet in above normal water years. SWP deliveries to contractors for calendar years 2008 through 2012 were reduced by a total of approximately 2.3 million acre-feet as a result of pumping restrictions. Based upon the latest verified information, pumping restrictions that are

impacting the SWP allocations for 2013 have reduced exports by approximately 596,000 acre-feet through calendar year 2013.[B]

As a result of California experiencing the third year of drought and the driest year on record, the DWR announced a 0 percent initial allocation of requested SWP requests for 2014. Due to the late winter storms the state has experienced, that initial allocation was raised to 5 percent in April 2014.[C]

5.2 San Diego County Water Authority

The Water Authority's service area lies within the foothill and coastal areas of the westerly third of San Diego County, encompassing 952,208 acres (1,488 square miles). When the Water Authority was established in 1944, its service area consisted of 94,707 acres. Growth has primarily resulted from the addition and annexation of service areas by member agencies. The City, with 210,726 acres, has the largest service area within the Water Authority's total service area. Of the total population of San Diego County, 97 percent live within the Water Authority's service area. The City represents approximately 43 percent of the total population of the Water Authority's service area.

The Water Authority's service area is a semi-arid region where the natural occurrence of water from rainfall and groundwater provides a firm water supply for only a small portion of the water demands of the current population. Since 1990, the Water Authority has provided an average of 85 percent of the water supply within its service area. As a wholesaling entity, the Water Authority has no retail customers, and only serves its member agencies.

The Water Authority's mission is to provide its service area a safe and reliable water supply. Historically, the principal source of supply for the Water Authority's service area has been water purchased by the Water Authority from MWD for sale to the Water Authority's member agencies. However, drought conditions and population growth in the Water Authority's service area have highlighted the need for diversification of the Water Authority's water supplies. Therefore, consistent with its mission statement, the Water Authority has actively pursued a strategy of supply diversification that includes the acquisition and importation of additional water supplies, the development of additional local water supply projects and augmentation of its water supply via local and regional water storage capacity. Water supplies utilized within the Water Authority service area originate from two sources: (1) water imported by the Water Authority and (2) local supplies (such as local runoff, groundwater, recycled water, and prospectively seawater desalination). Since 1990, local supplies have grown to constitute 15 percent of the Water Authority's water supply, and the Water Authority has implemented programs and supported new technologies in order to assist its member agencies in increasing this percentage. Although MWD remains the Water Authority's largest source of imported water, recent years have also seen the diversification of the Water Authority's sources of imported water through core and spot water transfers with other agencies.

[B] http://mwdh2o.com/mwdh2o/pages/finance/PDFs/2014-Ser.A-B-FOS.pdf

[C] http://www.water.ca.gov/waterconditions/

In late November 2012, the Water Authority's Board of Directors approved a 30-year Water Purchase Agreement with Poseidon Resources, a private investor-owned company, to purchase water from the proposed Carlsbad Desalination Plant, which is a fully-permitted ocean desalination plant and conveyance pipeline. The plant will produce 50 million gallons a day starting in 2016. By 2020, it will generate enough water to meet seven (7) percent of the region's current demands[D]. January 8, 2014 represented the first anniversary of construction putting the project a little more than 25 percent complete. The project is scheduled to be online by early 2016, though deliveries could begin as soon as fall 2015. As of May 29, 2014 the 10-mile pipeline that will connect the Carlsbad Desalination Plant to the San Diego County Water Authority's distribution system is 50 percent complete.

The Quantification Settlement Agreement (QSA) for the Colorado River was completed in October 2003. This historic agreement was enacted to help settle disputes regarding the persistent over-drafting of the state's 4.4 million acre-foot basic annual apportionment of Colorado River water. The agreement includes a long-term transfer of conserved water from the Imperial Irrigation District to the Water Authority. The QSA also commits the state to a restoration path for the environmentally sensitive Salton Sea and provides full mitigation for these water supply programs. Specific programs under the QSA that directly benefit the Water Authority include the San Diego County Water Authority-Imperial Irrigation District water transfer agreement, which currently transfers 100,000 acre-feet of high priority Colorado River water to the Water Authority and will provide up to 200,000 acre-feet of water a year through water conservation measures in Imperial Valley in 2021. The QSA also allows for the transfer of water conserved from the concrete lining of portions of the previously earthen All-American and Coachella Canals from the Imperial Irrigation District. The canal lining projects reduce the loss of water that occurs through seepage. MWD assigned to the Water Authority its right to develop approximately 77,700 acre-feet of conserved Colorado River water annually.

The QSA intended to assure the San Diego region a minimum of 75 years of stable Colorado River water supplies. On November 5, 2003, the Imperial Irrigation District (IID) filed a validation action in Imperial County Superior Court, seeking a judicial determination that 13 agreements associated with the IID/SDCWA water transfer and the QSA are valid, legal and binding. Other lawsuits also were filed contemporaneously challenging the execution, approval and implementation of the QSA on various grounds. All of the QSA cases were coordinated in the Sacramento Superior Court. A final judgment invalidating 11 of the 13 agreements in Phase 1 of the trial was entered on February 11, 2010, and subsequently appealed. On December 7, 2011 the Court of Appeal issued its opinion reversing the judgment and remanding to the trial court for further proceedings. The appellate Court decision resolved many issues in the case, including the validity and constitutionality of the QSA. Trial on compliance with the California Environmental Quality Act was held in November 2012. On June 4, 2013, the court validated the 2003 QSA and related 12 agreements regarding transfers and exchanges of Colorado River water between southern California water agencies. The IID, Coachella Valley Water District, MWD, and

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[D] http://www.sdcwa.org/issue-desal

http://carlsbaddesal.com/

SDCWA all sought validation of the agreements from the court under California Water Code section 22762 and California Code of Civil Procedure section 860 et seq., quantifying the amount of Colorado River water each agency may divert and subsequently transfer. The court found the agreements to be valid and adopted in compliance with the requirements of the Brown Act and the California Environmental Quality Act (CEQA). The ruling represents the latest chapter in the longstanding dispute regarding the diversion and use of California's apportionment of the Colorado River under state and federal law.

The Water Authority has encouraged the development of additional local water supply projects such as water recycling and groundwater projects through the award of Local Water Supply Development ("LWSD") incentives of up to $200 per acre-foot for recycled water and groundwater produced and beneficially reused within the Water Authority's service area. The purpose of the Water Authority's LWSD program is to promote the development of cost-effective water recycling and groundwater projects that prevent or reduce a demand for imported water and improve regional water supply reliability. The LWSD Program reimburses member agencies for all, or a portion of the difference between the actual per acre-foot cost of producing recycled water, and the revenue generated by the LWSD participant through the sale of that acre-foot of recycled water (not to exceed $200 per acre-foot). In February 2008, the program was expanded to include funding for local brackish and seawater desalination projects.

5.3 2009 Comprehensive Water Package

On November 4, 2009, the California State Legislature passed a comprehensive package of water legislation (the "2009 State Water Legislation") that included five bills (four of which were subsequently signed by Governor Schwarzenegger) addressing California's statewide water situation, with particular emphasis on the Bay-Delta. The 2009 State Water Legislation included, among other things, a 20 percent water conservation mandate for most localities in the State by 2020, new regulations regarding voluntary monitoring of groundwater levels by localities, and an $11.1 billion State general obligation bond measure. The water bond measure was originally certified to be on the State's 2010 ballot. The ballot has already been delayed twice, in 2010 and in 2012. However, the date of the ballot measure has since been pushed to November 2014. The 2009 State Water Legislation also created two new governmental agencies – the Delta Stewardship Council and the Sacramento-San Joaquin Delta Conservancy. The Delta Stewardship Council is charged with developing and implementing a Delta Plan, which would include the Bay Delta Conservation Plan, upon meeting certain conditions. The Sacramento-San Joaquin Delta Conservancy will implement ecosystem restoration activities in the Bay-Delta. In addition, the 2009 State Water Legislation included legislation addressing unauthorized Bay-Delta water diversions. At this time, it is not known what effect the 2009 State Water Legislation will have on future water supplies.

As of May 2014, several bills have been introduced aiming to reduce the amount of the original water bond measure, to amounts ranging between six and ten billion dollars. It is expected that one final bill will ultimately be selected and certified for the late 2014 ballot.

5.4 Public Utilities Department

The Department currently purchases approximately 85 to 90 percent of its water from the Water Authority, which supplies the water (raw and treated) through two aqueducts consisting of five pipelines. While the Department imports a majority of its water, it uses three local supply sources to meet or offset potable demands: local surface water, conservation, and recycled water.

The availability of sufficient imported and regional water supplies to serve existing and planned uses within the Department service area is demonstrated in the prior discussion on the water supply reliability of MWD and the Water Authority. The City has been receiving water from the Water Authority since 1947, and during the last 20 years purchased between 100,000 and 228,000 AFY. For Calendar Year 2013 water purchases totaled approximately 185,466 AF. Depending upon demands, growth and the success of local water supply initiatives, this could remain somewhat constant or increase up to a projected maximum of 298,860 AFY in 2035 during normal years. For the purpose of this analysis the maximum is used.

5.4.1 Demonstrating the Availability of Sufficient Supplies

Imported Supplies

Section 5, subdivision 11 of the County Water Authority Act states that the Water Authority "as far as practicable, shall provide each of its member agencies with adequate supplies of water to meet their expanding and increasing needs." Depending on local weather and supply conditions, the Water Authority provides between 75 to 95 percent of the total supplies used by its 24-member agencies. As mentioned in Section 4, the Public Utilities Department and other local retail water distributors formed the Water Authority in 1944 for the purpose of purchasing Colorado River water from the MWD.

Local Surface Water Supplies

The Department maintains and operates nine local surface raw water storage reservoirs which are connected directly or indirectly to water treatment operations. In the San Diego region approximately 13 percent of local precipitation produces surface run-off to streams that supply Department reservoirs. Approximately half of this run-off is used for the municipal water supply, while the remainder evaporates during reservoir storage. In very wet years, the run-off remainder may spill over the reservoir dams and return to the Pacific Ocean. Average rainfall produces less than half of the average run-off in San Diego. The local climate requires about average rainfall to saturate the soils sufficiently for significant surface run-off to occur. Therefore, most of the run-off to reservoirs is produced in years with much greater than average rainfall. Some flooding may occur even during average or below average rainfall years if the annual rainfall is concentrated in a few intense storms.

The use of local water is affected by availability and water resource management policies. The Department's policy is to use local water first to reduce imported water purchases and costs. The Department also operates emergency and seasonal storage programs in conjunction with its policy.

The purpose of emergency storage is to increase the reliability of the imported water aqueduct system. This is accomplished by maintaining an accessible amount of stored water that could provide an uninterrupted supply of water to the City's water treatment facilities should an interruption to the supply of imported water occur. The management of reservoirs is guided by Council Policy 400-04, which outlines the City's Emergency Water Storage Program. The policy mandates that the Department store sufficient water in active, available storage to meet six-tenths of the normal annual (7.2 months) City water demand requirements (conservation is not included). Active, available storage is that portion of the water that is above the lowest usable outlet of each reservoir.

The monthly emergency storage requirement changes from month-to-month, and is based on the upcoming seven months water demand. This results in a seasonally fluctuating emergency storage requirement, generally peaking in May and reaching its minimum in October. This seasonally fluctuating requirement makes a portion of the required emergency storage capacity available for impounding or seasonal storage.

The purpose of seasonal storage is to increase imported water supply. This is done by storing surplus imported water in the wet winter season for use during the dry summer season. This may also be accomplished by increased use of imported water in lieu of local water in the winter when local water may be saved in reservoirs or groundwater basins for summer use. In addition to increased water yield, this type of seasonal operation also reduces summer peaking on the imported water delivery system.

Conservation

The Department's Water Conservation Program is effective in promoting permanent water savings. Established by the City Council in 1985, the Water Conservation Program accounts for more than 35,650 acre-feet of potable water savings per year. This savings has been achieved by creating a water conservation ethic, adopting programs, policies and ordinances designed to promote water conservation practices, and implementing comprehensive public information and education campaigns.

The City offers a broad range of conservation methods to help meet the needs of our residential and commercial water customers. These include, but are not limited to, the following:

- Rebate programs for high efficiency toilets, washing machines and commercial water saving devices
- Rebates for replacing turf with sustainable landscapes and micro-irrigation systems
- Residential interior/exterior and commercial landscape survey programs
- Public education and outreach

Research conducted by the City, the Water Authority, and the Water Research Foundation has shown that more than half of residential water-use is outdoors. Therefore, the City has added outdoor conservation programs to focus on water efficient landscaping and irrigation management, which provide the best opportunity to achieve significant water savings.

Tools and services available for customers include:

- Commercial and Residential Water-Use Survey Programs — account for all water-use, determine leaks, and check irrigation systems for proper function and uniform coverage. Residential surveys average 15 percent water savings, while commercial surveys, depending on type of facility, can achieve 15 percent to 25 percent water savings. The current focus is on multi-family surveys.

- Nationally recognized Landscape Watering Calculator — an on-line tool that creates watering schedules based on landscaping features, soil type, and weather data. The Calculator is very popular [http://apps.sandiego.gov/landcalc/start.do] and those who have used it are impressed with its ease of use. MWD has adopted this tool and it is available throughout Southern California.

- Water Resources Landscape Database — another tool used to create water budgets and manage irrigation using aerial photographs, GIS maps, weather data, etc. This service has generated significant water savings in City parks, freeway landscapes, schools, and homeowner associations.

- New programs in place include incentives to install water efficient irrigation equipment and evapo-transpiration controllers (smart irrigation clocks that use weather data to set watering schedules); as well as incentives to replace turf with sustainable landscapes.

- The Water Conservation Section teamed up with the Transportation & Storm Water Department to include rain barrels as an item that can receive a rebate through the "Outdoor Water Conservation Rebate Program." Rain barrels are used to collect rainwater from hard surfaces such as household rooftops. When citizens install a rain barrel at their home, they are helping to maintain a healthy urban watershed by reducing the demand on the potable water system, while also reducing the amount of wet weather runoff that is collected and sent into the public storm water system.

- 'San Diego Municipal Code (SDMC) 67.06 Water Submeters' was adopted in April 2010, to encourage water conservation in multi-family residential and mixed-use buildings by requiring the use of water submeters for each individual residential unit. Billing individual residential units based on the actual amount of water consumed in the unit creates a financial incentive for residents of multi-family residential units to conserve water.

Planning efforts to increase water conservation is an ongoing process. The aforementioned water conservation programs undergo periodic reevaluation to ensure the realization of forecasted savings. Additionally, changes in water conservation technologies may require reassessment of long-range plans. The Department continues to work with proven water conservation programs, while including irrigation management programs to maximize water savings; regularly examines new technologies and annually checks progress towards conservation goals; and, continues to work collaboratively with MWD and the Water Authority to formulate new conservation initiatives. The City's water conservation report, prepared annually, is available at http://www.sandiego.gov/water/pdf/waterreuse/2013/fy13annualwater130101.pdf. The report provides an ongoing assessment and status update, redirecting or enhancing efforts as needed. The programs outlined in the document undergo periodic reevaluation to ensure the realization of forecasted savings.

Drought Management

On January 17, 2014, California Governor Jerry Brown declared a drought in California. On February 11, 2014, the Metropolitan Water District of Southern California's Board of Directors declared a Water Supply Alert throughout its 5,200-square-mile service area as part of a set of comprehensive actions to address the state's unprecedented dry conditions. Additionally, on February 13, 2014, the San Diego County Water Authority's Board of Directors unanimously called upon the region's residents, businesses and institutions to increase water conservation efforts in response to severe drought conditions across California. The Board also approved notifying the Water Authority's 24-member agencies, including the City of San Diego, which the region is at Level 1 Drought Watch of the Model Drought Response Ordinance.

The City has an extensive list of permanent water use restrictions that are outlined in San Diego Municipal Code Section §67.3803. These restrictions were updated several times during the last California drought. They are in effect every day in San Diego and include the following limitations:

a) no runoff/excessive irrigation;
b) repair leaks upon discovery or within seventy-two hours of notification;
c) no watering of paved areas;
d) no overfilling swimming pools and spas;
e) no non- recirculating decorative water fountains;
f) car washing only in a commercial car wash or using a hose with shutoff nozzle or a bucket;
g) new buildings must recycle cooling system water and car wash water;
h) restaurants will only serve and refill water upon request;
i) hotel guests must have the option of not laundering towels and linens daily;
j) no watering after 10 am and before 4 pm (winter)/before 6 pm (summer);

San Diego's permanent water use restrictions are typically similar to the restrictions many local water agencies implement when they invoke their Level 1 water restrictions.

The City's "Drought Response Level 1 – Drought Watch Condition" is typically invoked when the City Council finds a reasonable probability, that there will be a supply shortage and that a consumer demand reduction of up to ten percent is required in order to ensure that sufficient supplies will be available to meet anticipated demands. The Level 1 Drought Watch Condition adds additional voluntary water conservation measures that are added to the City's existing permanent water restrictions outlined in SDMC §67.3803. These voluntary measures include:

1) landscape irrigation limited to assigned three days per week
2) when watering without an irrigation system a shut-off nozzle or garden hose sprinkler system on a timer is required

3) washing vehicles limited to the same schedule as irrigation (except for: boats which may be washed after use; vehicles with health/safety issues; at a commercial carwash that recycles water)
4) use recycled or non-potable water for construction purposes
5) fire hydrants for firefighting only
6) construction operations can use water only as required by regulatory agencies
7) irrigation is not permitted during rain event

The San Diego City Council invoked a "Drought Response Level 1 – Drought Watch Condition" on May 20, 2014, that will go into effect on July 1, 2014.

Recycled Water Supplies

In CY 2013, the beneficial reuse of the recycled water was 12,205 AF: 7,877 AF from the NCWRP and 4,328 AF from the SBWRP. Although landscape irrigation continues to be the leading use of the recycled water, the customer base has become more varied over the years with an increase in the number of industrial and dual plumbed meter connections.

Proactive marketing activities targeting existing irrigation customers, to encourage them to convert their cooling systems to recycled water, coupled with outreach efforts to connect new customers have been successful, as recycled water meter connections have increased over 41 percent since 2007. As of December 2013, the City provides recycled water service to 576 retail meters and 4-5 wholesale meter connections, including the City of Poway, Olivenhain Municipal Water District (3 connections) and Otay Water District. The 2013 top ten retail customers included the City of San Diego Park & Recreation Department, Miramar Marine Corps Air Station Miramar, Black Mountain Ranch and Santa Luz HOA, Caltrans, El Camino Memorial Park, U.S. International Boundary & Water Commission, The Irvine Company, Qualcomm, Village Nurseries (Miramar Nursery) and the City of San Diego's Miramar Landfill.

In CY 2013, financial incentives from the sale of recycled water resulted in nearly $2.85 million in savings towards imported water purchases. The financial incentives are a result of local water resources development agreements with Metropolitan Water District and the San Diego County Water Authority.

The Department, in cooperation with the Park & Recreation Department, has aggressively pursued the retrofitting of City parkland, street landscaping and open space to use recycled water for irrigation; sites fronting recycled water distribution pipelines were targeted. In 2007 only 23 recycled water meters were serving City sites; as of March 2014 that number has grown to 84 meter connections. The Departments are currently working on retrofitting four additional parks/open spaces. The irrigation retrofits are funded in part by Federal and State grants.

Public Utilities Department's Capital Improvement Program

The Department reevaluates the Water projects contained in the Capital Improvements Program (CIP) and the timing thereof periodically. Changes to the CIP are made to reflect changing priorities within the water system and occur as a result of project scope changes, date revisions,

project sequencing, and operational considerations. The Public Utilities Department expended approximately $840 million from July 1, 2003 through June 30, 2013 on CIP projects. Improvements included projects to upgrade and expand water treatment plants, rehabilitate raw and treated water storage facilities, construct major transmission pipelines, replace and/or upgrade existing pump stations, replace cast iron water mains citywide, expand the recycled water system, and other new supply initiatives. In November 2013, the City Council adopted water rate increases of 7.25% beginning on January 1, 2014 and 7.5% beginning on January 1, 2015. These rate increases provided needed revenue to fund the upgrade and expansion of the water system in order to ensure a reliable water supply for all City residents and meet Department of Public Health mandates.

In 2009, the Department initiated a facilities master plan to identify long-term facility needs. With the completion of the water master plan in 2011, over 80 projects were identified through the master planning effort for CIP implementation of fiscal years 2012-2032. Project scopes were developed from facility condition assessments and system evaluations. The prioritization of CIP projects are based on the adopted City Council Policy 800-14 (CP 800-14) as well as inputs from Independent Rates Oversight Committee members and operational staff. The list of prioritized projects will be the basis for 2012-2032 CIP program.

Summary of Supplies

Historic imported water deliveries from the Water Authority to the Public Utilities Department and local surface water, conservation savings and recycled water deliveries are shown in **Table 5-1.**

Table 5-1
Historic Imported, Local and Recycled Water Demands*
Public Utilities Department (Source: 2010 UWMP)

Fiscal Year	Imported Water (acre-feet)	Local Surface Water (acre-feet)	Conservation[1] (acre-feet)	Recycled Water (acre-feet)	Total[2] (acre-feet)
1990	233,158	22,500	-	-	255,658
1995	162,404	59,024	8,914	-	230,342
2000	207,874	39,098	17,410	3,250	267,632
2005	204,144	26,584	29,410	4,294	264,432
2010	188,337	13,117	34,317	12,173	247,944

Table 5-1 Notes:

[1]Conserved water results in savings and is not a direct supply.
[2]Total includes water supplied and conserved.
*Includes retail and wholesale demands

5.4.2 Plans for Acquiring Additional Supplies

Future Supplies

In 2002, the City of San Diego City Council adopted the Long-Range Water Resources Plan (Long-Range Plan) 2002-2030. This plan provides a decision-making framework for evaluating water supply options. The Long-Range Plan identifies water conservation, water recycling, groundwater desalination, groundwater storage, ocean desalination, marine transport, water transfers, and imported supply from the Water Authority and MWD as potential near-term and long-term supplies. The Long-Range Plan concluded that no single supply source would be sufficient to meet the City's future water demands, but a portfolio of supply options would reduce the dependence upon imported water over time.

The Department completed the City Council approved 2012 Long-Range Water Resources Plan (2012 LRWRP) on December 10, 2013. The 2012 LRWRP is a high level strategy document that evaluates water supply and demand-side objectives against multiple planning objectives. The 2012 LRWRP was an open participatory – stakeholder driven process that evaluated over 20 water supply options such as water conservation, recycled water, groundwater storage, brackish groundwater desalination, rainwater harvesting, graywater and potable reuse. The plan takes a long-range viewpoint through the year 2035 in addressing risk and the uncertainty of future water supply conditions. It is a plan that sets the tone or direction of where the City places its efforts in developing local water supplies.

Conservation and water recycling programs have been implemented and are under investigation for ways to be expanded or increased. The Department is also investigating the development of groundwater and potable reuse.

Conservation

Like many agencies in California, the City is committed to reducing its per capita water consumption by at least 20 percent by the year 2020. Aside from the existing programs listed in Section 5.4.1 of this report, the City is also evaluating the following programs to help reduce overall water consumption:

- Water budget based billing for irrigation only customers - An effort is currently underway to evaluate billing irrigation customers based on their ability to meet property specific water use budgets, and implement a tier rate structure that encourages usage within water budgets.

- Conservation-oriented rate structures - The new rate structure, which took effect in January 2014, adds a new tier that recognizes water conservation efforts, and increases the rates for higher tiers to discourage high volume usage.

- Automated Meter Interface - The City is starting to install smart water meters in monthly billed accounts. These meters allow remote access to consumption patterns via a web portal, and give water customers data that they can monitor and use to manage better their water consumption.

Recycled Water

Recycled Water Study:

The Recycled Water Study was presented to and unanimously accepted by the City Council on July 17, 2012, following a three-year effort that included extensive stakeholder involvement. The Study can be located at the following link:

http://www.sandiego.gov/water/pdf/waterreuse/2012/recycledfinaldraft120510.pdf.

During the 2008 to 2010 Point Loma Wastewater Treatment Plant (Point Loma) permit modification process, San Diego Coastkeeper and the San Diego Chapter of the Surfrider Foundation entered into a Cooperative agreement with the City to conduct the Recycled Water Study (Study). In accordance with the agreement, the San Diego Coastkeeper and the San Diego Chapter of the Surfrider Foundation did not oppose the United States Environmental Protection Agency's (USEPA) decision to grant the permit modification. The City Council authorized the execution of the Cooperative Agreement on February 18, 2009. The modified Permit allows Point Loma to continue operating as a chemically enhanced primary treatment facility (CEPT) for five years until July 31, 2015 when the permit must be renewed rather than upgrading the treatment system to meet secondary standards as required in the federal Clean Water Act. The Study concluded meeting all terms of the Agreement with Coastkeeper and Surfrider.

The Recycled Water Study identified five (5) Reuse Alternatives. Non-Potable Reuse, Indirect Potable Reuse, and wastewater off-load to the Point Loma are the common components of each of the five alternatives. All reuse alternatives presented in the study achieve the study goals, provide a bold vision for the future water reuse in the Metro Service Area, and provides potential savings to ratepayers. For additional details on the Reuse Alternatives, please see the Recycled Water Study Report Dated July 2012 in the above link.

Potable Reuse:

Potable Reuse is an approach the City is considering for maximizing the use of recycled water. Recycled water that is used for non-drinking uses like irrigation and industrial processes, would undergo advanced water purification (AWP) to render it safe for reuse as a drinking water supply. The AWP process uses multiple treatment barriers to remove contaminants from the water and prevent them from re-entering the water supply. It begins with membrane filtration, followed by reverse osmosis, and ends with advanced oxidation. The result is purified water that meets all drinking water standards and is similar in quality to distilled water.

There are two major types: Indirect Potable Reuse (IPR) and Direct Potable Reuse (DPR). With IPR, the purified water is sent to an environmental buffer; for the City's IPR concept, San Vicente Reservoir would be the environmental buffer. The water in San Vicente is treated at a drinking

water treatment plant before it is distributed for drinking purposes. Direct potable reuse differs in that there is no environmental buffer. The California Department of Public health is mandated to determine the feasibility of establishing DPR regulations. Industry experts expect that DPR regulatory criteria to include the use of additional treatment or engineered storage barriers to compensate for the absence of an environmental buffer. The City monitoring the development of DPR regulations and how they might influence the viability of potable reuse implementation.

Water Purification Demonstration Project:

In order to assess the feasibility of indirect potable reuse with reservoir augmentation (IPR/RA), the City initiated a Water Purification Demonstration Project (Demonstration Project). The Demonstration Project evaluated the feasibility of using advanced water purification (AWP) technology to produce water that can be sent to San Vicente Reservoir, subsequently treated, and later be distributed as potable water.

As part of the Demonstration Project, the City tested and operated a one-million gallon per day demonstration-scale AWP Facility from June 2011 to August 2012. The purified water was routinely tested to determine the effectiveness of the treatment equipment and operating data was gathered to develop a cost estimate for full-scale facilities. A study of San Vicente Reservoir was also conducted to establish residence time and short circuiting conditions of the purified water in the reservoir. An extensive public outreach and education program was implemented to educate the public about the potential benefits and implications of an IPR/RA project. The City also coordinated with the State's regulatory agencies to help define the requirements for an IPR/RA project. The Final Project reports have been completed and are available at the following link: www.purewatersd.org/projectreports . The Demonstration Project reports were presented to full City Council on April 23, 2013. The City Council adopted the Demonstration Project Reports and directed staff to determine a preferred implementation plan and schedule that considers potable reuse options for maximizing local water supply and reduced flows to the Point Loma Wastewater Treatment Plant. This follow on effort, now known as the Pure Water San Diego Program, is described in more detail below.

Pure Water San Diego Program:

The Department's Pure Water San Diego Program (Program) is a 20-year program ending in year 2035. The program will create a safe and reliable local water supply through potable reuse, while reducing the Point Loma Wastewater Treatment Plant's ocean discharges and accomplishing secondary equivalency.

Department staff have initiated technical studies to refine system-wide reuse concepts development in the Recycled Water Study (July 2012), are developing a cost-sharing framework, serving on an advisory group to an Expert Panel on Direct Potable Reuse (DPR) and Recycled Water, and are continuing tours of the Advanced Water Purification Facility, speakers bureau presentations and community events participation.

In addition to the above, Department staff is engaged in the preparation of the National Pollution Discharge Elimination Permit (modified permit) for Point Loma which expires July 31, 2015. The

draft modified permit application will be brought forward for City Council consideration in fall 2014. Staff is also developing a regulatory and legislative strategy related to Point Loma that will require City Council input and involvement.

The Department is working on implementing the various facets of the Pure Water San Diego Program. Implementation strategy tasks include facility siting studies, engaging key regulatory agencies to develop a modified NPDES permit renewal application which secures long-term compliance with discharge standards at Point Loma through potable reuse and secondary equivalency, and establishing a financing plan and cost-sharing principles with other public agencies that use the City's wastewater system.

This comprehensive effort will provide a secure and reliable long-term local water supply for San Diego while resolving the decade's long issues associated with Point Loma.

Groundwater

There are several groundwater basins in the San Diego region that the City has rights, concerns jurisdiction or otherwise an interest in developing for municipal supply or other beneficial use. These basins are:

- San Pasqual Basin
- Mission Valley Basin
- El Monte/Santee Basin
- Tijuana Basin
- San Diego Formation

The groundwater quality from these basins is predominantly brackish. Improved technologies provide consideration of affordable water sources, such as brackish groundwater, that were not available a few decades ago. This source is a viable alternative and is part of the City's planning efforts. Local water supply projects, particularly groundwater exploration, benefit City rate payers, offer drought protection, and are locally controlled. The City is presently pursuing groundwater feasibility projects in Mission Valley Basin, El Monte/Santee Basin, and the San Diego Formation.

The City is the Monitoring Entity for the San Pasqual Basin as identified under the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Working cooperatively with the California Department of Water Resources (DWR), the City established a network of monitoring wells to regularly and systematically track seasonal and long-term trends in groundwater elevations for this alluvial groundwater basin. Included in this monitoring network are three multi-level monitoring wells in San Pasqual installed by the United States Geological Survey under a cooperative hydrogeological agreement with the City. Participation in the statewide CASGEM program allows basin groundwater data to be maintained and readily available through DWR's public data base.

A Salinity and Nutrient Management Plan (SNMP) is being developed for the San Pasqual Basin to identify excessive salt and nutrient loading for protection of groundwater quality for agriculture, potable water supply and other beneficial groundwater uses. In compliance with the adopted State

Water Resources Control Board's (State Board) Recycled Water Policy 2009 to complete SNMPs by May 30, 2014, the City facilitated a stakeholder driven basin-wide approach to complete this effort. The City has submitted the SNMP on May 29, 2014. The SNMP incorporates framework components from the SNMP guidelines *(Salinity/Nutrient Management Planning in the San Diego Region (9), Welch 2010)* adopted by the State Board.

The San Diego City Council adopted the San Pasqual Groundwater Management Plan (GMP) in 2007. Several management actions outlined in the GMP are currently being implemented and will continue in the future. For the next several years, basin activities such as surface water and groundwater monitoring programs, water quality testing, basin water budget, and basin capacity studies will be the focus for understanding, protecting and evaluating the long-term sustainable use of the San Pasqual Basin as a water supply source.

The City has been investigating Mission Valley Aquifer. Mission Valley is a narrow, east-west trending valley carved out by the San Diego River as it drains westward from Mission Gorge to the Pacific Ocean. The most conductive portion of the aquifer lies within the extent of an historical well field where the City has retained ownership of the property and where a substantial portion is overlain by Qualcomm Stadium and its parking lot. Part of the history is the establishment of the City's pueblo water right, a prior and paramount right to all of the water of the San Diego River (surface and underground). A fuel tank farm was built in Mission Valley at the mouth of Murphy Canyon in 1963 know as Mission Valley Terminal (MVT). Underground fuel contamination was suspected to being in 1986. From 1986 to 1991 approximately 200,000 gallons of gasoline leaked from the tank farm known as the Mission Valley Terminal located upstream of Qualcomm Stadium. Although remediation of the Mission Valley Aquifer has been ongoing for a period of time, the City is waiting for remediation to be complete before resuming its plans for development of the aquifer for municipal supply.

The City desires to use the San Diego Formation for groundwater municipal supply and seeks to manage the safe yield of the aquifer system in a prudent and efficient manner. The City has been engaged in investigating to gain a better understanding of the San Diego Formation Basin for many years. The City will be able to better characterize the water quality and quantity in the groundwater basin through monitoring wells installed in 2007, 2008, 2011 and 2012. In addition, the City has been working with the United States Geological Survey to develop an integrated and comprehensive understanding of the geology and hydrology of the San Diego Formation, and to use this understanding to evaluate a sustainable, long-term environmental sound use of the formation for municipal supply.

The City has been producing groundwater from the Santee – El Monte basin from two municipal supply wells. One well is located just downstream of the San Vicente Reservoir and the other is located just downstream of the El Capitan Reservoir. The City is evaluating the expansion of its groundwater production facilities at each location to maximize yield. The City's existing San Vicente Production well was constructed in 2004 and pumps a maximum of 600 gallons per minute. The well conveys groundwater directly to the City's existing raw water line from the reservoir and ultimately to the City's Alvarado Treatment Plant. The well located just downstream of the El Capitan reservoir. This well is installed in a granitic rock formation and extracts water

from a fractured rock system at an average yield of 50 gallons per minute. This well also conveys groundwater to a raw water pipeline coming from the dam to supply the Alvarado Treatment Plant.

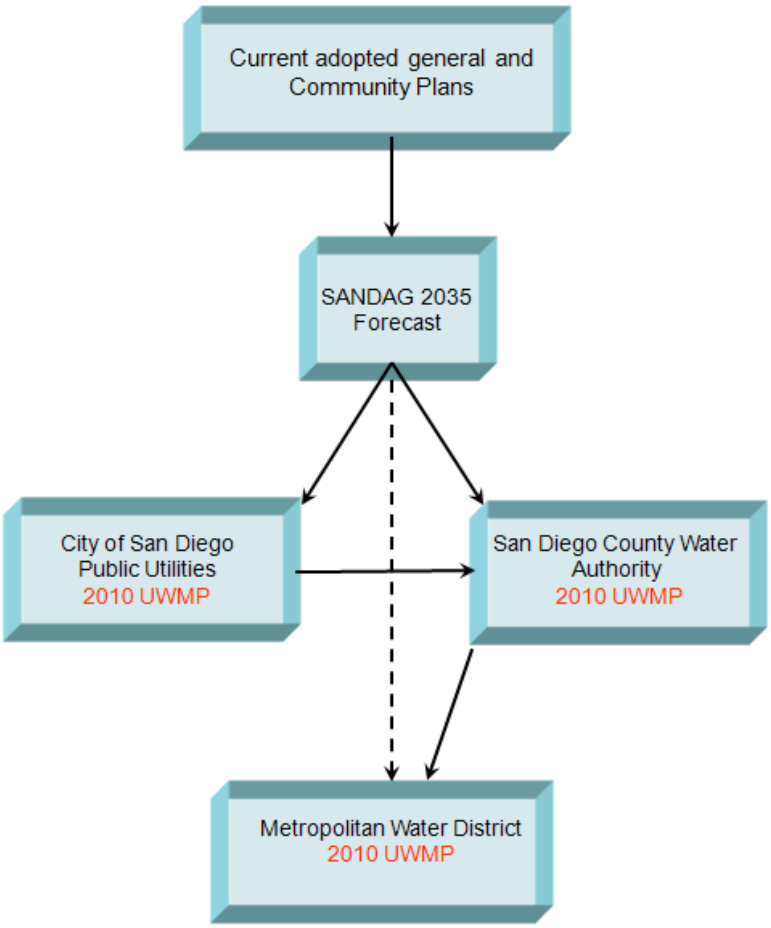
Section 6 - Projected Demands

Approximately every three years the Public Utilities Department (Department) calculates projected water demands within its service area for planning purposes. A computer model is used (IWR-MAIN) to break down water-use by major water-use sectors: Commercial, Industrial, Residential and Public uses. Using past water-use data from the Department and demographic data provided by SANDAG land use, the model is able to correlate the data to determine sector water demands. Using this correlated data, future demographic data is used to project water demands. The model also accounts for water conservation, weather and water rate changes.

In addition to the Department, the Water Authority and MWD use regional growth forecasts to calculate projected water demands within their respective service areas. This provides for consistency between the retail and wholesale agencies projected water demands, thereby ensuring that adequate supplies are being planned for the Department's existing and future water users. The SANDAG forecasts are based on adopted community plan land use, but not citywide zoning. SANDAG forecasts the number of residents, dwelling units, and employees in an area, but not square footage, hotel rooms, or visitors (non-residents or non-employees). For urban areas the smallest forecast geography is typically at the block level, but for suburban and less developed areas the forecast geography can be larger. SANDAG typically updates the regional growth forecast every three to four years. The Public Utilities Department water demand projections, based on the SANDAG Series 12 Forecast land use, are incorporated in the City's 2010 UWMP. These projections are then forwarded to the Water Authority for use in the preparation of their UWMP, which is further incorporated into MWD's UWMP to calculate the ultimate water demands of the region (see **Figure 6-1**).

The Department updates its UWMP every five years. The 2010 UWMP, originally scheduled for completion in December 2010, was completed and adopted in June 2011. The time extension granted for the completion of the 2010 UWMP was due to the new SBX7-7 reporting requirement that needed to be incorporated into the 2010 UWMP. SBX7-7, which is part of the 2009 Water Legislation, requires urban water agencies to reduce statewide per capita water consumption 20 percent by 2020.

FIGURE 6-1
WATER DEMAND PROJECTIONS



The demands from the 2010 UWMP are used throughout this Report. The historical and projected water demands for a normal year are shown in **Table 6-1**.

As part of the requirements for complying with SB 610, **Table 6-7** and **Table 6-8** show the single-dry year and consecutive multiple-dry year demands. All tables in this section are based on data from the 2010 UWMP.

TABLE 6-1
PAST, CURRENT, AND PROJECTED WATER DELIVERIES
(AFY)

Water Use Sector	2005				
	Metered		Unmetered		Total Volume (AFY)
	# Accounts	Volume (AFY)	# Accounts	Volume (AFY)	
Single-family	217,983	77,864	0	0	77,864
Multi-family	28,443	39,220	0	0	39,220
Commercial	14,468	33,099	0	0	33,099
Industrial	253	4,276	0	0	4,276
Institutional/Governmental	2,341	16,842	0	0	16,842
Landscape Irrigation	7,245	27,877	0	0	27,877
Total	270,733	199,178	0	0	199,178

Source: City of San Diego Public Utilities Report U02-P10715.

Water Use Sector	2010				
	Metered		Unmetered		Total Volume (AFY)
	# Accounts	Volume (AFY)	# Accounts	Volume (AFY)	
Single-family	220,862	62,367	0	0	62,367
Multi-family	28,361	36,324	0	0	36,324
Commercial	14,542	27,244	0	0	27,244
Industrial	186	2,325	0	0	2,325
Institutional/Governmental	2,321	13,774	0	0	13,774
Landscape Irrigation	7,327	20,257	0	0	20,257
Total	273,599	162,291	0	0	162,291

Source: City of San Diego Public Utilities Report U02-P100715.

Table 6-1, Continued

Water Use Sector	2015				
	Metered		Unmetered		Total Volume (AFY)
	# Accounts	Volume (AFY)	# Accounts	Volume (AFY)	
Single-family	231,346	75,922	0	0	75,922
Multi-family	32,082	47,266	0	0	47,266
Commercial	14,376	31,617	0	0	31,617
Industrial	186	2,071	0	0	2,071
Institutional/Governmental	2,302	13,359	0	0	13,359
Landscape Irrigation	7,583	25,452	0	0	25,452
Total	287,587	195,688	0	0	195,688

Water Use Sector	2020				
	Metered		Unmetered		Total Volume (AFY)
	# Accounts	Volume (AFY)	# Accounts	Volume (AFY)	
Single-family	236,639	79,992	0	0	79,992
Multi-family	37,330	56,700	0	0	56,700
Commercial	14,783	33,541	0	0	33,541
Industrial	186	2157	0	0	2157
Institutional/Governmental	2,302	13,772	0	0	13,772
Landscape Irrigation	7,869	27,247	0	0	27,247
Total	298,582	213,409	0	0	213,409

Water Use Sector	2025		2030		2035	
	Metered		Metered		Metered	
	# Accounts	Volume (AFY)	# Accounts	Volume (AFY)	# Accounts	Volume (AFY)
Single-family	241,491	83,370	244,138	85,633	245,682	86,471
Multi-family	42,662	66,070	47,910	75,328	52,420	82,781
Commercial	14,681	34,012	14,100	33,116	13,853	32,740
Industrial	176	2,077	166	1,995	166	1,967
Institutional/Governmental	2,247	13,639	2,172	13,399	2,154	13,329
Landscape irrigation	8,192	28,893	8,162	29,301	8,543	30,698
Total	308,505	228,061	315,534	238,772	321,337	247,986

Table 6-2 summarizes the current and planned water sources the City is relying on to meet future demands.

TABLE 6-2
PLANNED WATER SUPPLY SOURCES
(AFY)

Water Supply Sources	Wholesaler Supplied Volume (yes/no)	2015	2020	2025	2030	2035
San Diego County Water Authority	Yes	201,719	221,458	237,622	249,728	260,107
Supplier produced surface water [(a)]		29,000	29,000	29,000	29,000	29,000
Supplier produced groundwater		500	500	500	500	500
Transfers In		0	0	0	0	0
Exchanges In		0	0	0	0	0
Recycled Water [(b)]		9,253	9,253	9,253	9,253	9,253
Desalinated Water		0	0	0	0	0
Other		0	0	0	0	0
Total		240,472	260,211	276,375	288,481	298,860

Notes:

[(a)] Local surface water estimates provided by City, 2011.

[(b)] Recycled water excludes recycled water sold to other agencies and is from table entitled, "NCWRP and SBWRP Summary of Baseline Demands", provided by the City on April 22, 2011.

6.1 Water Sales to other Agencies

Potable Water

The City, through past agreements, sells treated water to the California American Water Company (Cal-Am) which provides water service to the cities of Coronado and Imperial Beach, and Naval Air Station North Island. The population of Naval Station North Island is located within the City of Coronado, whereas the other military bases that the City serves are within the City. The City also sells untreated water to Santa Fe Irrigation District and San Dieguito Water District. **Table 6-3** presents the water sales to other agencies.

Per the agreement between the City and Cal-Am, only local surface water is sold to Cal-Am to provide water to supply Cal-Am customers. A portion of City residents in the South Bay area are also served by Cal-Am and can be served by imported water as well. Per the agreement between the City and the City of Del Mar, the City takes deliveries of water, which the City of Del Mar purchases from the Water Authority, through the Second Aqueduct Connection at Miramar. This water is then treated at the City's Miramar WTP and transported to the City of Del Mar through several interconnections.

The City has agreements to provide surplus treated water to Otay Water District and untreated exchange water to Ramona Municipal Water District. These water deliveries occur infrequently and for short periods of time, and are therefore not shown in **Table 6-3**.

TABLE 6-3
SALES TO OTHER AGENCIES-POTABLE
(AFY)

Water Distributed	2005	2010	2015	2020	2025	2030	2035
California American Water Company	13,311	11,462	13,153	13,395	13,452	13,757	13,988
Santa Fe Irrigation District and San Dieguito Water District [(a)]	2,012	7,227	7,596	7,983	8,391	8,819	9,268
City of Del Mar [(b)]	1,324	1,058	1,112	1,168	1,228	1,290	1,356
Naval Air Station North Island	1,204	1,568	1,568	1,568	1,568	1,568	1,568
Total	14,515	13,030	14,721	14,963	15,020	15,325	15,556

Notes:

[(a)] Through a joint agreement, the City supplies raw water from local surface water supplies to Santa Fe Irrigation District/San Dieguito Water District, and treated water to the other agencies. This water supply is not included in total since the supply is not included in the local surface water supply.

[(b)] City of Del Mar not included in total as the City is treating water for Del Mar that is provided by Water Authority.

Recycled and Non-Revenue Water

The City has three separate agreements to sell recycled water. Olivenhain Municipal Water District and the City of Poway are provided recycled water from the City's North City Water Reclamation Plant while Otay Water District receives recycled water from the City's South Bay Water Reclamation Plant.

Non-Revenue Water (NRW) is water that is unaccounted for or unbilled water consumption. Unaccounted for water can be attributed to unauthorized consumption, meter inaccuracies, data errors, leakage on mains, leakage and overflow at storage and leakage at service connections. Using metered demand and total City delivered values; NRW was computed as 8.2 percent in 2012. Water use for firefighting, line flushing and other authorized, but unbilled use is classified in the computation of NRW as unbilled consumption.

City staff deemed it reasonable to assume this percent system loss could be maintained in future years given the City's aggressive program of leak detection and repair. The City is going forward with an automated meter reading system that could improve billing accuracy, better quantify real versus apparent losses and identify customer leaks. Thus, NRW is held constant in the projections at 9.0 percent for forecast years. **Table 6-4** represents the City's additional water uses (recycled water) and NRW.

TABLE 6-4
ADDITIONAL WATER USES AND LOSSES
(AFY)

Water Use	2005	2010	2015	2020	2025	2030	2035
Recycled water	4,294	7,656	9,253	9,253	9,253	9,253	9,253
Non-revenue water	10,404	21,909	20,810	22,586	24,041	25,131	26,065
Total	14,698	29,565	30,063	31,839	33,294	34,384	35,318

Notes:

1. *Source for recycled water: 2005 from Table 2-8 of the City's 2005 Urban Water Management Plan. 2010 from NCWRP and SBWRP beneficial reuse summary tables with wholesale deliveries excluded provided by the City on March 2, 2011. 2015 and later from table entitled, "NCWRP and SBWRP Summary of Baseline Demands", provided by the City on April 22, 2011.*
2. *Recycled water is City use only and excludes recycled water sold to other agencies.*
3. *Source for non-revenue water: For 2005, Table 2-8 of the City's 2005 Urban Water Management Plan with 4.3% assumption. For 2010 to 2035, City of San Diego Public Utilities, Update of Long-Term Water Demand Forecast, Table 6-5, Water Demand Forecast with Normal Weather, June 2010.*

Table 6-5 is a summary of and displays City's past water use from 2005 and 2010 with projected water use shown for 2015 thru 2035.

TABLE 6-5
TOTAL WATER-USE
(AFY)

Water Distributed	Total Water Use (AFY)						
	2005	2010	2015	2020	2025	2030	2035
Total Water Deliveries (Table 6-1)	199,178	162,291	195,688	213,409	228,061	238,772	247,986
Sales to Other Water Agencies (Table 6-3)	14,515	13,030	14,721	14,963	15,020	15,325	15,556
Additional Water Uses and Losses (Table 6-4)	14,698	29,565	30,063	31,839	33,294	34,384	35,318
Total	228,391	204,886	240,472	260,211	276,375	288,481	298,860

The analysis in **Table 6-6** below compares the projected normal water supply and customer demands from 2010 to 2035, in five-year increments.

TABLE 6-6
PROJECTED NORMAL SUPPLY AND DEMAND COMPARISON
(AFY)

	2015	2020	2025	2030	2035
Supply totals	240,472	260,211	276,375	288,481	298,860
Demand totals	240,472	260,211	276,375	288,481	298,860
Difference (supply minus demand)	0	0	0	0	0

6.2 Projected Single-dry Year Water Supply and Demand

Table 6-7 provides a comparison of a single-dry year water supply with projected total water use over the next 25 years, in five-year increments. The City's demands in single-dry years are projected to be higher similar in proportion to the increase in regional water demands projected in the Water Authority's 2010 UWMP. An increase in use for landscape irrigation accounts for most of the increase in demands. It is assumed that recycled water demands would not increase in single-dry years. The wholesale water supplies from the Water Authority are assumed to increase to meet the difference between the City's increased water demands and reduced local water supplies.

TABLE 6-7
PROJECTED SINGLE-DRY YEAR SUPPLY AND DEMAND COMPARISON
(AFY)

	2015	2020	2025	2030	2035
Supply totals	255,040	276,526	293,895	307,230	318,586
Demand totals	255,040	276,526	293,895	307,230	318,586
Difference (supply minus demand)	0	0	0	0	0

6.3 Projected Multiple-dry Year Water Supply and Demand

Table 6-8 compares the total water supply available in multiple-dry water years with projected total water use over the next 25 years. The City's demands in multiple-dry years are projected to be higher similar in proportion to the increase in regional water demands projected in Water Authority's 2010 UWMP. It is assumed that recycled water demands would not increase in multiple-dry years. The wholesale water supplies from Water Authority are assumed to increase to meet the difference between the City's increased water demands and reduced local water supplies. Multiple-dry year scenarios represent hot, dry weather periods which may generate urban water demands that are greater than normal.

No extraordinary conservation measures are reflected in the demand projections. The recycled water supplies are assumed to experience no reduction in a dry year.

TABLE 6-8
PROJECTED SUPPLY AND DEMAND COMPARISON DURING MULTIPLE DRY YEAR PERIOD ENDING IN 2035
(AFY)

		Supply and Demand Comparison – Multiple-dry Year Events				
		2015	2020	2025	2030	2035
Multiple-dry year First year supply	Supply totals	257,587	278,451	296,319	309,230	320,382
	Demand totals	257,587	278,451	296,319	309,230	320,382
	Difference	0	0	0	0	0
Multiple-dry year Second year supply	Supply totals	267,323	288,723	306,726	320,467	332,038
	Demand totals	267,323	288,723	306,726	320,467	332,038
	Difference	0	0	0	0	0
Multiple-dry year Third year supply	Supply totals	281,466	303,004	322,166	334,720	346,823
	Demand totals	281,466	303,004	322,166	334,720	346,823
	Difference	0	0	0	0	0

Section 7 - Conclusion - Availability of Sufficient Supplies

The Project is consistent with water demand assumptions in the regional water resource planning documents of the City, the Water Authority and MWD. The Public Utilities Department receives the majority of its water supply from MWD through the Water Authority. In addition, MWD and the Water Authority have developed water supply plans to improve reliability and reduce dependence upon existing imported supplies. MWD's Regional Urban Water Management Plan and Integrated Resources Plan, the Water Authority's 2010 UWMP and annual water supply report include projects that meet long-term supply needs through securing water from the State Water Project, Colorado River, local water supply development and recycled water.

The forecasted normal year water demands compared with projected supplies for the Public Utilities Department are shown in **Table 7-1**. This demonstrates that with existing supplies and implementation of the projects discussed in the three agencies' planning documents there will be adequate water supplies to serve all anticipated growth (existing and future planned uses) and development.

TABLE 7-1
PROJECTED SUPPLY AND DEMAND COMPARISON – NORMAL YEAR
(AFY)

	2015	2020	2025	2030	2035
Supply totals	240,472	260,211	276,375	288,481	298,860
Demand totals	240,472	260,211	276,375	288,481	298,860
Difference (supply minus demand)	0	0	0	0	0

Table 7-2 provides a comparison of a single-dry year water supply with projected total water use over the next 25 years, in five-year increments.

TABLE 7-2
PROJECTED SINGLE-DRY YEAR SUPPLY AND DEMAND COMPARISON
(AFY)

	2015	2020	2025	2030	2035
Supply totals	255,040	276,526	293,895	307,230	318,586
Demand totals	255,040	276,526	293,895	307,230	318,586
Difference (supply minus demand)	0	0	0	0	0

The multiple-dry year scenarios, within a 20-year projection, are shown in **Table 7-3**. This demonstrates that supplies will be adequate to meet all anticipated growth (existing and future planned uses) and development in multiple-dry year periods.

TABLE 7-3
PROJECTED SUPPLY AND DEMAND COMPARISON DURING MULTIPLE DRY YEAR PERIOD ENDING IN 2035
(AFY)

		Supply and Demand Comparison – Multiple-dry Year Events				
		2015	2020	2025	2030	2035
Multiple-dry year First year supply	Supply totals	257,587	278,451	296,319	309,230	320,382
	Demand totals	257,587	278,451	296,319	309,230	320,382
	Difference	0	0	0	0	0
Multiple-dry year Second year supply	Supply totals	267,323	288,723	306,726	320,467	332,038
	Demand totals	267,323	288,723	306,726	320,467	332,038
	Difference	0	0	0	0	0
Multiple-dry year Third year supply	Supply totals	281,466	303,004	322,166	334,720	346,823
	Demand totals	281,466	303,004	322,166	334,720	346,823
	Difference	0	0	0	0	0

This Report demonstrates that there are sufficient water supplies over a 20-year planning horizon to meet the projected demands of the Project as well as the existing and other planned development projects within the Public Utilities Department service area in normal, dry year, and multiple-dry year forecasts. This Project is proposing water demands which are included in the regional water resource planning documents of the City, the Water Authority, and MWD.

Source Documents

California Department of Water Resources (DWR), Progress on Incorporating Climate Change into Management of California's Water Resources, July 2006 Report
California Climate Change Center, 2006 Biennial Report: Our Changing Climate: Assessing the Risks to California, 2006
California Department of Water Resources Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001, March 2011
DSD Memorandum - Request for assessment and project description, February 2013
MWD 2010 Regional Urban Water Management Plan
MWD Report on Metropolitan's Water Supplies, A Blueprint for Water Reliability, March 2003
MWD Integrated Resources Plan Update, Oct 2010
Public Utilities Department 2010 Urban Water Management Plan
Public Utilities Department Annual 2012 Water Conservation Report
Public Utilities Department Recycled Water Study July 2012
Public Utilities Department Recycled Water Master Plan August 2011
Public Utilities Department Water Purification Demonstration Project Report
Water Authority 2010 Urban Water Management Plan
Water Authority Regional Water Facilities Master Plan, 2003
Water Department Long-Range Water Resources Plan (2002-2030), December 2002
Water Department The City of San Diego Subordinated Water Revenue Bonds, Series 2002, October 2002

THE CITY OF SAN DIEGO

MEMORANDUM

DATE: March 23, 2015

TO: Elizabeth Shearer-Nguyen, Senior Planner, Development Services Department

FROM: Marsi A. Steirer, Deputy Director, Long-Range Planning and Water Resources Division

SUBJECT: Addendum to Approved Glen at Scripps Ranch's Water Supply Assessment Report for Inclusion of Additional Information on Accelerated Forecasted Growth

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The City of San Diego (City) Development Services Department (DSD), as a lead agency, requested the Public Utilities Department (Department) prepare a Water Supply Assessment (WSA) for Glen at Scripps Ranch project as part of the environmental review. The Department completed, approved and submitted the WSA to DSD on June 5, 2014. The project's WSA report was prepared in compliance with the requirements of Senate Bill (SB) 610 as codified in Water Code Section 10912(a) using the City's and San Diego County Water Authority's (Water Authority) 2010 Urban Water Management Plans (UWMP).

The water demands for the project (88 acre-feet per year) are accounted for in the Water Authority's 2010 UWMP under the Accelerated Forecasted Growth (AFG) demand increment. An approval letter from the Water Authority granting the AFG demand for the project is shown in Attachment A. The Water Authority's accounting of the AFG demands is adjusted to reflect the additional water demands associated with each member agency AFG request after the Department approves the WSA. All requests to date that have been received and granted by the Water Authority are shown in Attachment B.

Should you have any questions, please feel free to contact George Adrian at gadrian@sandiego.gov, 619-533-4680 or Seevani Bista at sbista@sandiego.gov, 619-533-4222.

Marsi A. Steirer
Deputy Director

Sb/sb

Attachments: A- Approval Email from Water Authority
B - Water Authority's Accelerated Forecasted Growth Demands that have been Received and Granted

ATTACHMENT A

Approval Email from Water Authority

From: Weinberg, Ken [mailto:KWeinberg@sdcwa.org]
Sent: Thursday, June 05, 2014 4:45 PM
To: Steirer, Marsi; Adrian, George
Cc: Friehauf, Dana; Bombardier, Tim
Subject: FW: AFG request to SDCWA

Dear Marsi,

Thank you for your email regarding the Glen at Scripps Ranch project and revised Ballpark Village Parcel C Residences. The following is the Water Authority's response to your request to use the Accelerated Forecasted Growth (AFG) component of the Water Authority's 2010 Urban Water Management Plan to meet the unanticipated water demands associated with the proposed projects.

The purpose of the AFG component of the demand forecast is to estimate, on a regional basis, additional demand associated with proposed projects not yet included in local jurisdictions' general plans and to plan for sufficient regional supplies to reliably meet the water demand of those projects. The Glen at Scripps Ranch project and revised Ballpark Village Parcel C Residences identified in your e-mail, meets the criteria for the AFG component of the Water Authority's 2010 UWMP and we are planning to have water supplies to reliably meet the demand associated with the project. Our accounting of the AFG demand component will be adjusted to reflect the additional demand associated with the proposed projects.

Please let me know if you have any questions or want to discuss further.

Ken

Ken Weinberg
Director of Water Resources

Dana Friehauf
Acting Water Resources Manager
San Diego County Water Authority
dfriehauf@sdcwa.org
858-522-6749 (work)

From: Steirer, Marsi [mailto:MSteirer@sandiego.gov]
Sent: Friday, May 30, 2014 2:02 PM
To: Weinberg, Ken; Friehauf, Dana; Bombardier, Tim
Cc: Adrian, George; Bista, Seevani; Kaziha, Anas; Steirer, Marsi
Subject: AFG request to SDCWA

Dear Ken,

The City of San Diego is preparing two water supply assessments; the Glen at Scripps Ranch project and Ballpark Village Parcel C Residences in accordance with the requirements of SB 610. Please find attached two documents with descriptions of each project. As some of the proposed development for these projects were not accounted for in the SANDAG Series 12 forecast, the water demands associated with the unaccounted growth were also not included in the City's 2010 Urban Water Management Plan. The unaccounted water demand associated with these projects are as seen in the table below:

	Water Demands (Acre Feet per Year)		
Project	Planned	Projected	Delta
The Glen at Scripps Ranch Project	15.5 AFY	103.4 AFY	- 88
	Portion of the Project Not Accounted for in the SANDAG's Series 12 forecast		- 88
Ballpark Village Parcel C Residences Project	0 AFY	163.2 AFY	- 163.2
	Portion of the Project Not Accounted for in the SANDAG's Series 12 forecast		- 163.2

The City is requesting the use of the Accelerated Forecasted Growth (AFG) component of the Water Authority's 2010 Urban Water Management Plan to meet the unanticipated water demands associated with these projects, similar to the other projects requested.

Attached is a table showing the total AFG that the City has requested to date.

Your prompt assistance with this request will be greatly appreciated.

Thank you,

Marsi

Marsi A. Steirer
Deputy Director, Long-Range Planning and Water Resources
Public Utilities Department
(o) 619.533.4112 (m) 619.865.7458

ATTACHMENT B

Water Authority's Accelerated Forecasted Growth Demands that have been Received and Granted

2010 UWMP Accelerated Forecast Growth

				Running Total (AF)	Date Certified EIR Received
Response Date	**Agency**	**Project**	**Estimated (AF)**		
8/24/2011	City of San Diego	San Diego Corporate Center	147		
8/24/2011	City of San Diego	Metropolitan Airpark/Brown Field	38		
8/24/2011	City of San Diego	Barrio Logan Community Plan	272		
8/24/2011	City of San Diego	Otay Mesa Community Plan	170		
8/24/2011	City of San Diego	15th and Island	85		4/24/12 (Approved by CC)
9/26/2011	City of San Diego	Convention Center Expansion	**109**	**821**	9/19/12 (Approved by Port District)
1/31/2012	City of San Diego	WaterMark	**9**	**830**	
4/11/2012	City of San Diego	11th & Broadway Mixed-Use Project	**29**	**859**	12/4/12 (Phase 1 approved) Phase 2
2/13/2013	City of San Diego	Liberty Station East Hotel	**94**	**953**	6/4/13 (Approved by CC)
4/2/2013	City of San Diego	Cisterra Tower Development	**63**	**1,016**	
4/2/2013	City of San Diego	Kaiser Permanente Hospital	**227**	**1,243**	
5/29/2013	Otay Water District	Otay Ranch Planning Area 12	**127**	**1,370**	
7/9/2013	Otay Water District	Villages 3, 8east, and 10	**41**	**1,411**	
8/13/2013	Otay Water District	Village 2 (SPA Amendment)	**529**	**1,940**	
2/28/2013	City of San Diego	Chollas Triangle Development	**14.7**	**1,955**	
6/5/2014	City of San Diego	Glen at Scripps Ranch	**88**	**2,043**	
10/1/2014	City of San Diego	Encanto Community Plan Update	**1460**	**3,503**	
10/6/2014	City of San Diego	Ballpark Village Parcel C Reisdences	**170**	**3,673**	
12/8/2014	City of San Diego	Merge 56 Development	**72**	**3,745**	
			Running Total	**3,745**	
		Total City Usage	**3,048**		

Note: Data as of March 20, 2015

PRELIMINARY DRAINAGE STUDY

THE GLEN AT SCRIPPS RANCH
10455 POMERADO ROAD
SAN DIEGO, CA 92131

CONDITIONAL USE PERMIT,
SITE DEVELOPMENT PERMIT, PLANNED DEVLOPMENT PERMIT, AND
COMMUNITY PLAN AMENDMENT

ORIGINAL DATE: DECEMBER 7, 2011
REVISED: SEPTEMBER 17, 2012
REVISED: JULY 22, 2014

Prepared For:

THE GLEN AT SCRIPPS RANCH CCRC LLC
9903 Businesspark Ave. Suite #104
San Diego, California 92131

Prepared By:

LATITUDE 33 PLANNING AND ENGINEERING
5355 Mira Sorrento Place, Suite 650
San Diego, California 92121
(858) 751 - 0633

John C. Eardensohn	Date	Prepared by: CO
RCE 34584	Expires: 9/30/2015	Reviewed by: MV

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I. PURPOSE

The purpose of this preliminary drainage study is to evaluate the existing and proposed drainage conditions (i.e. anticipated runoff flows) associated with the Continuing Life Communities project located at 10455 Pomerado Road in San Diego, California in support of review of the entitlement permit processing. The intent is to provide a level of detail needed to adequately address concerns the City of San Diego may have in reviewing and approving the entitlement documents. This report has been prepared to document the hydrologic impacts as a result of the development.

II. PROJECT DESCRIPTION

PROJECT LOCATION

The proposed project site is located in the Scripps Ranch Community east of Interstate 15 south of Pomerado Road, and west of the Chabad Hebrew Academy. More particularly, the site is described as a Portion of Parcel 3 of Parcel Map 20640, in the City of San Diego, County of San Diego, State of California, filed in the Office of the County Recorder of San Diego County. The proposed improvements and construction activities will take place on the 53-acre site. Refer to the vicinity map included in this report.

PROPOSED PROJECT ACTIVITIES

The proposed project development will include the construction of a continuing care retirement community (Institutional Use) with 400 assisted living units of various configurations (villas, garden terraces and apartment style), 50 acute assisted living units (16 of which are memory care units) and 60 skilled nursing beds for a total of 450 assisted living units and 60 skilled nursing beds. The site will incorporate a commons/clubhouse building, a recreational building, a facilities/maintenance building, acute care health center, a pool house, surface parking lots, onsite vehicular circulation, onsite ADA compliant sidewalks and landscape/hardscape areas adjacent to all structures. The proposed development will be served by connecting to existing public infrastructure (water and sewer) within Chabad Center Driveway and Pomerado Road.

PROPOSED SITE PREPARATION

Site preparation for the 53-acre limit of disturbance will involve clearing and grubbing and demolition of the existing Alliant University Baseball Field. Without any spoils and undercut adjustments or bulk/shrinking factors applied (i.e. geometric quantities only), approximately 661,000 cubic-yards of soil cut and fill will be generated to balance the site. Remedial grading may be required based on additional geotechnical investigation/recommendations during the public grading permit phase.

FLOODPLAIN

The northern slope will encroach into the existing floodplain limits as discussed in the attached report entitled "Floodplain Analysis of Carrol Canyon Creek at The Glen at Scripps Ranch" dated April 2014. This will require a CLOMR and will be processed with the final engineering documents. As indicated in the report the floodway is not adversely affected.

III. METHODOLOGY

The estimate of both the existing and proposed drainage flows has been performed in conformance with the City of San Diego Drainage Design Manual (Drainage Manual) dated April 1984. In the hydrology study, all basins analyzed are less than 0.5 square mile. Therefore, the Rational Method was utilized to calculate storm runoff for a 100-year frequency storm. The future sizing of pipes and inlets will be based on Manning's equation and the criteria contained in the City of San Diego Drainage Manual. Other criteria are described below:

- A runoff coefficient between 0.45 and 0.70 was used for existing and developed conditions, respectively. The developed "C" value is based on the land use designation consistent with Table 2 of Appendix I contained within the Drainage Manual.

- Intensity values were calculated using the City of San Diego Intensity-Duration Design Charts, Figure 3-1 of the City Drainage Manual.

- Initial travel time values were computed using the Overland Time of Flow Calculation which are shown in Appendix D.

- Final times of concentration values for each basin were calculated by adding the initial and final travel times.

- A 100-yr design storm interval was used.

Charts and tables noted above can be found in Appendix D.

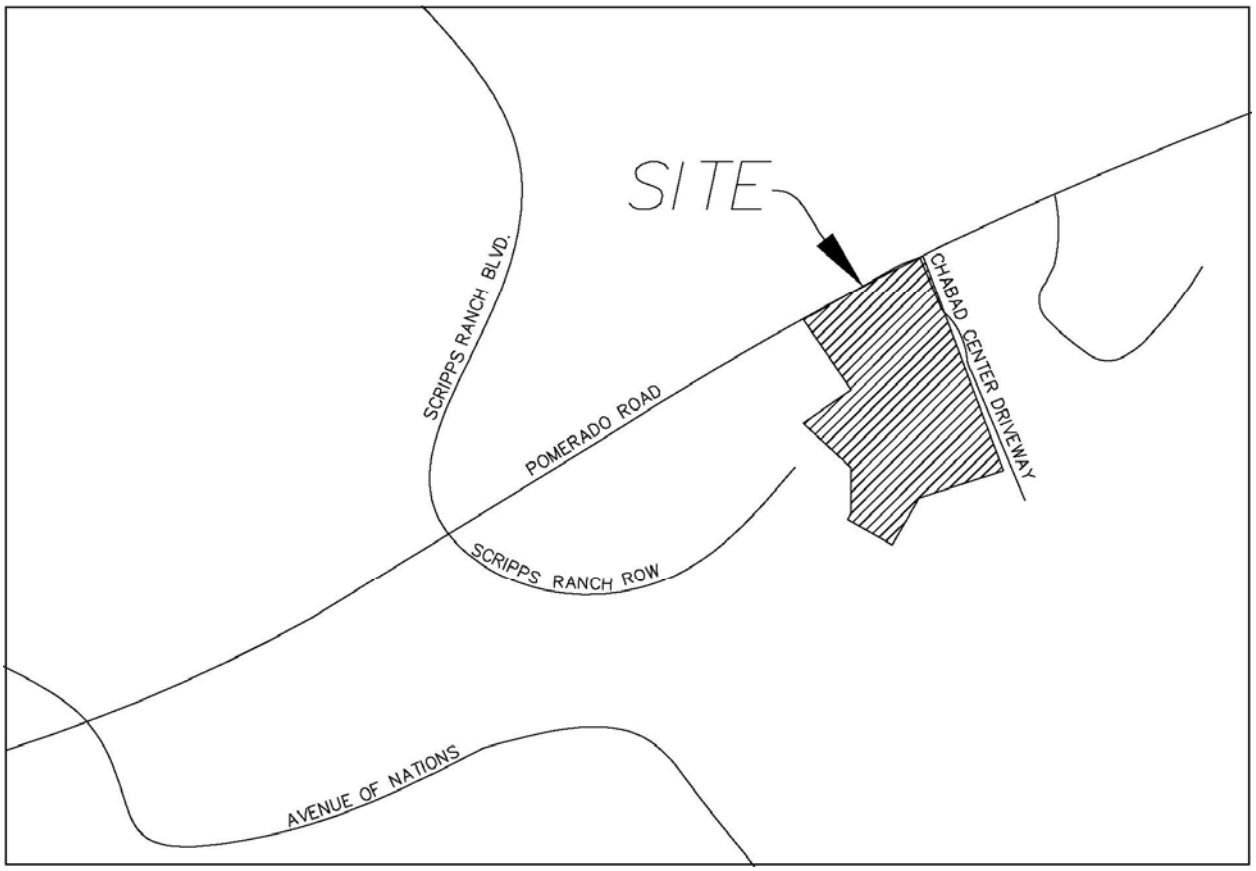


Figure 1 – VICINITY MAP

Figure 2 - PROJECT LOCATION MAP

IV. EXISTING CONDITION DRAINAGE

The project area lies within a portion of several existing onsite drainage basins. Refer to Figure 3, "Existing Drainage Basin Map" contained within Drainage Study prepared for this project for graphical depiction of existing hydrologic characteristics. The majority of the site drains north-westerly towards Pomerado Road and Interstate 15. Sheet runoff is directed through several natural earthen drainage swales and discharges into an existing natural drainage channel adjacent to Pomerado Road. Runoff is further directed and channelized under Scripps Ranch Row and Avenue of Nations towards Miramar Road via a box culvert drainage system. Refer to Table No. 1 for a summary of existing peak flow estimates.

TABLE NO. 1

Project Information

Project	City	Date	Project No.
Continuting Life Communities	San Diego	7/15/2014	1049.10
	Condition	By	Checked
100-Year Storm Event	Existing	RBP	SCK

Existing Conditions

BASIN NUMBER	*AREA (acres)*	*C*	*C*A*	[1] *Tc (min.)*	*I 100 (in/hr)*	*Q 100 (cfs)*
E.1	35.85	0.45	16.13	17.80	2.70	43.6
E.2	11.18	0.45	5.03	13.50	3.10	15.6
E.3	8.41	0.45	3.78	12.90	3.20	12.1
E.4	4.15	0.45	1.87	13.30	3.05	5.7
E.5	6.75	0.45	3.04	15.90	3.00	9.1
E.6	3.24	0.45	1.46	11.60	3.40	5.0
E.7	32.71	0.45	14.72	13.70	3.10	45.6
TOTAL WATERSHED AREA:→	**102.3**					
TOTAL FLOW						**136.7**
TOTAL FLOW (PLUS OFFSITE)		***1213cfs (1,332cfs 100yr) per 27827-5-D)**				**1349.7**

[1] Time of concentration for natural watersheds add ten minutes to computed Time of Concentration per City of San Diego Drainage Design Manual.

Table 1 - EXISTING PEAK FLOW ESTIMATES

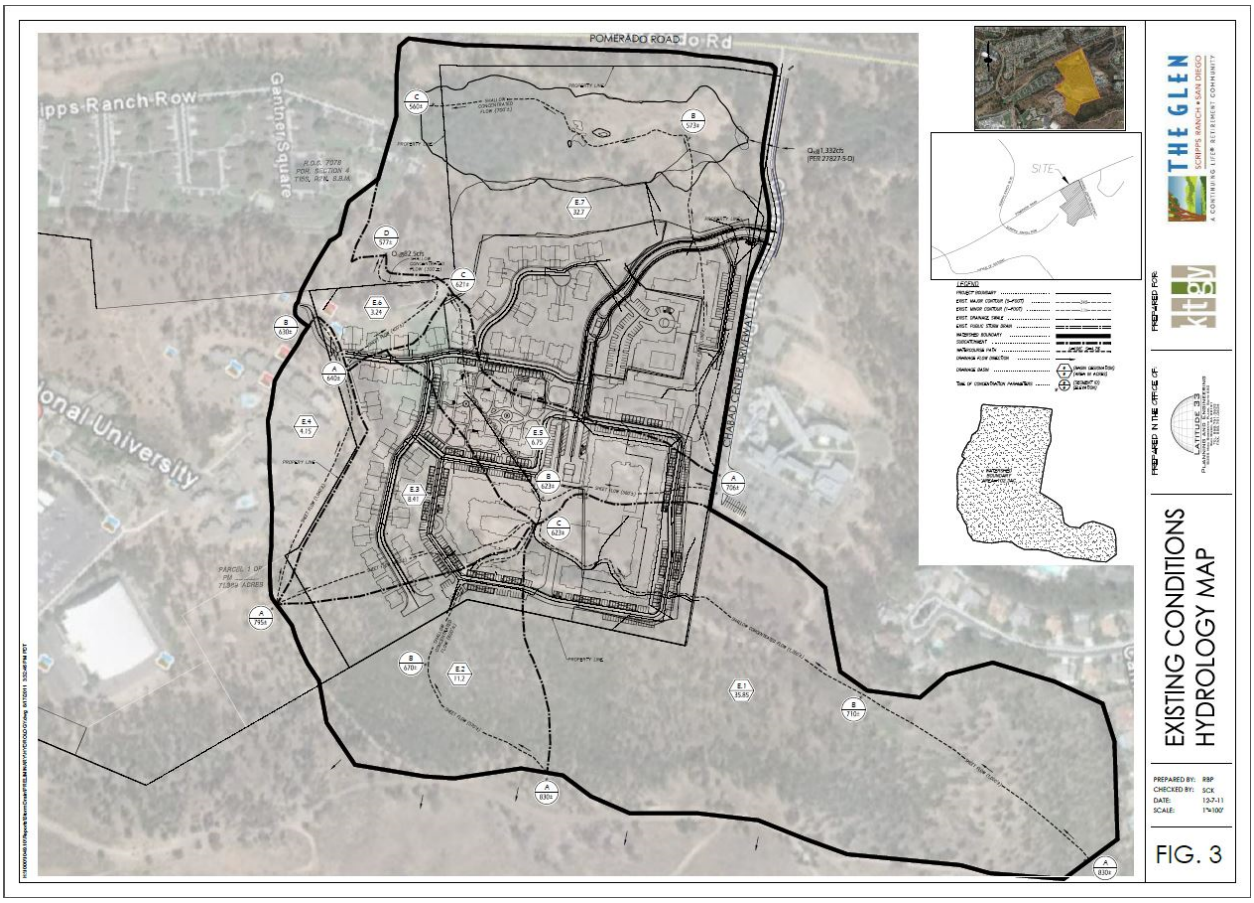


Figure 3 - EXISTING DRAINAGE BASIN MAP

V. PROPOSED CONDITION DRAINAGE

As previously mentioned, the proposed improvements include the construction of a continuing care retirement community (Institutional Use) with 400 assisted living units of various configurations (villas, garden terraces and apartment style), 50 acute assisted living units (16 of which are memory care units) and 60 skilled nursing beds for a total of 450 assisted living units and 60 skilled nursing beds. The site will incorporate several common areas including a health center, a recreational building (i.e. Common Building), a facilities building/central plant, a poll house, surface parking lots, onsite vehicular circulation, onsite ADA compliant sidewalks and landscape/hardscape areas adjacent to all structures. The proposed project area lies within the limits of the existing drainage basins mentioned above and generally maintains all existing drainage patterns. Offsite flows from the southeastern sub-basin (P.1) will be collected in a storm drain system which will pass through the project site and around the proposed treatment basins. This is referred to as the bypass system, no project flows will be introduced to the offsite flows from basin P1. Refer to Figure 4, "Proposed Drainage Basin Map" contained within the Drainage Study prepared for this project for graphical depiction of proposed hydrologic characteristics. Onsite runoff will be collected in proposed private storm drain facilities that will route to water quality and HMP compliant basins prior to discharging into the existing natural drainage creek adjacent to Pomerado Road. Refer to Table No. 2 below for a summary of proposed peak flow estimates.

TABLE NO. 2

Project Information

Project	City	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
	Condition	By	Checked
100-Year Storm Event	Proposed	CO	MV

Proposed Conditions

BASIN NUMBER	*AREA (acres)*	*C*	*C*A*	[1] *Tc (min.)*	*I 100 (in/hr)*	*Q 100 (cfs)*	
BYPASS SYSTEM							
P.1	29.76	0.45	13.39	15.30	3.10	41.5	
Total	29.76		13.39	15.30		41.5	BYPASS
BASIN 'A'							
P.2	6.59	0.55	3.62	20.70	2.50	9.1	
Total	6.59		3.62	20.70		9.1	*
BASIN 'B'							
P.6	13.37	0.70	9.36	12.10	3.20	29.9	
Total	13.37		9.36	12.10		29.9	*
BASIN 'C'							
P.3	9.67	0.45	4.35	12.20	3.20	13.9	
P.4	17.41	0.65	11.32	8.10	3.55	40.2	
P.5	3.12	0.45	1.40	11.40	3.40	4.8	
Total	30.20		17.07	31.70		58.87	*
BASIN 'D'							
P.7	22.33	0.45	10.05	12.90	3.20	32.2	
Total	22.33		10.05	12.90		32.2	*
TOTAL WATERSHED AREA:→	**102.3**						
TOTAL ONSITE FLOW:						**130.0**	*
TOTAL FLOW (PLUS OFFSITE)		***1213cfs (1,332cfs 100yr) per 27827-5-D)**				**1343.0**	

[1] Time of concentration for natural watersheds add ten minutes to computed Time of Concentration per City of San Diego Drainage Design Manual

Table 2 - PROPOSED PEAK FLOW ESTIMATES

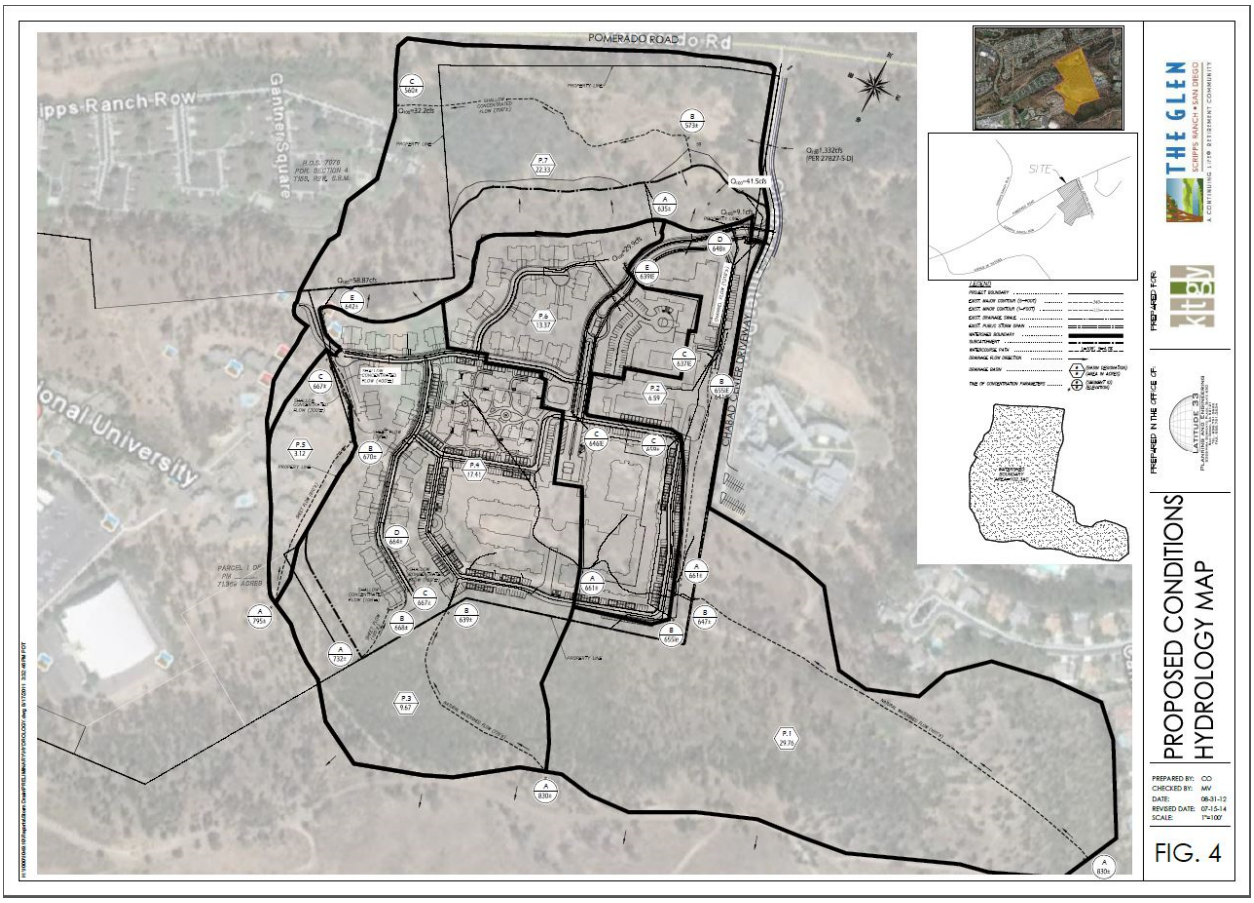


Figure 4 - PROPOSED DRAINAGE BASIN MAP

Although there is an overall increase in the runoff coefficient due to the additional hardscape area, the increased time of concentration (and decreased intensity values) the post project flows match the pre-project flow. Additionally, there are bioretention basins that are being introduced that will serve as detention basins during storm events. Although these are not sized as hydrological detention basins, they will perform in a similar manner to attenuate peak flows.

The basins will double as bioretention basins for water quality and hydromodification management compliance will effectively further reduce the runoff flow rates. Refer to the Preliminary Water Quality Technical Report prepared for this project for more detailed description and required water quality treatment calculations, including discussions regarding Hydromodification.

VI. WATER QUALITY AND HYDROMODIFICATION MANAGEMENT PLAN (HMP)

In accordance with City of San Diego requirements, the development of the property will include Best Management Practices (BMPs) to treat all anticipated developed runoff. The proposed water quality BMPs for the project are anticipated to include a combination of natural and mechanical features designed to treat anticipated pollutants to the maximum extent practicable prior to discharge. The proposed BMPs will be selected and designed to satisfy the State's

Hydromodification Program requirements. Bioretention basins vegetated swales, and filterra units will be utilized to meet the requirements of the city of San Diego's stormwater standards. A separate Preliminary Water Quality Technical Report has been prepared for this project that addresses the adequacy of the proposed stormwater structural treatment measures.

VII. DISCUSSION

As previously mentioned, the proposed development will match or decrease the current flow rates at the discharge locations by attenuating the 100 year storm event via detention basins. The locations of the discharge points will remain the same. A bypass storm drain system will convey the majority of offsite flows through the project site and around the proposed detention area.

The watershed boundary for this particular project encompasses approximately 102.3-acres and is the limit of the drainage analysis for this report. As stated earlier, portions of the offsite flows will be routed around the development. Existing watershed areas E.2 through E.6 contribute 47.5 cfs to the existing natural drainage course southwest of the ultimate discharge into the creek adjacent to Pomerado Road. After development, the proposed watershed areas P3, P.4 and P.5, are comparable to E.2 through E.6 and contribute 58.87 cfs. The proposed detention basins will be designed to reduce the potential for flooding/surcharging of the property north of the project adjacent to Pomerado Road.

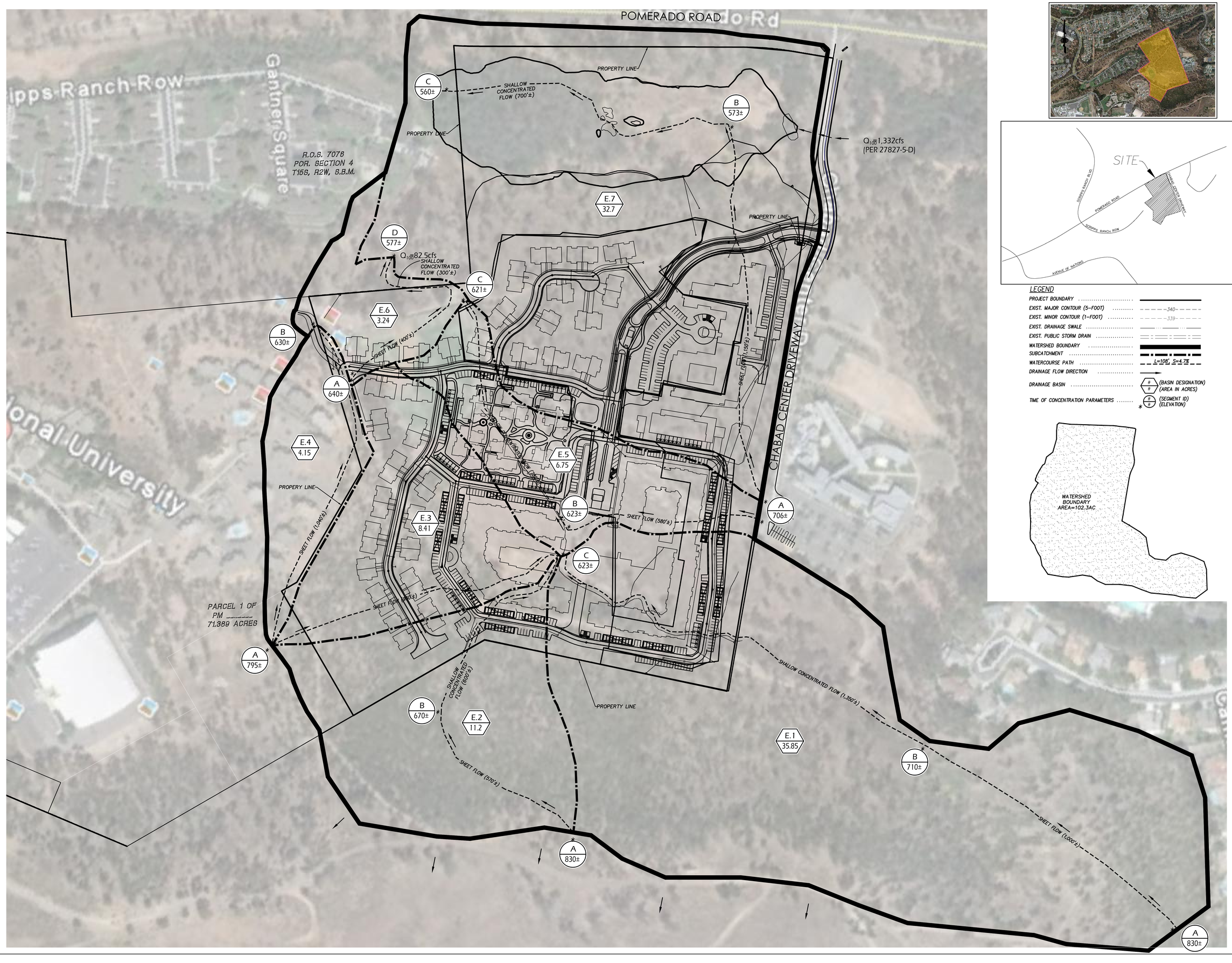
According to the calculations provided, there will be no adverse drainage effects due to the development of the project area as the estimated peak flows will effectively be the same when comparing total pre/post construction peak flows. Without detention, the development increase would account for about 3% increase in the overall flow amount at the point of compliance. With the basin attenuation, there will be no net increase.

VIII. CONCLUSIONS

This study has documented the existing and developed drainage conditions. The development of the project will not result in an increase in runoff. Because the proposed drainage patterns are consistent with the existing conditions and treatment control BMPs are being incorporated to meet water quality objectives as well as limit the potential adverse impacts of hydromodification, the proposed project will have no adverse impacts on the downstream facilities.

APPENDIX A

EXISTING CONDITIONS HYDROLOGY CALCULATIONS



LEGEND

PROJECT BOUNDARY	
EXIST. MAJOR CONTOUR (5-FOOT)	340
EXIST. MINOR CONTOUR (1-FOOT)	339
EXIST. DRAINAGE SWALE	
EXIST. PUBLIC STORM DRAIN	
WATERSHED BOUNDARY	
SUBCATCHMENT	
WATERCOURSE PATH	L=108', S=4.7%
DRAINAGE FLOW DIRECTION	
DRAINAGE BASIN	# # (BASIN DESIGNATION) (AREA IN ACRES)
TIME OF CONCENTRATION PARAMETERS	* # # (SEGMENT ID) (ELEVATION)

THE GLEN
SCRIPPS RANCH • SAN DIEGO
A CONTINUING LIFE® RETIREMENT COMMUNITY

PREPARED FOR:

KTGY

PREPARED IN THE OFFICE OF:

LATITUDE 33
PLANNING & ENGINEERING
8330 Miramar Place, Suite 200
San Diego, CA 92121
TEL: 858.791.0823
FAX: 858.791.0834

EXISTING CONDITIONS HYDROLOGY MAP

PREPARED BY:	RBP
CHECKED BY:	SCK
DATE:	12-7-11
SCALE:	1"=100'

FIG. 3

H:\10001049.10\Reports\Storm Drain\PRELIMINARY\HYDROLOGY.dwg 8/17/2011 3:32:46 PM PDT

TABLE NO. 1

Project Information

Project	City	Date	Project No.
Continuting Life Communities	San Diego	7/15/2014	1049.10
	Condition	By	Checked
100-Year Storm Event	Existing	RBP	SCK

Existing Conditions

BASIN NUMBER	AREA (acres)	C	C*A	[1] Tc (min.)	I_{100} (in/hr)	Q_{100} (cfs)
E.1	35.85	0.45	16.13	17.80	2.70	43.6
E.2	11.18	0.45	5.03	13.50	3.10	15.6
E.3	8.41	0.45	3.78	12.90	3.20	12.1
E.4	4.15	0.45	1.87	13.30	3.05	5.7
E.5	6.75	0.45	3.04	15.90	3.00	9.1
E.6	3.24	0.45	1.46	11.60	3.40	5.0
E.7	32.71	0.45	14.72	13.70	3.10	45.6
TOTAL WATERSHED AREA:→	**102.3**					
TOTAL FLOW						**136.7**
TOTAL FLOW (PLUS OFFSITE)		***1213cfs (1,332cfs 100yr) per 27827-5-D)**				**1349.7**

[1] Time of concentration for natural watersheds add ten minutes to computed Time of Concentration per City of San Diego Drainage Design Manual.

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
E.1	Existing	RBP	SCK

Initial Time (T_i)

Segment ID		ABC				
Surface Description		Natural				
Flow Length, D	ft	2350				
Elevation Difference, H	ft	207				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.131	+	0.167	=	0.297

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.297*

min = *17.8*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
E.2	Existing	RBP	SCK

Initial Time (T_i)

Segment ID		ABC				
Surface Description		Natural				
Flow Length, D	ft	1170				
Elevation Difference, H	ft	207				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.058	+	0.167	=	0.225

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.225*

min = *13.5*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
E.3	Existing	RBP	SCK

Initial Time (T_i)

Segment ID		AC				
Surface Description		Natural				
Flow Length, D	ft	930				
Elevation Difference, H	ft	172				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.048	+	0.167	=	0.215

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.215*

min = *12.9*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
E.4	Existing	RBP	SCK

Initial Time (T_i)

Segment ID		AB				
Surface Description		Natural				
Flow Length, D	ft	1040				
Elevation Difference, H	ft	165				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.056	+	0.167	=	0.222

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.222*

min = *13.3*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
E.5	Existing	RBP	SCK

Initial Time (T_i)

Segment ID		ABC				
Surface Description		Natural				
Flow Length, D	ft	1360				
Elevation Difference, H	ft	85				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.098	+	0.167	=	0.265

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.265*

min = *15.9*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
E.6	Existing	RBP	SCK

Initial Time (T_i)

Segment ID		AD				
Surface Description		Natural				
Flow Length, D	ft	400				
Elevation Difference, H	ft	63				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.027	+	0.167	=	0.193

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.193*

min = *11.6*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
E.7	Existing	RBP	SCK

Initial Time (T_i)

Segment ID		ABC				
Surface Description		Natural				
Flow Length, D	ft	1900				
Elevation Difference, H	ft	146				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.056	+	0.167	=	0.223

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.223*

min = *13.4*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

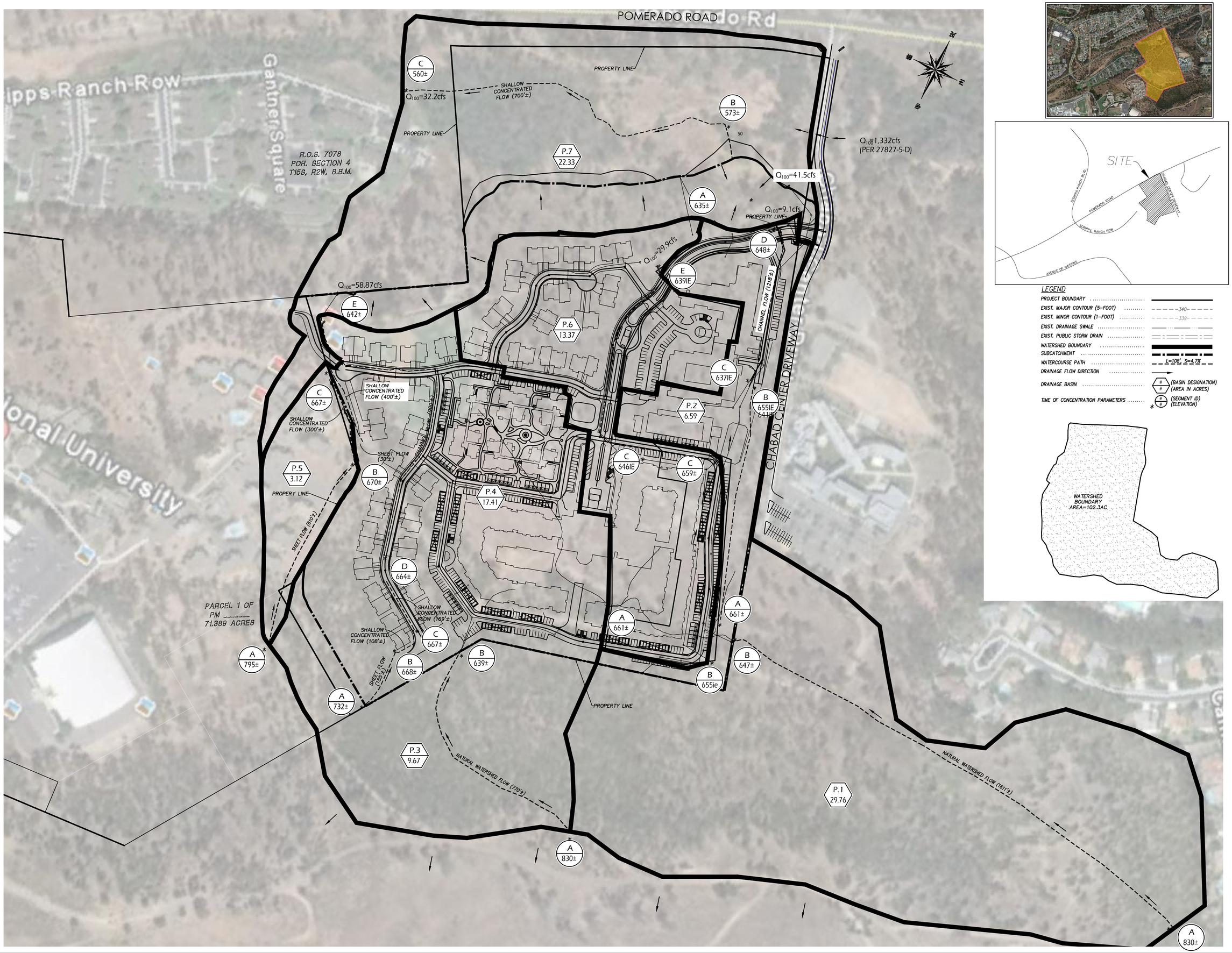
P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

APPENDIX B

PROPOSED HYDROLOGY CALCULATIONS



LEGEND

PROJECT BOUNDARY	
EXIST. MAJOR CONTOUR (5-FOOT)	340
EXIST. MINOR CONTOUR (1-FOOT)	339
EXIST. DRAINAGE SWALE	
EXIST. PUBLIC STORM DRAIN	
WATERSHED BOUNDARY	
SUBCATCHMENT	
WATERCOURSE PATH	L=108', S=4.7%
DRAINAGE FLOW DIRECTION	
DRAINAGE BASIN	# # (BASIN DESIGNATION) (AREA IN ACRES)
TIME OF CONCENTRATION PARAMETERS	* # # (SEGMENT ID) (ELEVATION)

THE GLEN
SCRIPPS RANCH • SAN DIEGO
A CONTINUING LIFE® RETIREMENT COMMUNITY

PREPARED FOR:
ktgy

PREPARED IN THE OFFICE OF:
LATITUDE 33
PLANNING & ENGINEERING
9339 Mira Mesa Blvd. Suite 220
San Diego, CA 92126
Tel: 858.791.0933
Fax: 858.791.0934

PROPOSED CONDITIONS HYDROLOGY MAP

PREPARED BY:	CO
CHECKED BY:	MV
DATE:	08-31-12
REVISED DATE:	07-15-14
SCALE:	1"=100'

FIG. 4

H:\10000\1049.10\Reports\Storm Drain\PRELIMINARY\HYDROLOGY.dwg 8/17/2011 3:32:46 PM PDT

TABLE NO. 2

Project Information

Project	City	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
	Condition	By	Checked
100-Year Storm Event	Proposed	CO	MV

Proposed Conditions

BASIN NUMBER	*AREA (acres)*	*C*	*C*A*	*[1] Tc (min.)*	*I 100 (in/hr)*	*Q 100 (cfs)*	
BYPASS SYSTEM							
P.1	29.76	0.45	13.39	15.30	3.10	41.5	
Total	29.76		13.39	15.30		41.5	BYPASS
BASIN 'A'							
P.2	6.59	0.55	3.62	20.70	2.50	9.1	
Total	6.59		3.62	20.70		9.1	*
BASIN 'B'							
P.6	13.37	0.70	9.36	12.10	3.20	29.9	
Total	13.37		9.36	12.10		29.9	*
BASIN 'C'							
P.3	9.67	0.45	4.35	12.20	3.20	13.9	
P.4	17.41	0.65	11.32	8.10	3.55	40.2	
P.5	3.12	0.45	1.40	11.40	3.40	4.8	
Total	30.20		17.07	31.70		58.87	*
BASIN 'D'							
P.7	22.33	0.45	10.05	12.90	3.20	32.2	
Total	22.33		10.05	12.90		32.2	*
TOTAL WATERSHED AREA: →	**102.3**						
TOTAL ONSITE FLOW:						**130.0**	*
TOTAL FLOW (PLUS OFFSITE)		***1213cfs (1,332cfs 100yr) per 27827-5-D)**				**1343.0**	

[1] Time of concentration for natural watersheds add ten minutes to computed Time of Concentration per City of San Diego Drainage Design Manual

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
P.1	Proposed	CO	MV

Overland Flow

Segment ID		AB				
Surface Description		Natural				
Flow Length, D	ft	1611				
Elevation Difference, H	ft	183.00				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.089	+	0.167	=	0.256

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c **hr** = ***0.256***

min = ***15.3***

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
P.2	Proposed	CO	MV

Overland Flow

Segment ID		AB				
Surface Description		Brow Ditch				
Flow Length, D	ft	1218				
Elevation Difference, H	ft	13.00				
Runoff Coefficient, C		0.55				
Travel Time, Ti	hr	0.178	+	0.167	=	0.345

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID					
Cross Sectional Flow Area, A	ft^2				
Wetted Perimeter, P	ft				
Hydraulic Radius, R	ft				
Channel Slope, S	ft/ft				
Manning's Roughness Coefficient, n					
Velocity, V	ft/s				
Flow Length, L	ft				
Travel Time, T_t	hr				

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.345*

min = *20.7*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
P.3	Proposed	RBP	MV

Overland Flow

Segment ID		AB				
Surface Description		Natural				
Flow Length, D	ft	770				
Elevation Difference, H	ft	191				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.037	+	0.167	=	0.204

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c **hr** = ***0.204***

min = ***12.2***

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
P.4	Proposed	RBP	MV

Overland Flow

Segment ID		AB				
Surface Description		Grass				
Flow Length, D	ft	185				
Land Slope, S	ft/ft	0.5				
Runoff Coefficient, C		0.66				
Travel Time, Ti	hr	0.049	+		=	0.049

Shallow Concentrated Flow

Segment ID		BC		CD				
Surface Description		U		P				
Flow Length, L	ft	108		250				
Watercourse Slope, S	ft/ft	0.01		0.02				
Average Velocity, V	ft/s	1.613		2.704				
Travel Time, T_t	hr	0.019	+	0.026	+		+	

Combined Travel Time, T_t = 0.044

Channel Flow

Segment ID		DE						
Cross Sectional Flow Area, A	ft^2	1.77						
Wetted Perimeter, P	ft	2.36						
Hydraulic Radius, R	ft	0.375						
Channel Slope, S	ft/ft	0.01						
Manning's Roughness Coefficient, n		0.013						
Velocity, V	ft/s	5.960						
Flow Length, L	ft	900						
Travel Time, T_t	hr	0.042	+		+		+	

Combined Travel Time, T_t hr = 0.042

Time of Concetration, T_c hr = *0.135*

min = *8.1*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
P.5	Proposed	RBP	MV

Overland Flow

Segment ID		AB				
Surface Description		Grass				
Flow Length, D	ft	610				
Land Slope, S	ft/ft	0.20				
Runoff Coefficient, C		0.55				
Travel Time, Ti	hr	0.149	+		=	0.149

Shallow Concentrated Flow

Segment ID		BC						
Surface Description		P						
Flow Length, L	ft	300						
Watercourse Slope, S	ft/ft	0.01						
Average Velocity, V	ft/s	2.033						
Travel Time, T_t	hr	0.041	+		+		+	

Combined Travel Time, T_t = 0.041

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s							
Flow Length, L	ft							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t hr =

Time of Concetration, T_c hr = *0.190*

min = *11.4*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
P.6	Proposed	CO	MV

Overland Flow

Segment ID		AB				
Surface Description		Asphalt				
Flow Length, D	ft	500				
Land Slope, S	ft/ft	0.02				
Runoff Coefficient, C		0.90				
Travel Time, Ti	hr	0.106	+		=	0.106

Shallow Concentrated Flow

Segment ID								
Surface Description								
Flow Length, L	ft							
Watercourse Slope, S	ft/ft							
Average Velocity, V	ft/s							
Travel Time, T_t	hr		+		+		+	

Combined Travel Time, T_t =

Channel Flow

Segment ID		BC		CD		DE		
Cross Sectional Flow Area, A	ft^2	0.785		1.77		1.77		
Wetted Perimeter, P	ft	3.14		4.71		4.71		
Hydraulic Radius, R	ft	0.25		0.25		0.25		
Channel Slope, S	ft/ft	0.01		0.01		0.1		
Manning's Roughness Coefficient, n		0.013		0.013		0.013		
Velocity, V	ft/s	4.549		4.549		14.384		
Flow Length, L	ft	900		650		50		
Travel Time, T_t	hr	0.055	+	0.040	+	0.001	+	

Combined Travel Time, T_t hr = 0.096

Time of Concetration, T_c hr = *0.202*

min = *12.1*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

TIME OF CONCENTRATION

Project Information

Project	County	Date	Project No.
Continuing Life Communities	San Diego	7/15/2014	1049.10
Location	**Condtion**	**By**	**Checked**
P.7	Proposed	RBP	MV

Overland Flow

Segment ID		AB				
Surface Description		Grass				
Flow Length, D	ft	310				
Land Slope, S	ft/ft	0.20				
Runoff Coefficient, C		0.45				
Travel Time, Ti	hr	0.126	+	0.000	=	0.126

Shallow Concentrated Flow

Segment ID		BC						
Surface Description		U						
Flow Length, L	ft	700						
Watercourse Slope, S	ft/ft	0.02						
Average Velocity, V	ft/s	2.199		0.000		0.000		0.000
Travel Time, T_t	hr	0.088	+	0.000	+	0.000	+	0.000

Combined Travel Time, T_t = 0.088

Channel Flow

Segment ID								
Cross Sectional Flow Area, A	ft^2							
Wetted Perimeter, P	ft							
Hydraulic Radius, R	ft							
Channel Slope, S	ft/ft							
Manning's Roughness Coefficient, n								
Velocity, V	ft/s	0.000		0.000		0.000		0.000
Flow Length, L	ft							
Travel Time, T_t	hr	0.000	+	0.000	+	0.000	+	0.000

Combined Travel Time, T_t hr = 0.000

Time of Concetration, T_c hr = *0.215*

min = *12.9*

Legend

Sheet Flow Surface Codes

A	Smooth Surfaces	F	Grass, Dense
B	Fallow (No Residue)	G	Grass, Bermuda
C	Cultivated (< 20% Residue)	H	Woods, Light
D	Cultivated (> 20% Residue)	I	Woods, Dense
E	Grass-Range, Short	J	Range, Natural

Shallow Concentrated Surface Codes

P	Paved	U	Unpaved

Channel Flow Roughness Condtion

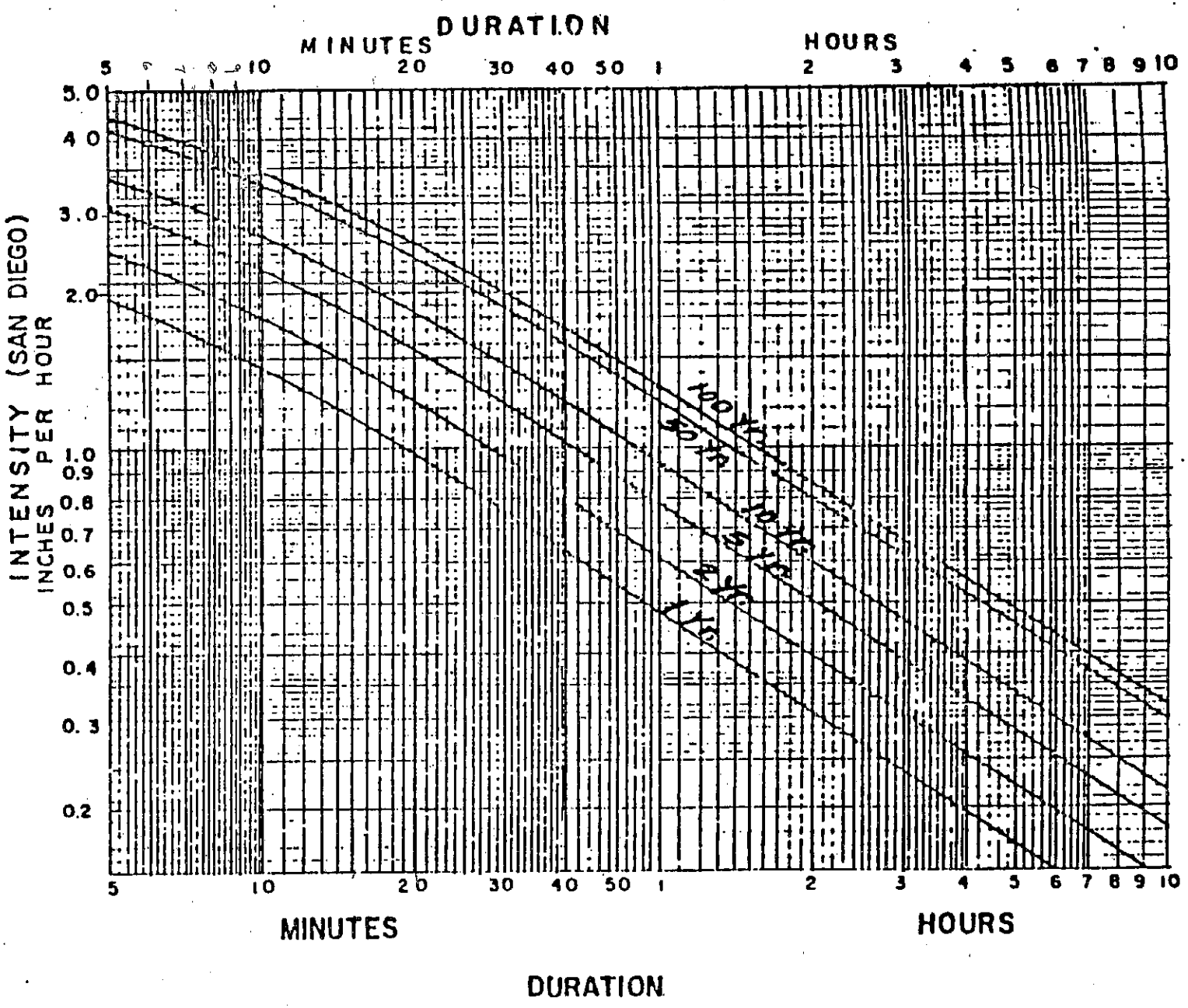
A	Clean Earth	D	Dense Brush
B	Short Grass	E	Natural Channel
C	Dense Weeds	F	

APPENDIX C

DRAINAGE MANUAL REFERENCE MATERIAL

ELEV.	FACTOR
0–1500	1.00
1500–3000	1.25
3000–4000	1.42
4000–5000	1.60
5000–6000	1.70
DESERT	1.25

To obtain correct intensity, multiply intensity on chart by factor for design elevation.



RAINFALL

INTENSITY-DURATION-FREQUEN

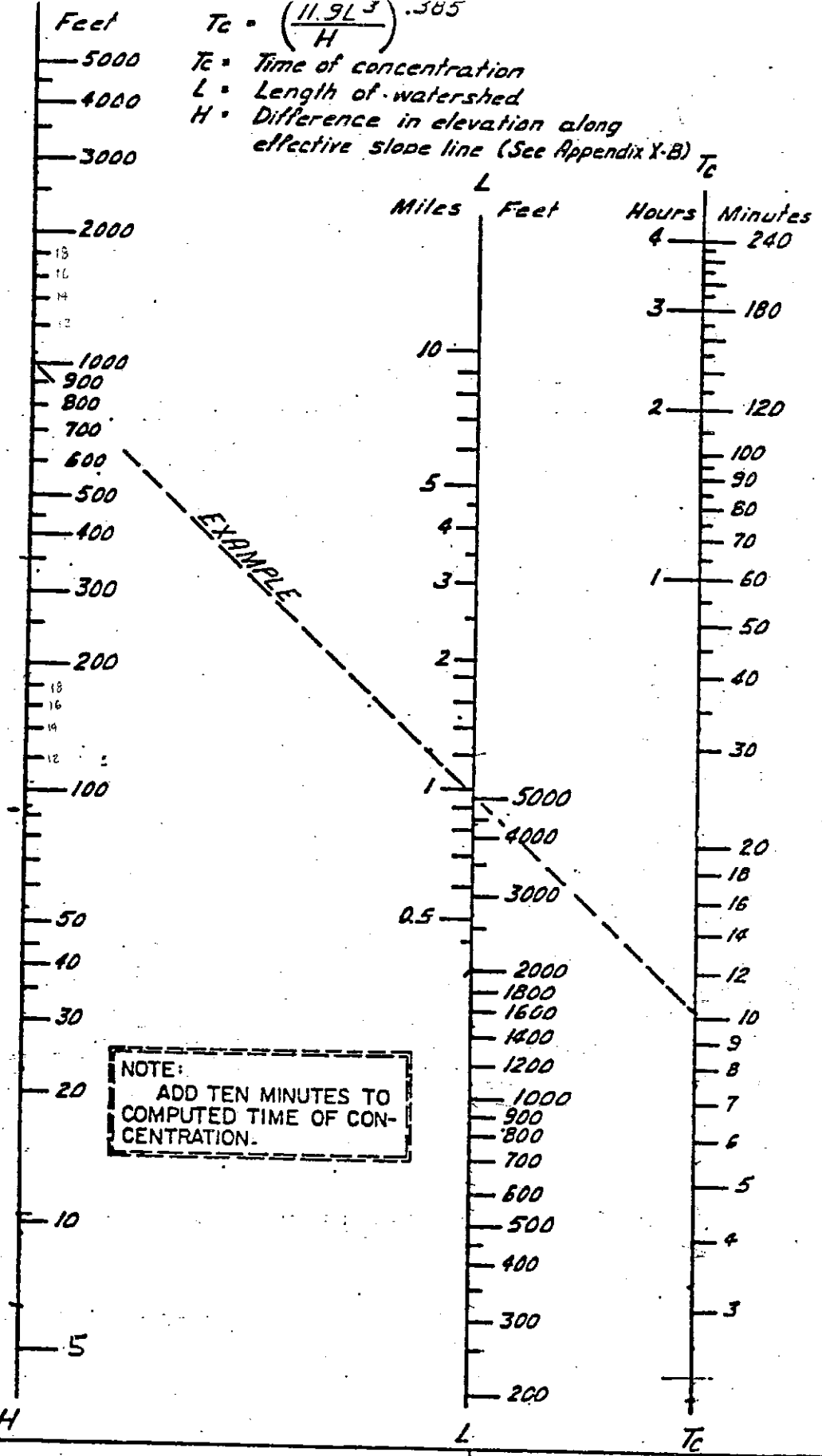
CURVES for

COUNTY OF SAN DIEGO

APPENDIX

$$T_c = \left(\frac{11.9L^3}{H}\right)^{.385}$$

T_c = Time of concentration
L = Length of watershed
H = Difference in elevation along effective slope line (See Appendix X-B)



SAN DIEGO COUNTY DEPARTMENT OF SPECIAL DISTRICT SERVICES DESIGN MANUAL APPROVED	NOMOGRAPH FOR DETERMINATION OF TIME OF CONCENTRATION (T_c) FOR NATURAL WATERSHEDS DATE _____ APPENDIX

TABLE 2

RUNOFF COEFFICIENTS (RATIONAL METHOD)

DEVELOPED AREAS (URBAN)

Land Use	Coefficient, C Soil Type (1)
	D
Residential:	
Single Family	.55
Multi-Units	.70
Mobile Homes	.65
Rural (lots greater than 1/2 acre)	.45
Commercial (2) 80% Impervious	.85
Industrial (2) 90% Impervious	.95

NOTES:

(1) Type D soil to be used for all areas.

(2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%

Tabulated imperviousness = 80%

Revised C = $\frac{50}{80} \times 0.85 = 0.53$

FLOODPLAIN ANALYSIS OF CARROL CANYON CREEK

at

THE GLEN AT SCRIPPS RANCH

CITY OF SAN DIEGO, CALIFORNIA

Prepared for:

Lattitude 33 Planning and Engineering
5355 Mira Sorrento Place, Suite 650
San Diego, CA, 92121
April, 2014

Tory R. Walker, R.C.E.
Tory R. Walker Engineering, Inc.

TORY R. WALKER ENGINEERING, INC.
WATER RESOURCES PLANNING & ENGINEERING
122 CIVIC CENTER DRIVE, SUITE 206, VISTA, CA 92084 | P: 760-414-9212 | WWW.TRWENGINEERING.COM

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- Existing Conditions	2
- Developed Conditions	3
- Topographic Data	3
- Roughness Coefficients	4
- Ineffective Flow Areas	4
- Downstream Boundary Conditions	4
- Double Box Culvert	4
Conclusion	5

Attachments

1.) HEC-RAS Output Files

- Existing Condition HEC-RAS
- Developed Condition HEC-RAS

2.) Ineffective Flow Area Calculations

3.) Double Box Culvert Elevation Calculations

4.) Improvement & Grading Plans For: Private Access Driveway

5.) HEC-RAS Work Maps

a. Existing Condition HEC-RAS Work Map
b. Developed Condition HEC-RAS Work Map
c. Existing vs Developed Conditions HEC-RAS Work Map
d. FIRM Panel 06073C1364G

Introduction

The Glen at Scripps Ranch is a proposed project located on the south side of Pomerado Road and west of Chabad Center Driveway in the City of San Diego, California (See Figure 1- Vicinity Map). The project is located just south of Carrol Canyon Creek, which runs parallel to Pomerado Road. The stretch of Carrol Canyon Creek that is adjacent to the project is located in FIRM Panel 06073C1364G and is designated as a Flood Zone AE.

The project site proposes the development of single family residences, along with access roads and sidewalks. Additionally, the project proposes grading that extends into areas of the current FEMA delineated 100-year floodplain for Carrol Canyon Creek.

Figure 1. Project Vicinity Map (no scale)

Study Purpose & Approach

This study was created to determine impacts of the proposed grading within the 100-year floodplain of Carrol Canyon Creek. The study limits begin approximately 100 feet downstream of the westerly property boundary and extend just upstream of Chabad Center Driveway. The Corps of Engineers HEC-RAS program was used to analyze the existing and proposed conditions.

Existing Conditions:

In existing conditions, the project site is mostly naturally vegetated. Runoff from the site drains in a northerly direction towards the existing Carrol Canyon Creek, which then conveys flow in a westerly direction parallel to Pomerado Road before discharging from the project limits.

In existing conditions, Carrol Canyon Creek conveys approximately 1,330 cfs (as indicated on the "Improvement and Grading Plans - Private Access Driveway In Chabad – Scripps Ranch Phase 1"). These flows are discharged to the project site by an existing 10-foot by 5-foot double box culvert constructed upstream of the project site within the adjacent access road to the neighboring development (Chabad of San Diego, Jewish Day School).

The project is located on FIRM Panel 06073C1364G, which indicates a 100-year BFE (base flood elevation) of 577 feet at the upstream project boundary and 563 feet at the downstream project boundary limit.

A HEC-RAS model was developed to model the portion of Carrol Canyon Creek pertinent to the project site, the results of which are summarized in Table 1.

Table 1 - Existing Conditions Carrol Canyon Creek HEC-RAS Results

Location	HEC-RAS Cross Section	W.S. Elevation (ft)	Top Width (ft)
Upstream Limit	1412.74	585.53	369.8
	1385.61	585.18	319.04
Culvert	1290.56		
	1204.11	580.34	215.62
	1114.37	575.36	299.47
	1050.48	574.85	342.15
	933.83	573.24	239.69
	830.23	572.06	283.73
	707.86	570.74	285.44
	616.16	569.64	328.58
	468.06	566.95	303.18
	345.85	565.83	372.65
	177.42	564.19	292.86
	94.15	563.49	252.67
Downstream Limit	24.12	562.63	162.14

Developed Conditions:

The project proposes grading embankments and a detention basin within the existing 100-year floodplain as delineated in the current effective FIRM panel.

No grading is proposed within the existing flowline of Carrol Canyon Creek and no changes are proposed to the existing culverts located upstream of the site. Onsite peak flows are to be mitigated by the proposed detention basin such that there is no anticipated change in peak 100 year flows within the adjacent creek.

A HEC-RAS model was created to determine the hydraulic impacts of the proposed grading; the results are summarized in Table 2 below.

Table 2 - Developed Conditions Carrol Canyon Creek HEC-RAS Results

Location	HEC-RAS Cross Section	W.S. Elevation (ft)	Top Width (ft)
Upstream Limit	1412.74	585.53	369.8
	1385.61	585.18	319.04
Culvert	1290.56		
	1204.11	580.34	215.62
	1114.37	575.38	268.61
	1050.48	574.84	275.44
	933.83	573.24	243.27
	830.23	572.18	285.6
	707.86	570.85	263.2
	616.16	569.68	294.76
	468.06	566.95	303.24
	345.85	565.85	350.34
	177.42	564.19	292.86
	94.15	563.49	252.67
Downstream Limit	24.12	562.63	162.14

Topographic Data:

A 3D surface model was constructed for the portion of Carrol Canyon Creek using flown topographic data. Cross sections were created and then exported from this 3D surface model to create the existing and proposed conditions HEC-RAS models. The topographic file is based on the NAVD 88 datum.

Roughness Coefficients:

The following Manning's roughness coefficients were used in both pre and post developed models accordingly:

- 0.04 is used throughout Carrol Canyon Creek, based on current vegetation.
- 0.014 is representative of the concrete culverts.

Ineffective Flow Areas:

In compliance with Table 6-1 of the HEC-RAS User's Manual and Equation B-2 from Appendix B of the HEC-RAS Reference Manual, the following ineffective flow areas, contraction ratio and reach lengths were used within the HEC-RAS models. Calculations are provided in Attachment 2 of this report.

- Station 1385.61 - Left and right ineffective sections are due to a sudden contraction that occurs as water enters the culvert.
- Station 1204.11 - Left and right ineffective sections are due to a sudden expansion that occurs as water exits the culvert.
- Station 1114.37 - Left and right ineffective sections are due to a sudden expansion that occurs as water exits the culvert.

Downstream Boundary Conditions:

Normal depth was assumed as the downstream boundary condition for both the existing and developed conditions HEC-RAS models. The normal depth used for both models has a channel slope of 0.0133 (1.33%), consistent with the natural slope of the channel.

Double Box Culvert:

Elevations for the 10-foot by 5-foot double box culvert at Chabad Center Driveway are detailed on the "Improvement and Grading plan for: PRIVATE ACCESS DRIVEWAY in Chabad – Scripps Ranch Phase 1", Plan Number 27827-5D, dated March 5, 1996 (See attachment 4).

Due to datum differences between the flown topographic data and the improvement plan, adjustments were made to the elevations detailed on the improvement plans.

An initial adjustment was due to an error in the U.S.C & G S Benchmark NO J-321 brass disc. The elevation of 604.141 M.S.L shown (County of San Diego vertical control records) was determined to be in error. The correct elevation is 608.458. Therefore the elevations on the improvement plans were increased by 4.317 feet to account for this error.

A second adjustment was due to the fact the topography used for the surface model is in NAVD 88 vertical datum while the improvement plans are in NVGD 29 vertical datum. To convert from

NVGD 29 to NAVD 88, an additional increase of 2.139 feet was required to convert the improvement plan elevations to coincide with the flown topographic datum.

As a result of these two adjustments (4.317 feet and 2.139 feet), a total of 6.456 feet was added to the elevations on the improvement plans (See attachment 6 for calculations).

Conclusion

Table 3 illustrates the difference between developed and existing conditions HEC-RAS models. It can be seen that the resultant 100-year water surface elevations of Carrol Canyon Creek throughout the reach coincident with the Glen at Scripps Ranch development do not exceed 1 foot when compared to the existing condition throughout the reach. All increases in water surface elevations are within the project site. Also it should be noted that there is no change in base flood elevations at both the upstream downstream limits of the HEC-RAS model.

Table 3 - Summary of Developed vs Existing HEC-RAS

Location	HEC-RAS Cross Section	Developed Model Q100 WSE (ft)	Existing Model Q100 WSE (ft)	Difference (ft)
Upstream Limit	1412.74	585.53	585.53	0
	1385.61	585.18	585.18	0
Culvert	1290.56			
	1204.11	580.34	580.34	0
	1114.37	575.38	575.36	0.02
	1050.48	574.84	574.85	-0.01
	933.83	573.24	573.24	0
	830.23	572.18	572.06	0.12
	707.86	570.85	570.74	0.11
	616.16	569.68	569.64	0.04
	468.06	566.95	566.95	0
	345.85	565.85	565.83	0.02
	177.42	564.19	564.19	0
	94.15	563.49	563.49	0
Downstream Limit	24.12	562.63	562.63	0

A maximum increase in water surface elevation of 0.12 feet (approximately 1-inch) is located at station 830.23. There are no structures or facilities to be impacted by this or any other increase in peak water surface elevation.

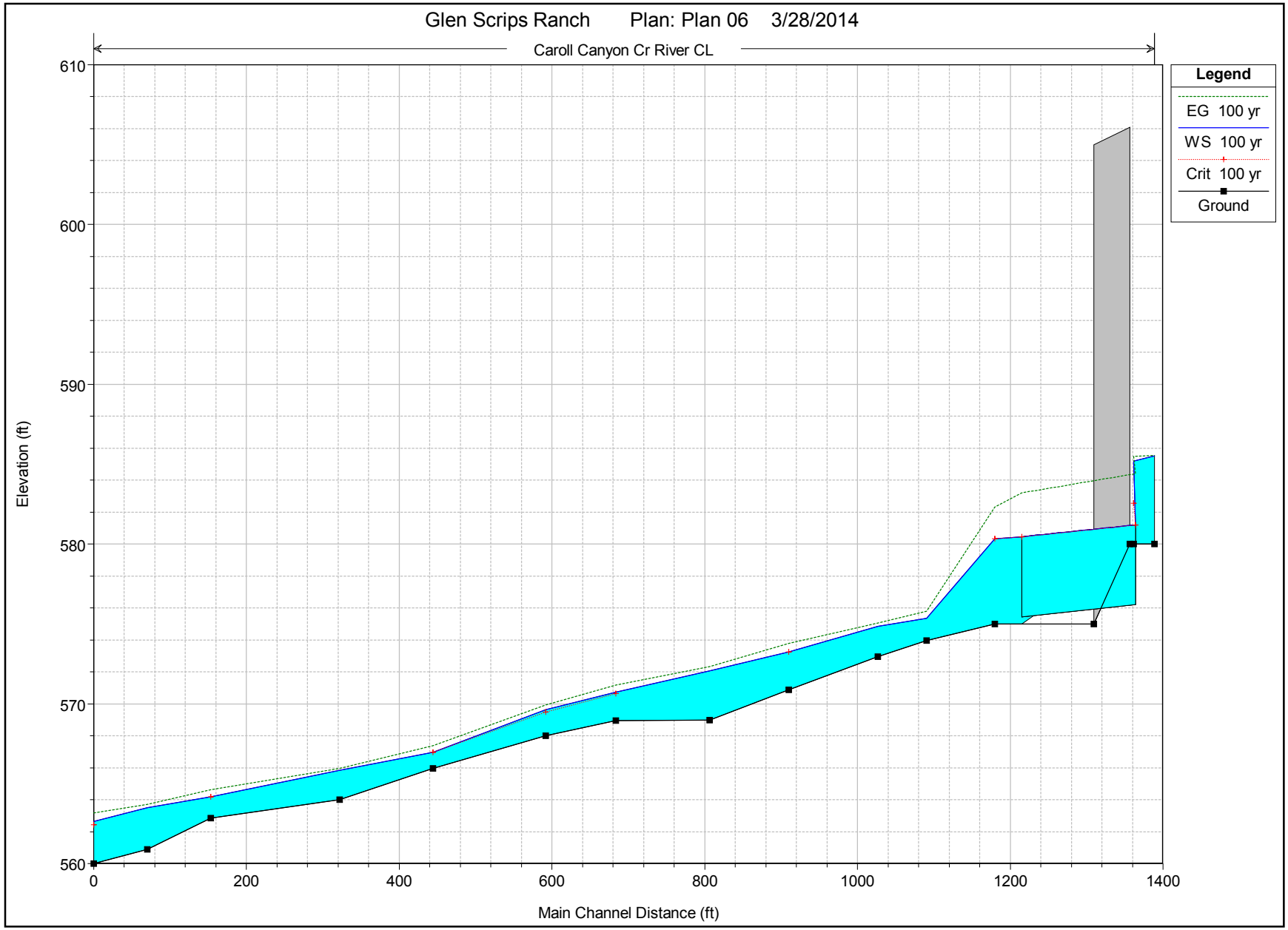
The proposed detention basin located at cross-section 1114.37 is not overtopped by 100-year flow conditions. Peak flooding is approximately 10 feet below the basin invert. Additionally, flow velocities in Carrol Canyon Creek are less than 6 feet per second and considered non-erosive. As such, the proposed detention basin will not be affected by the 100-year flooding in the creek.

No structures are inundated or affected by flood waters due to the proposed development, as demonstrated within this document and corresponding HEC-RAS analysis.

1. HEC-RAS OUTPUT FILES
EXISTING CONDITION ANALYSIS

HEC-RAS Plan: Plan 05 River: Caroll Canyon Cr Reach: River CL Profile: 100 yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
River CL	1412.74	100 yr	1332.00	580.00	585.53		585.54	0.000050	0.79	1737.98	369.80	0.06
River CL	1385.61	100 yr	1332.00	580.00	585.18	582.57	585.50	0.001656	4.53	294.19	319.04	0.35
River CL	1290.56		Culvert									
River CL	1204.11	100 yr	1332.00	575.00	580.34	580.34	582.33	0.015374	11.32	117.69	215.62	1.01
River CL	1114.37	100 yr	1332.00	573.95	575.36		575.80	0.015333	5.36	248.67	299.47	0.84
River CL	1050.48	100 yr	1332.00	572.96	574.85		575.07	0.007549	4.00	371.19	342.15	0.60
River CL	933.83	100 yr	1332.00	570.89	573.24	573.24	573.79	0.016507	6.16	241.50	239.69	0.90
River CL	830.23	100 yr	1332.00	568.99	572.06		572.33	0.006946	5.79	341.04	283.73	0.63
River CL	707.86	100 yr	1332.00	568.94	570.74	570.65	571.17	0.013485	5.49	274.14	285.44	0.79
River CL	616.16	100 yr	1332.00	567.99	569.64	569.49	569.94	0.012593	4.62	314.54	328.58	0.75
River CL	468.06	100 yr	1332.00	565.97	566.95	566.95	567.38	0.024786	5.39	254.46	303.18	1.01
River CL	345.85	100 yr	1332.00	564.01	565.83		565.96	0.004055	3.24	473.55	372.65	0.45
River CL	177.42	100 yr	1332.00	562.86	564.19	564.19	564.64	0.019165	6.08	262.79	292.86	0.95
River CL	94.15	100 yr	1332.00	560.88	563.49		563.71	0.004400	4.54	383.61	252.67	0.51
River CL	24.12	100 yr	1332.00	560.00	562.63	562.44	563.18	0.013304	5.99	226.69	162.14	0.82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WS 100 yr
Crit 100 yr
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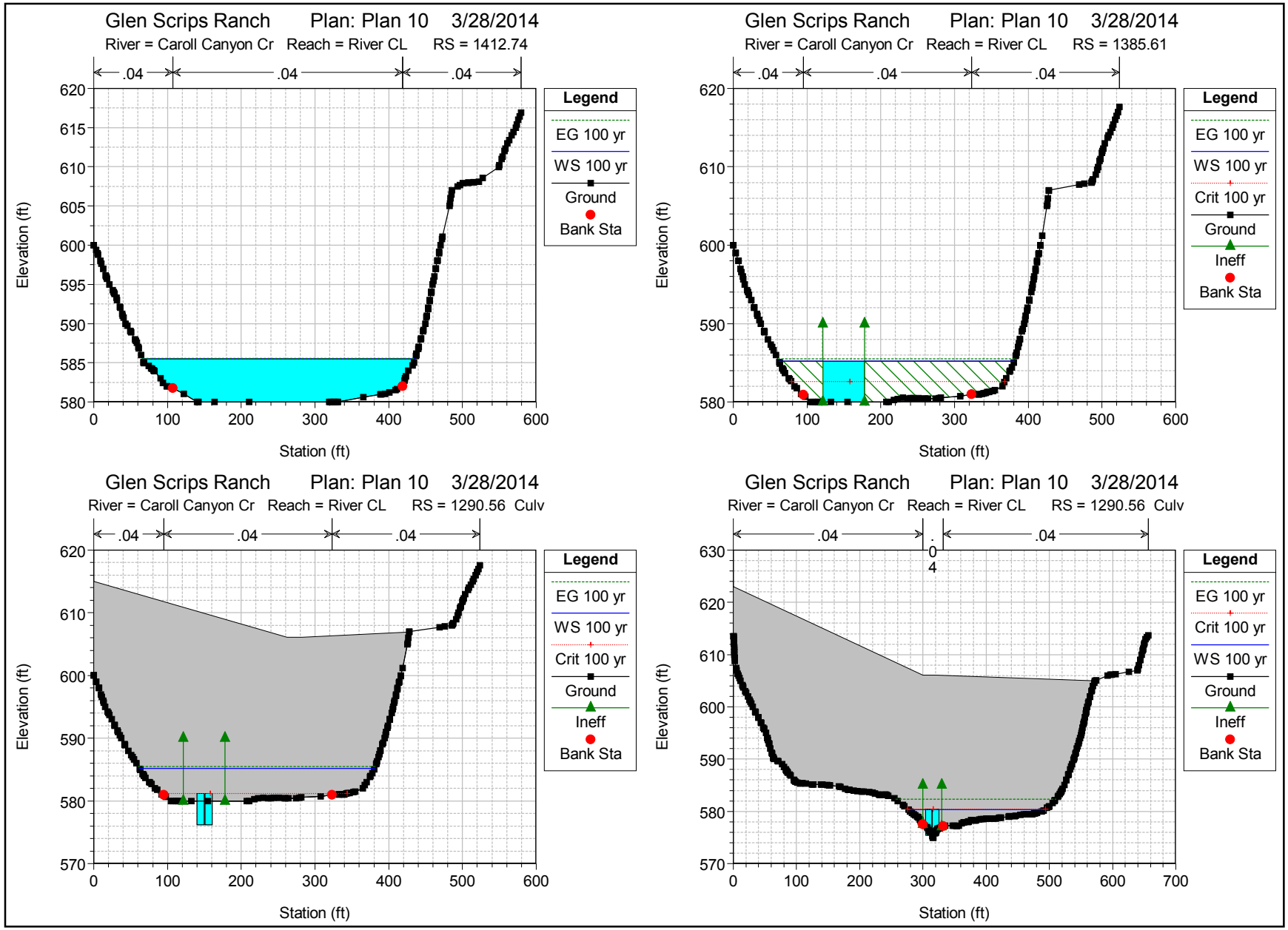
580
570
560
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)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Station (ft)
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Bank Sta
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Crit 100 yr
Ground
Ineff
Bank Sta
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Station (ft)
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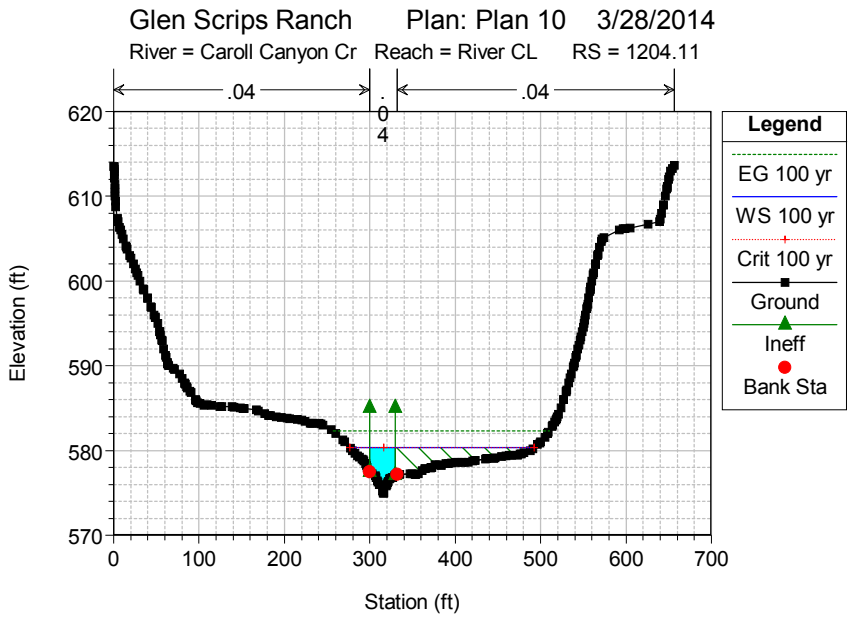
Station (ft)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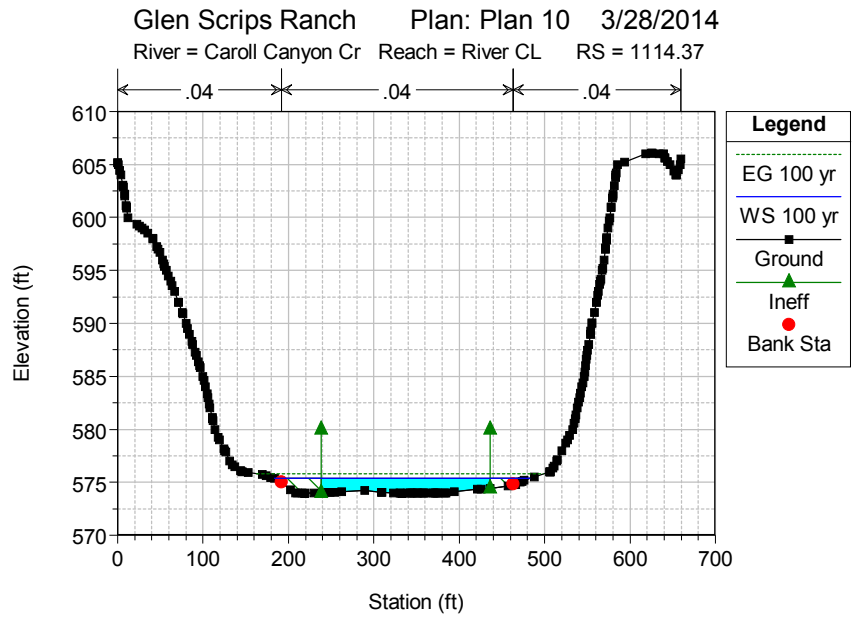
Station (ft)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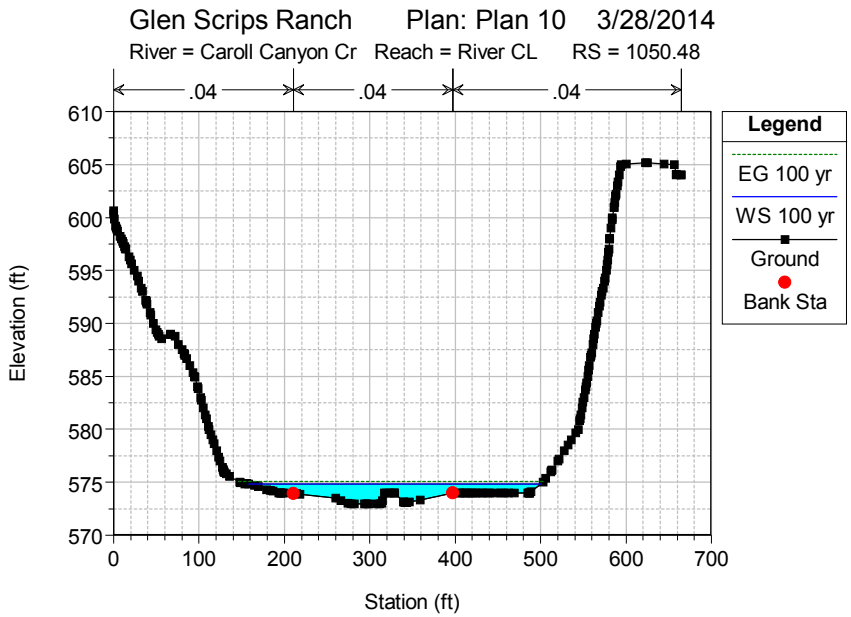
Station (ft)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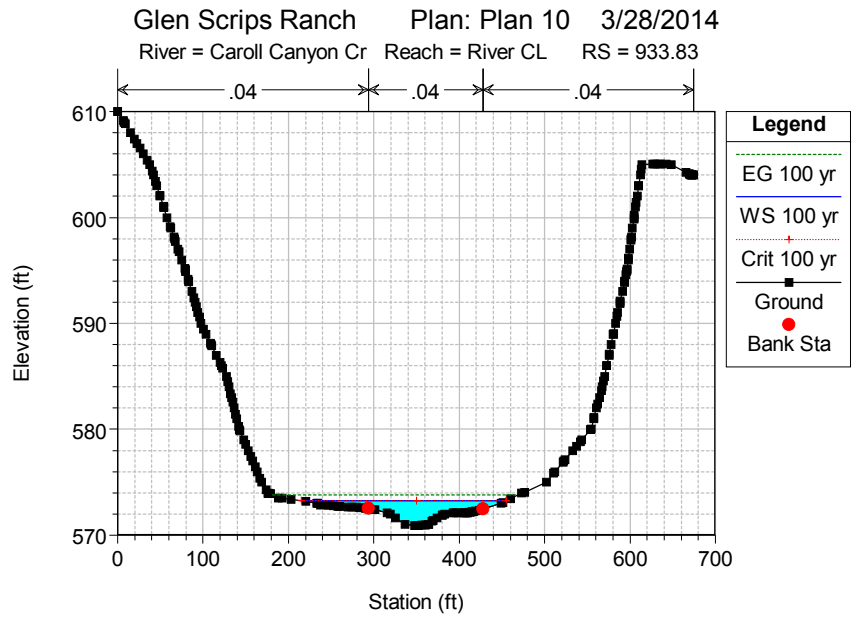
Station (ft)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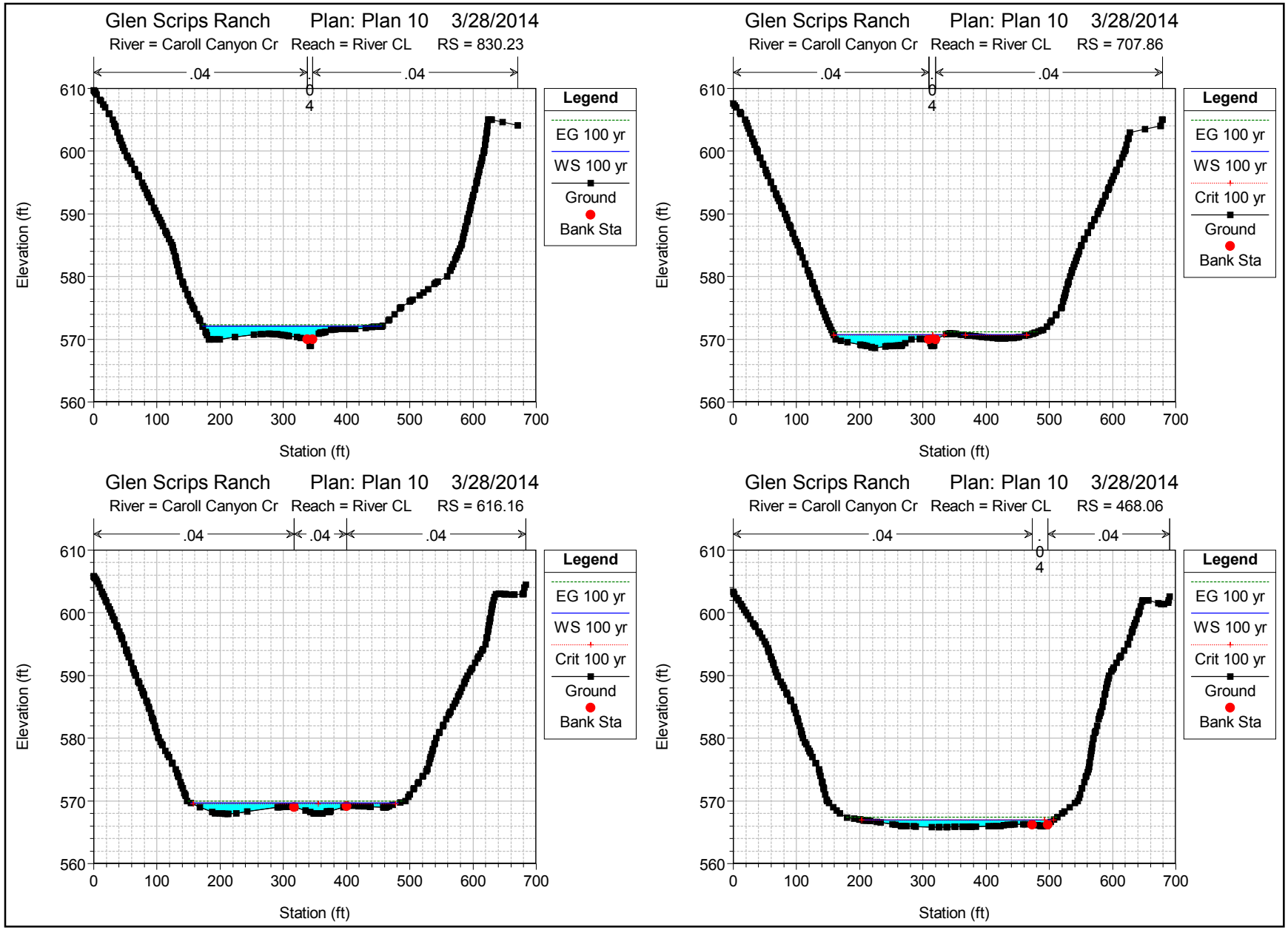
Station (ft)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Ground
Bank Sta
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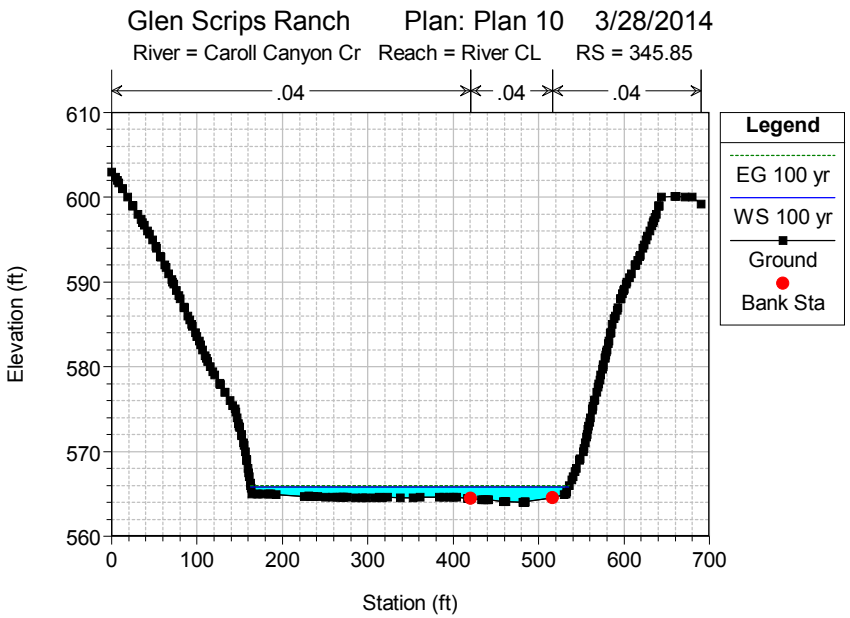
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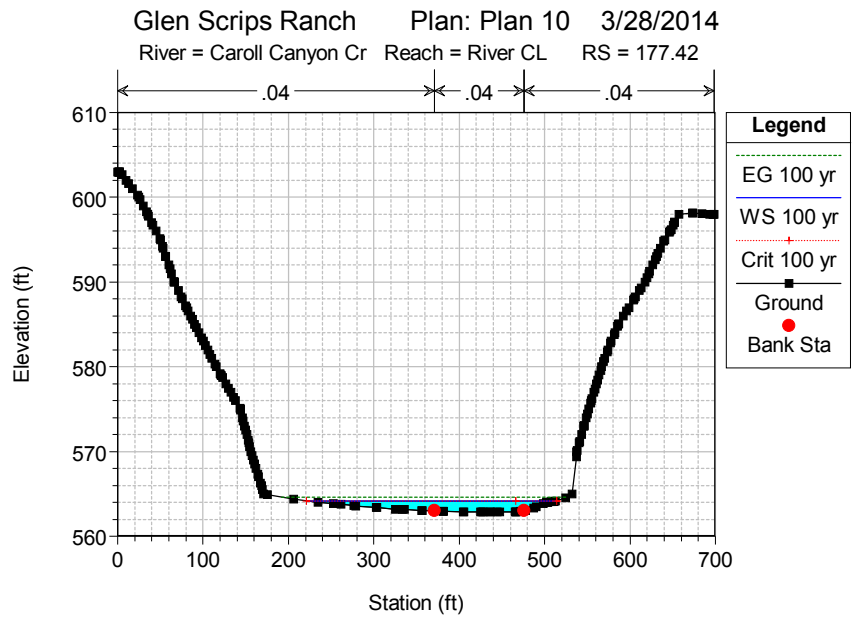
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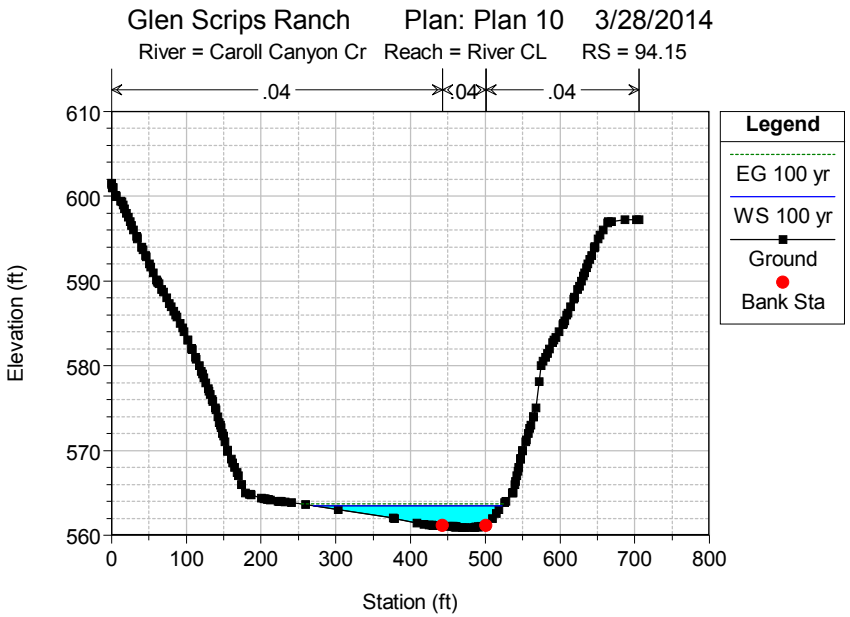
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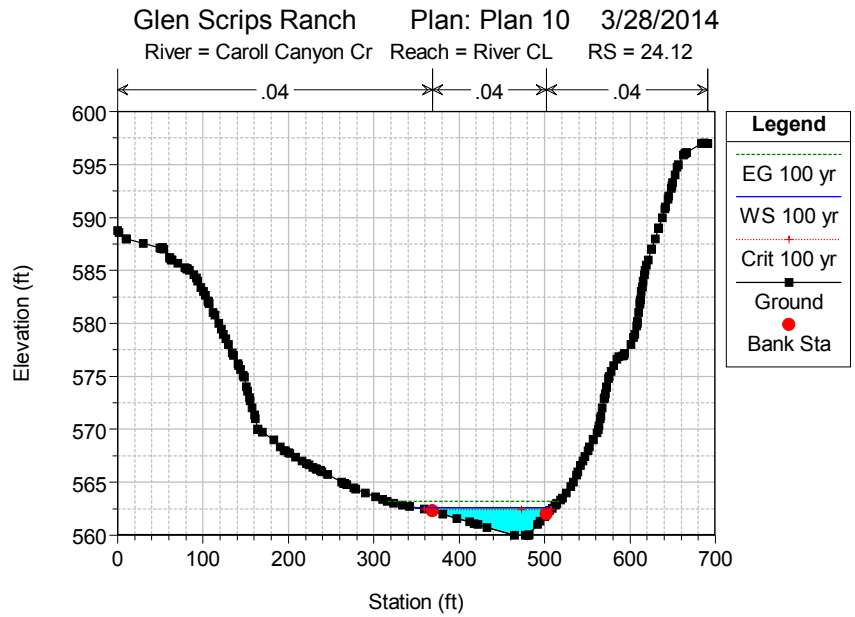
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Ground
Bank Sta
Elevation (ft)
Station (ft)

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                        HEC-RAS Version 4.1.0 Jan 2010
                         U.S. Army Corps of Engineers
                        Hydrologic Engineering Center
                              609 Second Street
                              Davis, California


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PROJECT DATA
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Project in English units

PLAN DATA

Plan Title: Plan 06
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Geometry Title: CC Exist
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Flow Title : 100 yr
Flow File : y:\Projects\240 (Lattitude 33)\02 (The Glen at Scrips Ranch)\HEC-RAS\New Geo From CAD\GlenScripsRanch.f01

Plan Summary Information:

Number of:	Cross Sections	= 14	Multiple Openings	=	0
	Culverts	= 1	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 100 yr
Flow File : y:\Projects\240 (Lattitude 33)\02 (The Glen at Scrips Ranch)\HEC-RAS\New Geo From CAD\GlenScripsRanch.f01

Flow Data (cfs)

River	Reach	RS	100 yr
Caroll Canyon Cr	River CL	1412.74	1332

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Caroll Canyon Cr	River CL	100 yr		Normal S = 0.0133

GEOMETRY DATA

Geometry Title: CC Exist
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CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1412.74

INPUT
Description:
Station Elevation Data num= 142

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	600.01	.09	600	2.94	599.42	5	599	5.93	598.81
9.1	598	10.55	597.63	13.01	597	16.37	596.15	16.94	596
17.31	595.9	18.07	595.71	21.19	595	25.39	594.25	26.89	594
27.33	593.92	28.01	593.78	30.6	593.29	31.61	593	35.28	592.17
35.84	592	38.32	591.23	39.25	591	40.17	590.77	43.16	590
45.47	589.7	49.57	589.06	49.93	589	50.49	588.9	55.97	588
57.17	587.8	58.32	587.56	60.57	587	61.25	586.83	64.21	586
67.49	585.08	67.77	585	68.16	584.97	68.19	584.97	74.39	584.57
77.88	584.32	79.31	584.24	81.14	584.06	81.74	584	82.42	583.91
90.67	583	93.61	582.39	99.21	582.02	99.68	582	107.26	581.77
122.34	581	139.79	580.03	141.11	580	141.66	580	163.6	580
210.86	580	319.17	580	320.56	580	321.77	580	325.23	580
326.53	580	328.13	580	330.79	580	330.89	580	365.66	580.59
388.48	580.99	389.9	580.99	394.95	581	400.76	581.21	408.97	581.52
410.91	581.61	418.57	582	418.58	582.003	421.26	582.74	422.18	583
423.17	583.27	426.65	584	432.18	584.68	433.96	585	436.77	585.85
437.24	586	437.72	586.15	439.75	586.79	440.41	587	440.48	587.02
443.5	588	443.83	588.11	446.57	589	447.12	589.18	449.63	590
451.19	590.79	451.63	591	453.24	591.82	453.62	592	455.29	592.85
455.61	593	457.37	593.89	457.59	594	457.79	594.09	459.48	595
460.43	595.46	461.72	596	463.69	596.96	463.78	597	463.87	597.04
465.91	598	466.11	598.09	468.08	599	468.38	599.13	470.24	600
472.46	600.77	472.89	601.08	482.42	605	482.95	605.3	483.93	606
484.84	606.49	485.9	607	493.21	607.52	496.4	607.65	500.22	607.89
507.87	608	507.93	608	507.94	608	515.13	608.01	515.34	608.01
522.14	608.08	527.16	608.56	549.06	610	549.86	610.21	553.09	611
554.3	611.32	557.06	612	558.37	612.34	560.99	613	563.12	613.39
566.6	614	569.01	614.44	572.23	615	573.74	615.42	575.83	616
577.41	616.44	579.17	616.93						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	107.26	.04	418.58	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
107.26	418.58	27.13	27.13	27.13	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1385.61

INPUT
Description:
Station Elevation Data num= 151

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	600.03	.16	600	3.27	599.03	3.36	599	7.02	598
7.03	598	7.06	597.99	9.93	597	11.12	596.57	12.77	596
13.75	595.66	15.55	595	18.39	594.28	19.72	594	21.15	593.68
24.24	593	28.07	592.11	28.44	592.02	28.54	592	31.92	591.24
32.94	591	35.36	590.45	37.28	590	41.57	589.06	41.83	589
42.07	588.95	42.23	588.91	47.06	588	50.89	587.31	52.57	587
54.87	586.59	57.85	586	62.33	585.09	62.77	585	63.18	584.92
66.37	584.28	67.15	584.19	68.36	584	70.1	583.69	75.02	583
76.2	582.91	78.25	582.66	82.57	582	85.98	581.78	91.98	581
95.02	580.93	95.3	580.93	95.72	580.9	97.84	580.67	104.89	580
107.16	580	111.63	580	114.05	580	114.79	580	132.18	580
155.02	580	207.18	580	210.88	580	217.69	580.26	223.01	580.39
229.75	580.52	236.66	580.41	240.4	580.46	244.03	580.49	251.31	580.48
258.75	580.4	260.18	580.4	263.84	580.43	274.05	580.44	278.48	580.49
281.16	580.56	307.58	580.72	323.12	580.98	331.88	580.99	332.94	580.99
333.49	580.99	337.4	581	339.09	581.06	339.55	581.06	342.38	581.16
344.14	581.24	347.06	581.28	352.07	581.41	354.42	581.5	364.95	582
367.59	582.52	370.08	583	374.48	583.84	375.3	584	377.53	584.42
380.41	585	382.83	585.87	383.2	586	383.98	586.3	385.95	587
387.29	587.48	388.7	588	388.85	588.05	391.43	589	392.2	589.28
394.23	590	395.46	590.53	396.59	591	398.25	591.69	399.02	592
401.26	592.94	401.4	593	401.56	593.06	403.78	594	405.13	594.59
406.13	595	407.51	595.67	408.06	596	409.56	596.73	410.01	597
411.67	597.8	412.02	598	413.82	598.86	414.07	599	416.04	599.93
416.17	600	418.59	601.23	425.41	605	425.75	605.23	426.65	606
428.06	606.96	428.12	607	469.24	607.72	476.16	607.84	485.9	608
486.32	608.12	486.69	608.19	487.76	608.38	491.13	609	493.13	609.58
494.42	610	496.84	610.75	497.54	611	500.07	611.79	500.68	612
501.68	612.33	503.85	613	507.27	613.69	508.85	614	511.27	614.47
513.87	615	515.4	615.41	517.64	616	519.57	616.5	521.41	617
523.78	617.62								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	95.02	.04	323.12	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
95.02	323.12	181.5	181.5	181.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	121.45	590	T
178.22	523.78	590	T

CULVERT

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1290.56

INPUT
Description:
Distance from Upstream XS = 5
Deck/Roadway Width = 47
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	615	580	262.28	606.076	576.206	282.78	606.076	576.206
428.06	606.96	580						

Upstream Bridge Cross Section Data
Station Elevation Data num= 151

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	600.03	.16	600	3.27	599.03	3.36	599	7.02	598

7.03	598	7.06	597.99	9.93	597	11.12	596.57	12.77	596
13.75	595.66	15.55	595	18.39	594.28	19.72	594	21.15	593.68
24.24	593	28.07	592.11	28.44	592.02	28.54	592	31.92	591.24
32.94	591	35.36	590.45	37.28	590	41.57	589.06	41.83	589
42.07	588.95	42.23	588.91	47.06	588	50.89	587.31	52.57	587
54.87	586.59	57.85	586	62.33	585.09	62.77	585	63.18	584.92
66.37	584.28	67.15	584.19	68.36	584	70.1	583.69	75.02	583
76.2	582.91	78.25	582.66	82.57	582	85.98	581.78	91.98	581
95.02	580.93	95.3	580.93	95.72	580.9	97.84	580.67	104.89	580
107.16	580	111.63	580	114.05	580	114.79	580	132.18	580
155.02	580	207.18	580	210.88	580	217.69	580.26	223.01	580.39
229.75	580.52	236.66	580.41	240.4	580.46	244.03	580.49	251.31	580.48
258.75	580.4	260.18	580.4	263.84	580.43	274.05	580.44	278.48	580.49
281.16	580.56	307.58	580.72	323.12	580.98	331.88	580.99	332.94	580.99
333.49	580.99	337.4	581	339.09	581.06	339.55	581.06	342.38	581.16
344.14	581.24	347.06	581.28	352.07	581.41	354.42	581.5	364.95	582
367.59	582.52	370.08	583	374.48	583.84	375.3	584	377.53	584.42
380.41	585	382.83	585.87	383.2	586	383.98	586.3	385.95	587
387.29	587.48	388.7	588	388.85	588.05	391.43	589	392.2	589.28
394.23	590	395.46	590.53	396.59	591	398.25	591.69	399.02	592
401.26	592.94	401.4	593	401.56	593.06	403.78	594	405.13	594.59
406.13	595	407.51	595.67	408.06	596	409.56	596.73	410.01	597
411.67	597.8	412.02	598	413.82	598.86	414.07	599	416.04	599.93
416.17	600	418.59	601.23	425.41	605	425.75	605.23	426.65	606
428.06	606.96	428.12	607	469.24	607.72	476.16	607.84	485.9	608
486.32	608.12	486.69	608.19	487.76	608.38	491.13	609	493.13	609.58
494.42	610	496.84	610.75	497.54	611	500.07	611.79	500.68	612
501.68	612.33	503.85	613	507.27	613.69	508.85	614	511.27	614.47
513.87	615	515.4	615.41	517.64	616	519.57	616.5	521.41	617
523.78	617.62								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	95.02	.04	323.12	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
95.02	323.12	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	121.45	590	T
178.22	523.78	590	T

Downstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	623	580	299.71	606.076	575.456	320.71	606.076	575.456
571.62	605	580						

Downstream Bridge Cross Section Data
Station Elevation Data num= 255

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	613.51	.69	613.54	.76	613.22	.84	612.89	.91	612.54
.99	612.17	1.24	611.4	1.37	610.97	1.54	610.51	1.71	610
1.97	609.43	2.39	608.76	4.49	607.42	5.05	607	6.76	606.36
7.97	606	9.39	605.51	10.87	605	14.37	604.16	15.01	604
15.98	603.74	19	603	20.25	602.69	23.03	602	25.44	601.4
27.1	601	28.4	600.66	30.92	600	34.78	599.11	35.28	599
35.59	598.93	39.44	598	39.74	597.93	43.54	597	44.04	596.88
47.59	596	48.49	595.79	48.85	595.71	51.61	595	54.07	594.01
54.09	594	54.1	594	54.92	593.65	56.46	593	56.6	592.94
58.83	592	60.7	591.21	61.21	591	62.6	590.4	63.04	590.24
63.79	590.09	64.23	590	69.89	589.69	71.24	589.56	77.38	589
80.37	588.51	82.82	588	83.17	587.93	83.76	587.8	85.08	587.56
86.02	587.38	89.47	587	90.78	586.86	95.74	586	96.12	585.94
96.6	585.83	98.26	585.67	101.32	585.54	105.33	585.36	109.35	585.38
114.62	585.32	124.7	585.15	126.95	585.16	138.74	585.16	140.98	585.14
148.52	585	151.52	584.95	151.89	584.95	152.96	584.93	167.09	584.77
169.59	584.66	176.55	584.35	181.65	584.15	183.35	584.13	190.47	584
196.63	583.88	202.96	583.81	206.1	583.78	215.32	583.68	220.17	583.57
224.42	583.42	230.18	583.24	231.95	583.18	233.33	583.18	240.94	583.2
242.72	583.11	244.79	583	255.01	582.49	260.21	582	268.24	581.25

270.56	581	277.3	580.29	279.25	580	282.68	579.68	285.64	579.4
287.68	579.25	290.69	579	292.05	578.88	292.74	578.78	295.25	578.43
295.26	578.43	295.83	578.26	296.92	578	299.95	577.49	302.99	577.28
306.18	577	307.17	576.82	309.09	576.44	309.84	576.28	310.98	576
314.87	575.22	315.87	575	316.01	575	316.19	575	316.38	575
319.08	575.82	319.8	576	320.55	576.21	321.34	576.36	322.93	576.63
323.68	576.69	326.39	576.8	326.4	576.8	326.41	576.8	328.79	577
330.05	577.1	331.98	577.19	334.95	577.21	347.14	577.24	349.2	577.22
353.2	577.19	353.73	577.2	356.54	577.28	361.53	577.66	364.19	577.86
364.74	577.88	370.65	577.95	371.86	578	372.74	578.03	372.83	578.04
376.23	578.3	377.41	578.33	381.43	578.29	384	578.27	388.74	578.43
392.15	578.48	395.69	578.54	399.97	578.6	402.93	578.61	407.72	578.61
410.56	578.63	415.47	578.63	420.16	578.76	422.9	578.81	423.63	578.82
435.11	579	436.89	579.03	437.24	579.03	445.45	579.1	446.92	579.11
454.52	579.32	459.38	579.39	463.13	579.43	466.37	579.46	472.87	579.45
476.28	579.59	477.29	579.61	480.09	579.71	487.91	580	490.53	580.17
496.48	580.69	498.82	580.89	499.69	581	504.81	581.59	507.91	582
508.25	582.04	509.07	582.17	513.24	582.82	514.28	583	516.32	583.35
517.63	583.59	518.55	583.78	519.51	584	521.12	584.31	524.14	585
527.2	585.99	527.24	586	529.96	586.92	530.18	587	530.56	587.14
533.01	588	534.57	588.55	535.81	589	538.25	589.84	538.77	590
539.62	590.33	541.14	591	541.73	591.24	543.55	592	544.63	592.46
546.02	593	547.19	593.45	548.49	594	549.85	594.56	550.97	595
551.63	595.34	552.67	596	553.87	596.71	554.44	597	554.98	597.26
556.23	598	557.48	598.74	558	599	558.72	599.33	559.91	600
561.49	600.71	562.13	601	564.39	601.93	564.55	602	564.59	602.02
566.85	603	567.18	603.15	569.11	604	570.83	604.66	571.62	605
574.08	605.12	592.24	606	596.93	606.17	598.99	606.19	604.55	606.29
625.66	606.71	639.05	607	639.69	607.28	641.31	608	643.56	609
643.58	609.01	646.05	610	647.79	610.83	648.13	611	648.43	611.17
650.13	612	650.62	612.26	652.11	613	654.35	613.31	656.86	613.68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	299.95	.04	331.98	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
299.95	331.98	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	299.95	585	T
330.05	656.86	585	T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name	Shape	Rise	Span
Culvert #1	Box	5	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
-2.5	149	.014	.014	0	.4	1

Upstream Elevation = 576.206
Centerline Station = 144.84
Downstream Elevation = 575.456
Centerline Station = 309.05

Culvert Name	Shape	Rise	Span
Culvert #2	Box	5	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	-2.5	149	.014	.014	0	.4	1

Upstream Elevation = 576.206
Centerline Station = 155.84
Downstream Elevation = 575.456
Centerline Station = 320.05

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1204.11

INPUT
Description:
Station Elevation Data num= 255

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	613.51	.69	613.54	.76	613.22	.84	612.89	.91	612.54
.99	612.17	1.24	611.4	1.37	610.97	1.54	610.51	1.71	610
1.97	609.43	2.39	608.76	4.49	607.42	5.05	607	6.76	606.36
7.97	606	9.39	605.51	10.87	605	14.37	604.16	15.01	604
15.98	603.74	19	603	20.25	602.69	23.03	602	25.44	601.4
27.1	601	28.4	600.66	30.92	600	34.78	599.11	35.28	599
35.59	598.93	39.44	598	39.74	597.93	43.54	597	44.04	596.88
47.59	596	48.49	595.79	48.85	595.71	51.61	595	54.07	594.01
54.09	594	54.1	594	54.92	593.65	56.46	593	56.6	592.94
58.83	592	60.7	591.21	61.21	591	62.6	590.4	63.04	590.24
63.79	590.09	64.23	590	69.89	589.69	71.24	589.56	77.38	589
80.37	588.51	82.82	588	83.17	587.93	83.76	587.8	85.08	587.56
86.02	587.38	89.47	587	90.78	586.86	95.74	586	96.12	585.94
96.6	585.83	98.26	585.67	101.32	585.54	105.33	585.36	109.35	585.38
114.62	585.32	124.7	585.15	126.95	585.16	138.74	585.16	140.98	585.14
148.52	585	151.52	584.95	151.89	584.95	152.96	584.93	167.09	584.77
169.59	584.66	176.55	584.35	181.65	584.15	183.35	584.13	190.47	584
196.63	583.88	202.96	583.81	206.1	583.78	215.32	583.68	220.17	583.57
224.42	583.42	230.18	583.24	231.95	583.18	233.33	583.18	240.94	583.2
242.72	583.11	244.79	583	255.01	582.49	260.21	582	268.24	581.25
270.56	581	277.3	580.29	279.25	580	282.68	579.68	285.64	579.4
287.68	579.25	290.69	579	292.05	578.88	292.74	578.78	295.25	578.43
295.26	578.43	295.83	578.26	296.92	578	299.95	577.49	302.99	577.28
306.18	577	307.17	576.82	309.09	576.44	309.84	576.28	310.98	576
314.87	575.22	315.87	575	316.01	575	316.19	575	316.38	575
319.08	575.82	319.8	576	320.55	576.21	321.34	576.36	322.93	576.63
323.68	576.69	326.39	576.8	326.4	576.8	326.41	576.8	328.79	577
330.05	577.1	331.98	577.19	334.95	577.21	347.14	577.24	349.2	577.22
353.2	577.19	353.73	577.2	356.54	577.28	361.53	577.66	364.19	577.86
364.74	577.88	370.65	577.95	371.86	578	372.74	578.03	372.83	578.04
376.23	578.3	377.41	578.33	381.43	578.29	384	578.27	388.74	578.43
392.15	578.48	395.69	578.54	399.97	578.6	402.93	578.61	407.72	578.61
410.56	578.63	415.47	578.63	420.16	578.76	422.9	578.81	423.63	578.82
435.11	579	436.89	579.03	437.24	579.03	445.45	579.1	446.92	579.11
454.52	579.32	459.38	579.39	463.13	579.43	466.37	579.46	472.87	579.45
476.28	579.59	477.29	579.61	480.09	579.71	487.91	580	490.53	580.17
496.48	580.69	498.82	580.89	499.69	581	504.81	581.59	507.91	582
508.25	582.04	509.07	582.17	513.24	582.82	514.28	583	516.32	583.35
517.63	583.59	518.55	583.78	519.51	584	521.12	584.31	524.14	585
527.2	585.99	527.24	586	529.96	586.92	530.18	587	530.56	587.14
533.01	588	534.57	588.55	535.81	589	538.25	589.84	538.77	590
539.62	590.33	541.14	591	541.73	591.24	543.55	592	544.63	592.46
546.02	593	547.19	593.45	548.49	594	549.85	594.56	550.97	595
551.63	595.34	552.67	596	553.87	596.71	554.44	597	554.98	597.26
556.23	598	557.48	598.74	558	599	558.72	599.33	559.91	600
561.49	600.71	562.13	601	564.39	601.93	564.55	602	564.59	602.02
566.85	603	567.18	603.15	569.11	604	570.83	604.66	571.62	605
574.08	605.12	592.24	606	596.93	606.17	598.99	606.19	604.55	606.29
625.66	606.71	639.05	607	639.69	607.28	641.31	608	643.56	609
643.58	609.01	646.05	610	647.79	610.83	648.13	611	648.43	611.17
650.13	612	650.62	612.26	652.11	613	654.35	613.31	656.86	613.68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	299.95	.04	331.98	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
299.95	331.98	89.74	89.74	89.74	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	299.95	585	T
330.05	656.86	585	T

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1114.37

INPUT
Description:
Station Elevation Data num= 208

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	605.16	.14	605.14	1.08	605	2.6	604.44	3.63	604
5.99	603.06	6.13	603	6.45	602.87	7.87	602.23	8.27	602
10.08	601.1	10.26	601	10.49	600.87	12.06	600	22.39	599.34
25.31	599.2	28.69	599	31.47	598.83	34.89	598.54	41.17	598.01
41.27	598	45.72	597.27	47.54	597	49.18	596.7	52.47	596
54.12	595.64	55.06	595.4	57.05	595	59.58	594.47	61.86	594
63.95	593.57	66.61	593	71.21	592	71.26	591.99	75.8	591
76.12	590.93	80.09	590	81.88	589.52	83.99	589	86.8	588.31
88.03	588	90.97	587.28	92.06	587	94.51	586.39	96.05	586
96.65	585.85	99.93	585	101.03	584.61	102.76	584	104.6	583.34
105.52	583	107.29	582.37	108.28	582	110.72	581.13	111.06	581
111.55	580.82	113.81	580	117.87	579.25	119.46	579	124.5	578.16
125.47	578	126.51	577.83	131.42	577	134.5	576.63	137	576.48
143.75	576.13	144.84	576.05	146.36	576	153.11	575.91	169.14	575.72
173.86	575.59	178.83	575.43	183.41	575.36	191.77	575	202.48	574.28
208.04	574	210.58	573.99	215.54	573.97	218.89	573.95	219.84	573.96
230.23	574	240.54	574.02	242.37	574.02	244.43	574.02	249	574.02
253.93	574.03	262.06	574.09	289.66	574.22	309.07	574.06	309.55	574.05
323.27	574	330.44	573.96	330.98	573.96	332.68	573.95	339.52	573.99
342.34	574	342.54	574	344.67	574	346.95	574	350.1	574
350.93	574	351.79	574	357.02	574	357.89	574	358.74	574
360.73	574	369.4	574.01	370.22	574.01	371.63	574.01	372.78	574.01
374.23	574.01	375.08	574.01	382	574.01	383.55	574.01	384.62	574.01
394.26	574.1	421.56	574.33	425.99	574.33	436.33	574.42	456.88	574.66
463.4	574.81	466.2	574.8	471.31	575	473.58	575.1	476.09	575.17
488.02	575.49	505.64	576	505.75	576	506.31	576	506.46	576
509.68	576.36	510.82	576.51	513.94	577	514.97	577.16	520.35	578
524.91	578.72	526.67	579	529.43	579.43	533.16	580	534.7	580.56
535.78	581	536.7	581.38	538.3	582	539.68	582.55	540.83	583
541.91	583.41	543.39	584	544.5	584.41	546.03	585	546.92	585.43
547.88	586	548.89	586.62	549.61	587	550.42	587.45	551.58	588
553.48	588.98	553.51	589	554.11	589.3	555.5	590	555.59	590.04
558.01	591	560.33	591.97	560.4	592	562.07	592.65	562.84	593
564.5	593.68	565.29	594	565.77	594.19	567.66	595	568	595.22
569.29	596	571.04	596.98	571.06	597	571.29	597.13	572.56	597.88
572.74	598	572.89	598.1	574.34	599	575.56	599.67	576.03	600
577.72	600.91	577.91	601	579.47	601.84	579.78	602	580.18	602.2
581.49	603	582.9	603.76	583.35	604	583.78	604.21	585.28	605
593.47	605.22	618.31	606	624.72	606.05	625.44	606.05	626.14	606.05
634.1	606.04	639.14	606	640.6	605.63	641	605.57	643.77	605.31
647.08	605	651.33	604.39	653.6	604	653.98	604	654.51	604
656.54	604.53	658.59	605	659.34	605.54				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	191.77	.04	463.4	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
191.77	463.4	63.89	63.89	63.89	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent

0	238.05	580	T
435.94	659.34	580	T

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1050.48

INPUT
Description:
Station Elevation Data num= 214

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	600.61	.19	600.31	.52	599.85	2.37	599.21	3.24	599
3.97	598.86	4.8	598.7	7.66	598.2	8.65	598	10.29	597.72
10.91	597.57	12.47	597.26	13.62	597.06	13.92	597	17.71	596.31
19.17	596	21.06	595.63	23.76	595	27.38	594.48	29.59	594
32.44	593.34	33.96	593	37.47	592.18	37.88	592.09	38.26	592
39.08	591.8	42.57	591	43.43	590.8	46.53	590	49.48	589.4
51.28	589.13	52.21	589	53.02	588.8	56.29	588.54	66.94	589
66.95	589	66.96	589	66.98	589	72.11	588.81	75.97	588
80.27	587.53	82.33	587.17	82.94	587.08	83.46	587	85.57	586.69
89.43	586	92.86	585.37	94.51	585	94.83	584.91	98.2	584
98.8	583.81	101.66	583	102.45	582.76	105.06	582	107.39	581.33
108.46	581	110.8	580.27	111.64	580	113.8	579.49	116.02	579
117.44	578.66	120.31	578	123	577.37	124.63	577	127.13	576.43
128.15	576.21	128.73	576.11	129.14	576	129.9	575.9	131.82	575.8
135.52	575.54	147.39	575	148.45	574.96	153.38	574.85	154.93	574.88
156.23	574.88	158.04	574.85	164.96	574.71	169.19	574.6	179.45	574.3
183.55	574.21	186.81	574.15	193.05	574	195.74	573.99	195.75	573.99
195.78	573.99	197.57	573.98	199	573.97	210.42	573.93	214.01	573.91
218.04	573.87	260.1	573.51	265.92	573.29	274.16	573	278.29	572.99
281.76	572.99	293.46	572.96	295.73	572.96	297.36	572.96	307.38	572.98
311.8	572.99	314.13	573	315	573.29	316.75	574	318.98	574.01
322.68	574.01	328.37	574	328.53	574	328.66	574	339.39	573.16
339.5	573.16	341.1	573.1	341.5	573.09	342.42	573.07	342.44	573.07
342.78	573.07	343.15	573.08	346.2	573.12	358.8	573.32	397.39	574
404.6	574.01	405.23	574.01	409.74	574	412.08	574	414.72	574
419.24	573.99	420.62	573.99	424.34	573.99	429.1	573.98	431.81	573.98
437.44	573.98	439.61	573.98	446.32	573.98	453.65	573.99	456.94	573.99
462.68	573.99	469.1	573.99	484.97	574	486.59	574	486.64	574
486.91	574	487.01	574	488.81	574.1	502.63	575	506.1	575.36
511.67	576	512.51	576.09	513.28	576.18	519.92	577	521.29	577.18
527.91	578	532.02	578.52	535.76	579	541.48	579.69	543.94	580
545.73	580.82	546.11	581	546.9	581.34	548.36	582	549.63	582.56
550.63	583	552.18	583.69	552.88	584	553.69	584.37	555.06	585
556.24	585.61	557.05	586	558.57	586.78	559.03	587	559.51	587.23
561.03	588	562.13	588.53	563.01	589	564.22	589.62	564.95	590
565.57	590.25	567.36	591	568.92	591.63	569.82	592	571.31	592.63
572.19	593	573.13	593.35	574.71	594	575.41	594.27	577.16	595
577.92	595.58	578.48	596	579.45	596.73	579.79	597	581.09	597.95
581.16	598	581.19	598.03	582.53	599	583.58	599.76	583.92	600
585.71	600.94	585.84	601	586.59	601.39	587.86	602	588.24	602.19
590.04	603	590.8	603.38	592.06	604	593.59	604.83	593.96	605
600.42	605.03	622.91	605.14	625.13	605.15	644.78	605.06	656.32	605
658.83	604.07	659.03	604	664.21	603.99	664.49	603.99		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	210.42	.04	397.39	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
210.42	397.39	116.65	116.65	116.65	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 933.83

INPUT

Description:
Station Elevation Data num= 224

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	610	.24	610	6.77	609.14	7.8	609	8.77	608.87
15.25	608	19.59	607.42	22.7	607	25.95	606.56	30.16	606
34.68	605.39	37.59	605	40.12	604.38	41.61	604	44.17	603.39
45.71	603	49.32	602.11	49.76	602	53.61	601.05	53.8	601
54.01	600.95	57.81	600	61.5	599.15	62.17	599	65.86	598.15
66.5	598	67.63	597.74	70.79	597	71.73	596.78	75.15	596
78.66	595.17	79.15	595.06	79.4	595	79.66	594.92	82.6	594.14
83.13	594	83.3	593.95	86.73	593	88.94	592.43	90.54	592
91.98	591.57	93.96	591	95.57	590.58	97.58	590	100.71	589.48
103.56	589	108.8	588.12	109.5	588	110.23	587.88	115.46	587
119.65	586.3	121.4	586	122.55	585.8	127.17	585	128.66	584.51
130.24	584	132.2	583.38	133.33	583	134.66	582.59	136.44	582
138.03	581.45	139.41	581	141.88	580.26	142.62	580	143.48	579.85
147.79	579	149.95	578.6	153.03	578	156.06	577.42	158.27	577
160.95	576.47	163.35	576	166.52	575.37	168.39	575	173.89	574.28
175.93	574	176.49	573.93	176.95	573.92	177.63	573.9	177.93	573.9
178.77	573.9	188.44	573.5	192.64	573.5	203.2	573.39	220.5	573.18
233.39	573.01	233.78	573.01	234.4	573	237.46	572.87	239.28	572.9
240.6	572.91	246.62	572.83	247.04	572.83	252.65	572.77	257.85	572.72
259.89	572.71	269.8	572.66	274.55	572.65	279.21	572.63	283.29	572.6
286.57	572.59	290.05	572.56	293.65	572.56	301.06	572.42	315.63	572.13
319.48	572	325.52	571.64	336.46	571	347.91	570.9	349.96	570.89
352.27	570.91	355.92	570.94	359.69	570.96	360.34	570.97	364.06	571
364.43	571.04	367.95	571.3	369.62	571.39	373.93	571.61	380.06	571.88
381.01	571.93	383.18	572	392.8	572.12	393.8	572.12	396.65	572.13
398.87	572.14	404.55	572.13	405.86	572.12	407.93	572.13	408.65	572.13
409.39	572.13	410.19	572.14	412.5	572.17	413.61	572.19	414.94	572.21
416.7	572.24	419.27	572.29	423.44	572.38	428.04	572.49	448.8	573
451.12	573.09	459.84	573.43	472.89	574	476.39	574.07	501.91	575
510.39	575.84	512.11	576	521.36	576.89	522.56	577	523.66	577.11
533.05	578	537.19	578.39	541.59	578.82	543.51	579	554	579.98
554.21	580	554.22	580	554.28	580.02	557.57	581	557.91	581.11
560.97	582	562.2	582.38	564.32	583	566.3	583.65	567.48	584
569.2	584.56	570.46	585	572.93	586	572.94	586	575.46	587
575.64	587.07	577.99	588	580.38	588.95	580.5	589	580.65	589.06
583.09	590	584.82	590.66	585.64	591	588	591.87	588.33	592
588.67	592.14	590.97	593	593.22	593.84	593.61	594	595.23	594.59
596.1	594.89	596.45	595	596.66	595.14	598.18	596	598.39	596.14
599.75	597	601.11	597.86	601.32	598	601.53	598.14	602.89	599
604.51	599.87	604.73	600	605.04	600.19	606.38	601	607.17	601.45
608.33	602	610.04	602.99	610.06	603	610.11	603.02	612.11	604
613.3	604.58	614.13	605	626.54	605.06	628.85	605.07	632.22	605.06
635.64	605.05	642.54	605.02	648.25	605	665.81	604.26	668.93	604.12
669.79	604.08	670.02	604.07	670.74	604	672.33	604	672.44	604
672.51	604	672.53	604	673.74	604	674.32	604		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	293.65	.04	428.04	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
293.65	428.04	103.6	103.6	103.6	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 830.23

INPUT
Description:
Station Elevation Data num= 219

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	609.69	.43	609.64	1.5	609.51	2.17	609.4	3.21	609.23
4.66	609	9.74	608.22	11.14	608	14.63	607.46	17.68	607
23.75	606.03	23.96	606	24.37	605.93	30.23	605	32.52	604.37
33.86	604	34.14	603.91	37.51	603	40.54	602.15	41.11	602
42.43	601.65	44.78	601	46.42	600.55	48.47	600	52.41	599.31

54.17	599	57.39	598.43	59.76	598	64.58	597.14	65.37	597
69.33	596.28	70.84	596	71.03	595.97	76.17	595	78.72	594.47
81.01	594	83.97	593.37	85.68	593	87.82	592.55	90.4	592
91.14	591.85	95.2	591	97.41	590.55	100.04	590	102.9	589.42
104.97	589	107.1	588.55	109.78	588	113.23	587.3	114.71	587
116.46	586.64	119.5	586	122.19	585.44	124.37	585	125.31	584.64
126.85	584	128.75	583.24	129.34	583	130.66	582.42	131.64	582
132.03	581.82	134.02	581	134.3	580.88	136.44	580	139.79	579.2
140.63	579	141.88	578.71	144.86	578	148.02	577.21	148.96	577
152.42	576.21	153.35	576	155.87	575.42	157.71	575	158.65	574.82
162.81	574	163.07	573.95	166.3	573.29	167.62	573.02	167.72	573
172.2	572.08	172.59	572	176.66	571.16	177.38	571	178.94	570.65
181.85	570	183.81	569.99	185.07	569.99	190.73	569.98	195.53	569.99
199.45	570	223.2	570.38	253.37	570.71	263.5	570.79	266.51	570.78
276.71	570.87	278.86	570.84	282.19	570.79	284.33	570.82	285.88	570.83
287.01	570.83	289.62	570.8	291.14	570.78	295.99	570.72	298.69	570.68
302.04	570.63	306.62	570.57	308.82	570.53	321.22	570.32	327.76	570.2
338.15	570	338.24	570	338.25	570	338.3	569.99	341.7	569
341.86	569	342.22	568.99	342.63	568.99	342.89	568.99	343.44	569
345.75	569.86	346.08	570	355.97	570.84	357.95	571	359.45	571.04
359.75	571.04	359.83	571.04	361.19	571.05	363.39	571.07	364.72	571.08
366.83	571.17	375.49	571.46	379.3	571.53	382.56	571.59	389.96	571.64
395.95	571.66	401.35	571.66	404.65	571.64	408.18	571.63	413.88	571.61
430.01	571.75	439.72	571.92	443.09	571.99	452.41	572	453.19	572
454.09	572	455.49	572	457.1	572.16	465.95	573	467.46	573.16
476.18	574	484	574.88	485.05	575	486.44	575.1	499.81	576
501.74	576.13	504.57	576.3	515.86	577	521.53	577.45	528.91	578
539.13	578.84	541.26	579	543.84	579.18	559.35	580	563.83	580.9
564.3	581	566.66	581.5	568.79	582	572.15	582.76	573.19	583
574.99	583.44	577.28	584	579.52	584.49	581.78	585	582.35	585.25
583.98	586	584.93	586.38	586.36	587	587.65	587.55	588.68	588
590.36	588.73	591.01	589	591.64	589.27	593.4	590	594.72	590.57
595.79	591	596.59	591.32	598.25	592	599.79	592.63	600.66	593
602.67	593.82	603.12	594	605.29	594.87	605.6	595	606.15	595.24
607.89	596	609.42	596.64	610.25	597	611.84	597.67	612.6	598
613.66	598.46	614.92	599	616.78	599.75	617.4	600	617.5	600.08
618.84	601	620.03	601.87	620.25	602	621.43	602.85	621.69	603
622.15	603.25	623.03	604	624.34	605	624.4	605	626.89	605
628.9	605	629.45	605	647.06	604.63	670.72	604.11		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	338.15	.04	346.08	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
338.15	346.08	122.37	122.37	122.37	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 707.86

INPUT
Description:
Station Elevation Data num= 231

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	607.55	2.24	607.26	4.18	607	10.17	606.2	11.23	606.06
11.7	606	12.19	605.93	19.05	605	20.94	604.51	22.84	604
24.34	603.6	26.63	603	27.27	602.83	30.35	602	32.02	601.55
34.07	601	36.7	600.31	37.46	600.1	37.85	600	38.4	599.87
42.14	599	42.45	598.93	46.54	598	47.23	597.84	50.75	597
52.81	596.51	55.02	596	59.06	595.09	59.43	595	63.37	594.1
63.8	594	67.19	593.22	68.16	593	70.19	592.5	72.47	592
75.79	591.28	77	591	77.97	590.78	81.55	590	83.67	589.47
85.57	589	88.7	588.22	89.59	588	90.34	587.81	93.59	587
94.34	586.82	97.57	586	99.48	585.51	101.6	585	105.08	584.14
105.67	584	106.21	583.87	109.49	583	113.09	582.08	113.41	582
113.55	581.97	117.36	581	119.65	580.45	121.39	580	124.85	579.1
125.23	579	126	578.8	128.39	578.17	129.04	578	131.58	577.31
132.73	577	135.05	576.39	136.55	576	136.85	575.92	140.29	575

142.15	574.53	144.48	574	146.45	573.51	148.72	573	150.73	572.48
152.89	572	155.21	571.48	157.41	571	159	570.62	161.74	570
170.17	569.78	180.73	569.51	200.66	569.14	202.4	569.09	204.06	569.07
205.26	569.07	208.19	569	211.1	568.91	218.69	568.73	218.94	568.72
224.02	568.6	240.84	568.85	242.54	568.89	247.9	568.92	253.51	568.95
257.87	568.97	260.62	568.98	261.64	568.99	264.92	568.99	265.36	568.99
265.66	569	265.95	569	266.04	569	267.18	569.06	272.03	569.36
282.15	570	295.46	570.01	295.6	570.01	302.54	570.01	306.28	570
309.79	570	311.84	569.37	313.04	569	313.38	568.99	313.8	568.98
315.4	568.94	315.73	568.94	316.39	568.96	317.74	569	319.68	569.85
320.02	570	336.14	570.8	340.48	570.9	342.19	570.92	343.3	570.91
346.06	570.88	346.86	570.88	349.08	570.87	352.08	570.84	359.51	570.75
362.46	570.72	370.4	570.61	374.53	570.57	382.71	570.48	389.23	570.39
393.19	570.33	401.8	570.26	411.02	570.19	418.42	570.12	422.14	570.1
422.73	570.1	423.34	570.1	425.79	570.11	429.23	570.14	429.89	570.15
431.36	570.18	436.87	570.19	442.04	570.18	444.05	570.23	449.2	570.25
452.28	570.34	461.64	570.61	465.68	570.68	468.4	570.72	472.9	570.88
474.69	570.9	476.73	571	478.17	571.06	482.57	571.23	487.02	571.38
490.12	571.5	496	572	501.36	572.7	503.75	573	510.04	573.85
511.16	574	518.51	574.92	519.08	575	519.46	575.14	521.67	576
523.27	576.59	524.44	577	525.42	577.36	527.19	578	529.19	578.73
529.94	579	530.42	579.17	532.71	580	534.95	580.62	536.24	581
537.99	581.51	539.83	582	541.74	582.51	543.41	583	545.6	583.58
547.03	584	550.06	584.83	550.62	585	555.58	585.98	555.68	586
555.7	586	560.77	586.98	560.86	587	560.95	587.02	566.04	588
566.81	588.14	571.2	589	572.19	589.18	576.43	590	578.14	590.41
580.77	591	583.42	591.64	584.91	592	588.21	592.77	589.15	593
592.79	593.86	593.36	594	594.19	594.21	597.55	595	599.35	595.42
601.91	596	605.09	596.72	606.34	597	610.46	597.93	610.8	598
610.96	598.04	611.42	598.14	615.21	599	617.84	599.58	619.76	600
620.48	600.28	622.32	601	624.67	601.91	624.89	602	625.08	602.07
627.51	603	651.42	603.5	676.25	604	676.32	604.02	678.52	605
678.66	605.05								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	309.79	.04	320.02	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
309.79	320.02	91.7	91.7	91.7	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 616.16

INPUT
Description:
Station Elevation Data num= 231

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	605.82	.36	605.76	.77	605.7	1.55	605.58	3.38	605.3
5.45	605	7.29	604.6	10.03	604	12.85	603.38	14.51	603
16.42	602.59	19.03	602	20.48	601.68	23.51	601	25.39	600.59
28.05	600	30.28	599.44	32.07	599	32.74	598.85	36.15	598
37.12	597.77	40.15	597	42.54	596.4	43.95	596.05	44.16	596
44.98	595.79	48.14	595	51.35	594.11	51.69	594.01	51.74	594
51.84	593.97	53.37	593.55	55.4	593	55.64	592.93	59.05	592
62.47	591.09	62.81	591	62.96	590.96	64.73	590.47	66.32	590.04
66.47	590	70.46	589.09	70.82	589	71.85	588.74	74.89	588
76.89	587.53	78.31	587.2	79.07	587	79.71	586.82	83.21	586
84.4	585.66	87.1	585	87.97	584.72	90.36	584	92.44	583.3
93.36	583	94.18	582.73	96.45	582	97.6	581.62	99.53	581
101.83	580.18	102.37	580	105.46	579.42	107.8	579	108.5	578.87
113.3	578	116.76	577.39	119.02	577	123.97	576.09	124.45	576
124.69	575.96	129.89	575	131.85	574.46	133.62	574	134.27	573.82
137.15	573	139.02	572.49	140.86	572	143.32	571.28	144.29	571
145.06	570.78	147.9	570	153.74	569.64	167.83	569	187.08	568.2
191.96	568	199.48	567.98	203.39	567.97	207.39	567.96	211.24	567.95
212.68	567.95	225.4	568	242.59	568.32	290.56	569	291.87	569.01
293.79	569.02	297.73	569.04	303.01	569.07	304.62	569.07	310.7	569.04

316.8	569	318.26	568.98	335.31	568.45	342.25	568.26	347.98	568.03
349.11	568.02	349.75	568.01	350.91	568.01	351.34	568.01	351.57	568
351.92	568	354.74	568	355.37	567.99	355.85	568	356.24	568
357.47	568	360.75	568	360.98	568	361.04	568	361.3	568
361.76	568	368.37	568.34	369.45	568.29	370.12	568.33	371.33	568.26
372.18	568.26	373.01	568.26	374.96	568.37	394.62	569	400.38	569.12
409.98	569.18	419.06	569.17	426.84	569.14	428.84	569.11	436.97	569.08
437.55	569.07	438.01	569.06	458.19	569.01	458.33	569.01	458.45	569.01
458.48	569.01	461.33	569	461.37	569	461.43	569	461.49	569.01
461.58	569.01	464.05	569.04	467.17	569.15	473.15	569.33	484.8	569.73
493.14	570	497.34	570.62	499.99	571	505.72	571.83	506.87	572
512.38	572.8	513.83	573	520.18	573.93	520.68	574	525.91	574.74
527.53	575	527.92	575.14	530.37	576	532.15	576.66	533.14	577
534.45	577.46	536.04	578	536.87	578.3	538.87	579	539.45	579.22
541.72	580	546.1	580.81	547.16	581	552.14	581.94	552.49	582
553.3	582.15	557.85	583	561.35	583.68	563.06	584	564.28	584.23
568.33	585	570.83	585.52	573.07	586	576.17	586.65	577.79	587
579.94	587.43	582.62	588	586.04	588.73	587.13	589	589.17	589.48
591.6	590	594.78	590.56	597.25	591	598.53	591.22	602.99	592
606.95	592.67	608.77	593	611.32	593.46	614.38	594	615.83	594.25
620	595	621.66	595.94	621.76	596	621.98	596.12	623.5	597
624.14	597.38	625.17	598	626.18	598.6	626.87	599	627.07	599.11
628.67	600	629.77	600.56	630.64	601	631.26	601.32	632.59	602
634.28	602.49	636.33	603	640.69	603.02	643.38	603.03	648.78	603
649.75	603	651.03	602.99	651.81	602.99	661.01	602.93	665.01	602.91
665.3	602.91	678.38	602.99	679.79	603	680.01	603.15	681.6	604
683.37	604.47								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	316.8	.04	400.38	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
316.8	400.38	148.1	148.1	148.1	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 468.06

INPUT
Description:
Station Elevation Data num= 222

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	603.32	1.06	603.08	1.49	603	5.6	602.36	7.87	602
11.97	601.36	14.27	601	17.51	600.49	20.54	600	23.28	599.59
27.03	599	31.36	598.31	33.38	598	34.89	597.76	39.64	597
41.68	596.68	45.9	596	49.37	595.43	52.02	595	54.34	594.35
55.62	594	56.49	593.76	59.12	593	60.66	592.56	62.66	592
63.52	591.75	66.11	591	67.75	590.53	69.64	590	70.81	589.78
74.82	589	77.61	588.47	80.21	588	84.24	587.24	85.49	587
90.2	586.11	90.78	586	91.07	585.94	95.92	585	97	584.65
98.76	584	101.1	583.21	101.67	583	102.54	582.69	104.56	582
106.86	581.22	107.49	581	108.62	580.61	110.4	580	113.43	579.36
115.24	579	118.69	578.32	120.29	578	120.85	577.88	122.18	577.63
125.25	577	130.3	576.01	130.36	576	130.45	575.98	135.31	575
136.4	574.57	137.89	574	140.41	573.05	140.54	573	140.93	572.84
142.6	572.16	143.02	572	143.34	571.88	145.63	571	147.52	570.23
148.12	570	151.32	569.69	158.22	569	163.19	568.49	168.5	568
179.69	567.35	191.15	567.15	199.57	567	200.7	566.99	200.73	566.99
206.32	566.91	206.96	566.91	207.21	566.92	207.46	566.92	207.88	566.92
209.68	566.9	212.43	566.88	216.42	566.81	227.45	566.67	233.19	566.57
251.75	566.24	256.66	566.16	265.07	566	267.14	565.99	268.38	565.99
271.23	565.98	274.64	565.97	285.76	565.94	288.43	565.92	314.4	565.8
325.07	565.82	326.23	565.82	337.38	565.84	338.52	565.84	350.24	565.87
351.46	565.87	362.5	565.88	363.32	565.89	372.64	565.89	373.45	565.9
374.47	565.9	375.43	565.9	376.06	565.9	376.69	565.9	383.74	565.89
403.73	565.95	412.11	565.99	415.02	565.99	422.8	566	428.11	566.09
433.95	566.17	438.93	566.22	443.01	566.26	445.35	566.27	458.59	566.28
461.9	566.27	472.6	566.23	480.86	566.09	484.64	566.02	485.4	566.01

487.04	566	487.43	566	488.96	565.99	489.36	565.99	490.43	565.98
490.86	565.98	492.17	565.97	493.12	565.97	495.14	566	497.6	566.211
502.5	566.63	507.21	567	512.47	567.42	519.79	568	523.76	568.32
532.37	569	540.66	569.65	545.19	570	546.79	570.48	548.58	571
551.81	571.98	551.88	572	551.94	572.02	555.28	573	557.94	573.81
558.57	574	560.5	574.58	561.93	575	562.61	575.42	563.49	576
563.72	576.15	565.09	577	565.93	577.53	566.68	578	567.38	578.45
568.29	579	569.54	579.85	569.79	580	572.16	580.85	572.58	581
572.98	581.15	575.28	582	578.09	583	579.7	583.6	580.79	584
581.37	584.21	583.54	585	585.3	585.85	585.63	586	587.71	586.94
587.83	587	588.01	587.08	589.86	588	591.37	588.63	592.16	589
593.32	589.52	594.31	590	598.25	590.66	600.25	591	601.91	591.28
606.16	592	611.04	592.82	612.1	593	613.02	593.16	617.95	594
623.96	594.99	624.03	595	624.06	595.01	627.41	596	630.42	596.87
630.91	597	632.14	597.35	634.34	598	635.6	598.37	637.76	599
640.79	599.83	641.42	600	642.29	600.24	642.3	600.25	644.37	601
646.6	601.79	647.54	602	650.43	602.01	651.37	602.01	655.16	602
656.58	602	672.33	601.57	677	601.42	681.48	601.42	688.17	601.62
688.81	602	690.53	602.57						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	472.6	.04	497.6	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
472.6	497.6	122.21	122.21	122.21	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 345.85

INPUT
Description:
Station Elevation Data num= 224

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	603	4.13	602.35	6.38	602	8.22	601.71	12.71	601
12.76	600.99	18.94	600	24.6	599.03	24.75	599	24.83	598.98
30.57	598	34.18	597.37	36.31	597	38.17	596.68	42.04	596
44.08	595.64	47.75	595	51.57	594.21	52.6	594	57.09	593.04
57.28	593	57.55	592.94	62.13	592	63.6	591.69	66.68	591
70.14	590.27	71.41	590	72.62	589.73	75.88	589	78.38	588.43
80.32	588	84.71	587.06	84.97	587	85.13	586.96	89.36	586
91.65	585.5	93.8	585	94.66	584.81	98.05	584	99.84	583.59
102.33	583	104.14	582.58	106.59	582	109.72	581.27	110.87	581
112.41	580.64	115.08	580	118.72	579.39	120.97	579	126.42	578.07
126.83	578	127.36	577.91	132.68	577	132.9	576.96	138.52	576
141.92	575.42	144.34	575	145.24	574.64	146.83	574	148.69	573.26
149.32	573	149.73	572.84	151.82	572	152.26	571.83	154.34	571
155	570.74	156.81	570	158.2	569.06	158.31	569	158.45	568.9
159.75	568	160.52	567.5	161.13	567	162.3	566.25	162.6	566
163.09	565.65	164.06	565	170.23	565	171.88	565	176.66	564.99
183.66	564.99	185.61	564.99	186.27	564.99	192.38	564.94	225.79	564.72
230.5	564.73	232.82	564.71	234.03	564.7	235.11	564.7	236.04	564.69
236.8	564.69	241.62	564.66	250.46	564.64	258.92	564.63	264.07	564.62
267.83	564.62	269.85	564.61	271.16	564.61	272.18	564.61	276.11	564.58
285.48	564.54	293.97	564.52	297.45	564.53	307.32	564.55	313.01	564.57
317.15	564.56	322.69	564.57	338.11	564.56	353.26	564.56	361.18	564.58
383.44	564.62	389.29	564.6	395.94	564.57	399.96	564.57	403.61	564.57
416.88	564.46	417.16	564.46	420.19	564.46	433.11	564.3	435.44	564.3
437.78	564.3	439.6	564.29	441.54	564.29	458.99	564.11	459.83	564.11
461.28	564.1	461.99	564.09	481.59	564.02	481.71	564.02	481.82	564.01
482.14	564.01	482.5	564.02	482.68	564.02	482.84	564.02	483.06	564.02
483.69	564.04	483.8	564.04	484.51	564.05	516.68	564.55	530.15	564.94
532.2	565	532.94	565.19	536.14	566	538.69	566.62	540.21	567
542.67	567.61	544.23	568	548.14	568.98	548.21	569	548.71	569.13
552.3	570	553.02	570.36	554.41	571	555.89	571.71	556.56	572
557.73	572.59	558.61	573	559.63	573.48	560.74	574	562.55	574.88
562.82	575	563.59	575.31	565.3	576	565.56	576.11	567.88	577
569.38	577.63	570.32	578	571.47	578.46	572.83	579	574.66	579.72

575.34	580	575.92	580.27	577.49	581	577.64	581.07	578.31	581.38
579.2	581.76	579.77	582	581.35	582.7	582	583	584.02	583.91
584.23	584	584.26	584.01	586.45	585	588.56	585.68	589.63	586
591.8	586.66	592.93	587	596.17	587.99	596.18	588	596.2	588
598.42	588.65	599.55	589	600.05	589.15	602.46	589.79	603.15	590
606.18	590.55	608.38	591	613.01	591.96	613.19	592	613.27	592.01
613.46	592.06	616.33	592.59	618.14	593	619	593.18	622.07	594
623.76	594.39	625.85	595	627.66	595.45	630.02	596	632.53	596.62
634.11	597	635.15	597.25	636.65	597.63	637.91	598	641.05	598.98
641.1	599	641.11	599	641.12	599	643.93	600	659.43	600.09
661.39	600.1	671.76	600.05	679.93	600	690.61	599.22		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	420.19	.04	516.68	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
420.19	516.68	168.43	168.43	168.43	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 177.42

INPUT
Description:
Station Elevation Data num= 198

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	603	.72	603	1.37	603	1.63	603	1.97	603
2.23	603	2.62	603	4.96	602.68	10.09	602	12.82	601.63
17.52	601	23.04	600.25	24.84	600	26.28	599.72	29.87	599
33.36	598.33	34.88	598	36.02	597.76	39.87	597	41.22	596.72
44.85	596	49.12	595.15	49.88	595	52.35	594.24	53.1	594
56.46	593.01	56.48	593	56.49	593	59.75	592	61.21	591.55
62.94	591	66.11	590.06	66.31	590	66.39	589.98	71.06	589
74.57	588.25	75.82	588	79.61	587.21	80.65	587	82.57	586.61
85.52	586	87.48	585.58	90.25	585	92.19	584.61	95.28	584
98.04	583.43	100.3	583	103.04	582.48	105.35	582	107.86	581.48
110.25	581	113.66	580.28	115.13	580	119.84	579.2	121.03	579
121.52	578.92	122.57	578.73	126.64	578	129.68	577.47	132.42	577
135.79	576.42	138.18	576	143.31	575.1	143.89	575	144.21	574.87
146.29	574	147.26	573.61	148.74	573	149.97	572.51	151.22	572
152.84	571.36	153.73	571	154.67	570.61	156.14	570	157.5	569.53
159.14	569	160.56	568.5	162.15	568	164.08	567.34	165.14	567
167.34	566.28	168.27	566	169.75	565.52	171.19	565	175.29	564.93
206.02	564.4	234.26	564	252.45	563.82	261.24	563.74	276.51	563.59
279.01	563.56	302.41	563.38	303.58	563.37	324.96	563.2	333.58	563.15
335.57	563.15	356.06	563.04	356.62	563.04	370.62	563	380.93	562.95
381.32	562.95	381.8	562.95	404.5	562.9	405.45	562.89	425.3	562.88
426.26	562.88	427.98	562.88	436.11	562.88	436.66	562.87	444.78	562.88
447.4	562.87	465.65	562.87	466.21	562.86	466.82	562.86	471.39	562.92
472.43	562.93	475.65	562.99	477.27	563	477.54	563	487.16	563.36
490.28	563.5	498.57	563.83	502.38	564	503.33	564.01	503.73	564.01
507.57	564.06	507.75	564.06	508.85	564.07	511.05	564.08	512.78	564.15
524.49	564.56	531.77	565	537.07	569.38	537.73	570	538.05	570.1
540.6	571	541.22	571.21	543.31	572	545.97	572.99	545.99	573
546.06	573.03	548.8	574	549.97	574.46	551.48	575	553.86	575.73
554.7	576	555.28	576.21	557.78	577	558.79	577.36	560.77	578
561.89	578.4	563.85	579	565.51	579.56	566.69	580	569.15	580.63
570.53	581	573.42	581.74	574.35	582	577.43	582.78	578.21	583
581.48	583.82	582.11	584	585.23	584.8	586.08	585	586.6	585.09
592.36	586	595.83	586.56	598.62	587	603.94	587.85	604.85	588
606.16	588.22	611.05	589	612.84	589.29	617.34	590	619.53	590.49
621.86	591	622.97	591.25	626.46	592	629.24	592.6	631.05	593
632.63	593.35	635.81	594	639.53	594.82	640.42	595	646.16	595.85
647.13	596	647.95	596.19	650.52	596.74	651.74	597	652.36	597.12
657.12	598	672.96	598.13	674.13	598.14	684.01	598.08	693.31	598
696.84	597.99	698.09	597.98	698.87	597.99				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	370.62	.04	475.65	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
370.62	475.65	83.27	83.27	83.27	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 94.15

INPUT
Description:
Station Elevation Data num= 209

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	601.57	.34	601.4	.9	601.02	1.2	601.01	1.23	601.01
1.31	601.01	1.44	601.01	1.59	601	5.1	600.12	5.57	600
5.99	599.96	11.74	599.46	13.77	599.34	15.23	599	17.34	598.54
19.92	598	22.16	597.54	24.64	597	26.91	596.56	29.44	596
33.04	595.27	33.98	595.12	34.58	595	40.05	594.01	40.11	594
41.71	593.71	45.51	593	46.33	592.85	50.7	592	52.47	591.65
55.78	591	59.9	590.17	60.74	590	61.66	589.86	63	589.66
67.15	589	68.97	588.69	73.31	588	77.44	587.35	79.61	587
82.91	586.46	85.8	586	87.39	585.72	91.91	585	94.84	584.44
97.1	584	102.06	583.04	102.26	583	106.99	582.07	107.32	582
107.64	581.93	112.27	581	113.28	580.78	117.04	580	119.72	579.37
121.56	579	123.23	578.61	125.85	578	128.92	577.28	130.21	577
132.01	576.59	134.41	576	135.34	575.78	138.82	575	139.4	574.82
142.12	574	144.23	573.33	145.32	573	146.26	572.7	148.58	572
149.6	571.68	151.87	571	154.64	570.06	154.81	570	155.33	569.9
159.89	569	162.1	568.52	164.58	568	167.48	567.38	169.31	567
173.95	566	173.96	566	178.79	565	184.36	564.84	185.67	564.81
186.82	564.78	200.28	564.41	203.45	564.34	205.7	564.29	207.85	564.25
210.26	564.21	212	564.19	222.7	564.02	224.08	564	224.33	564
225.8	564	226.29	564	226.66	564	232.43	563.93	241.02	563.84
259.36	563.65	303.01	563	377.24	562.02	378.38	562	408.76	561.47
418.38	561.31	424.52	561.22	428.11	561.18	429.91	561.17	431.52	561.17
432.88	561.16	433.75	561.15	435.87	561.15	442.5	561.14	443.1	561.13
450.93	561.03	453.24	561.03	455.61	561.02	456.62	561.02	457.1	561.02
458.08	561.02	458.81	561.01	459.69	561.01	460.43	561	460.6	561
460.76	561	461.24	560.99	469.53	560.93	472.18	560.91	481.97	560.88
485.75	560.94	487.21	560.99	490.59	561	490.6	561	490.68	561
494.45	561.04	499.13	561.03	499.37	561.04	499.48	561.04	499.65	561.06
500.84	561.17	509.45	562	514.45	562.56	518.43	563	526.06	563.85
527.43	564	536.29	564.96	536.67	565	536.75	565.03	539.28	566
540.25	566.37	542.1	567	543.52	567.52	544.78	568	547.38	568.96
547.48	569	547.62	569.05	550.05	569.98	550.11	570	550.12	570
553.75	571	554.8	571.29	557.43	572	559.71	572.64	561.02	573
564.56	573.98	564.63	574	564.68	574.01	568.28	575	572.34	578.09
574.69	580	577.67	580.53	580.42	581	582.99	581.43	586.26	582
590.51	582.72	592.1	583	594.16	583.33	598.36	584	603.68	584.85
604.6	585	606.06	585.31	609.2	586	610.39	586.24	614.15	587
618.32	587.85	619.04	588	619.42	588.08	623.91	589	625.76	589.38
628.92	590	631.4	590.56	633.36	591	635.66	591.55	637.67	592
639.88	592.53	642.01	593	645.99	593.93	646.28	594	646.71	594.1
650.61	595	653.88	595.44	657.88	596	663.81	596.84	665.04	597
669.07	597.02	686.85	597.25	702.57	597.27	705.9	597.25		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	442.5	.04	500.84	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
442.5	500.84	70.03	70.03	70.03	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 24.12

INPUT
Description:
Station Elevation Data num= 190

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	588.77	1.52	588.55	9.73	588	10.17	588	29.8	587.55
49.09	587.11	50.78	587.09	52.26	587.09	52.34	587.1	52.44	587.11
52.55	587.11	52.79	587.11	53.95	587	60.43	586.22	61.52	586.09
63.1	586	63.81	585.99	70.67	585.66	78.66	585.25	80.61	585.17
81	585.15	81.34	585.15	83.59	585	89.04	584.58	91.84	584.31
93.83	584	97.61	583.41	100.21	583	102.52	582.64	105.91	582.1
106.25	582.04	106.47	582	107.23	581.86	111.79	581	113.66	580.76
118.41	580	121.56	579.46	123.71	579	126.59	578.54	129.78	578
134.41	577.23	135.83	577	140.82	576.17	141.76	576	144.01	575.63
146.96	575.12	147.69	575	148.02	574.9	151.01	574	152.28	573.61
154.36	573	155.39	572.66	157.72	572	160.15	571.34	161.29	571
164.02	570.02	164.07	570	164.46	569.97	169.42	569.71	182.64	569
190.36	568.35	195.19	568	196.08	567.95	200.01	567.79	201.64	567.71
208.24	567.39	216.15	567	221.18	566.76	224.28	566.62	228.31	566.43
232.3	566.29	233.18	566.25	237.35	566.09	237.42	566.09	239.29	566
245.72	565.71	262.07	565	264.54	564.92	265.11	564.9	265.7	564.88
268.46	564.78	276.79	564.46	279	564.37	289.72	564	302.3	563.61
310.52	563.37	315.27	563.23	323.18	563	333.74	562.86	341.99	562.71
358.8	562.45	368.68	562.29	380.82	562	397.46	561.6	412.03	561.24
417.27	561.11	421.86	561	432.28	560.75	464.51	560	477.19	560
480.38	560	481.29	560	481.84	560.05	491.64	561	494.86	561.31
499.59	561.76	500.92	561.88	502.25	562	506.08	562.35	508.67	562.56
511.64	562.81	513.14	562.93	514.08	563	518.52	563.34	520.54	563.51
525.49	564	530.72	564.57	533.33	565	537.28	565.69	538.75	566
542.15	566.56	544.72	567	547.46	567.46	550.59	568	552.68	568.34
556.72	569	557.2	569.07	561.06	569.64	563.17	570	563.86	570.31
565.2	571	565.84	571.25	567.55	572	569.75	572.9	569.97	573
570.83	573.34	572.37	573.93	572.57	574	574.65	574.78	575.3	575
577.94	575.46	581.03	576	584.9	576.63	586.99	576.83	591.32	576.9
592.79	577	593.74	577.19	601.4	578	604.13	578.7	605.5	579
607.66	579.76	608.21	580	608.51	580.17	609.71	581	611.23	581.83
611.56	582	612.02	582.24	613.41	583	614.33	583.46	615.36	584
616.49	584.59	617.37	585	619.27	585.48	621.38	586	625.34	586.99
625.36	587	625.38	587	629.59	588	633.24	588.94	633.48	589
633.58	589.02	637.75	590	640.85	590.8	641.53	591	644.45	591.75
645.29	592	648.2	592.77	648.97	593	649.96	593.29	652.74	594
655.38	594.74	656.29	595	662.9	595.89	663.74	596	664.51	596.05
666.23	596.13	683.59	597	686.3	597.01	690.84	597	690.96	597

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	368.68	.04	502.25	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
368.68	502.25	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Caroll Canyon Cr

Reach	River Sta.	n1	n2	n3
River CL	1412.74	.04	.04	.04
River CL	1385.61	.04	.04	.04
River CL	1290.56	Culvert		
River CL	1204.11	.04	.04	.04
River CL	1114.37	.04	.04	.04
River CL	1050.48	.04	.04	.04
River CL	933.83	.04	.04	.04
River CL	830.23	.04	.04	.04
River CL	707.86	.04	.04	.04
River CL	616.16	.04	.04	.04
River CL	468.06	.04	.04	.04
River CL	345.85	.04	.04	.04

River CL	177.42	.04	.04	.04
River CL	94.15	.04	.04	.04
River CL	24.12	.04	.04	.04

SUMMARY OF REACH LENGTHS

River: Caroll Canyon Cr

Reach	River Sta.	Left	Channel	Right
River CL	1412.74	27.13	27.13	27.13
River CL	1385.61	181.5	181.5	181.5
River CL	1290.56	Culvert		
River CL	1204.11	89.74	89.74	89.74
River CL	1114.37	63.89	63.89	63.89
River CL	1050.48	116.65	116.65	116.65
River CL	933.83	103.6	103.6	103.6
River CL	830.23	122.37	122.37	122.37
River CL	707.86	91.7	91.7	91.7
River CL	616.16	148.1	148.1	148.1
River CL	468.06	122.21	122.21	122.21
River CL	345.85	168.43	168.43	168.43
River CL	177.42	83.27	83.27	83.27
River CL	94.15	70.03	70.03	70.03
River CL	24.12			

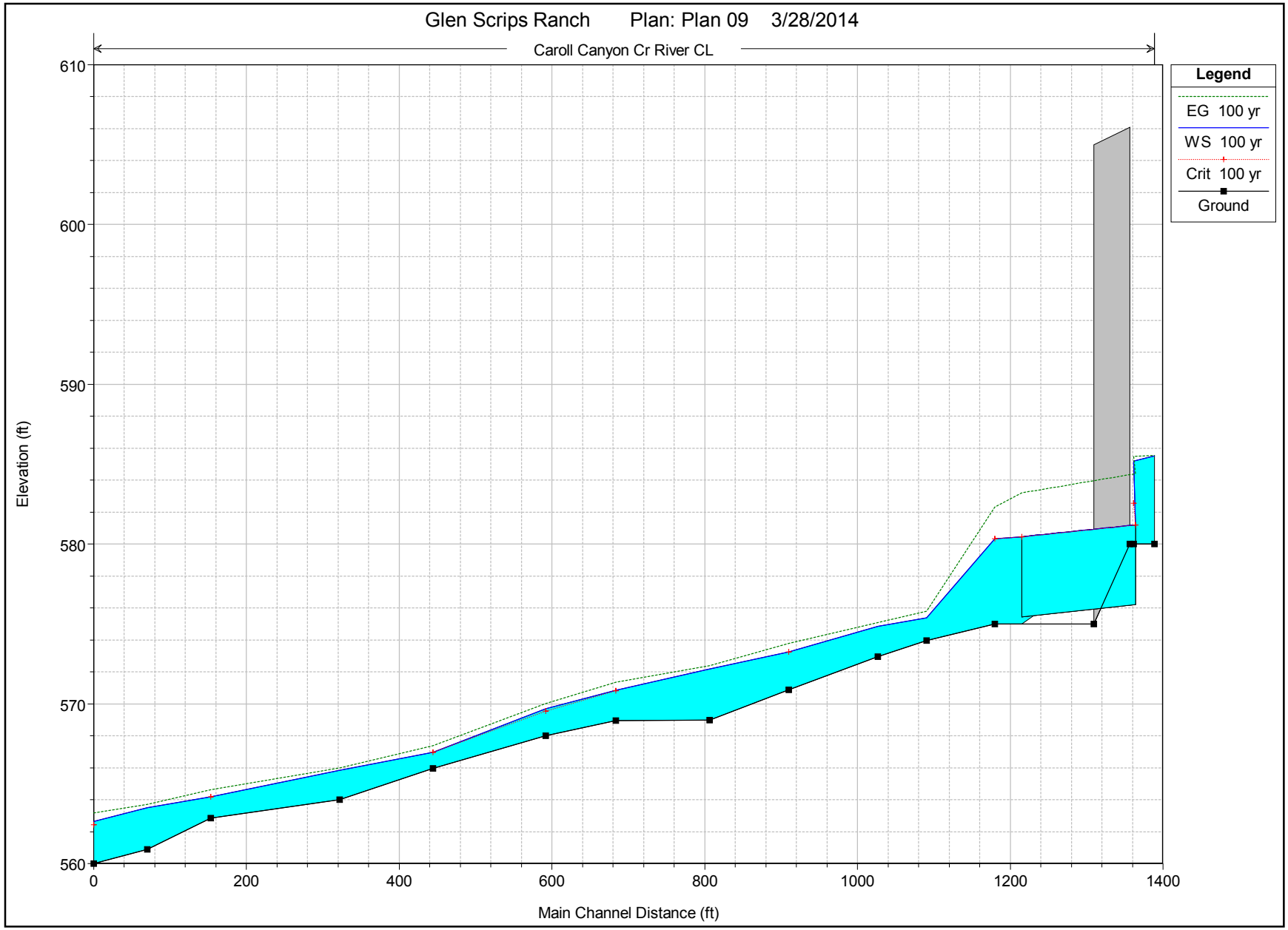
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Caroll Canyon Cr

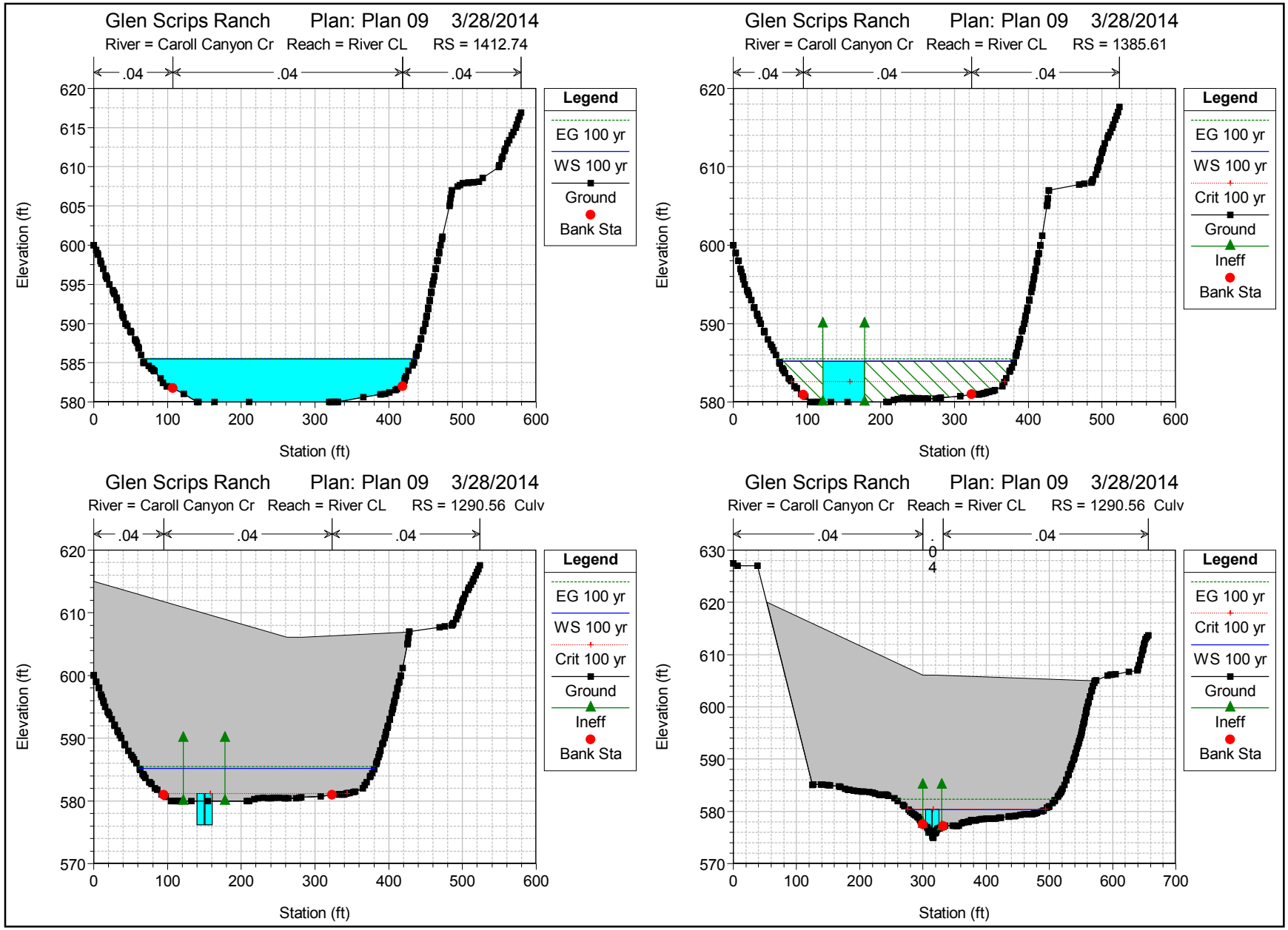
Reach	River Sta.	Contr.	Expan.
River CL	1412.74	.1	.3
River CL	1385.61	.3	.5
River CL	1290.56	Culvert	
River CL	1204.11	.3	.5
River CL	1114.37	.1	.3
River CL	1050.48	.1	.3
River CL	933.83	.1	.3
River CL	830.23	.1	.3
River CL	707.86	.1	.3
River CL	616.16	.1	.3
River CL	468.06	.1	.3
River CL	345.85	.1	.3
River CL	177.42	.1	.3
River CL	94.15	.1	.3
River CL	24.12	.1	.3

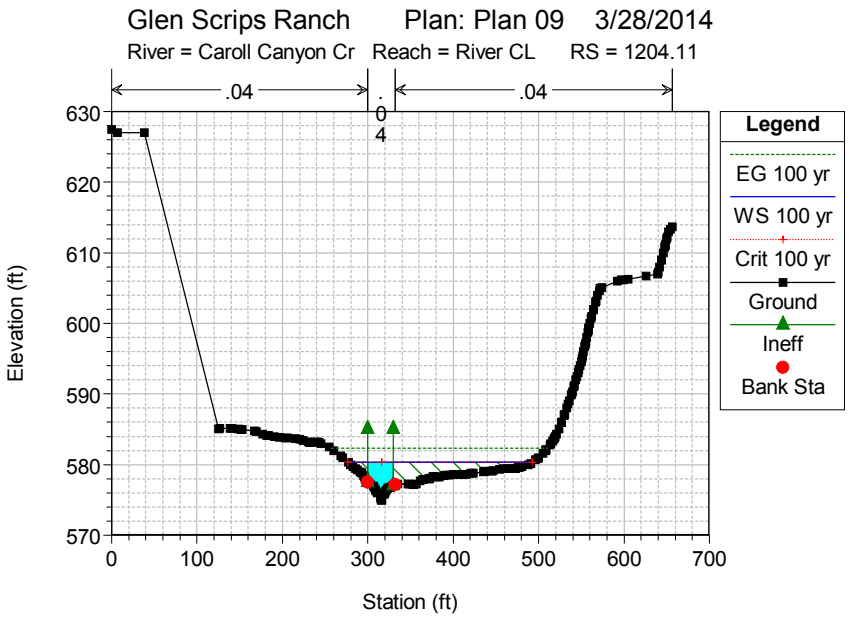
1. HEC-RAS OUTPUT FILES
DEVELOPED CONDITION ANALYSIS

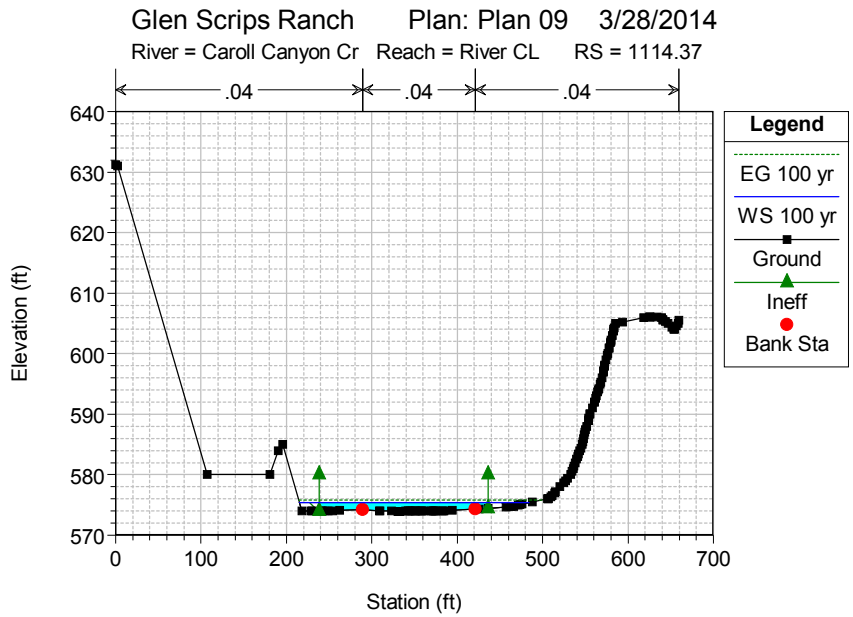
HEC-RAS Plan: Plan 05 River: Caroll Canyon Cr Reach: River CL Profile: 100 yr

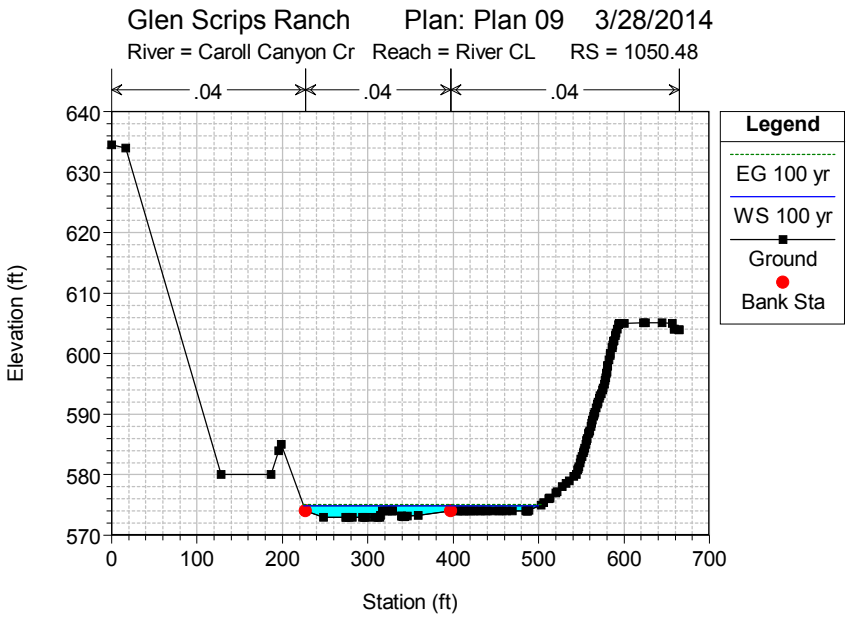
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
River CL	1412.74	100 yr	1332.00	580.00	585.53		585.54	0.000050	0.79	1737.98	369.80	0.06
River CL	1385.61	100 yr	1332.00	580.00	585.18	582.57	585.50	0.001656	4.53	294.19	319.04	0.35
River CL	1290.56		Culvert									
River CL	1204.11	100 yr	1332.00	575.00	580.34	580.34	582.33	0.015374	11.32	117.69	215.62	1.01
River CL	1114.37	100 yr	1332.00	573.95	575.38		575.81	0.014194	5.31	254.21	268.61	0.82
River CL	1050.48	100 yr	1332.00	572.96	574.84		575.10	0.007891	4.31	337.46	275.44	0.62
River CL	933.83	100 yr	1332.00	570.89	573.24	573.24	573.79	0.016505	6.15	241.88	243.27	0.90
River CL	830.23	100 yr	1332.00	568.99	572.18		572.40	0.005224	5.18	376.50	285.60	0.55
River CL	707.86	100 yr	1332.00	568.94	570.85	570.82	571.36	0.014998	6.06	253.84	263.20	0.85
River CL	616.16	100 yr	1332.00	567.99	569.68	569.54	570.02	0.013310	4.85	295.37	294.76	0.78
River CL	468.06	100 yr	1332.00	565.97	566.95	566.95	567.38	0.024703	5.29	254.67	303.24	1.00
River CL	345.85	100 yr	1332.00	564.01	565.85		565.98	0.004155	3.30	458.99	350.34	0.46
River CL	177.42	100 yr	1332.00	562.86	564.19	564.19	564.64	0.019165	6.08	262.79	292.86	0.95
River CL	94.15	100 yr	1332.00	560.88	563.49		563.71	0.004400	4.54	383.61	252.67	0.51
River CL	24.12	100 yr	1332.00	560.00	562.63	562.44	563.18	0.013304	5.99	226.69	162.14	0.82

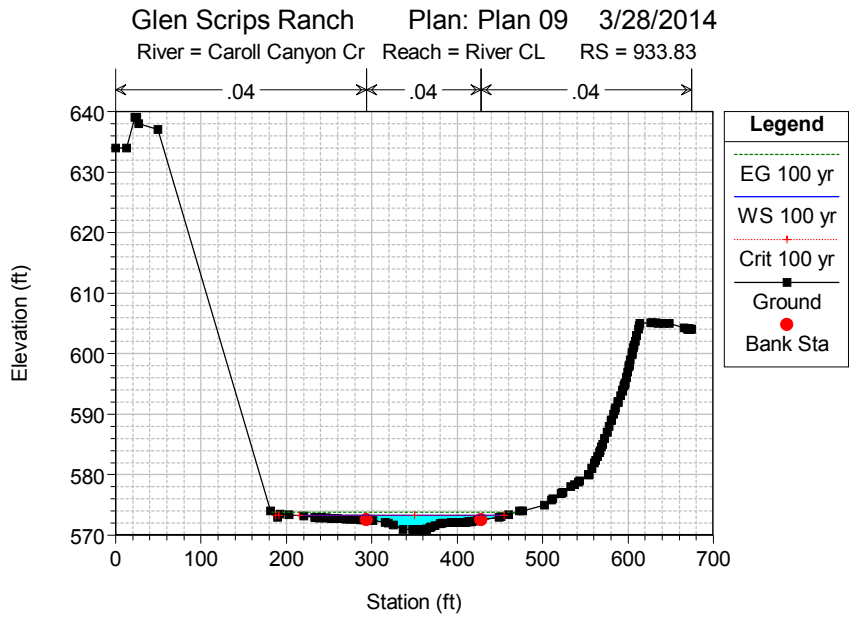

Glen Scrips Ranch Plan: Plan 09 3/28/2014
Caroll Canyon Cr River CL
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Elevation (ft)
610
600
590
580
570
560
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

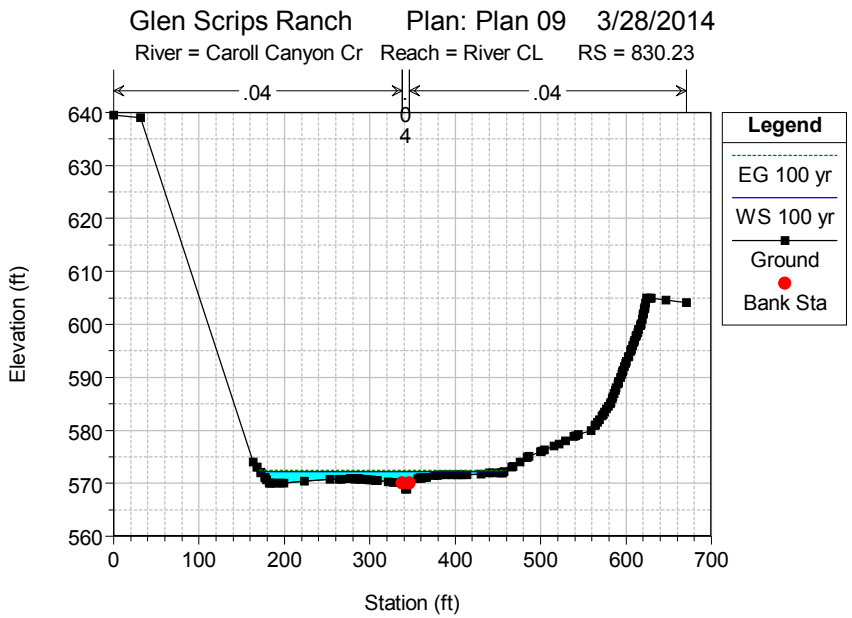

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 1412.74
.04 .04 .04
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 1385.61
.04 .04 .04
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 1290.56 Culv
.04 .04 .04
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 1290.56 Culv
.04 .04 .04
Legend
EG 100 yr
Crit 100 yr
WS 100 yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

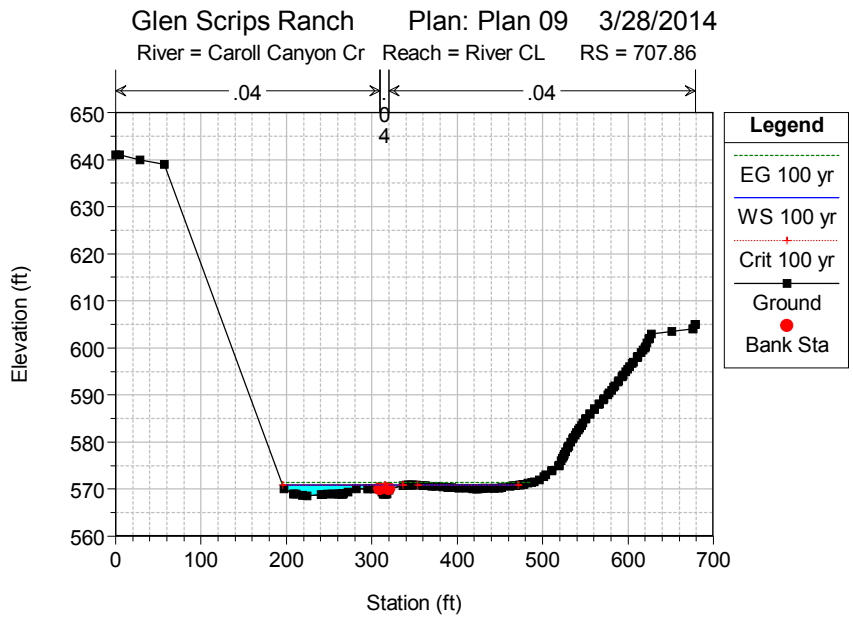

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 1204.11
.04
.04
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Ineff
Bank Sta

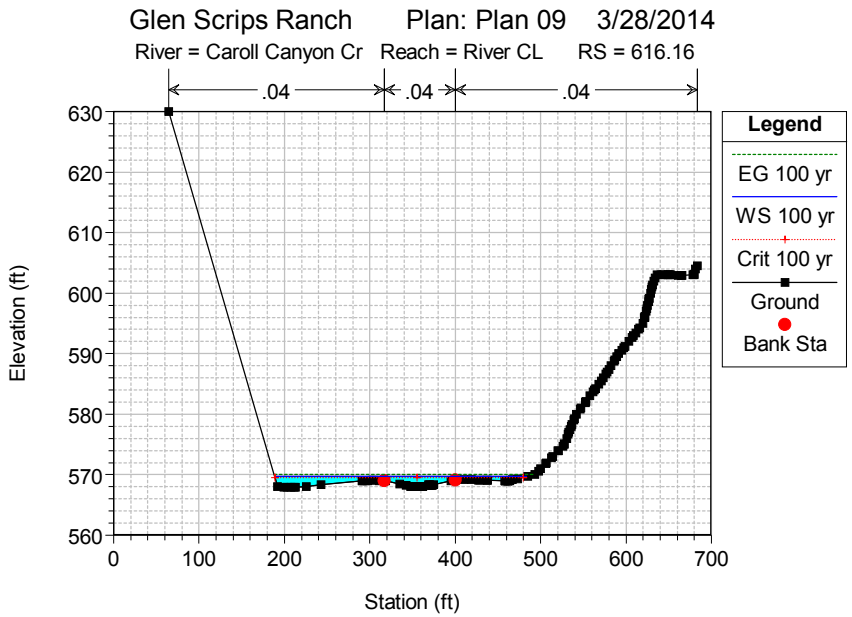

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 1114.37
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Ineff
Bank Sta

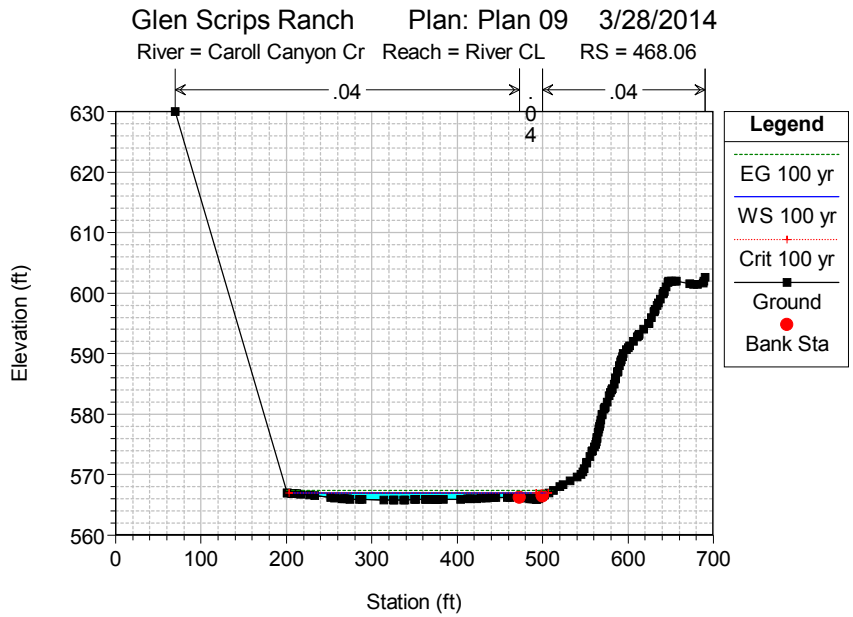

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 1050.48
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta

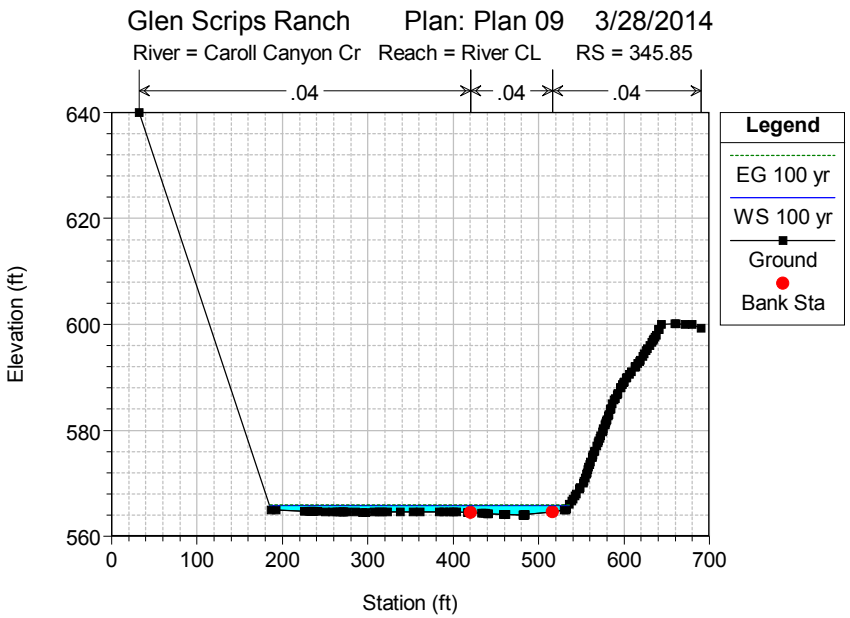

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 933.83
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta

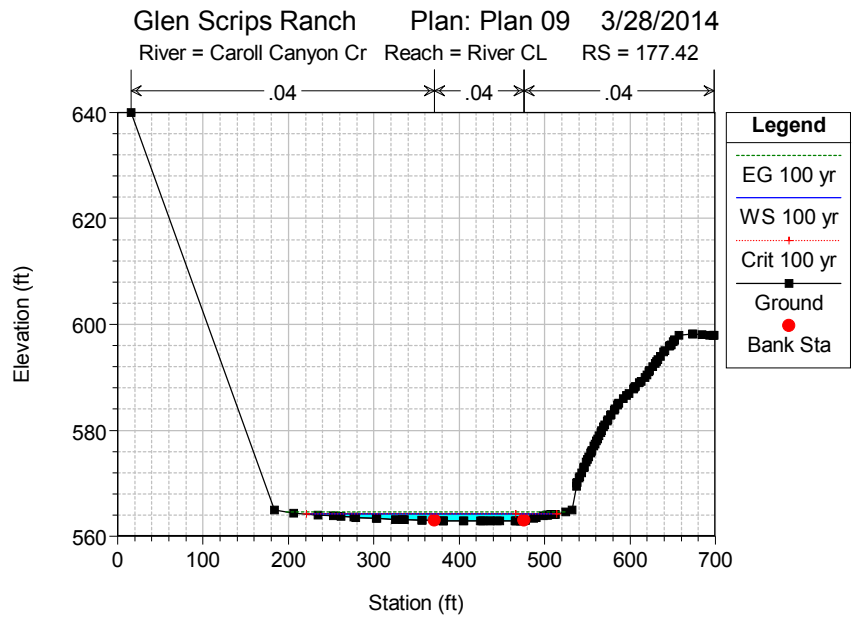

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 830.23
.04
.04
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

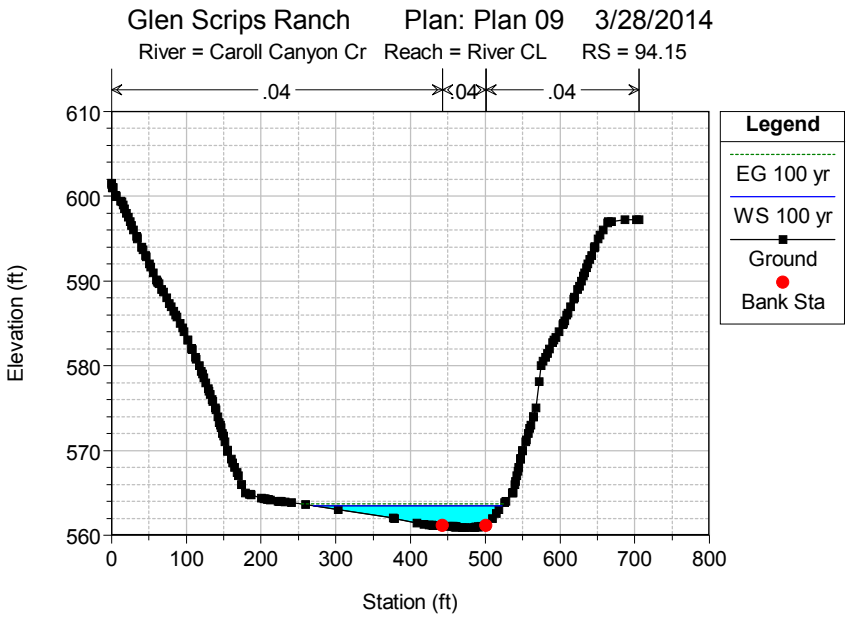

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 707.86
.04
.04
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

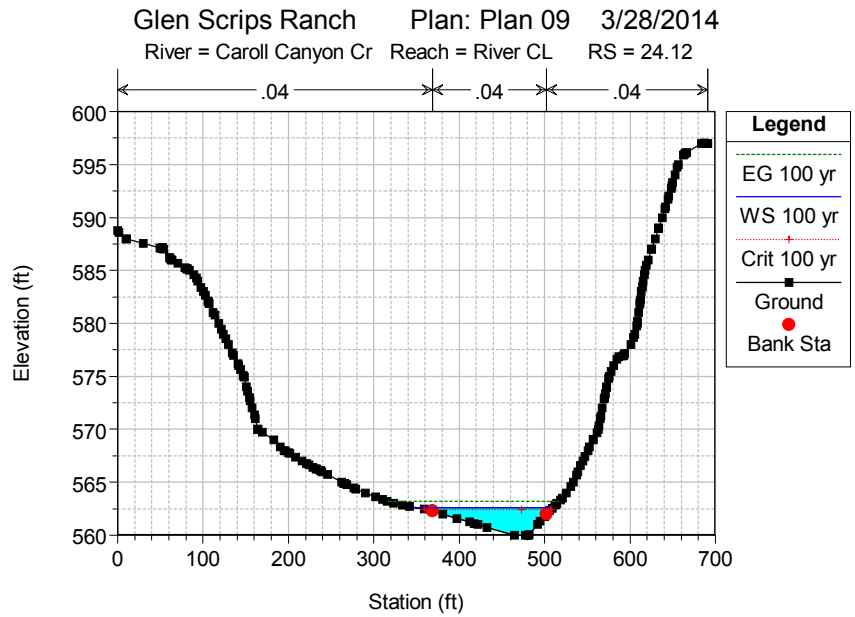

Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 616.16
.04
.04
.04
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 468.06
.04
.04
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 345.85
.04
.04
.04
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 177.42
.04
.04
.04
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 94.15
.04
.04
.04
Legend
EG 100 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Glen Scrips Ranch Plan: Plan 09 3/28/2014
River = Caroll Canyon Cr Reach = River CL RS = 24.12
.04
.04
.04
Legend
EG 100 yr
WS 100 yr
Crit 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

```
                        HEC-RAS Version 4.1.0 Jan 2010
                         U.S. Army Corps of Engineers
                        Hydrologic Engineering Center
                              609 Second Street
                              Davis, California


            X     X  XXXXXX    XXXX        XXXX       XX      XXXX
            X     X  X        X    X       X   X     X  X    X
            X     X  X        X            X   X    X    X   X
            XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
            X     X  X        X            X  X     X    X        X
            X     X  X        X    X       X   X    X    X        X
            X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Glen Scrips Ranch
Project File : GlenScripsRanch.prj
Run Date and Time: 3/28/2014 12:58:40 PM

Project in English units

PLAN DATA

Plan Title: Plan 07
Plan File : y:\Projects\240 (Lattitude 33)\02 (The Glen at Scrips Ranch)\HEC-RAS\New Geo From CAD\GlenScripsRanch.p07

Geometry Title: CC Developed
Geometry File : y:\Projects\240 (Lattitude 33)\02 (The Glen at Scrips Ranch)\HEC-RAS\New Geo From CAD\GlenScripsRanch.g02

Flow Title : 100 yr
Flow File : y:\Projects\240 (Lattitude 33)\02 (The Glen at Scrips Ranch)\HEC-RAS\New Geo From CAD\GlenScripsRanch.f01

Plan Summary Information:

Number of:	Cross Sections	= 14	Multiple Openings	=	0
	Culverts	= 1	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 100 yr
Flow File : y:\Projects\240 (Lattitude 33)\02 (The Glen at Scrips Ranch)\HEC-RAS\New Geo From CAD\GlenScripsRanch.f01

Flow Data (cfs)

River	Reach	RS	100 yr
Caroll Canyon Cr	River CL	1412.74	1332

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Caroll Canyon Cr	River CL	100 yr		Normal S = 0.0133

GEOMETRY DATA

Geometry Title: CC Developed
Geometry File : y:\Projects\240 (Lattitude 33)\02 (The Glen at Scrips Ranch)\HEC-RAS\New Geo From CAD\GlenScripsRanch.g02

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1412.74

INPUT
Description:
Station Elevation Data num= 142

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	600.01	.09	600	2.94	599.42	5	599	5.93	598.81
9.1	598	10.55	597.63	13.01	597	16.37	596.15	16.94	596
17.31	595.9	18.07	595.71	21.19	595	25.39	594.25	26.89	594
27.33	593.92	28.01	593.78	30.6	593.29	31.61	593	35.28	592.17
35.84	592	38.32	591.23	39.25	591	40.17	590.77	43.16	590
45.47	589.7	49.57	589.06	49.93	589	50.49	588.9	55.97	588
57.17	587.8	58.32	587.56	60.57	587	61.25	586.83	64.21	586
67.49	585.08	67.77	585	68.16	584.97	68.19	584.97	74.39	584.57
77.88	584.32	79.31	584.24	81.14	584.06	81.74	584	82.42	583.91
90.67	583	93.61	582.39	99.21	582.02	99.68	582	107.26	581.77
122.34	581	139.79	580.03	141.11	580	141.66	580	163.6	580
210.86	580	319.17	580	320.56	580	321.77	580	325.23	580
326.53	580	328.13	580	330.79	580	330.89	580	365.66	580.59
388.48	580.99	389.9	580.99	394.95	581	400.76	581.21	408.97	581.52
410.91	581.61	418.57	582	418.58	582.003	421.26	582.74	422.18	583
423.17	583.27	426.65	584	432.18	584.68	433.96	585	436.77	585.85
437.24	586	437.72	586.15	439.75	586.79	440.41	587	440.48	587.02
443.5	588	443.83	588.11	446.57	589	447.12	589.18	449.63	590
451.19	590.79	451.63	591	453.24	591.82	453.62	592	455.29	592.85
455.61	593	457.37	593.89	457.59	594	457.79	594.09	459.48	595
460.43	595.46	461.72	596	463.69	596.96	463.78	597	463.87	597.04
465.91	598	466.11	598.09	468.08	599	468.38	599.13	470.24	600
472.46	600.77	472.89	601.08	482.42	605	482.95	605.3	483.93	606
484.84	606.49	485.9	607	493.21	607.52	496.4	607.65	500.22	607.89
507.87	608	507.93	608	507.94	608	515.13	608.01	515.34	608.01
522.14	608.08	527.16	608.56	549.06	610	549.86	610.21	553.09	611
554.3	611.32	557.06	612	558.37	612.34	560.99	613	563.12	613.39
566.6	614	569.01	614.44	572.23	615	573.74	615.42	575.83	616
577.41	616.44	579.17	616.93						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	107.26	.04	418.58	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
107.26	418.58	27.13	27.13	27.13	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1385.61

INPUT
Description:
Station Elevation Data num= 151

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	600.03	.16	600	3.27	599.03	3.36	599	7.02	598
7.03	598	7.06	597.99	9.93	597	11.12	596.57	12.77	596
13.75	595.66	15.55	595	18.39	594.28	19.72	594	21.15	593.68
24.24	593	28.07	592.11	28.44	592.02	28.54	592	31.92	591.24
32.94	591	35.36	590.45	37.28	590	41.57	589.06	41.83	589
42.07	588.95	42.23	588.91	47.06	588	50.89	587.31	52.57	587
54.87	586.59	57.85	586	62.33	585.09	62.77	585	63.18	584.92
66.37	584.28	67.15	584.19	68.36	584	70.1	583.69	75.02	583
76.2	582.91	78.25	582.66	82.57	582	85.98	581.78	91.98	581
95.02	580.93	95.3	580.93	95.72	580.9	97.84	580.67	104.89	580
107.16	580	111.63	580	114.05	580	114.79	580	132.18	580
155.02	580	207.18	580	210.88	580	217.69	580.26	223.01	580.39
229.75	580.52	236.66	580.41	240.4	580.46	244.03	580.49	251.31	580.48
258.75	580.4	260.18	580.4	263.84	580.43	274.05	580.44	278.48	580.49
281.16	580.56	307.58	580.72	323.12	580.98	331.88	580.99	332.94	580.99
333.49	580.99	337.4	581	339.09	581.06	339.55	581.06	342.38	581.16
344.14	581.24	347.06	581.28	352.07	581.41	354.42	581.5	364.95	582
367.59	582.52	370.08	583	374.48	583.84	375.3	584	377.53	584.42
380.41	585	382.83	585.87	383.2	586	383.98	586.3	385.95	587
387.29	587.48	388.7	588	388.85	588.05	391.43	589	392.2	589.28
394.23	590	395.46	590.53	396.59	591	398.25	591.69	399.02	592
401.26	592.94	401.4	593	401.56	593.06	403.78	594	405.13	594.59
406.13	595	407.51	595.67	408.06	596	409.56	596.73	410.01	597
411.67	597.8	412.02	598	413.82	598.86	414.07	599	416.04	599.93
416.17	600	418.59	601.23	425.41	605	425.75	605.23	426.65	606
428.06	606.96	428.12	607	469.24	607.72	476.16	607.84	485.9	608
486.32	608.12	486.69	608.19	487.76	608.38	491.13	609	493.13	609.58
494.42	610	496.84	610.75	497.54	611	500.07	611.79	500.68	612
501.68	612.33	503.85	613	507.27	613.69	508.85	614	511.27	614.47
513.87	615	515.4	615.41	517.64	616	519.57	616.5	521.41	617
523.78	617.62								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	95.02	.04	323.12	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
95.02	323.12	181.5	181.5	181.5	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	121.45	590	T
178.22	523.78	590	T

CULVERT

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1290.56

INPUT
Description:
Distance from Upstream XS = 5
Deck/Roadway Width = 47
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	615	580	262.28	606.076	576.206	282.78	606.076	576.206
428.06	606.96	580						

Upstream Bridge Cross Section Data
Station Elevation Data num= 151

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	600.03	.16	600	3.27	599.03	3.36	599	7.02	598

7.03	598	7.06	597.99	9.93	597	11.12	596.57	12.77	596
13.75	595.66	15.55	595	18.39	594.28	19.72	594	21.15	593.68
24.24	593	28.07	592.11	28.44	592.02	28.54	592	31.92	591.24
32.94	591	35.36	590.45	37.28	590	41.57	589.06	41.83	589
42.07	588.95	42.23	588.91	47.06	588	50.89	587.31	52.57	587
54.87	586.59	57.85	586	62.33	585.09	62.77	585	63.18	584.92
66.37	584.28	67.15	584.19	68.36	584	70.1	583.69	75.02	583
76.2	582.91	78.25	582.66	82.57	582	85.98	581.78	91.98	581
95.02	580.93	95.3	580.93	95.72	580.9	97.84	580.67	104.89	580
107.16	580	111.63	580	114.05	580	114.79	580	132.18	580
155.02	580	207.18	580	210.88	580	217.69	580.26	223.01	580.39
229.75	580.52	236.66	580.41	240.4	580.46	244.03	580.49	251.31	580.48
258.75	580.4	260.18	580.4	263.84	580.43	274.05	580.44	278.48	580.49
281.16	580.56	307.58	580.72	323.12	580.98	331.88	580.99	332.94	580.99
333.49	580.99	337.4	581	339.09	581.06	339.55	581.06	342.38	581.16
344.14	581.24	347.06	581.28	352.07	581.41	354.42	581.5	364.95	582
367.59	582.52	370.08	583	374.48	583.84	375.3	584	377.53	584.42
380.41	585	382.83	585.87	383.2	586	383.98	586.3	385.95	587
387.29	587.48	388.7	588	388.85	588.05	391.43	589	392.2	589.28
394.23	590	395.46	590.53	396.59	591	398.25	591.69	399.02	592
401.26	592.94	401.4	593	401.56	593.06	403.78	594	405.13	594.59
406.13	595	407.51	595.67	408.06	596	409.56	596.73	410.01	597
411.67	597.8	412.02	598	413.82	598.86	414.07	599	416.04	599.93
416.17	600	418.59	601.23	425.41	605	425.75	605.23	426.65	606
428.06	606.96	428.12	607	469.24	607.72	476.16	607.84	485.9	608
486.32	608.12	486.69	608.19	487.76	608.38	491.13	609	493.13	609.58
494.42	610	496.84	610.75	497.54	611	500.07	611.79	500.68	612
501.68	612.33	503.85	613	507.27	613.69	508.85	614	511.27	614.47
513.87	615	515.4	615.41	517.64	616	519.57	616.5	521.41	617
523.78	617.62								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	95.02	.04	323.12	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
95.02	323.12	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	121.45	590	T
178.22	523.78	590	T

Downstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	623	580	299.71	606.076	575.456	320.71	606.076	575.456
571.62	605	580						

Downstream Bridge Cross Section Data
Station Elevation Data num= 187

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	627.5	7.11	627	38.48	627	124.94	585	126.95	585.16
138.74	585.16	140.98	585.14	148.52	585	151.52	584.95	151.89	584.95
152.96	584.93	167.09	584.77	169.59	584.66	176.55	584.35	181.65	584.15
183.35	584.13	190.47	584	196.63	583.88	202.96	583.81	206.1	583.78
215.32	583.68	220.17	583.57	224.42	583.42	230.18	583.24	231.95	583.18
233.33	583.18	240.94	583.2	242.72	583.11	244.79	583	255.01	582.49
260.21	582	268.24	581.25	270.56	581	277.3	580.29	279.25	580
282.68	579.68	285.64	579.4	287.68	579.25	290.69	579	292.05	578.88
292.74	578.78	295.25	578.43	295.26	578.43	295.83	578.26	296.92	578
299.95	577.49	302.99	577.28	306.18	577	307.17	576.82	309.09	576.44
309.84	576.28	310.98	576	314.87	575.22	315.87	575	316.01	575
316.19	575	316.38	575	319.08	575.82	319.8	576	320.55	576.21
321.34	576.36	322.93	576.63	323.68	576.69	326.39	576.8	326.4	576.8
326.41	576.8	328.79	577	330.05	577.1	331.98	577.19	334.95	577.21
347.14	577.24	349.2	577.22	353.2	577.19	353.73	577.2	356.54	577.28
361.53	577.66	364.19	577.86	364.74	577.88	370.65	577.95	371.86	578
372.74	578.03	372.83	578.04	376.23	578.3	377.41	578.33	381.43	578.29
384	578.27	388.74	578.43	392.15	578.48	395.69	578.54	399.97	578.6
402.93	578.61	407.72	578.61	410.56	578.63	415.47	578.63	420.16	578.76
422.9	578.81	423.63	578.82	435.11	579	436.89	579.03	437.24	579.03

```
  445.45   579.1  446.92  579.11  454.52  579.32  459.38  579.39  463.13  579.43
  466.37  579.46  472.87  579.45  476.28  579.59  477.29  579.61  480.09  579.71
  487.91     580  490.53  580.17  496.48  580.69  498.82  580.89  499.69     581
  504.81  581.59  507.91     582  508.25  582.04  509.07  582.17  513.24  582.82
  514.28     583  516.32  583.35  517.63  583.59  518.55  583.78  519.51     584
  521.12  584.31  524.14     585   527.2  585.99  527.24     586  529.96  586.92
  530.18     587  530.56  587.14  533.01     588  534.57  588.55  535.81     589
  538.25  589.84  538.77     590  539.62  590.33  541.14     591  541.73  591.24
  543.55     592  544.63  592.46  546.02     593  547.19  593.45  548.49     594
  549.85  594.56  550.97     595  551.63  595.34  552.67     596  553.87  596.71
  554.44     597  554.98  597.26  556.23     598  557.48  598.74     558     599
  558.72  599.33  559.91     600  561.49  600.71  562.13     601  564.39  601.93
  564.55     602  564.59  602.02  566.85     603  567.18  603.15  569.11     604
  570.83  604.66  571.62     605  574.08  605.12  592.24     606  596.93  606.17
  598.99  606.19  604.55  606.29  625.66  606.71  639.05     607  639.69  607.28
  641.31     608  643.56     609  643.58  609.01  646.05     610  647.79  610.83
  648.13     611  648.43  611.17  650.13     612  650.62  612.26  652.11     613
  654.35  613.31  656.86  613.68

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  299.95     .04  331.98     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
        299.95  331.98             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  299.95     585       T
  330.05  656.86     585       T

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  2

Culvert Name     Shape      Rise    Span
Culvert #1           Box       5      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
Coef
               -2.5     149     .014     .014        0                   .4                1
Upstream   Elevation =  576.206
           Centerline Station =  144.84
Downstream Elevation =  575.456
           Centerline Station =  309.05

Culvert Name     Shape      Rise    Span
Culvert #2           Box       5      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
Coef
               -2.5     149     .014     .014        0                   .4                1
Upstream   Elevation =  576.206
           Centerline Station =  155.84
Downstream Elevation =  575.456
           Centerline Station =  320.05

CROSS SECTION


RIVER: Caroll Canyon Cr
REACH: River CL           RS: 1204.11
```

INPUT
Description:
Station Elevation Data num= 187

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	627.5	7.11	627	38.48	627	124.94	585	126.95	585.16
138.74	585.16	140.98	585.14	148.52	585	151.52	584.95	151.89	584.95
152.96	584.93	167.09	584.77	169.59	584.66	176.55	584.35	181.65	584.15
183.35	584.13	190.47	584	196.63	583.88	202.96	583.81	206.1	583.78
215.32	583.68	220.17	583.57	224.42	583.42	230.18	583.24	231.95	583.18
233.33	583.18	240.94	583.2	242.72	583.11	244.79	583	255.01	582.49
260.21	582	268.24	581.25	270.56	581	277.3	580.29	279.25	580
282.68	579.68	285.64	579.4	287.68	579.25	290.69	579	292.05	578.88
292.74	578.78	295.25	578.43	295.26	578.43	295.83	578.26	296.92	578
299.95	577.49	302.99	577.28	306.18	577	307.17	576.82	309.09	576.44
309.84	576.28	310.98	576	314.87	575.22	315.87	575	316.01	575
316.19	575	316.38	575	319.08	575.82	319.8	576	320.55	576.21
321.34	576.36	322.93	576.63	323.68	576.69	326.39	576.8	326.4	576.8
326.41	576.8	328.79	577	330.05	577.1	331.98	577.19	334.95	577.21
347.14	577.24	349.2	577.22	353.2	577.19	353.73	577.2	356.54	577.28
361.53	577.66	364.19	577.86	364.74	577.88	370.65	577.95	371.86	578
372.74	578.03	372.83	578.04	376.23	578.3	377.41	578.33	381.43	578.29
384	578.27	388.74	578.43	392.15	578.48	395.69	578.54	399.97	578.6
402.93	578.61	407.72	578.61	410.56	578.63	415.47	578.63	420.16	578.76
422.9	578.81	423.63	578.82	435.11	579	436.89	579.03	437.24	579.03
445.45	579.1	446.92	579.11	454.52	579.32	459.38	579.39	463.13	579.43
466.37	579.46	472.87	579.45	476.28	579.59	477.29	579.61	480.09	579.71
487.91	580	490.53	580.17	496.48	580.69	498.82	580.89	499.69	581
504.81	581.59	507.91	582	508.25	582.04	509.07	582.17	513.24	582.82
514.28	583	516.32	583.35	517.63	583.59	518.55	583.78	519.51	584
521.12	584.31	524.14	585	527.2	585.99	527.24	586	529.96	586.92
530.18	587	530.56	587.14	533.01	588	534.57	588.55	535.81	589
538.25	589.84	538.77	590	539.62	590.33	541.14	591	541.73	591.24
543.55	592	544.63	592.46	546.02	593	547.19	593.45	548.49	594
549.85	594.56	550.97	595	551.63	595.34	552.67	596	553.87	596.71
554.44	597	554.98	597.26	556.23	598	557.48	598.74	558	599
558.72	599.33	559.91	600	561.49	600.71	562.13	601	564.39	601.93
564.55	602	564.59	602.02	566.85	603	567.18	603.15	569.11	604
570.83	604.66	571.62	605	574.08	605.12	592.24	606	596.93	606.17
598.99	606.19	604.55	606.29	625.66	606.71	639.05	607	639.69	607.28
641.31	608	643.56	609	643.58	609.01	646.05	610	647.79	610.83
648.13	611	648.43	611.17	650.13	612	650.62	612.26	652.11	613
654.35	613.31	656.86	613.68						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	299.95	.04	331.98	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
299.95	331.98	89.74	89.74	89.74	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	299.95	585	T
330.05	656.86	585	T

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1114.37

INPUT
Description:
Station Elevation Data num= 136

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	631.2	2.32	631	107.04	580	180.94	580	190.06	584
195.43	585	218.3	574	228.54	574	230.23	574	240.54	574.02
242.37	574.02	244.43	574.02	249	574.02	253.93	574.03	262.06	574.09
289.66	574.22	309.07	574.06	309.55	574.05	323.27	574	330.44	573.96
330.98	573.96	332.68	573.95	339.52	573.99	342.34	574	342.54	574
344.67	574	346.95	574	350.1	574	350.93	574	351.79	574

357.02	574	357.89	574	358.74	574	360.73	574	369.4	574.01
370.22	574.01	371.63	574.01	372.78	574.01	374.23	574.01	375.08	574.01
382	574.01	383.55	574.01	384.62	574.01	394.26	574.1	421.56	574.33
425.99	574.33	436.33	574.42	456.88	574.66	463.4	574.81	466.2	574.8
471.31	575	473.58	575.1	476.09	575.17	488.02	575.49	505.64	576
505.75	576	506.31	576	506.46	576	509.68	576.36	510.82	576.51
513.94	577	514.97	577.16	520.35	578	524.91	578.72	526.67	579
529.43	579.43	533.16	580	534.7	580.56	535.78	581	536.7	581.38
538.3	582	539.68	582.55	540.83	583	541.91	583.41	543.39	584
544.5	584.41	546.03	585	546.92	585.43	547.88	586	548.89	586.62
549.61	587	550.42	587.45	551.58	588	553.48	588.98	553.51	589
554.11	589.3	555.5	590	555.59	590.04	558.01	591	560.33	591.97
560.4	592	562.07	592.65	562.84	593	564.5	593.68	565.29	594
565.77	594.19	567.66	595	568	595.22	569.29	596	571.04	596.98
571.06	597	571.29	597.13	572.56	597.88	572.74	598	572.89	598.1
574.34	599	575.56	599.67	576.03	600	577.72	600.91	577.91	601
579.47	601.84	579.78	602	580.18	602.2	581.49	603	582.9	603.76
583.35	604	583.78	604.21	585.28	605	593.47	605.22	618.31	606
624.72	606.05	625.44	606.05	626.14	606.05	634.1	606.04	639.14	606
640.6	605.63	641	605.57	643.77	605.31	647.08	605	651.33	604.39
653.6	604	653.98	604	654.51	604	656.54	604.53	658.59	605
659.34	605.54								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	289.66	.04	421.56	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
289.66	421.56	63.89	63.89	63.89	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	238.05	580	T
435.94	659.34	580	T

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 1050.48

INPUT
Description:
Station Elevation Data num= 130

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	634.5	16.3	634	128.48	580	186.44	580	195.82	584
198.82	585	226.8	574	247.73	573	273.93	573	274.16	573
278.29	572.99	281.76	572.99	293.46	572.96	295.73	572.96	297.36	572.96
307.38	572.98	311.8	572.99	314.13	573	315	573.29	316.75	574
318.98	574.01	322.68	574.01	328.37	574	328.53	574	328.66	574
339.39	573.16	339.5	573.16	341.1	573.1	341.5	573.09	342.42	573.07
342.44	573.07	342.78	573.07	343.15	573.08	346.2	573.12	358.8	573.32
397.39	574	404.6	574.01	405.23	574.01	409.74	574	412.08	574
414.72	574	419.24	573.99	420.62	573.99	424.34	573.99	429.1	573.98
431.81	573.98	437.44	573.98	439.61	573.98	446.32	573.98	453.65	573.99
456.94	573.99	462.68	573.99	469.1	573.99	484.97	574	486.59	574
486.64	574	486.91	574	487.01	574	488.81	574.1	502.63	575
506.1	575.36	511.67	576	512.51	576.09	513.28	576.18	519.92	577
521.29	577.18	527.91	578	532.02	578.52	535.76	579	541.48	579.69
543.94	580	545.73	580.82	546.11	581	546.9	581.34	548.36	582
549.63	582.56	550.63	583	552.18	583.69	552.88	584	553.69	584.37
555.06	585	556.24	585.61	557.05	586	558.57	586.78	559.03	587
559.51	587.23	561.03	588	562.13	588.53	563.01	589	564.22	589.62
564.95	590	565.57	590.25	567.36	591	568.92	591.63	569.82	592
571.31	592.63	572.19	593	573.13	593.35	574.71	594	575.41	594.27
577.16	595	577.92	595.58	578.48	596	579.45	596.73	579.79	597
581.09	597.95	581.16	598	581.19	598.03	582.53	599	583.58	599.76
583.92	600	585.71	600.94	585.84	601	586.59	601.39	587.86	602
588.24	602.19	590.04	603	590.8	603.38	592.06	604	593.59	604.83
593.96	605	600.42	605.03	622.91	605.14	625.13	605.15	644.78	605.06
656.32	605	658.83	604.07	659.03	604	664.21	603.99	664.49	603.99

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	226.8	.04	397.39	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
226.8	397.39	116.65	116.65	116.65	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 933.83

INPUT
Description:
Station Elevation Data num= 150

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	634	12.72	634	22.69	639	24.7	639	26.71	638
49.39	637	181.18	574	189.24	573	192.64	573.5	203.2	573.39
220.5	573.18	233.39	573.01	233.78	573.01	234.4	573	237.46	572.87
239.28	572.9	240.6	572.91	246.62	572.83	247.04	572.83	252.65	572.77
257.85	572.72	259.89	572.71	269.8	572.66	274.55	572.65	279.21	572.63
283.29	572.6	286.57	572.59	290.05	572.56	293.65	572.56	301.06	572.42
315.63	572.13	319.48	572	325.52	571.64	336.46	571	347.91	570.9
349.96	570.89	352.27	570.91	355.92	570.94	359.69	570.96	360.34	570.97
364.06	571	364.43	571.04	367.95	571.3	369.62	571.39	373.93	571.61
380.06	571.88	381.01	571.93	383.18	572	392.8	572.12	393.8	572.12
396.65	572.13	398.87	572.14	404.55	572.13	405.86	572.12	407.93	572.13
408.65	572.13	409.39	572.13	410.19	572.14	412.5	572.17	413.61	572.19
414.94	572.21	416.7	572.24	419.27	572.29	423.44	572.38	428.04	572.49
448.8	573	451.12	573.09	459.84	573.43	472.89	574	476.39	574.07
501.91	575	510.39	575.84	512.11	576	521.36	576.89	522.56	577
523.66	577.11	533.05	578	537.19	578.39	541.59	578.82	543.51	579
554	579.98	554.21	580	554.22	580	554.28	580.02	557.57	581
557.91	581.11	560.97	582	562.2	582.38	564.32	583	566.3	583.65
567.48	584	569.2	584.56	570.46	585	572.93	586	572.94	586
575.46	587	575.64	587.07	577.99	588	580.38	588.95	580.5	589
580.65	589.06	583.09	590	584.82	590.66	585.64	591	588	591.87
588.33	592	588.67	592.14	590.97	593	593.22	593.84	593.61	594
595.23	594.59	596.1	594.89	596.45	595	596.66	595.14	598.18	596
598.39	596.14	599.75	597	601.11	597.86	601.32	598	601.53	598.14
602.89	599	604.51	599.87	604.73	600	605.04	600.19	606.38	601
607.17	601.45	608.33	602	610.04	602.99	610.06	603	610.11	603.02
612.11	604	613.3	604.58	614.13	605	626.54	605.06	628.85	605.07
632.22	605.06	635.64	605.05	642.54	605.02	648.25	605	665.81	604.26
668.93	604.12	669.79	604.08	670.02	604.07	670.74	604	672.33	604
672.44	604	672.51	604	672.53	604	673.74	604	674.32	604

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	293.65	.04	428.04	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
293.65	428.04	103.6	103.6	103.6	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 830.23

INPUT
Description:
Station Elevation Data num= 144

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	639.5	31.84	639	163.58	574	167.65	573	167.72	573
172.2	572.08	172.59	572	176.66	571.16	177.38	571	178.94	570.65
181.85	570	183.81	569.99	185.07	569.99	190.73	569.98	195.53	569.99
199.45	570	223.2	570.38	253.37	570.71	263.5	570.79	266.51	570.78
276.71	570.87	278.86	570.84	282.19	570.79	284.33	570.82	285.88	570.83
287.01	570.83	289.62	570.8	291.14	570.78	295.99	570.72	298.69	570.68

302.04	570.63	306.62	570.57	308.82	570.53	321.22	570.32	327.76	570.2
338.15	570	338.24	570	338.25	570	338.3	569.99	341.7	569
341.86	569	342.22	568.99	342.63	568.99	342.89	568.99	343.44	569
345.75	569.86	346.08	570	355.97	570.84	357.95	571	359.45	571.04
359.75	571.04	359.83	571.04	361.19	571.05	363.39	571.07	364.72	571.08
366.83	571.17	375.49	571.46	379.3	571.53	382.56	571.59	389.96	571.64
395.95	571.66	401.35	571.66	404.65	571.64	408.18	571.63	413.88	571.61
430.01	571.75	439.72	571.92	443.09	571.99	452.41	572	453.19	572
454.09	572	455.49	572	457.1	572.16	465.95	573	467.46	573.16
476.18	574	484	574.88	485.05	575	486.44	575.1	499.81	576
501.74	576.13	504.57	576.3	515.86	577	521.53	577.45	528.91	578
539.13	578.84	541.26	579	543.84	579.18	559.35	580	563.83	580.9
564.3	581	566.66	581.5	568.79	582	572.15	582.76	573.19	583
574.99	583.44	577.28	584	579.52	584.49	581.78	585	582.35	585.25
583.98	586	584.93	586.38	586.36	587	587.65	587.55	588.68	588
590.36	588.73	591.01	589	591.64	589.27	593.4	590	594.72	590.57
595.79	591	596.59	591.32	598.25	592	599.79	592.63	600.66	593
602.67	593.82	603.12	594	605.29	594.87	605.6	595	606.15	595.24
607.89	596	609.42	596.64	610.25	597	611.84	597.67	612.6	598
613.66	598.46	614.92	599	616.78	599.75	617.4	600	617.5	600.08
618.84	601	620.03	601.87	620.25	602	621.43	602.85	621.69	603
622.15	603.25	623.03	604	624.34	605	624.4	605	626.89	605
628.9	605	629.45	605	647.06	604.63	670.72	604.11		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	338.15	.04	346.08	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
338.15	346.08	122.37	122.37	122.37	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 707.86

INPUT
Description:
Station Elevation Data num= 151

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	641	4.4	641	28.57	640	56.68	639	197.11	570
208	569	208.19	569	211.1	568.91	218.69	568.73	218.94	568.72
224.02	568.6	240.84	568.85	242.54	568.89	247.9	568.92	253.51	568.95
257.87	568.97	260.62	568.98	261.64	568.99	264.92	568.99	265.36	568.99
265.66	569	265.95	569	266.04	569	267.18	569.06	272.03	569.36
282.15	570	295.46	570.01	295.6	570.01	302.54	570.01	306.28	570
309.79	570	311.84	569.37	313.04	569	313.38	568.99	313.8	568.98
315.4	568.94	315.73	568.94	316.39	568.96	317.74	569	319.68	569.85
320.02	570	336.14	570.8	340.48	570.9	342.19	570.92	343.3	570.91
346.06	570.88	346.86	570.88	349.08	570.87	352.08	570.84	359.51	570.75
362.46	570.72	370.4	570.61	374.53	570.57	382.71	570.48	389.23	570.39
393.19	570.33	401.8	570.26	411.02	570.19	418.42	570.12	422.14	570.1
422.73	570.1	423.34	570.1	425.79	570.11	429.23	570.14	429.89	570.15
431.36	570.18	436.87	570.19	442.04	570.18	444.05	570.23	449.2	570.25
452.28	570.34	461.64	570.61	465.68	570.68	468.4	570.72	472.9	570.88
474.69	570.9	476.73	571	478.17	571.06	482.57	571.23	487.02	571.38
490.12	571.5	496	572	501.36	572.7	503.75	573	510.04	573.85
511.16	574	518.51	574.92	519.08	575	519.46	575.14	521.67	576
523.27	576.59	524.44	577	525.42	577.36	527.19	578	529.19	578.73
529.94	579	530.42	579.17	532.71	580	534.95	580.62	536.24	581
537.99	581.51	539.83	582	541.74	582.51	543.41	583	545.6	583.58
547.03	584	550.06	584.83	550.62	585	555.58	585.98	555.68	586
555.7	586	560.77	586.98	560.86	587	560.95	587.02	566.04	588
566.81	588.14	571.2	589	572.19	589.18	576.43	590	578.14	590.41
580.77	591	583.42	591.64	584.91	592	588.21	592.77	589.15	593
592.79	593.86	593.36	594	594.19	594.21	597.55	595	599.35	595.42
601.91	596	605.09	596.72	606.34	597	610.46	597.93	610.8	598
610.96	598.04	611.42	598.14	615.21	599	617.84	599.58	619.76	600
620.48	600.28	622.32	601	624.67	601.91	624.89	602	625.08	602.07
627.51	603	651.42	603.5	676.25	604	676.32	604.02	678.52	605

678.66 605.05

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	309.79	.04	320.02	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
309.79	320.02	91.7	91.7	91.7	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 616.16

INPUT
Description:
Station Elevation Data num= 147

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
64.62	630	191.96	568	199.48	567.98	203.39	567.97	207.39	567.96
211.24	567.95	212.68	567.95	225.4	568	242.59	568.32	290.56	569
291.87	569.01	293.79	569.02	297.73	569.04	303.01	569.07	304.62	569.07
310.7	569.04	316.8	569	318.26	568.98	335.31	568.45	342.25	568.26
347.98	568.03	349.11	568.02	349.75	568.01	350.91	568.01	351.34	568.01
351.57	568	351.92	568	354.74	568	355.37	567.99	355.85	568
356.24	568	357.47	568	360.75	568	360.98	568	361.04	568
361.3	568	361.76	568	368.37	568.34	369.45	568.29	370.12	568.33
371.33	568.26	372.18	568.26	373.01	568.26	374.96	568.37	394.62	569
400.38	569.12	409.98	569.18	419.06	569.17	426.84	569.14	428.84	569.11
436.97	569.08	437.55	569.07	438.01	569.06	458.19	569.01	458.33	569.01
458.45	569.01	458.48	569.01	461.33	569	461.37	569	461.43	569
461.49	569.01	461.58	569.01	464.05	569.04	467.17	569.15	473.15	569.33
484.8	569.73	493.14	570	497.34	570.62	499.99	571	505.72	571.83
506.87	572	512.38	572.8	513.83	573	520.18	573.93	520.68	574
525.91	574.74	527.53	575	527.92	575.14	530.37	576	532.15	576.66
533.14	577	534.45	577.46	536.04	578	536.87	578.3	538.87	579
539.45	579.22	541.72	580	546.1	580.81	547.16	581	552.14	581.94
552.49	582	553.3	582.15	557.85	583	561.35	583.68	563.06	584
564.28	584.23	568.33	585	570.83	585.52	573.07	586	576.17	586.65
577.79	587	579.94	587.43	582.62	588	586.04	588.73	587.13	589
589.17	589.48	591.6	590	594.78	590.56	597.25	591	598.53	591.22
602.99	592	606.95	592.67	608.77	593	611.32	593.46	614.38	594
615.83	594.25	620	595	621.66	595.94	621.76	596	621.98	596.12
623.5	597	624.14	597.38	625.17	598	626.18	598.6	626.87	599
627.07	599.11	628.67	600	629.77	600.56	630.64	601	631.26	601.32
632.59	602	634.28	602.49	636.33	603	640.69	603.02	643.38	603.03
648.78	603	649.75	603	651.03	602.99	651.81	602.99	661.01	602.93
665.01	602.91	665.3	602.91	678.38	602.99	679.79	603	680.01	603.15
681.6	604	683.37	604.47						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
64.62	.04	316.8	.04	400.38	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
316.8	400.38	148.1	148.1	148.1	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 468.06

INPUT
Description:
Station Elevation Data num= 145

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
70.01	630	200.7	566.99	200.73	566.99	206.32	566.91	206.96	566.91
207.21	566.92	207.46	566.92	207.88	566.92	209.68	566.9	212.43	566.88
216.42	566.81	227.45	566.67	233.19	566.57	251.75	566.24	256.66	566.16
265.07	566	267.14	565.99	268.38	565.99	271.23	565.98	274.64	565.97

285.76	565.94	288.43	565.92	314.4	565.8	325.07	565.82	326.23	565.82
337.38	565.84	338.52	565.84	350.24	565.87	351.46	565.87	362.5	565.88
363.32	565.89	372.64	565.89	373.45	565.9	374.47	565.9	375.43	565.9
376.06	565.9	376.69	565.9	383.74	565.89	403.73	565.95	412.11	565.99
415.02	565.99	422.8	566	428.11	566.09	433.95	566.17	438.93	566.22
443.01	566.26	445.35	566.27	458.59	566.28	461.9	566.27	472.6	566.23
480.86	566.09	484.64	566.02	485.4	566.01	487.04	566	487.43	566
488.96	565.99	489.36	565.99	490.43	565.98	490.86	565.98	492.17	565.97
493.12	565.97	495.14	566	500	566.416	502.5	566.63	507.21	567
512.47	567.42	519.79	568	523.76	568.32	532.37	569	540.66	569.65
545.19	570	546.79	570.48	548.58	571	551.81	571.98	551.88	572
551.94	572.02	555.28	573	557.94	573.81	558.57	574	560.5	574.58
561.93	575	562.61	575.42	563.49	576	563.72	576.15	565.09	577
565.93	577.53	566.68	578	567.38	578.45	568.29	579	569.54	579.85
569.79	580	572.16	580.85	572.58	581	572.98	581.15	575.28	582
578.09	583	579.7	583.6	580.79	584	581.37	584.21	583.54	585
585.3	585.85	585.63	586	587.71	586.94	587.83	587	588.01	587.08
589.86	588	591.37	588.63	592.16	589	593.32	589.52	594.31	590
598.25	590.66	600.25	591	601.91	591.28	606.16	592	611.04	592.82
612.1	593	613.02	593.16	617.95	594	623.96	594.99	624.03	595
624.06	595.01	627.41	596	630.42	596.87	630.91	597	632.14	597.35
634.34	598	635.6	598.37	637.76	599	640.79	599.83	641.42	600
642.29	600.24	642.3	600.25	644.37	601	646.6	601.79	647.54	602
650.43	602.01	651.37	602.01	655.16	602	656.58	602	672.33	601.57
677	601.42	681.48	601.42	688.17	601.62	688.81	602	690.53	602.57

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
70.01	.04	472.6	.04	500	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
472.6	500	122.21	122.21	122.21	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 345.85

INPUT
Description:
Station Elevation Data num= 143

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
32.18	640	186.94	565	192.38	564.94	225.79	564.72	230.5	564.73
232.82	564.71	234.03	564.7	235.11	564.7	236.04	564.69	236.8	564.69
241.62	564.66	250.46	564.64	258.92	564.63	264.07	564.62	267.83	564.62
269.85	564.61	271.16	564.61	272.18	564.61	276.11	564.58	285.48	564.54
293.97	564.52	297.45	564.53	307.32	564.55	313.01	564.57	317.15	564.56
322.69	564.57	338.11	564.56	353.26	564.56	361.18	564.58	383.44	564.62
389.29	564.6	395.94	564.57	399.96	564.57	403.61	564.57	416.88	564.46
417.16	564.46	420.19	564.46	433.11	564.3	435.44	564.3	437.78	564.3
439.6	564.29	441.54	564.29	458.99	564.11	459.83	564.11	461.28	564.1
461.99	564.09	481.59	564.02	481.71	564.02	481.82	564.01	482.14	564.01
482.5	564.02	482.68	564.02	482.84	564.02	483.06	564.02	483.69	564.04
483.8	564.04	484.51	564.05	516.68	564.55	530.15	564.94	532.2	565
532.94	565.19	536.14	566	538.69	566.62	540.21	567	542.67	567.61
544.23	568	548.14	568.98	548.21	569	548.71	569.13	552.3	570
553.02	570.36	554.41	571	555.89	571.71	556.56	572	557.73	572.59
558.61	573	559.63	573.48	560.74	574	562.55	574.88	562.82	575
563.59	575.31	565.3	576	565.56	576.11	567.88	577	569.38	577.63
570.32	578	571.47	578.46	572.83	579	574.66	579.72	575.34	580
575.92	580.27	577.49	581	577.64	581.07	578.31	581.38	579.2	581.76
579.77	582	581.35	582.7	582	583	584.02	583.91	584.23	584
584.26	584.01	586.45	585	588.56	585.68	589.63	586	591.8	586.66
592.93	587	596.17	587.99	596.18	588	596.2	588	598.42	588.65
599.55	589	600.05	589.15	602.46	589.79	603.15	590	606.18	590.55
608.38	591	613.01	591.96	613.19	592	613.27	592.01	613.46	592.06
616.33	592.59	618.14	593	619	593.18	622.07	594	623.76	594.39
625.85	595	627.66	595.45	630.02	596	632.53	596.62	634.11	597
635.15	597.25	636.65	597.63	637.91	598	641.05	598.98	641.1	599
641.11	599	641.12	599	643.93	600	659.43	600.09	661.39	600.1

671.76	600.05	679.93	600	690.61	599.22

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
32.18	.04	420.19	.04	516.68	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
420.19	516.68	168.43	168.43	168.43	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 177.42

INPUT
Description:
Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
15.42	640	183.37	565	206.02	564.4	234.26	564	252.45	563.82
261.24	563.74	276.51	563.59	279.01	563.56	302.41	563.38	303.58	563.37
324.96	563.2	333.58	563.15	335.57	563.15	356.06	563.04	356.62	563.04
370.62	563	380.93	562.95	381.32	562.95	381.8	562.95	404.5	562.9
405.45	562.89	425.3	562.88	426.26	562.88	427.98	562.88	436.11	562.88
436.66	562.87	444.78	562.88	447.4	562.87	465.65	562.87	466.21	562.86
466.82	562.86	471.39	562.92	472.43	562.93	475.65	562.99	477.27	563
477.54	563	487.16	563.36	490.28	563.5	498.57	563.83	502.38	564
503.33	564.01	503.73	564.01	507.57	564.06	507.75	564.06	508.85	564.07
511.05	564.08	512.78	564.15	524.49	564.56	531.77	565	537.07	569.38
537.73	570	538.05	570.1	540.6	571	541.22	571.21	543.31	572
545.97	572.99	545.99	573	546.06	573.03	548.8	574	549.97	574.46
551.48	575	553.86	575.73	554.7	576	555.28	576.21	557.78	577
558.79	577.36	560.77	578	561.89	578.4	563.85	579	565.51	579.56
566.69	580	569.15	580.63	570.53	581	573.42	581.74	574.35	582
577.43	582.78	578.21	583	581.48	583.82	582.11	584	585.23	584.8
586.08	585	586.6	585.09	592.36	586	595.83	586.56	598.62	587
603.94	587.85	604.85	588	606.16	588.22	611.05	589	612.84	589.29
617.34	590	619.53	590.49	621.86	591	622.97	591.25	626.46	592
629.24	592.6	631.05	593	632.63	593.35	635.81	594	639.53	594.82
640.42	595	646.16	595.85	647.13	596	647.95	596.19	650.52	596.74
651.74	597	652.36	597.12	657.12	598	672.96	598.13	674.13	598.14
684.01	598.08	693.31	598	696.84	597.99	698.09	597.98	698.87	597.99

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
15.42	.04	370.62	.04	475.65	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
370.62	475.65	83.27	83.27	83.27	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 94.15

INPUT
Description:
Station Elevation Data num= 209

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	601.57	.34	601.4	.9	601.02	1.2	601.01	1.23	601.01
1.31	601.01	1.44	601.01	1.59	601	5.1	600.12	5.57	600
5.99	599.96	11.74	599.46	13.77	599.34	15.23	599	17.34	598.54
19.92	598	22.16	597.54	24.64	597	26.91	596.56	29.44	596
33.04	595.27	33.98	595.12	34.58	595	40.05	594.01	40.11	594
41.71	593.71	45.51	593	46.33	592.85	50.7	592	52.47	591.65
55.78	591	59.9	590.17	60.74	590	61.66	589.86	63	589.66
67.15	589	68.97	588.69	73.31	588	77.44	587.35	79.61	587
82.91	586.46	85.8	586	87.39	585.72	91.91	585	94.84	584.44
97.1	584	102.06	583.04	102.26	583	106.99	582.07	107.32	582
107.64	581.93	112.27	581	113.28	580.78	117.04	580	119.72	579.37

121.56	579	123.23	578.61	125.85	578	128.92	577.28	130.21	577
132.01	576.59	134.41	576	135.34	575.78	138.82	575	139.4	574.82
142.12	574	144.23	573.33	145.32	573	146.26	572.7	148.58	572
149.6	571.68	151.87	571	154.64	570.06	154.81	570	155.33	569.9
159.89	569	162.1	568.52	164.58	568	167.48	567.38	169.31	567
173.95	566	173.96	566	178.79	565	184.36	564.84	185.67	564.81
186.82	564.78	200.28	564.41	203.45	564.34	205.7	564.29	207.85	564.25
210.26	564.21	212	564.19	222.7	564.02	224.08	564	224.33	564
225.8	564	226.29	564	226.66	564	232.43	563.93	241.02	563.84
259.36	563.65	303.01	563	377.24	562.02	378.38	562	408.76	561.47
418.38	561.31	424.52	561.22	428.11	561.18	429.91	561.17	431.52	561.17
432.88	561.16	433.75	561.15	435.87	561.15	442.5	561.14	443.1	561.13
450.93	561.03	453.24	561.03	455.61	561.02	456.62	561.02	457.1	561.02
458.08	561.02	458.81	561.01	459.69	561.01	460.43	561	460.6	561
460.76	561	461.24	560.99	469.53	560.93	472.18	560.91	481.97	560.88
485.75	560.94	487.21	560.99	490.59	561	490.6	561	490.68	561
494.45	561.04	499.13	561.03	499.37	561.04	499.48	561.04	499.65	561.06
500.84	561.17	509.45	562	514.45	562.56	518.43	563	526.06	563.85
527.43	564	536.29	564.96	536.67	565	536.75	565.03	539.28	566
540.25	566.37	542.1	567	543.52	567.52	544.78	568	547.38	568.96
547.48	569	547.62	569.05	550.05	569.98	550.11	570	550.12	570
553.75	571	554.8	571.29	557.43	572	559.71	572.64	561.02	573
564.56	573.98	564.63	574	564.68	574.01	568.28	575	572.34	578.09
574.69	580	577.67	580.53	580.42	581	582.99	581.43	586.26	582
590.51	582.72	592.1	583	594.16	583.33	598.36	584	603.68	584.85
604.6	585	606.06	585.31	609.2	586	610.39	586.24	614.15	587
618.32	587.85	619.04	588	619.42	588.08	623.91	589	625.76	589.38
628.92	590	631.4	590.56	633.36	591	635.66	591.55	637.67	592
639.88	592.53	642.01	593	645.99	593.93	646.28	594	646.71	594.1
650.61	595	653.88	595.44	657.88	596	663.81	596.84	665.04	597
669.07	597.02	686.85	597.25	702.57	597.27	705.9	597.25		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	442.5	.04	500.84	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
442.5	500.84	70.03	70.03	70.03	.1	.3

CROSS SECTION

RIVER: Caroll Canyon Cr
REACH: River CL RS: 24.12

INPUT
Description:
Station Elevation Data num= 190

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	588.77	1.52	588.55	9.73	588	10.17	588	29.8	587.55
49.09	587.11	50.78	587.09	52.26	587.09	52.34	587.1	52.44	587.11
52.55	587.11	52.79	587.11	53.95	587	60.43	586.22	61.52	586.09
63.1	586	63.81	585.99	70.67	585.66	78.66	585.25	80.61	585.17
81	585.15	81.34	585.15	83.59	585	89.04	584.58	91.84	584.31
93.83	584	97.61	583.41	100.21	583	102.52	582.64	105.91	582.1
106.25	582.04	106.47	582	107.23	581.86	111.79	581	113.66	580.76
118.41	580	121.56	579.46	123.71	579	126.59	578.54	129.78	578
134.41	577.23	135.83	577	140.82	576.17	141.76	576	144.01	575.63
146.96	575.12	147.69	575	148.02	574.9	151.01	574	152.28	573.61
154.36	573	155.39	572.66	157.72	572	160.15	571.34	161.29	571
164.02	570.02	164.07	570	164.46	569.97	169.42	569.71	182.64	569
190.36	568.35	195.19	568	196.08	567.95	200.01	567.79	201.64	567.71
208.24	567.39	216.15	567	221.18	566.76	224.28	566.62	228.31	566.43
232.3	566.29	233.18	566.25	237.35	566.09	237.42	566.09	239.29	566
245.72	565.71	262.07	565	264.54	564.92	265.11	564.9	265.7	564.88
268.46	564.78	276.79	564.46	279	564.37	289.72	564	302.3	563.61
310.52	563.37	315.27	563.23	323.18	563	333.74	562.86	341.99	562.71
358.8	562.45	368.68	562.29	380.82	562	397.46	561.6	412.03	561.24
417.27	561.11	421.86	561	432.28	560.75	464.51	560	477.19	560
480.38	560	481.29	560	481.84	560.05	491.64	561	494.86	561.31
499.59	561.76	500.92	561.88	502.25	562	506.08	562.35	508.67	562.56

511.64	562.81	513.14	562.93	514.08	563	518.52	563.34	520.54	563.51
525.49	564	530.72	564.57	533.33	565	537.28	565.69	538.75	566
542.15	566.56	544.72	567	547.46	567.46	550.59	568	552.68	568.34
556.72	569	557.2	569.07	561.06	569.64	563.17	570	563.86	570.31
565.2	571	565.84	571.25	567.55	572	569.75	572.9	569.97	573
570.83	573.34	572.37	573.93	572.57	574	574.65	574.78	575.3	575
577.94	575.46	581.03	576	584.9	576.63	586.99	576.83	591.32	576.9
592.79	577	593.74	577.19	601.4	578	604.13	578.7	605.5	579
607.66	579.76	608.21	580	608.51	580.17	609.71	581	611.23	581.83
611.56	582	612.02	582.24	613.41	583	614.33	583.46	615.36	584
616.49	584.59	617.37	585	619.27	585.48	621.38	586	625.34	586.99
625.36	587	625.38	587	629.59	588	633.24	588.94	633.48	589
633.58	589.02	637.75	590	640.85	590.8	641.53	591	644.45	591.75
645.29	592	648.2	592.77	648.97	593	649.96	593.29	652.74	594
655.38	594.74	656.29	595	662.9	595.89	663.74	596	664.51	596.05
666.23	596.13	683.59	597	686.3	597.01	690.84	597	690.96	597

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	368.68	.04	502.25	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
368.68	502.25	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Caroll Canyon Cr

Reach	River Sta.	n1	n2	n3
River CL	1412.74	.04	.04	.04
River CL	1385.61	.04	.04	.04
River CL	1290.56	Culvert		
River CL	1204.11	.04	.04	.04
River CL	1114.37	.04	.04	.04
River CL	1050.48	.04	.04	.04
River CL	933.83	.04	.04	.04
River CL	830.23	.04	.04	.04
River CL	707.86	.04	.04	.04
River CL	616.16	.04	.04	.04
River CL	468.06	.04	.04	.04
River CL	345.85	.04	.04	.04
River CL	177.42	.04	.04	.04
River CL	94.15	.04	.04	.04
River CL	24.12	.04	.04	.04

SUMMARY OF REACH LENGTHS

River: Caroll Canyon Cr

Reach	River Sta.	Left	Channel	Right
River CL	1412.74	27.13	27.13	27.13
River CL	1385.61	181.5	181.5	181.5
River CL	1290.56	Culvert		
River CL	1204.11	89.74	89.74	89.74
River CL	1114.37	63.89	63.89	63.89
River CL	1050.48	116.65	116.65	116.65
River CL	933.83	103.6	103.6	103.6
River CL	830.23	122.37	122.37	122.37
River CL	707.86	91.7	91.7	91.7
River CL	616.16	148.1	148.1	148.1
River CL	468.06	122.21	122.21	122.21
River CL	345.85	168.43	168.43	168.43
River CL	177.42	83.27	83.27	83.27
River CL	94.15	70.03	70.03	70.03

River CL	24.12

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Caroll Canyon Cr

Reach	River Sta.	Contr.	Expan.
River CL	1412.74	.1	.3
River CL	1385.61	.3	.5
River CL	1290.56	Culvert	
River CL	1204.11	.3	.5
River CL	1114.37	.1	.3
River CL	1050.48	.1	.3
River CL	933.83	.1	.3
River CL	830.23	.1	.3
River CL	707.86	.1	.3
River CL	616.16	.1	.3
River CL	468.06	.1	.3
River CL	345.85	.1	.3
River CL	177.42	.1	.3
River CL	94.15	.1	.3
River CL	24.12	.1	.3

2. INEFFECTIVE FLOW AREA CALCULATIONS DOWNSTREAM OF CHABAD CENTER DRIVEWAY CULVERT

Calculation of Expansion Ratio (ER) and Length of Expansion Reach (L_e)

Location: Cross Section 1204.11 and Cross Section 1114.37 (downstream of box culvert under Chabad Center Driveway)

Per Table 6-1 of HEC-RAS User's Manual:

b	20	culvert opening width		
B	170.37	total flood plain width		
b/B	0.12			
nob	0.04	avg. Manning's n for overbanks		
nc	0.04	Manning's n for main channel		
nob/nc	1.0	--> Choose closest value:	nob/nc =	1
S	0.005	avg. longitudinal bed slope through the culvert reach		
S	26.4	ft/mi --> Choose closest value:	S =	10 ft/mi

1st Iteration:

Based on Table 6-1 choose Expansion Ratio (ER) = 1.0

L_obs	89.75	ft	average obstruction length = half of total reduction in floodplain width caused by the two culvert approach embankments
L_e	89.75	ft	length of expansion reach = expansion ratio*average obstruction length = ER*L_obs

Model Output:

F_c2:	0.86	Froude number at Station 1204.11
F_c1:	0.66	Froude number at Station 1114.37

2nd Iteration:

Width of the floodplain is less than 1000 ft and Q=1332 cfs which is less than 5000 cfs

Therfore use equation B-2 in Appendix B of HEC-RAS Reference Manual to compute a new ER:

ER:	1.08	where ER = L_e/L_obs = 0.421 + 0.485*(F_c2/F_c1) + 0.000018*Q
L_obs:	89.75 ft	
L_e:	96.65 ft	

Model Output:

F_c2:	1.01	Froude number at Station 58
F_c1:	0.84	Froude number at Station 57

3rd Iteration:

Width of the floodplain is less than 1000 ft and Q=1332 cfs which is less than 5000 cfs

Therfore use equation B-2 in Appendix B of HEC-RAS Reference Manual to compute a new ER:

ER:	1.0	where ER = L_e/L_obs = 0.421 + 0.485*(F_c2/F_c1) + 0.000018*Q
L_obs:	89.75 ft	
L_e:	92 ft	

Compare 3rd Iteration values to 2nd Iteration values:

ER for 3rd iteration is close to ER for 2nd Iteration

L_e for 3rd iteration is close to L_e for 2nd Iteration

Therefore 2nd Iteration Values are appropriate:

Use ER:	1.0
Use L_e:	97 ft

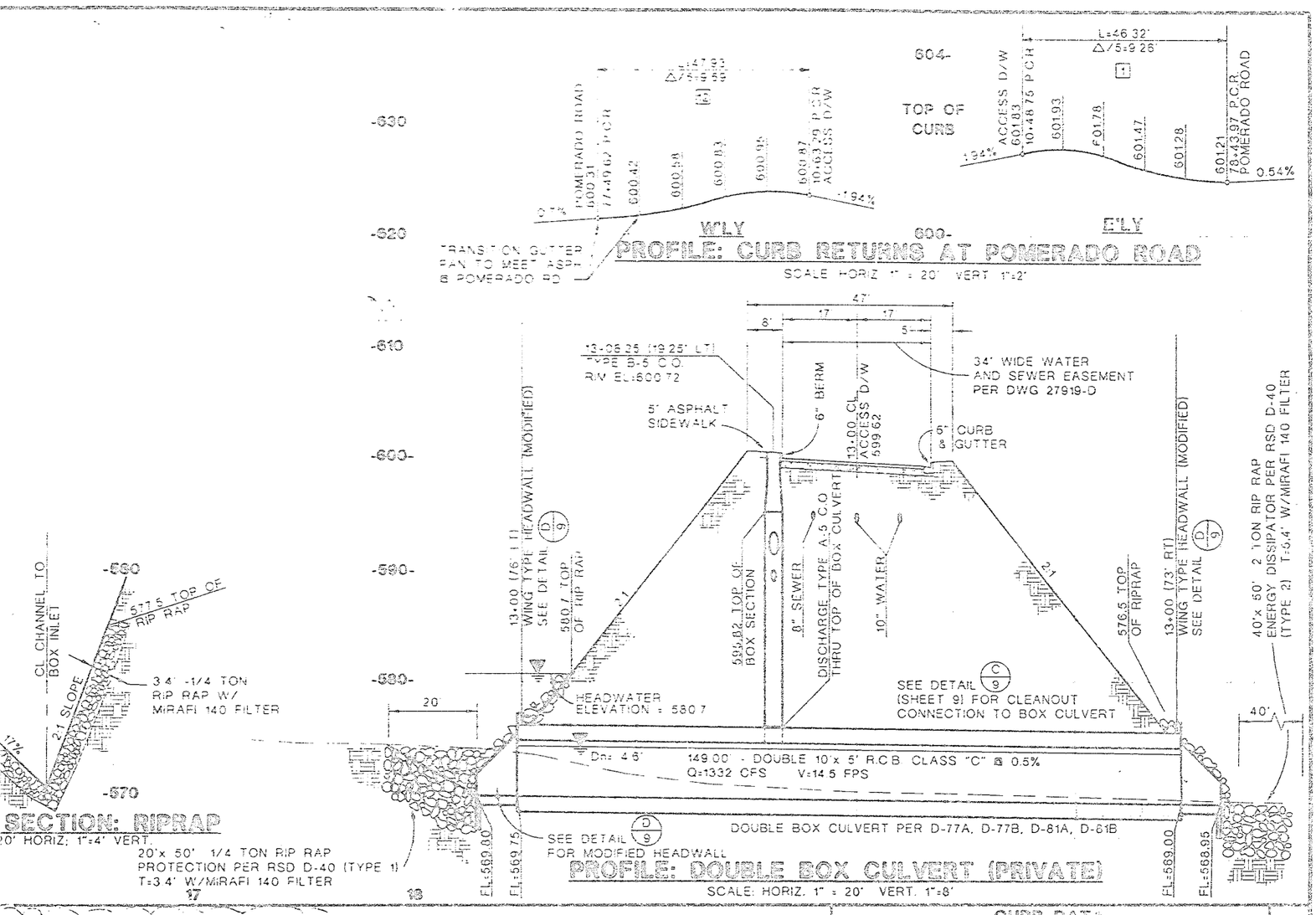
3. DOUBLE BOX CULVERT ELEVATION CALCULATIONS

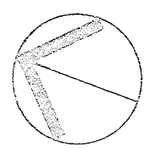
Vertical Adjustment

		Meters	Feet
NVGD 29 to NAVD 88		0.652	2.139
Error			4.317
Feet to Add To Vertical Elevations			6.456

	Culvert	Culvert	Road
	Up Elev	DN Elev	Low Pt
Plan Bott Culv Elev	569.75	569	599.62
Correct Bott Culv Elev	576.206	575.456	606.076
Plan Top Culv Elev	574.75	574	
Correct Top Culv Elev	581.2061076	580.4561	

4. IMPROVEMENT PLANS FOR CHABAD CENTER DRIVEWAY





SCALE: 1"=40'

CURB DATA				
NO	DELTA/BRG	RADIUS	LEN.	REMARKS
1	Δ= 88°27'30"	30.00'	46.32'	6" A.C. BERM
2	N20°28'18"W		264.70'	6" A.C. BERM
3	Δ= 21°25'02"	283.00'	105.79'	6" A.C. BERM
4	N41°53'21"W		49.40'	6" A.C. BERM
9	N41°53'21"W		49.40'	"G" CURB & GUTTER
10	Δ= 21°25'02"	317.00'	118.50'	"G" CURB & GUTTER
11	N20°28'18"W		250.17'	"G" CURB & GUTTER
12	Δ= 91°32'30"	30.00'	47.93'	6" A.C. BERM

PRIVATE SEWER DATA				
NO	DELTA/BRG	RADIUS	LEN.	REMARKS
1	N20°28'18"W		337.97'	8" P.V.C. (SDR-35)
2	Δ= 21°25'02"	290.00'	108.40'	8" P.V.C. (SDR-35)
3	N41°53'21"W		49.40'	8" P.V.C. (SDR-35)

FOR PRIVATE STORM DRAIN PIPES, INLETS AND CLEANOUTS WITHIN WATER AND SEWER EASEMENT SEE ENCROACHMENT REMOVAL AGREEMENT NO. 950282-2

SEE DRAWING NUMBER 27919-D FOR SEWER & WATER EASEMENT

E LETTER OF PERMISSION FOR FSITE GRADING DATED AUGUST 15, 1995

P.M. 17199

PUBLIC WATER DATA			
ELTA/BRG	RADIUS	LEN.	REMARKS
N20°28'18"W		295.45	10" P.V.C. (CL 200)
Δ= 21°25'02"	300.00	112.14	10" P.V.C. (CL 200)
N41°53'21"W		49.40	10" P.V.C. (CL 200)
N41°53'21"W		49.40	10" P.V.C. (CL 200)
Δ= 21°25'02"	310.00	115.88	10" P.V.C. (CL 200)
N20°28'18"W		318.19	10" P.V.C. (CL 200)

BENCHMARK

USC & GS BENCHMARK NO. J 321 BRASS DISC IN CONCRETE MONUMENT ON NORTHERLY SIDE OF POMERADO ROAD 1200' WESTERLY OF AVENIDA MAGNIFICA ELEVATION 604.141 M.S.L. (COUNTY OF SAN DIEGO VERTICAL CONTROL RECORDS) THIS ELEVATION WAS DETERMINED TO BE IN ERROR. THE CORRECT ELEVATION SHOULD BE 608.458 (CITY OF SAN DIEGO VERTICAL CONTROL RECORDS) ADD 4.317 FEET TO ELEV. SHOWN TO GET MEAN SEA LEVEL DATUM

ENGINEER OF WORK

3-5-76

JAMES M. ROBERTS R.C.E. 33487 DATE

C.U.P. 133-PC

PRIVATE CONTRACT REF. 949571.00

IMPROVEMENT & GRADING PLAN FOR:

PRIVATE ACCESS DRIVEWAY

IN CHABAD - SCRIPPS RANCH PHASE 1

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING DEPARTMENT
SHEET 5 OF 59 SHEETS

WO NO. 950282

FOR CITY ENGINEER — DATE

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	KHA			
"A" CHANGE	KHA			
RE-AS-BUILT	HE		6-12-06	
AS-BUILT	KHA		8-21-06	

1908-6299 NAD83 COORDINATE

268-1739 LAMBERT COORDINATES

CONTRACTOR SWINERTON DATE STARTED 3-15-97
INSPECTOR CAOTIK DATE COMPLETED 6-20-05

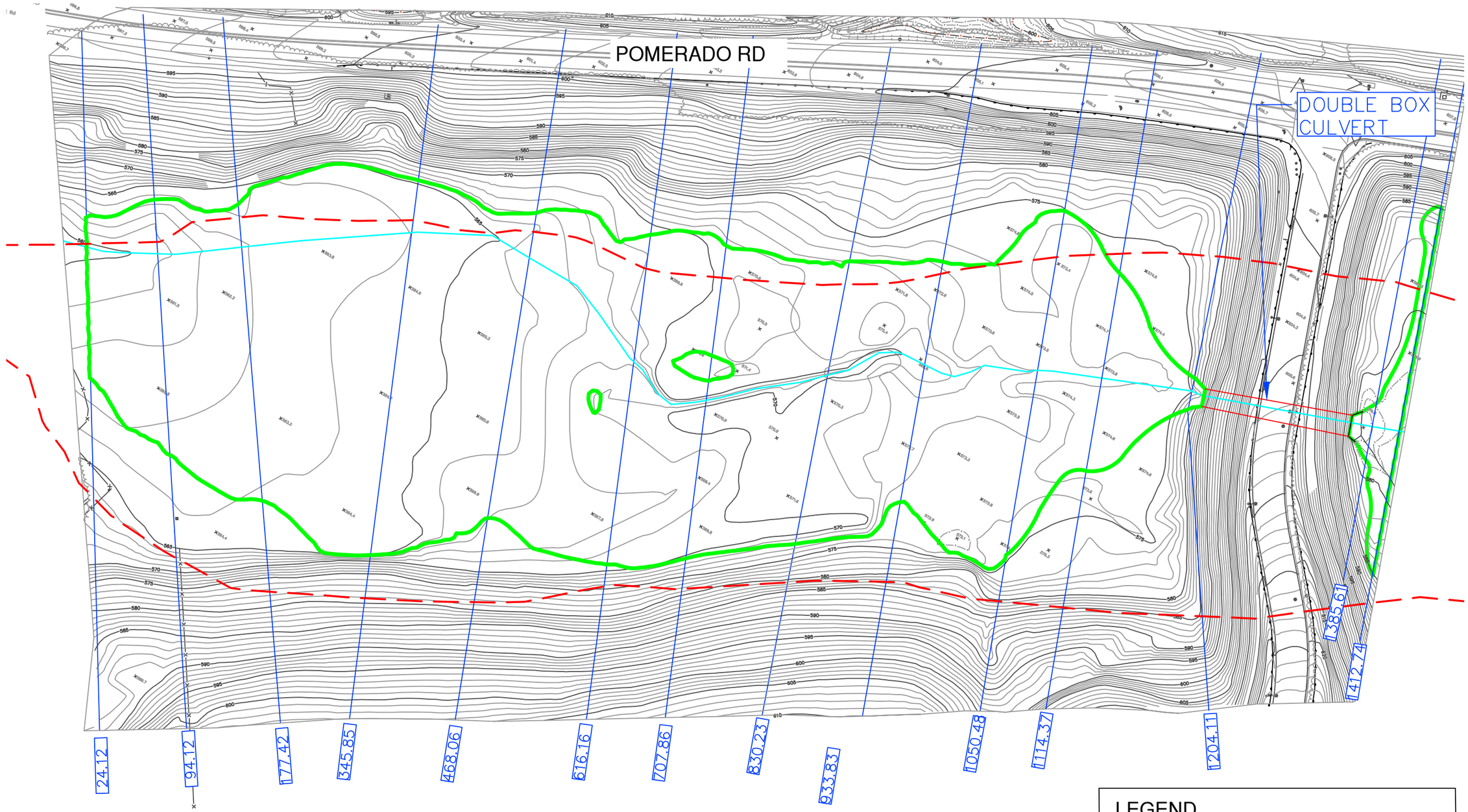
27827-5-D

RE-AS-BUILT: CHANGE PUBLIC SEWER TO PRIVATE

"A" CHANGE: REALIGNMENT OF PRIVATE ACCESS DRIVEWAY, DELETE PORTION OF PUBLIC DRIVE, ADD REF TO NEW SHT. NO. FOR DELETED SHEET 4.

RE-AS-BUILT

5. HEC-RAS WORK MAPS



1"=100'

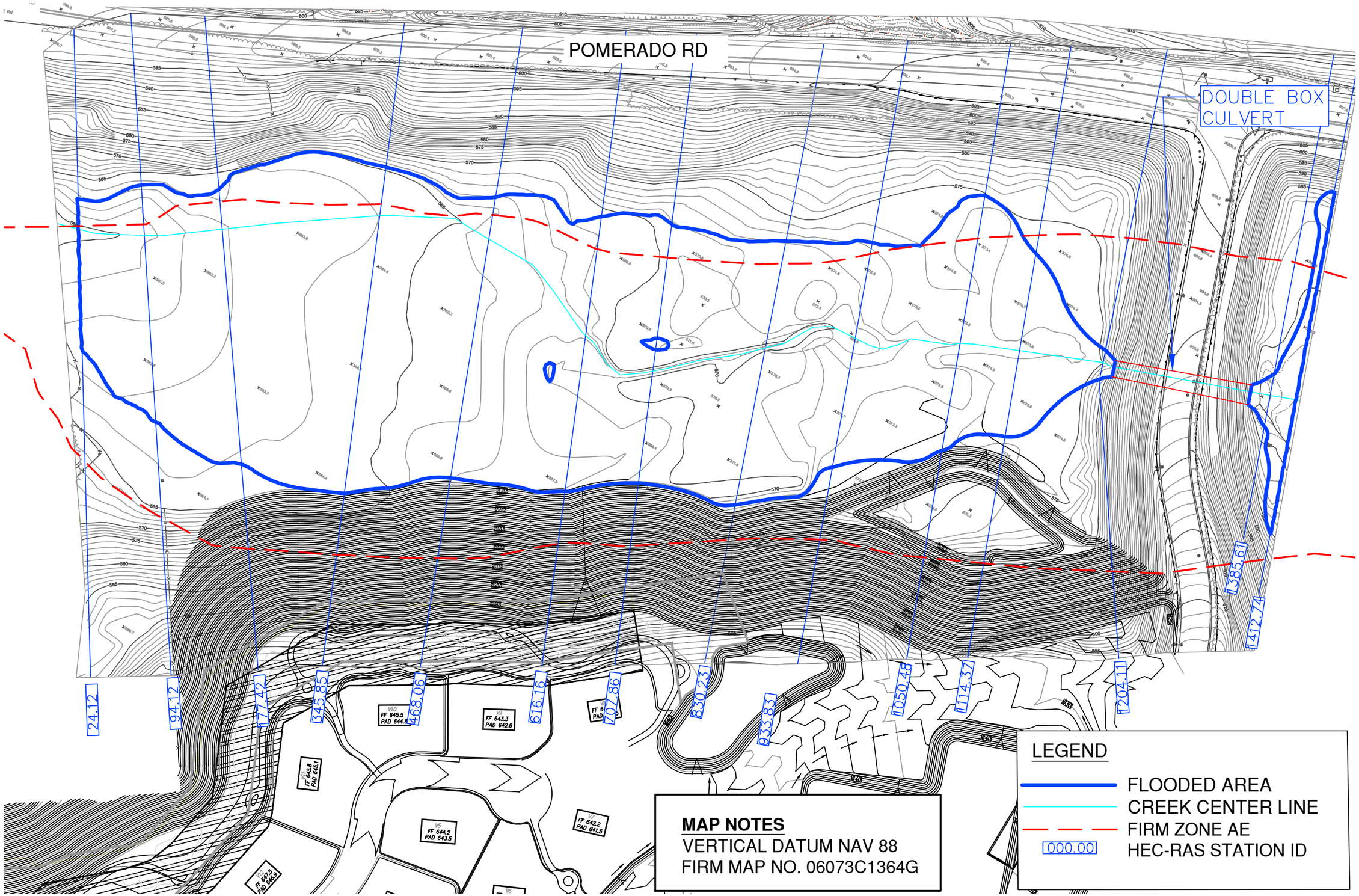
Carrol Canyon Creek
Existing Conditions
HEC-RAS Floodplain

MAP NOTES
VERTICAL DATUM NAV 88
FIRM MAP NO. 06073C1364G

LEGEND

FLOODED AREA
CREEK CENTER LINE
FIRM ZONE AE
000.00 HEC-RAS STATION ID

TORY R. WALKER ENGINEERING, INC.
WATER RESOURCES PLANNING & ENGINEERING
122 CIVIC CENTER DRIVE, SUITE 206, VISTA, CA 92084 | P: 760-4149212 | WWW.TRWENGINEERING.COM



MAP NOTES
VERTICAL DATUM NAV 88
FIRM MAP NO. 06073C1364G

LEGEND

- FLOODED AREA
- CREEK CENTER LINE
- FIRM ZONE AE
- 000.00 HEC-RAS STATION ID

1"=100'

Carrol Canyon Creek
Developed Conditions
HEC-RAS Floodplain

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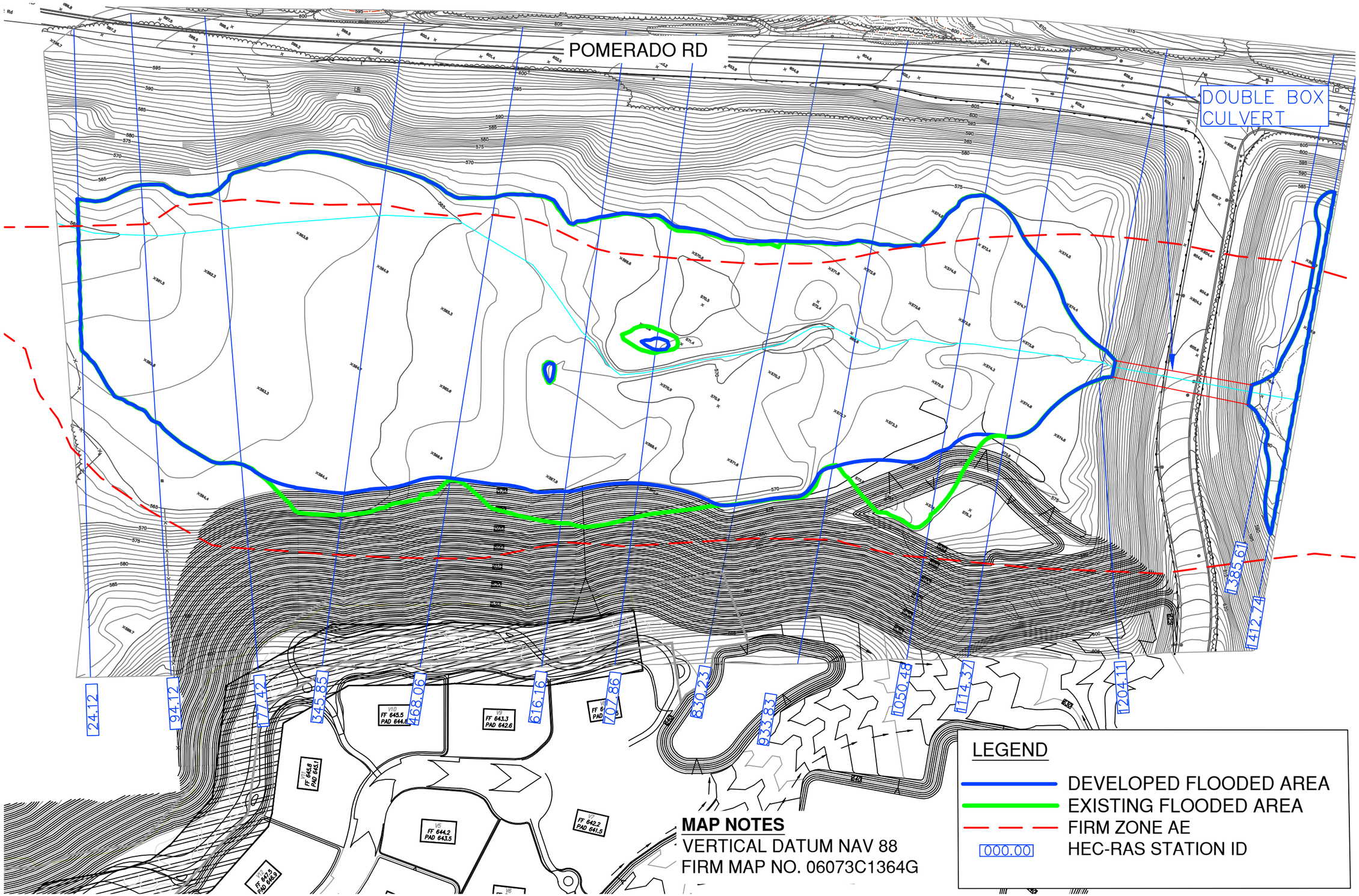


1"=100'

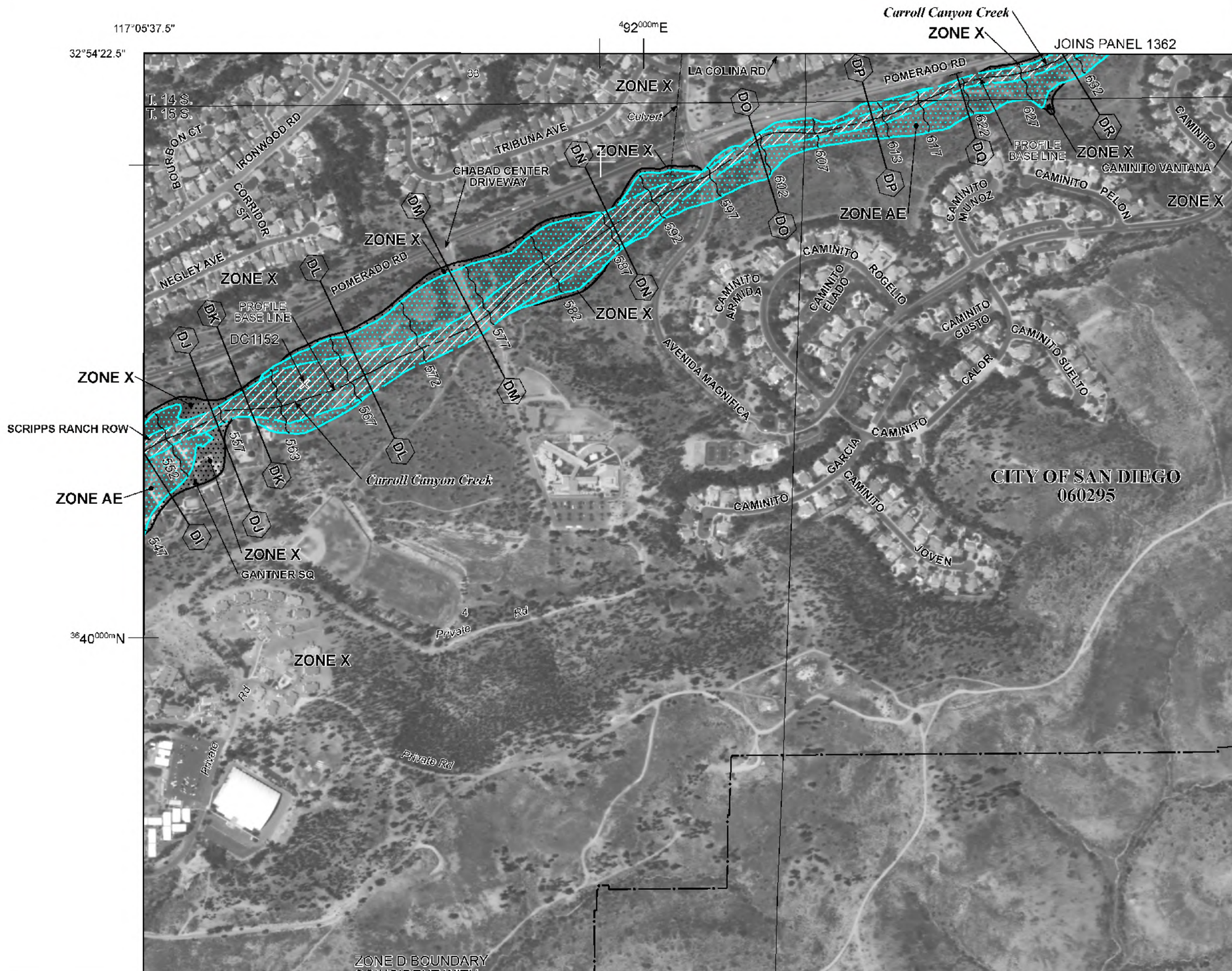
Carrol Canyon Creek
Existing vs Developed Conditios
HEC-RAS Floodplain

TORY R. WALKER ENGINEERING, INC.
WATER RESOURCES PLANNING & ENGINEERING
122 CIVIC CENTER DRIVE, SUITE 206, VISTA, CA 92084 | P: 760-4149212 | WWW.TRWENGINEERING.COM

ance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 250 500 750 1,000 FEET



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1364G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 1364 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO, CITY OF	060295	1364	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C1364G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

WATER QUALITY TECHNICAL REPORT

THE GLEN AT SCRIPPS RANCH
10455 POMERADO ROAD
SAN DIEGO, CA 92131

CONDITIONAL USE PERMIT AND
SITE DEVELOPMENT PERMIT, PLANNED DEVELOPMENT PERMIT
AND COMMUNITY PLAN AMENDMENT

ORIGINAL DATE: DECEMBER 7, 2011
REVISED JULY 22, 2014

Prepared For:

THE GLEN AT SCRIPPS RANCH CCRC LLC
9903 Businesspark Ave. Suite #104
San Diego, California 92131

Prepared By:

LATITUDE 33 PLANNING AND ENGINEERING
5355 Mira Sorrento Place, Suite 650
San Diego, California 92121
(858) 751 - 0633

John C. Eardensohn	Date	Prepared by: CO
RCE 34584	Expires: 9/30/2013	Reviewed by: MV

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APPENDIX

Appendix A 2010 Clean Water Act Section 303(d) List
Appendix B Site Map
Appendix C Bio-Retention Basin Details

1. INTRODUCTION

The City of San Diego's Storm Water Quality Standards states a Water Quality Technical Report (WQTR) must accompany all applications for a permit or approval associated with a Land Disturbance Activity. The purpose of this WQTR is to describe how the project will minimize the short and long-term impacts on receiving water quality. The plans and specifications found in this WQTR are conceptual, in nature, and not intended for construction purposes.

This report represents a technical description of water quality measures associated with The Glen at Scripps Ranch located at 10455 Pomerado Road in San Diego, California in support of the Condition Use Permit and Site Development Permit. This report will provide a detailed pre/post construction water quality analysis consistent with the City of San Diego Standard Urban Stormwater Mitigation Plan (SUSMP) requirements as promulgated in the City of San Diego most recent Storm Water Standards Manual. This report also describes the implementation and maintenance of water quality best management practices (BMPs) that will be installed onsite.

2. PROJECT DESCRIPTION

2.1 Project Location/Setting

The proposed project site is located in the Scripps Ranch Community east of Interstate 15 south of Pomerado Road, and west of the Chabad Hebrew Academy. More particularly, the site is described as a Portion of Parcel 3 of Parcel Map 20640, in the City of San Diego, County of San Diego, State of California, filed in the Office of the County Recorder of San Diego County. The proposed improvements and construction activities will take place on the 53-acre site.

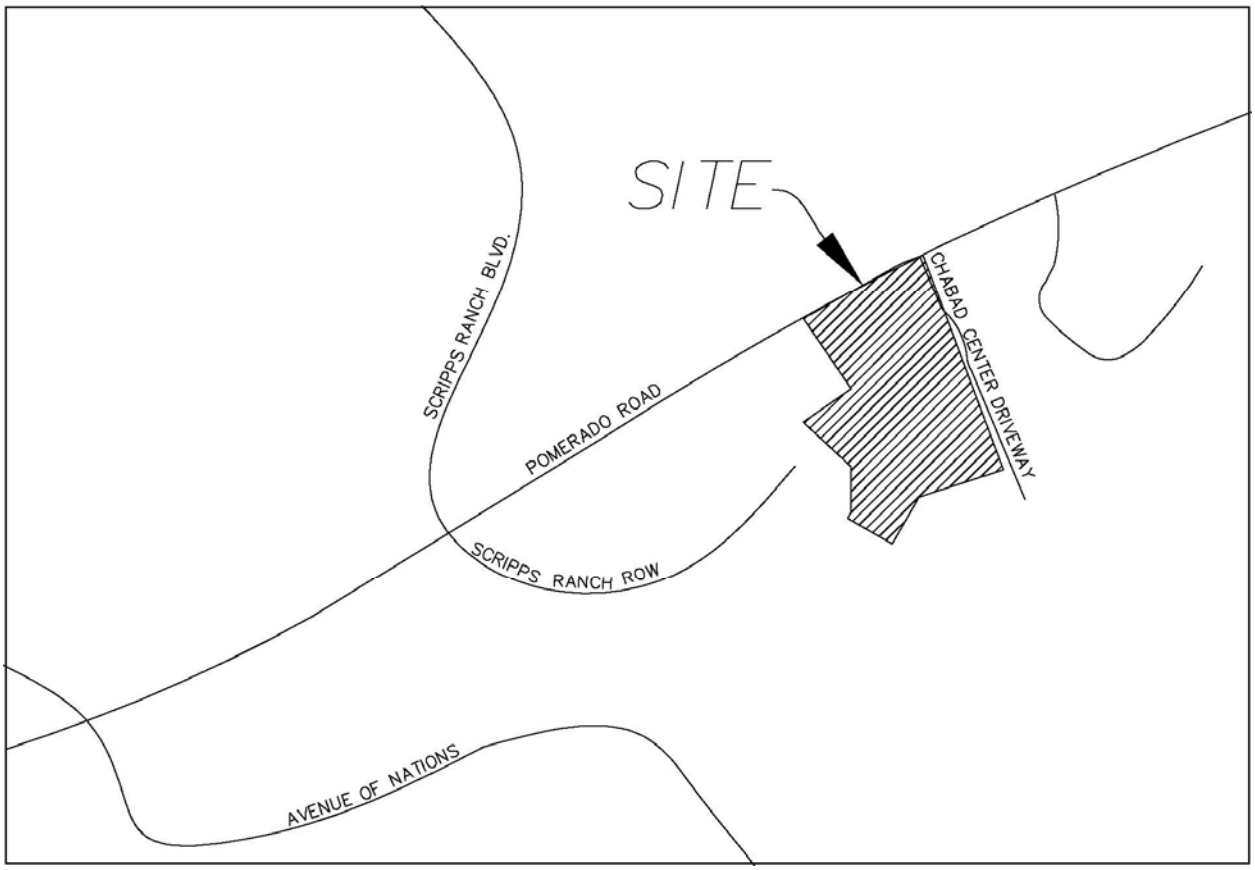


Figure 1: Vicinity Map

2.2 Project Description

The proposed project development will include the construction of a continuing care retirement community (Institutional Use) with 400 assisted living units of various configurations (villas, garden terraces and apartment style), 50 acute assisted living units (16 of which are memory care units) and 60 skilled nursing beds for a total of 450 assisted living units and 60 skilled nursing beds. The site will incorporate a commons/clubhouse building, a recreational building, a facilities/maintenance building, acute care health center, surface parking lots, onsite vehicular circulation, onsite ADA compliant sidewalks and landscape/hardscape areas adjacent to all

structures. Proposed private storm drain facilities will be installed to collect and treat runoff prior to discharge.

Figure 2: Project location map.

2.3 Project Activities

Site preparation for the 53-acre limit of disturbance will involve clearing and grubbing and demolition of the existing Alliant University Baseball Field. Without any spoils and undercut adjustments or bulk/shrinking factors applied (i.e. geometric quantities only), approximately 661,000 cubic-yards of soil cut and fill will be generated to balance the site. Remedial grading may be required based on additional geotechnical investigation/recommendations during the public grading permit phase.

2.4 Existing Drainage Discussion

The project area lies within a portion of several existing onsite drainage basins. Refer to Figure 3, "Existing Drainage Basin Map" contained within Preliminary Drainage Study prepared for this project for graphical depiction of existing hydrologic characteristics. The majority of the site drains westerly towards Pomerado Road and Interstate 15 via Carroll Canyon Creek. Sheet runoff is directed through several natural earthen drainage swales, which is collected and channelized under Scripps Ranch Row and Avenue of Nations towards Miramar Road via a box culvert drainage system in Carroll Canyon Creek which discharges to Los Penasquitos Lagoon.

2.5 Proposed Drainage Discussion

The proposed project development will include the construction of a continuing care retirement community (Institutional Use) with 400 assisted living units of various configurations (villas, garden terraces and apartment style), 50 acute assisted living units (16 of which are memory care units) and 60 skilled nursing beds for a total of 450 assisted living units and 60 skilled nursing beds. The site will incorporate several common areas including a health center, a recreational building (i.e. Common Building), a facilities building/central plant, surface parking lots, onsite vehicular circulation, onsite ADA compliant sidewalks and landscape/hardscape areas adjacent to all structures. The proposed project area lies within the limits of the existing drainage basins mentioned above and generally maintains all existing drainage patterns. Refer to Figure 4, "Proposed Drainage Basin Map" contained within the Preliminary Drainage Study prepared for this project for graphical depiction of proposed hydrologic characteristics. The majority of the runoff will be collected in proposed private storm drain facilities that will outlet into the existing natural drainage creek adjacent to Pomerado Road.

A large offsite drainage area will be collected and piped through the site as a bypass line. The site storm runoff will not mix with the offsite flows. By bypassing the site, the offsite flows will not enter the proposed BMPs.

The runoff associated with the proposed condition is estimated to match the pre-project flows. Bio-retention basins will be used in with other BMPs (i.e. bio-swales and bio-retention basins) to address the City's latest Hydromodification Program requirements. Refer to the Preliminary Drainage Study prepared for this project for particulars.

2.6 Downstream Conditions

Runoff from the project flows directly into Carroll Canyon Creek, defined by the City of San Diego as water quality sensitive area. Carroll Canyon Creek discharges into the Los Peñasquitos Lagoon to the west of the project.

2.7 Hydrologic Context Watershed Contribution

The project is located within the Los Peñasquitos Hydrologic Unit (HA 906.1) as defined by the Water Quality Control Plan for the San Diego Basin (9). The Los Peñasquitos Hydrologic Unit covers a total watershed area of approximately 100 square miles. The major receiving water body, Los Peñasquitos Lagoon, empties into the Pacific Ocean.

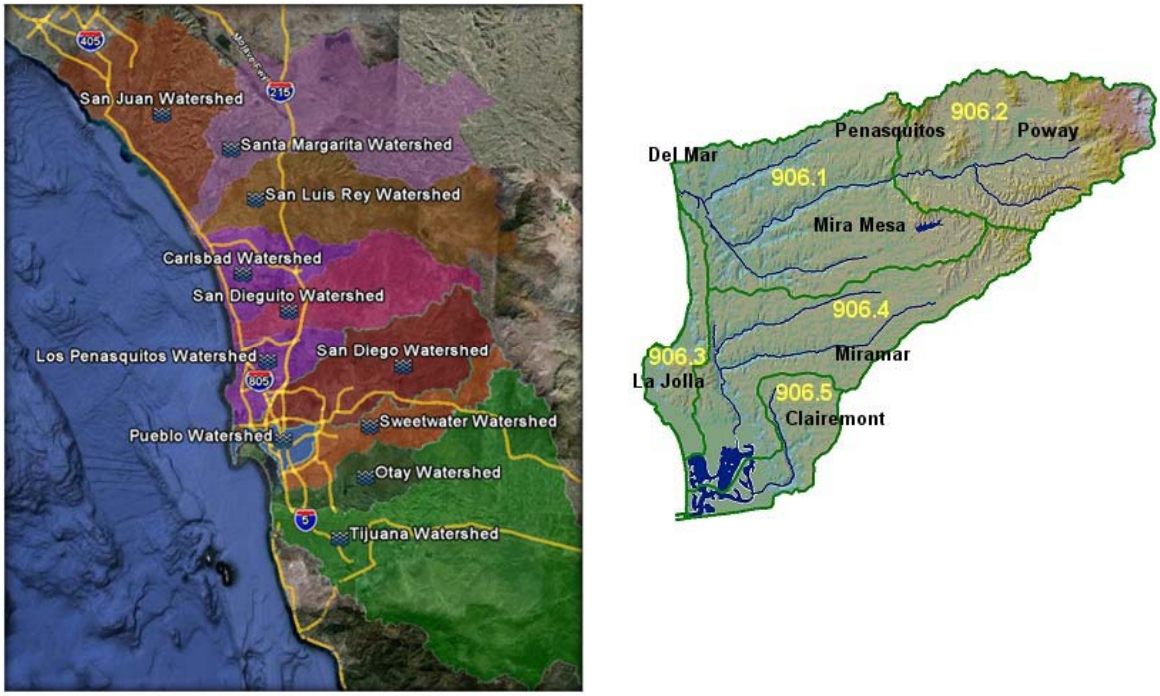


Figure 3: Hydrologic watershed.

3. PRIORITY PROJECT DETERMINATION

The following table determines whether the project is a "priority project" according to guidelines laid out in city of San Diego Storm Water Standards dated January 20, 2012. Projects are subject to MS4 Priority Project requirements if one or more of the criteria described in the table are met. Based on the information presented in the table below, the proposed project is a priority project.

PRIORITY PROJECT	YES	NO
1. Does the project disturb one acre or more and not meet one of the exclusions listed below?	✓	
Exclusions: Projects creating less than 5,000 sf of impervious surface; projects that add landscaping that does not require regular use of pesticides and fertilizers such as a slope stabilization project using native plants; linear pathway projects that are for infrequent vehicle use, such as for emergency or maintenance access or for bicycle or pedestrian use, if they are built with impervious surfaces or if they sheet flow to surrounding pervious surfaces; and, projects that do not meet the definition of New Development or Significant Redevelopment in the Storm Water Standards.		
2. New detached or attached residential development of 10 or more units	✓	
3. New developments of heavy industry greater than 1 acre		✓
4. New commercial development greater than 1 acre		✓
5. New automotive repair shop		✓
6. New restaurant		✓
7. New hillside development greater than 5,000 square feet	✓	
8. New project within, directly adjacent to or discharging to receiving waters within the Environmentally Sensitive Areas.	✓	
9. New parking lots greater than or equal to 5,000 square feet or with at least 15 parking spaces	✓	
10. New streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater	✓	
11. New retail gasoline outlets		✓
12. Redevelopment that installs and/or replaces 5,000 square feet or more of impervious surface and the existing site meets at least one of the categories 2-11 above		✓

4. HYDROLOGIC SETTING

4.1 Topography

The project is located in an area of San Diego called Scripps Ranch/Poway (Latitude: 32.902, Longitude -117.1). A majority of the project site is undeveloped. The highest point, at 761 feet MSL, is located in the southwest corner along the property line. Elevations within the project range from 761 feet MSL to 560 feet MSL.

4.2 Land Use & Vegetation

As shown in the attached photo below, the existing site consists primarily of a vacant lot. The site is currently zoned RS-1-8. East and west of the property is the Chabad Hebrew Academy and Alliant International University, respectively. Existing vegetation consists of native brush and trees.

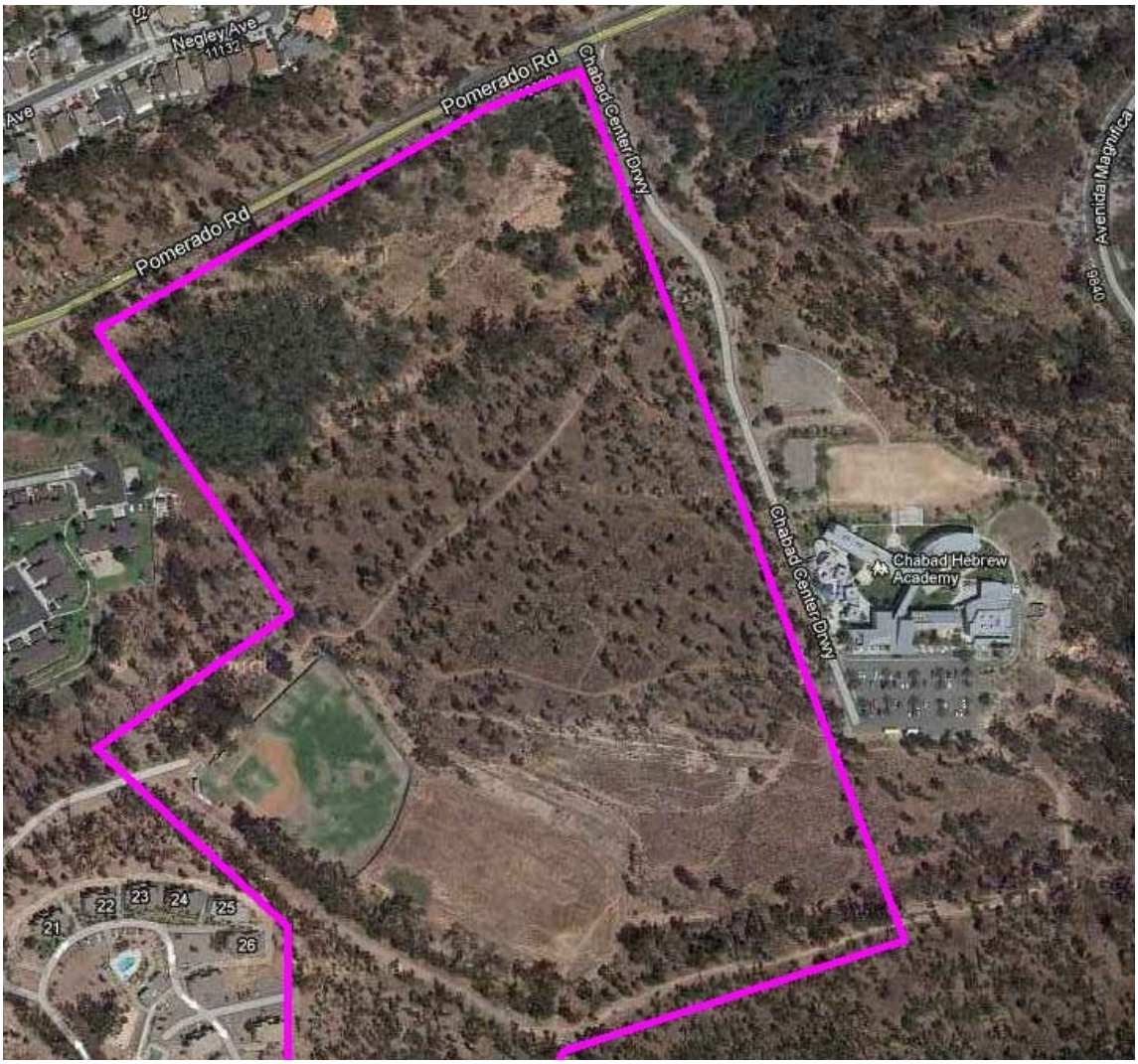


Figure 4: Existing land use.

4.3 Receiving Waters

The most immediate receiving water is the Carroll Canyon Creek, which drains into the Los Peñasquitos Lagoon, and into the Pacific Ocean. The Los Peñasquitos Lagoon is listed as an impaired water body on the California 2010 303(d) list.

Under the 303(d) section of the Clean Water Act, States are required to identify and list surface water bodies that are polluted. States area required to compile these water bodies into a list, referred to as the "Clean Water Act Section 303(d) List of Water Quality Limited Segments". States must also prioritize the water bodies on the list and develop Total Maximum Daily Loads (TMDLs) to improve the water quality. Table 4-1 summarizes the 303(d) impairments of the receiving waters for this project.

Table 4-1: Summary of Receiving Surface Waters

Receiving Water	Hydrologic Unit Code	Approximate Distance From Site	303(d) Impairment(s)
Peñasquitos Hydrologic Unit (906.00)			
Los Peñasquitos Lagoon (Miramar Reservoir)	906.10	2 miles	Sedimentation/Siltation

4.4 Risk Assessment

This project poses no risk to drinking water supplies or other sensitive resources.

4.5 Total Maximum Daily Load (TMDL)

TMDLs exist for the receiving waters for the following pollutants:

- Sedimentation/Siltation

4.6 Soil Characteristics

Based on the Natural Resources Conservation Service (NRCS) soils report the soil in the project area is made up of Redding (78%) and Riverwash (22%). The depth to the water table is over 80 inches in Redding soil group and between 60 to 72 inches in the Riverwash (based on observations). These soils have a very slow infiltration rate (high runoff potential). Infiltration is not recommended.

4.7 Contaminated Soil & Hazardous Waste Assessment

No contaminated soil or hazardous waste has been reported or is anticipated for this project.

5. BENEFICIAL USES

5.1 Definitions

From the San Diego County Basin Plan, The Porter-Cologne Act establishes a comprehensive program for the protection of beneficial uses of the waters of the state. California Water Code Section 13050(f) describes the beneficial uses of surface and ground waters that may be designated by the State or Regional Board for protection as follows:

> *"Beneficial uses of the waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves."*

Beneficial uses for surface waters are designated under the Clean Water Act Section 303 in accordance with regulations contained in 40 CFR 131. The State is required to specify appropriate water uses to be achieved and protected. The beneficial use designation of surface waters of the state must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial and other purposes including navigation.

In 1972, the State Board adopted a uniform list and description of beneficial uses to be applied throughout all basins of the State. During the 1994 San Diego Basin Plan update, beneficial use definitions were revised and some new beneficial uses were added. The following beneficial uses are defined statewide and are designated within the San Diego Region:

Municipal and Domestic Supply (MUNI) Includes uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) Includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PROC) Includes uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND) Includes 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.

Ground Water Recharge (GWR) Includes uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) Includes uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

Navigation (NAV) Includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW) Includes uses of water for hydropower generation.

Contact Water Recreation (REC-1) Includes 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, white water activities, fishing, or use of natural hot springs.

Non-Contact Water Recreation (REC-2) Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water 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.

Commercial and Sport Fishing (COMM) Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA) Includes the 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 or bait purposes.

Warm Freshwater Habitat (WARM) Includes 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 Freshwater Habitat (COLD) Includes 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.

Inland Saline Water Habitat (SAL) Includes uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Marine Habitat (MAR) Includes 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., marine mammals, shorebirds).

Wildlife Habitat (WILD). Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) Includes 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.

Tables 5-1 and 5-2 summarize the beneficial uses of the downstream waters.

Table 5-1: Beneficial Uses of Downstream Inland Surface Waters (RWQCB, 1998).

● Existing Beneficial Use ○ Potential Beneficial Use + Except from Municipal Use	Beneficial Use														
Receiving Water (Hydrologic Unit Code)	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPAWN
Carol Canyon		●	●					○	●		●	●	●	●	

Table 5-2: Beneficial Uses of Downstream Coastal Waters (RWQCB, 1998).

● Existing Beneficial Use ○ Potential Beneficial Use + Except from Municipal Use	Beneficial Use														
Receiving Water (Hydrologic Unit Code)	IND	NAV	REC1	REC2	COMM	BIOL	EST	WILD	RARE	MAR	AQUA	MIGR	SPWN	WARM	SHELL
Los Peñasquitos Lagoon (906.10)[1]			●	●		●	●	●	●	●		●	●		●
Pacific Ocean	●	●	●	●	●	●		●	●	●	●	●	●		●

[1] Fishing from shore or boat permitted, but other water contact recreational (REC-1) uses are prohibited.

6. POLLUTANTS OF CONCERN

6.1 Potential Pollutants

Table 6-1 identifies generally anticipated pollutants that might be generated from priority project categories. This project proposes a detached and attached residential development on a hillside with private streets and parking for residents. Pollutants of concern are highlighted on the table below.

Table 6-1: Anticipated and Potential Pollutants by Project Type (San Diego County SUSMP, March 2010)

✓ Anticipated Pollutants **P** Potential Pollutants	General Pollutant Categories								
Priority Project Categories	Sediments	Nutrients	Heavy Metals	Organic Substances	Trash and Debris	Oxygen-Demanding Substances	Oils and Grease	Bacteria and Viruses	Pesticides
Detached Housing Development	✓	✓			✓	✓	✓	✓	✓
Attached Residential Development	✓	✓			✓	**P**(1)	**P**(2)	**P**	✓
Commercial (>1 acre)	**P**(1)	**P**(1)		**P**(2)	✓	**P**(5)	✓	**P**(3)	**P**(5)
Heavy Industry	✓		✓	✓	✓	✓	✓		
Auto Repair Shops			✓	✓	✓		✓		
Restaurants					✓	✓	✓	✓	**P**(1)
Hillside Development (>5,000 sf)	✓	✓			✓	✓	✓		✓
Parking Lots	**P**(1)	**P**(1)	✓		✓	**P**(1)	✓		**P**(1)
Streets, Highways, and Freeways	✓	**P**(1)	✓	**P**(4)	✓	**P**(5)	✓	✓	**P**(1)
Retail Gasoline Outlets			✓	✓	✓	✓	✓		

(1) A potential pollutant if landscaping exists on-site
(2) A potential pollutant if the project includes uncovered parking areas
(3) A potential pollutant if land use involved food or animal waste product
(4) Including petroleum hydrocarbons
(5) Including solvents.

6.2 Pollutant Definitions

Sediments: Sediments are soils or other surface materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.

Nutrients: Nutrients are inorganic substances, such as nitrogen and phosphorus. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

Heavy Metals: Metals are raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. The primary sources of metal pollution in storm water are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooling tower systems. At low concentrations naturally occurring in soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

Organic Compounds: Organic compounds are carbon-based (commercially available or naturally occurring) substances found in pesticides, solvents, and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in the cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life.

Trash & Debris: Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash and debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. Also, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

Oxygen Demanding Substances: This category includes biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Proteins, carbohydrates, and fats are examples of biodegradable organic compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.

Oil & Grease: Oil and grease are characterized as high-molecular weight organic compounds. The primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids. Introduction of these pollutants to the water bodies are very possible due to the wide uses and applications of some

of these products in municipal, residential, commercial, industrial, and construction areas. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

Bacteria & Viruses: Bacteria and viruses are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Water containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

Pesticides: Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

6.3 Pollutants of Concern

Primary pollutants of concern are those that correspond with any CWA 303(d) designation for the receiving waters and the anticipated pollutants generated from the project (Table 6-1). This project's receiving waters, the Los Peñasquitos Lagoon is impaired for sedimentation and siltation. Table 6-2 summarizes common 303(d) impairment listings and the probable pollutants that cause the impairment.

Table 6-2: **Probable Pollutants causing 303(d) Designation (San Diego Storm Water Manual)**

	303(d) Impairment Listing				
Probable Pollutants	Eutrophic	Benthic Community Degradation	Sediment Toxicity	Toxicity (in storm water runoff)	Low dissolved Oxygen
Sediment					
Nutrients	✓				✓
Heavy Metals		✓	✓		
Organic Compounds		✓	✓		✓
Trash & Debris					✓
Oxygen Demanding Substances	✓				✓
Oil & Grease					
Bacteria & Viruses					
Pesticides				✓	

7. CONSTRUCTION BMPS

Best management practices is defined by any schedule of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, structural treatment BMPs, and other management practices to prevent or reduce to the maximum extent practicable the discharge of pollutants directly or indirectly to receiving waters. Construction Storm Water BMPs are practices, procedures, devices, or materials used to prevent the transport and introduction of pollutants both on and from a project site during construction. The selected BMPs must meet or exceed the minimum specified in both the statewide Construction General Permit (2009-0009-DWQ) and the San Diego Regional MS4 Permit.

Due to the project site being larger than one acre in size, and pursuant to the requirements for the Construction General Permit, a full Storm Water Pollution Prevention Plan for Construction Activities (SWPPP) will be developed for the project, separate from this WQTR. A SWPPP and erosion control plans will be prepared as part of the grading permit phase of the project.

The WDID number assigned from the Water Quality Control Board will be included with the grading plans.

8. DESIGN CRITERIA

This section summarizes the design criteria and methodology applied during the drainage analysis of the project site. Two basins are proposed for storm drain detention and will also function for water quality treatment and HMP compliance. In addition to the basins, localized bioretention areas will be design to control runoff rates to meet HMP requirements.

Flow-Based Water Quality Numeric Sizing Criteria
Flow-based BMPs are sized to filter or otherwise treat the peak flow of runoff from a stormwater quality storm event. Flow-based BMPs include bio-swales and bio-retention basins. Basins and swales have been designed to meet hydromodification flow criteria.

The San Diego RWQCB has defined the design discharge for flow-based BMPs as the runoff generated from a storm with a rainfall intensity of 0.2 inch/hour.

Since the linear basins will be sized for HMP compliance, the water quality sizing will be covered. The HMP sizing factors are 6.5% compared with the 4% required for water quality purposes.

Volume-Based Water Quality Numeric Sizing Criteria
Volume based sizing has been utilized in order to establish the sizes of the proposed bioretention basins. Hydromodification sizing factors of 6.5% were used, which exceed the 4% requirement for treatment of a 0.2 in/hr storm event. Tables for the bioretention sizing are shown in the exhibit 'A' and are further described in the HMP section of the report.

The project has been designed to limit post-development storm water runoff discharge rates and velocities to maintain or reduce pre-development erosion and to reduce nutrients, organic compounds, oxygen demanding substances, oil and grease, bacteria and viruses and pesticides by applying the following concepts.

9.1 Standard LID BMP Requirements

9.1.1 Conserve natural areas, provide buffer zones between natural water bodies and the project footprint, preserve existing native trees and shrubs, and concentrate or cluster development on the least environmentally sensitive portions of the site.

The northerly 300' of the property will remain undisturbed habitat. A graded slope will be provided to serve as a buffer area between the development and the habitat. Density is concentrated away from the most sensitive portions of the property. Because the proposed use is an assisted living care facility, there are significant amounts of ADA paths of travel within the project boundaries. These areas have been clustered as best possible to avoid damaging the environmentally sensitive portions of the site.

9.1.2 Minimize impervious footprint.

Fire access lane, private streets/drives, parking areas, pedestrian drop off areas, and loading areas will be designed to minimum required pavement width, according to the City of San Diego Guidelines. A perimeter fire access lane at the health center features grass-cell paving to promote infiltration.

9.1.3 Minimize directly connection impervious areas.

Runoff from driveways, parking areas, and rooftops will be directed into landscape areas prior to entering the vegetated drainage swales. A portion of the roof water will be designed to splash on landscape areas and swale to minor storm drain inlets as available.

9.1.4 Soil Amendments - Landscape topsoil improvements play a significant role in maintaining plan and lawn health plus improves the soil's capacity to retain moisture, which will reduce runoff from the water quality design storm and improved water quality

The San Diego Landscape regulations shall be adhered to for the landscaped areas.

9.1.5 Convey runoff safely from the tops of slopes.

All runoff will be directed away from the tops of slopes through the use of brow ditches along the project perimeter.

9.1.6 Vegetate slopes with native or drought tolerant vegetation.

Slopes disturbed by the construction of these facilities shall be vegetated with native or drought tolerant vegetation pursuant of the City of San Diego Landscape design guidelines.

9.1.7 Stabilize permanent channel crossings.

There are no permanent channel crossings.

9.1.8 Energy dissipaters shall be installed in such a matter as to minimize impacts to receiving waters.

The outlet of storm drain pipes will be equipped with a designed energy dissipater.

10. SOURCE CONTROL BMPS

Source control BMPs are defined as land use or site planning practices, or structures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimize the contact between pollutants and urban runoff.

10.1 Design Outdoor Material Storage Areas to Reduce Pollution Introduction

10.1.1 Materials with the potential to contaminate urban runoff shall be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with rain, runoff or spillage to the storm water conveyance system; and (2) protected by secondary containment structures such as berms, dikes, or curbs. The storage area shall be paved and sufficiently impervious to contain leaks and spills, and have a roof or awning to minimize direct precipitation within the secondary containment area.

No outdoor material storage is proposed.

10.2 Design Trash Storage Areas to Reduce Pollution Introduction

10.2.1 Trash storage areas shall be: (1) paved with an impervious surface, designed not to allow run-on from adjoining areas, and screened or walled to prevent off-site transport of trash; and, (2) contain attached lids on all trash containers that exclude rain; or (3) contain a roof or awning to minimize direct precipitation.

The property owner will be actively engaged in regular trash pickup and sweeping of the property. Trash containers will be covered and screened.

10.3 Design Employ Integrated Pest Management Principles

10.3.1 Eliminate and/or reduce the need for pesticide use in the project design by: (1) Plant pest-resistant or well-adapted plant varieties such as native plants; and (2) Discourage pests by modifying the site and landscaping design. Pollution prevention is the primary "first line of defense" because pollutants that are never used do not have to be controlled or treated (methods which are inherently less efficient).

Landscape design will include pest resistant plant varieties. As part of the operations and maintenance instructions, the owners will be provided with alternatives and guidelines for application of pesticides as outlined by UC Davis website. Owner will be instructed to train facility staff regarding pest management and the use of pesticides.

10.3.2 Distribute IPM educational materials to future site residents/tenants. Minimally, educational materials must address the following topics: (1) Keeping pests out of buildings and landscaping using barriers, screens, and caulking; (2) Physical pest elimination techniques, such as, weeding, squashing, trapping, washing, or pruning out pests; (3) Relying on natural enemies to eat pests; (4) Proper use of pesticides as a last line of defense. More information may be obtained at the UC Davis website (http://www.ipm.ucdavis.edu/WATER/U/index.html).

BMPs and pest control information packages will be distributed to the future residents and facilities staff.

10.4 Use Efficient Irrigation Systems & Landscape Design:

10.4.1 Employ rain shutoff devices to prevent irrigation during and after precipitation.

Irrigation systems will utilize computer-controlled, weather-based satellite controller/s, linked by digital, local radio, phone modem or hardwire method. A site rain gauge or tipping rain bucket will be connected to the control system Rain shutoff devices to prevent irrigation during and after precipitation will be included in the design.

10.4.2 Design irrigation systems to each landscape area's specific water requirements.

Planting areas will be receiving carefully regulated irrigation coverage by means of an automatically controlled, electrically operated underground, and state of the art sprinkler system.

10.4.3 Use flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

Mainlines shall be controlled by means of master valves and flow sensors to control water loss in the event of broken sprinkler heads or pipes will be included in the irrigation design.

10.5 Provide Storm Water conveyance System Stenciling and Signage

10.5.1 Provide concrete stamping, or equivalent, of all storm water conveyance system inlets and catch basins within the project area with prohibitive language (e.g., "No Dumping – I Live in <<name receiving water>>"), satisfactory to the City Engineer. Stamping may also be required in Spanish.

Concrete stamping will be provided for all storm water conveyance system inlets with prohibitive language

10.5.2 Post signs and prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area, trailheads, parks and building entrances.

Signage will be posted throughout the project area, including trash receptacles, prohibiting illegal dumping.

10.6 Private Roads

10.6.1 The design of private roadway drainage shall use at least one of the following (for further guidance, see Start at the Source [1999]): (1) rural swale system- street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings; (2) urban curb/swale system- street slopes to curb, periodic swale inlets drain to vegetated swale/bio-filter; or (3) dual drainage system- first flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder.

Runoff from parking lots shall flow into urban curb and gutter, vegetated bio-swales or Filterra units.

10.7 Residential Driveways and Guest Parking

10.7.1 Driveways shall have one of the following: (1) shared access; (2) flared entrance (single lane at street); (3) wheelstrips (paving only under tires); (4) porous paving; or (5) designed to drain into landscaping prior to discharging to the storm water conveyance system.

Runoff from driveways will flow into urban curb and gutter, bio-swales or Filtera units prior to discharge to a public drainage facility.

10.7.2 Uncovered temporary or guest parking on private residential lots shall be: (1) paved with a permeable surface; or (2) designed to drain into landscaping prior to discharging to the storm water conveyance system.

Runoff from all impervious areas will flow into bio-swales or Filterra units prior to discharge to a public drainage facility.

10.8 Dock Areas

10.8.1 Loading/unloading dock areas shall include the following: (1) cover loading dock areas, or design drainage to preclude urban run-on and runoff; and (2) An acceptable method of containment and pollutant removal, such as a shut-off valve and containment area. Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.

No loading docks or truck wells are proposed for the project.

10.9 Maintenance Bays

10.9.1 Maintenance bays shall include at least one of the following: (1) repair/maintenance bays hall be indoors; or, (2) designed to preclude urban run-on and runoff.

No maintenance bays are proposed.

10.9.2 Maintenance bays shall include a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm water conveyance system is prohibited.

No maintenance bays are proposed.

10.10 Vehicle and Equipment Wash Areas

10.10.1 Areas for washing/steam cleaning of vehicles and areas for outdoor equipment/accessory washing and steam cleaning shall be: (1) self-contained to preclude run-on and run-off, covered with a roof or overhang, and equipped with a clarifier or other pretreatment facility; and (2) properly connected to a sanitary sewer.

No Vehicle/Equipment wash areas are proposed.

10.11 Outdoor Industrial Processing Areas

10.11.1 Outdoor processing areas shall: (1) cover or enclose areas that would be the most significant source of pollutants; or, (2) slope the area toward a dead-end sump; or, (3) discharge to the sanitary sewer system.

No outdoor processing areas are proposed.

10.11.2 Grade or berm processing areas to prevent run-on from surrounding areas.

No outdoor processing areas are proposed.

10.12 Surface Parking Lots

10.12.1 Where landscaping is proposed in surface parking areas (both covered and uncovered), incorporate landscape areas into the drainage design.

Runoff from all impervious areas will flow into landscaped areas surrounding parking areas to the maximum extent practicable. This size, spacing and type of trees and ground cover will meet the City's minimum requirement for parking lots.

10.12.2 Overflow parking (parking in excess of the project's minimum parking requirements) may be constructed with permeable paving.

Runoff from all impervious areas will flow into landscaped areas to the maximum extent possible.

10.13 Non-Retail Fueling Areas:

10.13.1 Fuel dispensing area that is: (1) paved with Portland cement concrete or equivalent smooth impervious surface (asphalt concrete is prohibited); (2) designed to extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less; (3) sloped to prevent ponding; (4) separated from the rest of the site by a grade break that prevents run-on of urban runoff; and (5) designed to drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.

No fueling areas are proposed.

10.13.2 Overhanging roof structure or canopy that is: (1) equal to or greater than the area within the fuel dispensing area's grade break; and (2) designed not to drain onto or across the fuel dispensing area.

No fueling areas are proposed.

10.14 Steep Hillside Landscaping

10.14.1 Steep hillside areas disturbed by project development shall be landscaped with deep-rooted, drought tolerant plant species selected for erosion control, in accordance with the Landscape Technical Manual.

Native or naturalized ground cover consisting of rooted cuttings or a hydroseed mix, and native or naturalized trees and shrubs will be applied all disturbed areas.

11. TREATMENT CONTROL BMPS

Treatment Control BMPs (structural) are defined as any engineered system designed and constructed to remove pollutants from urban runoff. Pollutant removal is achieved by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption or any other physical, biological, or chemical process.

11.1 Selection of Treatment Control BMPs

The selection of Treatment control BMPs should be based on medium to high removal efficiency of primary pollutants of concern, as indicated in Section 6.3. They shall be correctly sized and designed so as to remove pollutants to the Maximum Extent Possible (MEP).

Table 11-1: Grouping of Potential Pollutants of Concern (San Diego SUSMP, 2010)

Pollutant	Coarse Sediment & Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	✓	✓	
Nutrients		✓	✓
Heavy Metals		✓	
Organic Compounds		✓	
Trash & Debris	✓		
Oxygen Demanding Substances		✓	
Oil & Grease		✓	
Bacteria & Viruses		✓	
Pesticides		✓	

Table 11-2: Treatment Control BMP Selection Matrix (San Diego SUSMP, 2010).

Pollutants of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Constructed Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	Higher-rate Biofilters	Higher-rate Media Filters	Trash Racks & Hydro-dynamic Devices	Vegetated Swales
Coarse Sediment and Trash	High	High	High	High	High	High	High	High	High
Pollutants that tend to associate with fine particles during treatment	High	High	High	High	High	Medium	Medium	Low	Medium
Pollutants that tend to be dissolved following treatment	Medium	Low	Medium	High	Low	Low	Low	Low	Low

11.2 Treatment Control BMP Program

Treatment Control BMPs treat runoff from all developed portions of the site. Bio-swales can be classified as a combination of Bio-retention Facilities, Infiltration Facilities, Media Filters, and Vegetated Swales. Bio-swales provide a medium to high removal efficiency of all 3 general pollutant groupings and thus are adequate in treatment of the Primary and Secondary targeted pollutants identified in Section 6.

11.3 Treatment Control BMP Design

The project is comprised of four main watershed areas that drain to the north. All areas use vegetated bio-swales and bio-retention basins in combination or singly. See the "Proposed Conditions Hydrology Map" in Appendix D for details.

Bio-swales and inlets will be designed to treat the water quality flow and sized to accommodate the peak flow. Bioretention basins for hydromodification BMPs will be sized and configured to provide treatment for water quality issues. The basins have a high treatment category for sediment which is a pollutant of concern for the downstream receiving water.

Because of the potential of groundwater within 5'-10' in certain portions of the property per the geotechnical report, any bioretention basins and swales should include an impermeable liner and subdrain.

12. HYDROMODIFICATION

Based on Table 2-1 (Priority Development Project Determination) contained in the City of San Diego Storm Water Standards, it have been determined that the proposed project meets at least one of the thresholds and is subject to Priority Development Project requirements. In addition, the project is subject to the state's Hydromodification Management requirements. The project proposes LID and water quality treatment requirements as described in this report. The project proposes to satisfy the state's HMP requirements by the use of bio-swales, and multiple bioretention basins at discharge locations.

Sizing of the treatment areas is completed in accordance with SUSMP requirements. The Oceanside rain gauge is used. Type D soils are onsite and the existing slope conditions are steep. Per the sizing tables in the Model SUSMP, for a 0.1Q2 low flow threshold, the sizing factor is 6.5% for the bioretention facilities for areas that are located within the existing conditions 'steep' slope designation. For areas of 'moderate' and 'flat' slope, a factor of 0.13 is used. Locations and sizing of the proposed BMPs are shown on the HMP exhibit.

Discharge rates will meet all requirements set out in the HMP section of the city of San Diego storm water standards.

13. MAINTENANCE

13.1 Storm Water BMP Maintenance

In order for this plan to be effective and meet the performance standards identified in Federal, State and local ordinances a maintenance plan is required.

Continuing Life Communities and their contractors are responsible for maintaining construction activity BMPs. Continuing Life Communities will be responsible for long term maintenance of the private storm drain facilities, vegetated swales and landscaped areas. The owner shall enter maintenance agreements with the city for the ongoing maintenance of the permanent BMPs.

Typical maintenance requirements for storm drain facilities are as follows:

- Inlet Stenciling – Inlets and stenciling and or tiling shall be inspected annually prior to the rainy season (October 1 – April 30). Inlets shall be cleared out of any debris and trash. Existing stenciling or tiling shall be replaced as necessary so the message is legible for another year period.

- Vegetated Bio-swales: Maintenance demands for vegetated bio-swales are similar to general landscaping maintenance.

- Bioretention Basins: Maintenance demands for bioretention basins include removal of trash and debris and general landscaping maintenance.

- Filterra Units: Filterra units will need to be inspected to remove surface trash and debris on a monthly basis and prior to rain events. Plant material will also need to be inspected to ensure plant health and be replaced as required. Mulch and filter media need to be inspected annually to ensure that no compaction has occurred.

13.2 Annual BMP Maintenance Cost

- Landscape and Irrigation to be maintained as part of the overall Landscape Maintenance costs.
- Swales, parking lot cleaning and trash pick-up to be maintained as part of the overall Landscape Maintenance costs
- Inlet tiling and/or stenciling to be considered minor. Estimate $2800/year for repainting and/or tile replacement.
- Filterra units will be cleaned and maintained as part of Landscape Maintenance costs. Estimate $200/year per unit for replacement of planting material and mulch.

14. SUMMARY

The proposed project will not have a significant water quality impact since the proposed project will implement various natural and structural post construction BMPs. These proposed BMPs will reduce the anticipated pollutants of concern prior to the runoff entering the storm water system.

The proposed project could impact water quality during construction if sediment is allowed to flow offsite. A Stormwater Pollution prevention plan will be developed in accordance with the construction general permit to ensure that no sediment discharges occur during construction. The downstream impacts due to the development will be mitigated by erosion control measures implemented during the construction phase.

15. REFERENCES

City of San Diego Storm Water Manual - Storm Water Standards, January 20, 2012

Countywide Model SUSMP - Standard Urban Stormwater Mitigation Plan, March 25, 2011

Water Quality Control Plan for the San Diego Basin, California Regional Water Quality Control Board: San Diego Region, September 8, 1994

Low Impact Development Handbook: Stormwater Management Strategies, County of San Diego, December 31, 2007

Los Peñasquitos Lagoon Watershed Profile, California State Coastal Conservancy, August 16, 2001, http://wrpinfo.scc.ca.gov/watersheds/lp/lp_wsprofile.html

Appendix A

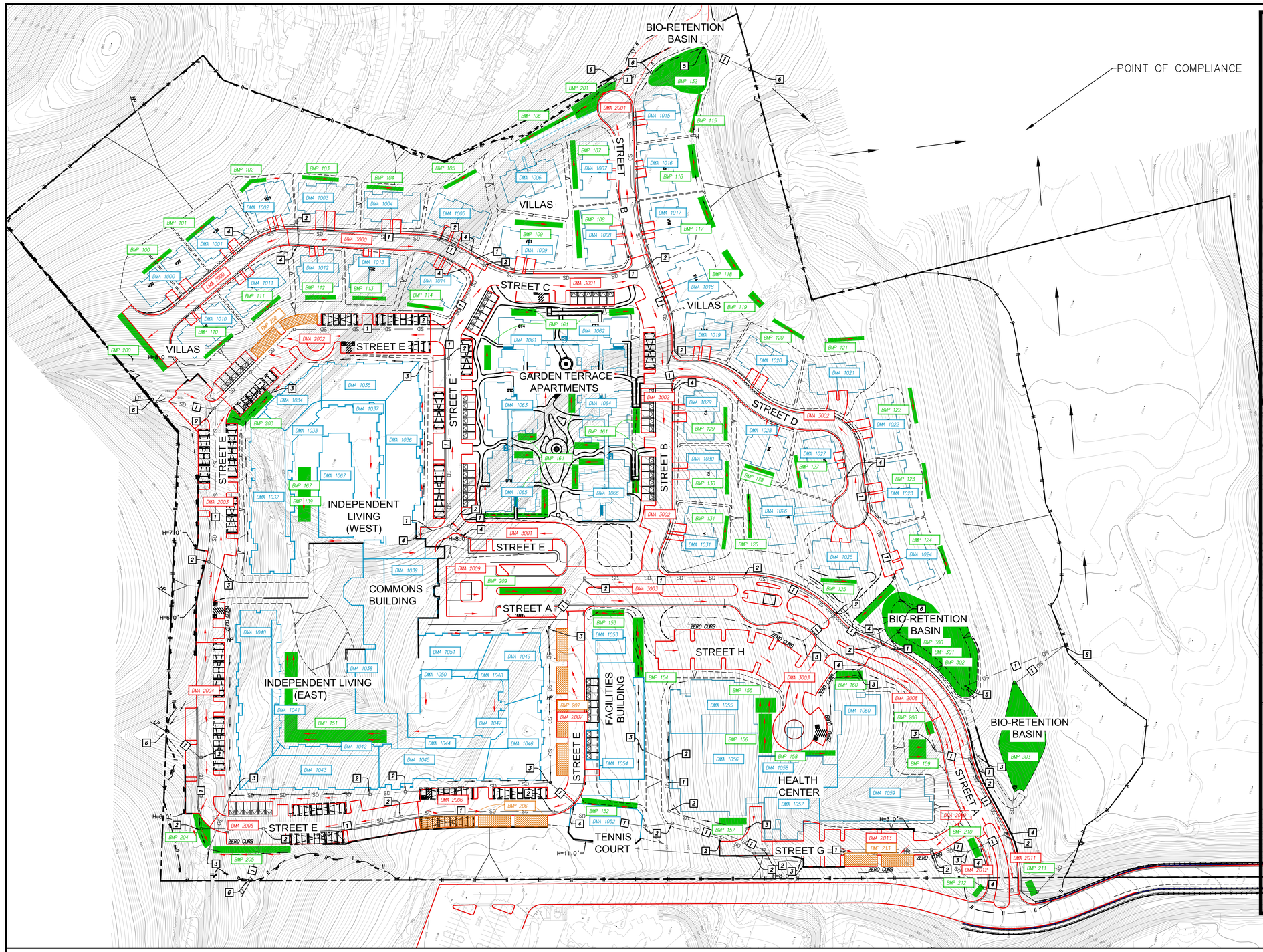
2010 CLEAN WATER ACT SECTION 303(D) LIST

2010 CALIFORNIA 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS

REGION	WATER BODY NAME	WATER BODY TYPE	WBID	INTEGRATED REPORT CATEGORY	USGS CATALOGING UNIT*	CALWATER WATERSHED	ESTIMATED SIZE AFFECTED	UNIT	POLLUTANT	POLLUTANT CATEGORY	FINAL LISTING DECISION	TMDL REQUIREMENT STATUS**	EXPECTED TMDL COMPLETION DATE***	EXPECTED ATTAINMENT DATE***	USEPA TMDL APPROVED DATE***	COMMENTS INCLUDED ON 303(d) LIST
9	Los Coches Creek	River & Stream	CAR9071400020081210155144	5	18070304	90714000	9	Miles	Selenium	Metals/Metalloids	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Los Penasquitos Creek	River & Stream	CAR9061000020011025112826	5	18070304	90610000	12	Miles	Enterococcus	Pathogens	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Los Penasquitos Creek	River & Stream	CAR9061000020011025112826	5	18070304	90610000	12	Miles	Fecal Coliform	Pathogens	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Los Penasquitos Creek	River & Stream	CAR9061000020011025112826	5	18070304	90610000	12	Miles	Selenium	Metals/Metalloids	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Los Penasquitos Creek	River & Stream	CAR9061000020011025112826	5	18070304	90610000	12	Miles	Total Dissolved Solids	Salinity	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Los Penasquitos Creek	River & Stream	CAR9061000020011025112826	5	18070304	90610000	12	Miles	Total Nitrogen as N	Nutrients	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Los Penasquitos Creek	River & Stream	CAR9061000020011025112826	5	18070304	90610000	12	Miles	Toxicity	Toxicity	List on 303(d) list (TMDL required list)	5A	01-Jan-21			
9	Los Penasquitos Lagoon	Estuary	CAE9061000019990209152610	5	18070304	90610000	469	Acres	Sedimentation/Siltation	Sediment	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Loveland Reservoir	Lake & Reservoir	CAL9093100020011025093606	5	18070304	90931000	420	Acres	Aluminum	Metals/Metalloids	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Loveland Reservoir	Lake & Reservoir	CAL9093100020011025093606	5	18070304	90931000	420	Acres	Manganese	Metals/Metalloids	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Loveland Reservoir	Lake & Reservoir	CAL9093100020011025093606	5	18070304	90931000	420	Acres	Oxygen, Dissolved	Nutrients	List on 303(d) list (TMDL required list)	5A	01-Jan-19			
9	Loveland Reservoir	Lake & Reservoir	CAL9093100020011025093606	5	18070304	90931000	420	Acres	pH	Miscellaneous	List on 303(d) list (TMDL required list)	5A	01-Jan-19			This listing was made by USEPA for 2006.

Appendix B

SITE MAP



BUILDINGS AND LANDSCAPING:

DMA ID #	PRE-PROJECT SLOPE	TRIBUTARY AREA (SF)	SIZING FACTOR	TREATMENT AREA REQUIRED (SF)	TREATMENT VOL REQUIRED (CFT)	BMP ID #	TREATMENT AREA PROVIDED (SF)	TREATMENT VOL PROVIDED (CFT)
1000	STEEP (10+%)	4,530	0.065	294	421	BMP 100	300	430
1001	STEEP (10+%)	4,530	0.065	294	421	BMP 101	300	430
1002	STEEP (10+%)	3,800	0.065	247	354	BMP 102	240	344
1003	STEEP (10+%)	4,530	0.065	294	421	BMP 103	300	430
1004	STEEP (10+%)	4,530	0.065	294	421	BMP 104	300	430
1005	STEEP (10+%)	4,530	0.065	294	421	BMP 105	300	430
1006	STEEP (10+%)	7,790	0.065	506	725	BMP 106	510	731
1007	MODERATE (5-10%)	4,530	0.130	589	844	BMP 107	593	850
1008	FLAT (0-5%)	4,530	0.130	589	844	BMP 108	593	850
1009	FLAT (0-5%)	4,530	0.130	589	844	BMP 109	593	850
1010	STEEP (10+%)	4,530	0.065	294	421	BMP 110	300	430
1011	STEEP (10+%)	4,530	0.065	294	421	BMP 111	300	430
1012	STEEP (10+%)	3,800	0.065	247	354	BMP 112	250	358
1013	STEEP (10+%)	4,165	0.065	271	388	BMP 113	275	394
1014	STEEP (10+%)	4,530	0.065	294	421	BMP 114	300	430
1015	FLAT (0-5%)	3,800	0.130	494	708	BMP 115	325	466
1016	FLAT (0-5%)	4,165	0.130	541	775	BMP 116	540	774
1017	FLAT (0-5%)	4,165	0.130	541	775	BMP 117	540	774
1018	STEEP (10+%)	3,800	0.065	494	708	BMP 118	500	717
1019	STEEP (10+%)	4,165	0.065	271	388	BMP 119	275	394
1020	STEEP (10+%)	4,530	0.065	294	421	BMP 120	300	430
1021	STEEP (10+%)	4,530	0.065	294	421	BMP 121	300	430
1022	STEEP (10+%)	4,530	0.065	294	421	BMP 122	300	430
1023	STEEP (10+%)	4,530	0.065	294	421	BMP 123	300	430
1024	STEEP (10+%)	4,315	0.065	280	401	BMP 124	262	376
1025	STEEP (10+%)	4,530	0.065	294	421	BMP 125	300	430
1026	STEEP (10+%)	5,535	0.065	360	516	BMP 126	360	516
1027	STEEP (10+%)	4,165	0.065	271	388	BMP 127	270	387
1028	STEEP (10+%)	3,800	0.065	247	354	BMP 128	250	358
1029	STEEP (10+%)	4,165	0.065	271	388	BMP 129	275	394
1030	STEEP (10+%)	4,165	0.065	271	388	BMP 130	275	394
1031	STEEP (10+%)	4,165	0.065	271	388	BMP 131	275	394
1032	STEEP (10+%)	14,440	0.065	939	1,346	BMP 132		
1033	STEEP (10+%)	3,920	0.065	255	365	BMP 132		
1034	STEEP (10+%)	5,320	0.065	346	496	BMP 132		
1035	FLAT (0-5%)	7,388	0.130	960	1,376	BMP 132		
1036	FLAT (0-5%)	13,820	0.130	1,797	2,575	BMP 132		
1037	FLAT (0-5%)	5,057	0.130	657	941	BMP 132		
1038	STEEP (10+%)	8,822	0.065	573	821	BMP 132		
1032-1038		58,767	0.065	5,527	7,920	BMP 132	5,527	7,922
1039	STEEP (10+%)	14,977	0.065	974	1,396	BMP 139	974	1,396
1040	STEEP (10+%)	17,836	0.065	1,159	1,661	BMP 151		
1041	STEEP (10+%)	3,310	0.065	215	308	BMP 151		
1042	STEEP (10+%)	3,452	0.065	224	321	BMP 151		
1043	STEEP (10+%)	10,157	0.065	660	946	BMP 151		
1044	STEEP (10+%)	2,454	0.065	160	229	BMP 151		
1045	STEEP (10+%)	9,781	0.065	636	911	BMP 151		
1046	FLAT (0-5%)	8,782	0.130	1,142	1,636	BMP 151		
1047	FLAT (0-5%)	1,121	0.130	146	209	BMP 151		
1048	STEEP (10+%)	1,546	0.065	100	143	BMP 151		
1049	STEEP (10+%)	7,944	0.065	516	739	BMP 151		
1050	FLAT (0-5%)	1,400	0.130	182	261	BMP 151		
1051	STEEP (10+%)	6,116	0.065	795	1,139	BMP 151		
1040-1051		73,899	0.065	5,935	8,505	BMP 151	6,000	8,600
1052	MODERATE (5-10%)	6,945	0.130	903	1,294	BMP 152	928	1,330
1053	MODERATE (5-10%)	3,896	0.130	506	725	BMP 153	520	745
1054	MODERATE (5-10%)	12,304	0.130	1,600	2,293	BMP 154	1623	2,326
1055	STEEP (10+%)	11,375	0.065	739	1,059	BMP 155	763	1,094
1056	STEEP (10+%)	18,345	0.065	1,192	1,708	BMP 156	1294	1,855
1057	STEEP (10+%)	6,995	0.065	455	652	BMP 157	450	645
1058	STEEP (10+%)	6,358	0.065	413	592	BMP 158	414	593
1059	STEEP (10+%)	12,695	0.065	825	1,182	BMP 159	858.66	1,231
1060	STEEP (10+%)	11,070	0.065	720	1,032	BMP 160	559	801
1061	FLAT (0-5%)	9,000	0.130	1,170	1,677	BMP 161		
1062	MODERATE (5-10%)	8,265	0.130	1,074	1,539	BMP 161		
1063	MODERATE (5-10%)	9,000	0.130	1,170	1,677	BMP 161		
1064	STEEP (10+%)	8,265	0.065	537	770	BMP 161		
1065	STEEP (10+%)	9,755	0.065	634	909	BMP 161		
1066	STEEP (10+%)	9,150	0.065	595	853	BMP 161		
1061-1066		53,435	0.065	5,180	7,423	BMP 161	5,200	7,453
1067	STEEP (10+%)	9,751	0.065	634	909	BMP 167	634	909
TOTAL:		629,353		36,775	52,699		36,846	52,812

PRIVATE ROADS AND DRIVEWAYS:

DMA ID #	PRE-PROJECT SLOPE	TRIBUTARY AREA (SF)		TREATMENT AREA REQUIRED (SF)	TREATMENT VOL REQUIRED (CFT)	BMP ID #	TREATMENT AREA PROVIDED (SF)	TREATMENT VOL PROVIDED (CFT)
2000	STEEP (10+%)	13,405	0.065	871	1,248	BMP 200	1200	1,720
2001	FLAT (0-5%)	12,280	0.130	798	1,144	BMP 201	1478	2,118
2002	STEEP (10+%)	20,046	0.065	1,303	1,867	BMP 202	2,069	2,966
2003	STEEP (10+%)	21,536	0.065	1,400	2,006	BMP 203	1,406	2,015
2004	STEEP (10+%)	13,975	0.065	908	1,301	BMP 204	908	1,301
2005	STEEP (10+%)	19,843	0.065	1,290	1,849	BMP 205	1290	1,849
2006	FLAT (0-5%)	12,872	0.130	1,673	2,397	BMP 206	3809	5,460
2007	FLAT (0-5%)	11,012	0.130	1,432	2,052	BMP 207	4104	5,882
2008	STEEP (10+%)	2,425	0.065	158	226	BMP 208	158	226
2009	STEEP (10+%)	3,862	0.065	251	360	BMP 209	586	840
2010	STEEP (10+%)	4,010	0.065	261	374	BMP 210	327	469
2011		4,400	0.065	286	410	BMP 211	292	419
2012	STEEP (10+%)	1,900	0.065	124	178	BMP 212	173	248
2013	STEEP (10+%)	12,455	0.065	810	1,161	BMP 213	2049	2,937
TOTAL:		154,021		11,565	16,573		19,849	28,450

PRIVATE ROADS AND DRIVEWAYS TREATED BY BIO-RETENTION BASIN:

DMA ID #	PRE-PROJECT SLOPE	TRIBUTARY AREA (SF)		TREATMENT AREA REQUIRED (SF)	TREATMENT VOLUME REQUIRED (CFT)	BMP ID #	TREATMENT AREA PROVIDED (SF)	TREATMENT VOLUME PROVIDED (CFT)
3000	STEEP (10+%)	12,750	0.065	829	1,188	BMP 300	3,583	5,136
3001	FLAT (0-5%)	52,825	0.130	6,867	9,840	BMP 301	9,621	13,790
3002	STEEP (10+%)	41,650	0.065	2,707	3,879	BMP 302	5,461	7,827
3003	STEEP (10+%)	55,120	0.065	3,583	5,134	BMP 303	6,337	9,083
TOTAL:		149,595		13,157	18,854		21,419	30,700

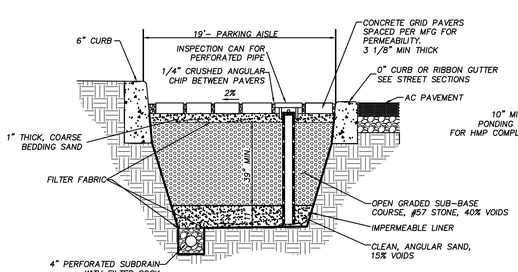
TOTAL AREAS:

TRIBUTARY AREA (SF)	TREATMENT AREA REQUIRED (SF)	TREATMENT VOLUME REQUIRED (CFT)	TREATMENT AREA PROVIDED (SF)	TREATMENT VOLUME PROVIDED (CFT)
932,969	61,497	88,125	78,114	111,963

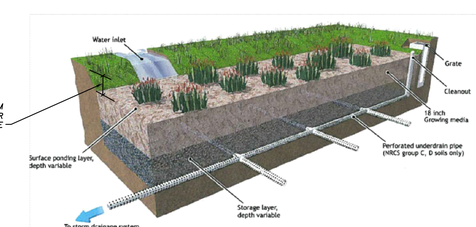
NOTES:

1. OCEANSIDE RAIN BASIN (13.3 INCHES ANNUALLY)
2. SOIL TYPE 'D'
3. PRE-PROJECT SITE INCLUDES FLAT, MODERATE, AND STEEP SLOPES

SIZING FACTORS USED:
FLAT AND MODERATE = 0.13
STEEP = 0.065



TYPICAL DETAIL - PERMEABLE PAVERS
NO SCALE



TYPICAL DETAIL - BIO-RETENTION BASIN
NO SCALE

PROPOSED STORM DRAIN (PVT.)

+ 1 PROPOSED STORM DRAIN
2 PROPOSED STORM DRAIN CLEANOUT
3 PROPOSED CATCH BASIN
4 PROPOSED FILTERRA UNIT WITH INTERNAL BYPASS
+ 5 PROPOSED RISER STRUCTURE
6 PROPOSED HEADWALL AND RIPRAP

+ SIZE TO BE DETERMINED UPON FINAL ENGINEERING.

HYDRO-MOD LEGEND:

DRAINAGE MANAGEMENT AREA ID NO. (BUILDINGS AND LANDSCAPING) — DMA 1040
DRAINAGE MANAGEMENT AREA ID NO. (PRIVATE ROADS AND DRIVEWAYS) — DMA 2003
BIO-RETENTION AREA ID NO. — BMP 140
BIO-RETENTION AREA = 59,744 SF (PER DETAIL ON THIS SHEET) SUBDRAIN WILL CONNECT TO SITE STORM DRAIN SYSTEM
PERMEABLE PAVERS ID NO. — BMP 206
PERMEABLE PAVERS = 18,370 SF (PER DETAIL ON THIS SHEET)
DRAINAGE FLOW ARROW

SITE LEGEND:

SLOPES 2:1 MAX. (TYP.)
DAYLIGHT LINE
RIGHT OF WAY
BOUNDARY
RETAINING WALL
PROPOSED PRIVATE STORM DRAIN
PROPOSED STORM DRAIN CLEANOUT
PROPOSED CURB INLET
PROPOSED CATCH BASIN
BIO-SWALE
BROW DITCH
GARAGES
CARPORTS

0 60 120 180
(IN FEET)
1 inch = 60 ft.

THE GLEN AT SCRIPPS RANCH CCRC
HYDRO-MODIFICATION EXHIBIT

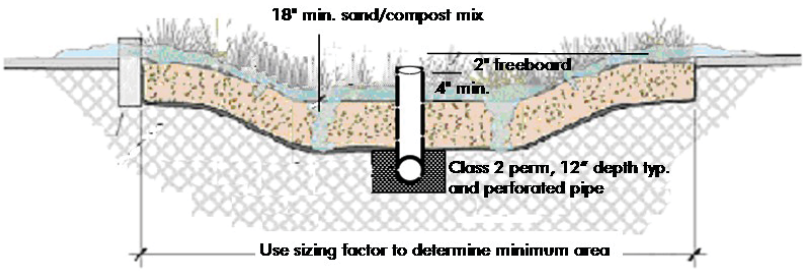
LATITUDE 33
PLANNING AND ENGINEERING
5355 MIRA SORRENTO PLACE, SUITE 650
SAN DIEGO, CA 92121
TEL: 858.751.0633
FAX: 858.751.0634

SCALE:	1"=60'
DATE:	JULY 16, 2014
JOB NO:	1049.10
SHEET:	1 OF 1

Appendix C

BIO-RETENTION BASIN DETAILS

4.7 Bioretention Facilities



Bioretention facility configured for treatment-only requirements. Bioretention facilities can rectangular, linear, or nearly any shape.

Bioretention detains runoff in a surface reservoir, filters it through plant roots and a biologically active soil mix, and then infiltrates it into the ground. Where native soils are less permeable, an underdrain conveys treated runoff to storm drain or surface drainage.

Bioretention facilities can be configured in nearly any shape. When configured as linear **swales**, they can convey high flows while percolating and treating lower flows.

Bioretention facilities can be configured as in-ground or above-ground planter boxes, with the bottom open to allow infiltration to native soils underneath. If infiltration cannot be allowed, use the sizing factors and criteria for the Flow-Through Planter.

Best Uses

- Commercial areas
- Residential subdivisions
- Industrial developments
- Roadways
- Parking lots
- Fit in setbacks, medians, and other landscaped areas

Advantages

- Can be any shape
- Low maintenance
- Can be landscaped

Limitations

- Require 4% of tributary impervious square footage
- Typically requires 3-4 feet of head
- Irrigation typically required

4.7.1 Criteria

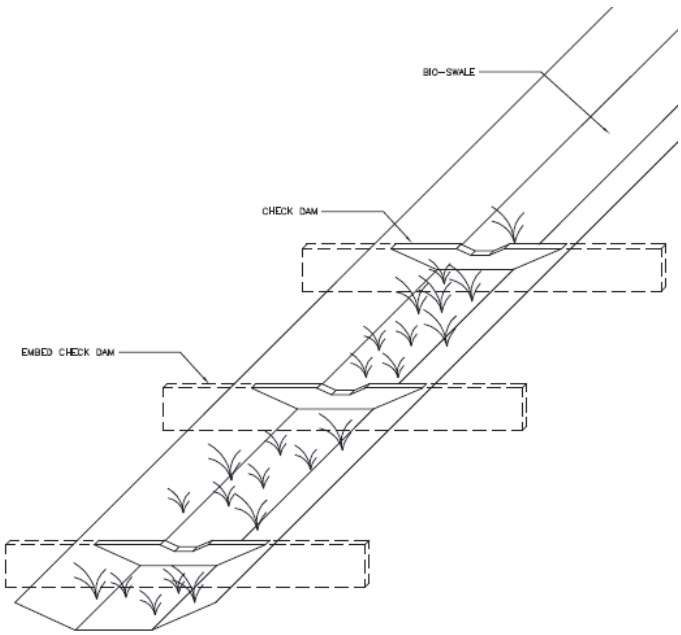
For development projects subject only to runoff treatment requirements, the following criteria apply:

Parameter	Criterion
Soil mix depth	18 inches minimum
Soil mix minimum percolation rate	5 inches per hour minimum sustained (10 inches per hour initial rate recommended)
Soil mix surface area	0.04 times tributary impervious area (or equivalent)
Surface reservoir depth	6 inches minimum; may be sloped to 4 inches where adjoining walkways.

Parameter	Criterion
Underdrain	Required in Group “C” and “D” soils. Perforated pipe embedded in gravel (“Class 2 permeable” recommended), connected to storm drain or other accepted discharge point.

4.7.2 Details

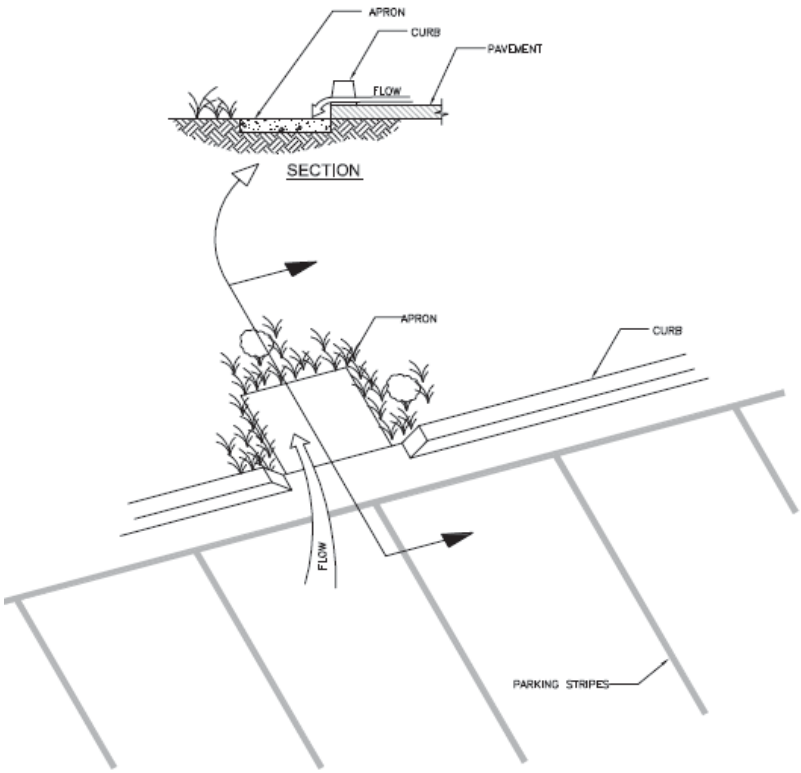
Plan. On the surface, a bioretention facility should be one level, shallow basin—or a series of basins. As runoff enters each basin, it should flood and fill throughout before runoff overflows to the outlet or to the next downstream basin. This will help prevent movement of surface mulch and soil mix.



Use check dams for linear bioretention facilities (swales) on a slope.

In a linear swale, check dams should be placed so that the lip of each dam is at least as high as the toe of the next upstream dam. A similar principle applies to bioretention facilities built as terraced roadway shoulders.

Inlets. Paved areas draining to the facility should be graded, and inlets should be placed, so that runoff remains as sheet flow or as dispersed as possible. Curb cuts should be wide (12" is recommended) to avoid clogging with leaves or debris. Allow for a minimum reveal of 4"-6" between the inlet and soil mix elevations to ensure turf or mulch buildup does not block the inlet. In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet.



Recommended design details for bioretention facility inlets (see text).

Where runoff is collected in pipes or gutters and conveyed to the facility, protect the landscaping from high-velocity flows with energy-dissipating rocks. In larger installations, provide cobble-lined channels to better distribute flows throughout the facility.

Upturned pipe outlets can be used to dissipate energy when runoff is piped from roofs and upgradient paved areas.

Soil mix. The required soil mix is similar to a loamy sand. It must maintain a minimum percolation rate of 5" per hour throughout the life of the facility, and it must be suitable for maintaining plant life. Typically, on-site soils will not be suitable due to clay content.

Storage and drainage layer. "Class 2 permeable," Caltrans specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires 4"-6" washed pea gravel be substituted at the top of the crushed rock gravel layers. Do not use filter fabric to separate the soil mix from the gravel drainage layer or the gravel drainage layer from the native soil.

Underdrains. No underdrain is required where native soils beneath the facility are Hydrologic Soil Group A or B. For treatment-only facilities where native soils are Group C or D, a perforated pipe must be bedded in the gravel layer and must terminate at a storm drain or other approved discharge point.

Outlets. In treatment-only facilities, outlets must be set high enough to ensure the surface reservoir fills and the entire surface area of soil mix is flooded before the outlet elevation is reached. In swales, this can be achieved with appropriately placed check dams.

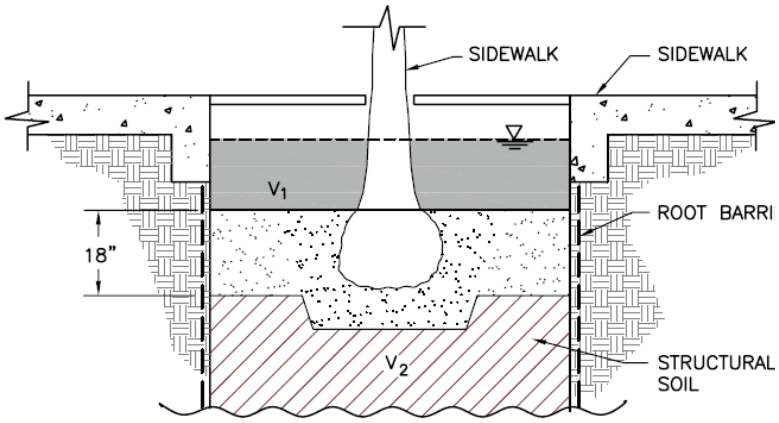
The outlet should be designed to exclude floating mulch and debris.

Vaults, utility boxes and light standards. It is best to locate utilities outside the bioretention facility—in adjacent walkways or in a separate area set aside for this purpose. If utility structures are to be placed within the facility, the locations should be anticipated and adjustments made to ensure the minimum bioretention surface area and volumes are achieved. Leaving the final locations to each individual utility can produce a haphazard, unaesthetic appearance and make the bioretention facility more difficult to maintain.

Emergency overflow. The site grading plan should anticipate extreme events and potential clogging of the overflow and route emergency overflows safely.

Trees. Bioretention areas can accommodate small or large trees. There is no need to subtract the area taken up by roots from the effective area of the facility. Extensive tree roots maintain soil permeability and help retain runoff. Normal maintenance of a bioretention facility should not affect tree lifespan.

The bioretention facility can be integrated with a tree pit of the required depth and filled with structural soil. If a root barrier is used, it can be located to allow tree roots to spread throughout the bioretention facility while protecting adjacent pavement. Locations and planting elevations should be selected to avoid blocking the facility's inlets and outlets.



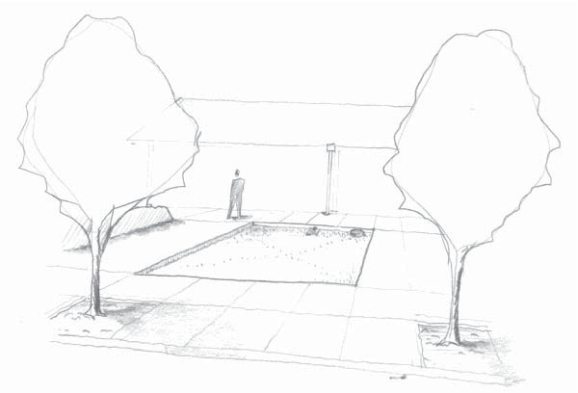
Bioretention facility configured as a tree well. The root barrier is optional.

4.7.3 Applications

Multi-purpose landscaped areas. Bioretention facilities are easily adapted to serve multiple purposes. The loamy sand soil mix will support turf or a plant palette suitable to the location and a well-drained soil.

Example landscape treatments:

- Lawn with sloped transition to adjacent landscaping.
- Swale in setback area
- Swale in parking median
- Lawn with hardscaped edge treatment
- Decorative garden with formal or informal plantings
- Traffic island with low-maintenance landscaping
- Raised planter with seating
- Bioretention on a terraced slope

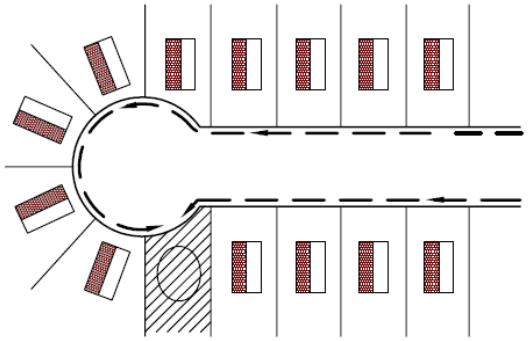


Bioretention facility configured as a recessed decorative lawn with hardscaped edge.

Bioretention facility configured and planted as a lawn/ play area.

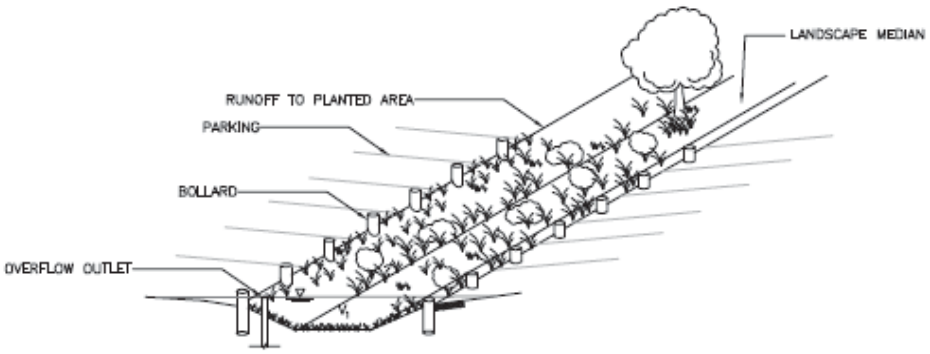
Residential subdivisions. Some subdivisions are designed to drain roofs and driveways to the streets (in the conventional manner) and then drain the streets to bioretention areas, with one bioretention area for each 1 to 6 lots, depending on subdivision layout and topography.

If allowed by the local jurisdiction, bioretention areas can be placed on a separate, dedicated parcel with joint ownership.



Bioretention facility receiving drainage from
individual lots and the street in a residential subdivision.

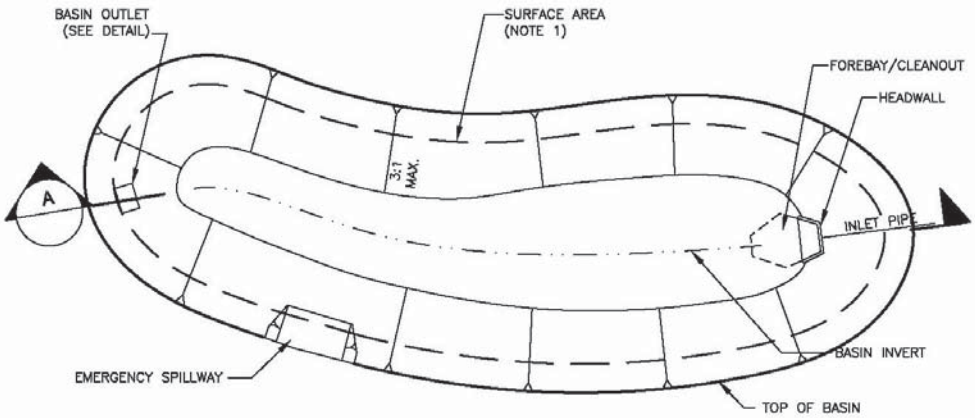
Sloped sites. Bioretention facilities must be constructed as a basin, or series of basins, with the circumference of each basin set level. It may be necessary to add curbs or low retaining walls.



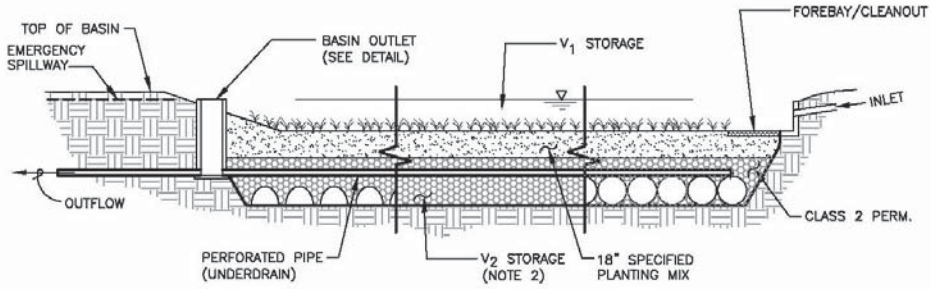
Bioretention facility configured as a parking median.
Note use of bollards in place of curbs, eliminating the need for curb cuts.

4.7.4 Design Checklist for Bioretention

- ❒ Volume or depth of surface reservoir meets or exceeds minimum.
- ❒ 18" depth “loamy sand” soil mix with minimum long-term percolation rate of 5"/hour.
- ❒ Area of soil mix meets or exceeds minimum.
- ❒ Perforated pipe underdrain bedded in “Class 2 perm” with connection and sufficient head to storm drain or discharge point (except in “A” or “B” soils).
- ❒ No filter fabric.
- ❒ Underdrain has a clean-out port consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ Location and footprint of facility are shown on site plan and landscaping plan.
- ❒ Bioretention area is designed as a basin (level edges) or a series of basins, and grading plan is consistent with these elevations. If facility is designed as a swale, check dams are set so the lip of each dam is at least as high as the toe of the next upstream dam.
- ❒ Inlets are 12" wide, have 4"-6" reveal and an apron or other provision to prevent blockage when vegetation grows in, and energy dissipation as needed.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ Irrigation system with connection to water supply.
- ❒ Vaults, utility boxes, and light standards are located outside the minimum soil mix surface area.
- ❒ When excavating, avoid smearing of the soils on bottom and side slopes. Minimize compaction of native soils and “rip” soils if clayey and/or compacted. Protect the area from construction site runoff.



PLAN VIEW
NOT TO SCALE



A SECTION
NOT TO SCALE

NOTE

1. SURFACE AREA LIMIT DETERMINED BY EXTENT OF SPECIFIED PLANTING MIX, WHICH IS GOVERNED BY THE OUTLET SPILL ELEVATION. FOR REQUIRED SURFACE AREA REFER TO THE FACTORS AND EQUATIONS IN THE STORMWATER C.3 GUIDEBOOK.
2. V_2 STORAGE ACCOMPLISHED WITH INFILTRATION ARCHES, PERFORATED PIPES, CLASS 2 PERM OR OTHER AT THE DESIGNERS DISCRETION.

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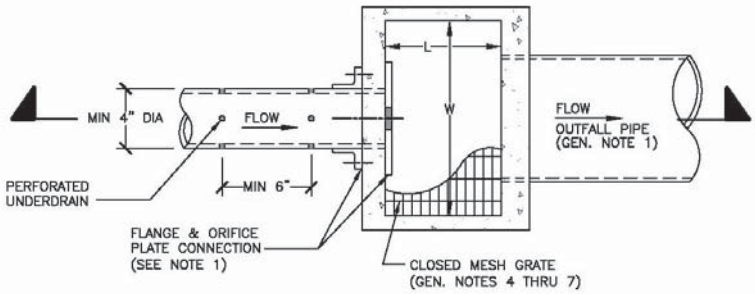
Bioretention Facility



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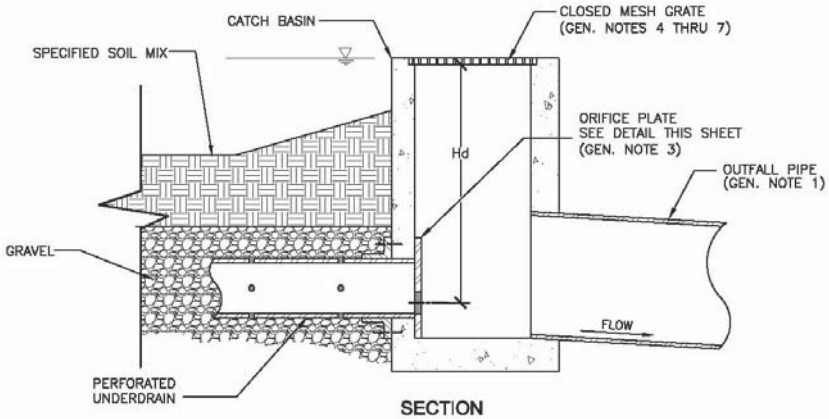

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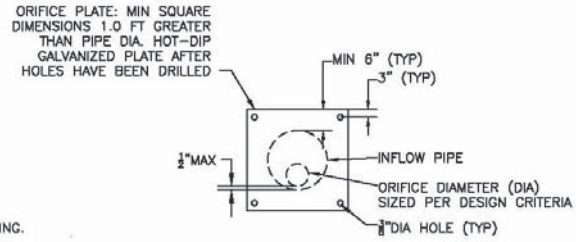

FLOW CONTROL ORIFICE PLATE

NOTE

1. ORIFICE PLATE & FLANGE CONNECTION TO CONCRETE SHALL BE FITTED WITH 30 DUROMETER NEOPRENE RING.

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Bioretention Facility Outlet Detail - A

4.8 Flow-through Planter

Portland 2004 Stormwater Manual

Best Uses

- Management of roof runoff
- Next to buildings
- Dense urban areas
- Where infiltration is not desired

Advantages

- Can be used next to structures
- Versatile
- Can be any shape
- Low maintenance

Limitations

- Can be used for flow-control only on sites with "C" and "D" soils
- Requires underdrain
- Requires 3-4 feet of head

Flow-through planters treat and detain runoff without allowing seepage into the underlying soil. They can be used next to buildings and on slopes where stability might be affected by adding soil moisture.

Flow-through planters typically receive runoff via downspouts leading from the roofs of adjacent buildings. However, they can also be set in-ground and receive sheet flow from adjacent paved areas.

Pollutants are removed as runoff passes through the soil layer and is collected in an underlying layer of gravel or drain rock. A perforated-pipe underdrain is typically connected to a storm drain or other discharge point. An overflow inlet conveys flows which exceed the capacity of the planter.

4.8.1 Criteria

Treatment only. For development projects subject only to runoff treatment requirements, the following criteria apply:

Parameter	Criterion
Soil mix depth	18 inches minimum
Soil mix minimum percolation rate	5 inches per hour minimum sustained (10 inches per hour initial rate recommended)
Soil mix surface area	0.04 times tributary impervious area (or equivalent)
Surface reservoir depth	6" minimum; may be sloped to 4" where adjoining walkways.
Underdrain	Typically used. Perforated pipe embedded in gravel ("Class 2 permeable" recommended), connected to storm drain or other accepted discharge point.

4.8.2 Details

Configuration. The planter must be level. To avoid standing water in the subsurface layer, set the perforated pipe underdrain and orifice as nearly flush with the planter bottom as possible.

Inlets. Protect plantings from high-velocity flows by adding rocks or other energy-dissipating structures at downspouts and other inlets.

Soil mix. The required soil mix is similar to a loamy sand. It must maintain a minimum percolation rate of 5" per hour throughout the life of the facility, and it must be suitable for maintaining plant life. Typically, on-site soils will not be suitable due to clay content.

Gravel storage and drainage layer. "Class 2 permeable," Caltrans specification 68-1.025, is recommended. Open-graded crushed rock, washed, may be used, but requires 4"-6" of washed pea gravel be substituted at the top of the crushed rock layer. Do not use filter fabric to separate the soil mix from the gravel drainage layer.

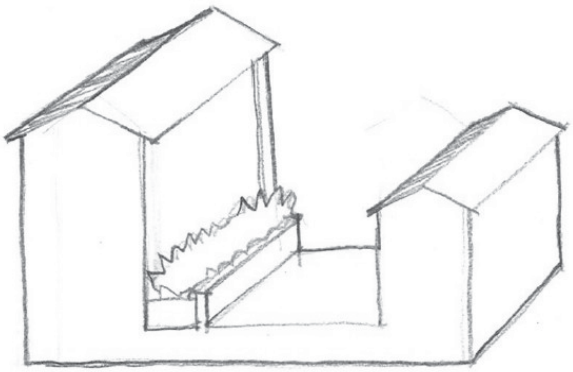
Emergency overflow. The planter design and installation should anticipate extreme events and potential clogging of the overflow and route emergency overflows safely.

4.8.3 Applications

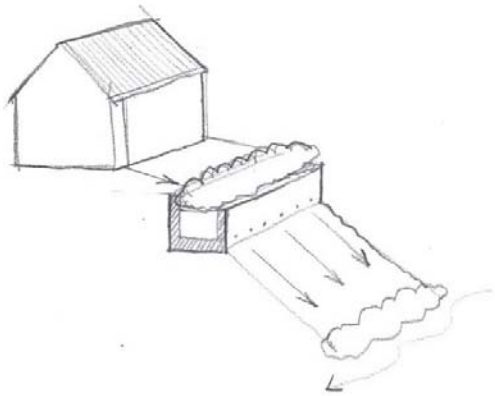
Adjacent to buildings. Flow-through planters may be located adjacent to buildings, where the planter vegetation can soften the visual effect of the building wall. A setback with a raised planter box may be appropriate even in some neo-traditional pedestrian-oriented urban streetscapes.

At plaza level. Flow-through planters have been successfully incorporated into podium-style developments, with the planters placed on the plaza level and receiving runoff from the tower roofs above. Runoff from the plaza level is typically managed separately by additional flow-through planters or bioretention facilities located at street level.

Steep slopes. Flow-through planters provide a means to detain and treat runoff on slopes that cannot accept infiltration from a bioretention facility. The planter can be built into the slope similar to a retaining wall. The design should consider the need to access the planter for periodic maintenance. Flows from the planter underdrain and overflow must be directed in accordance with local requirements. It is sometimes possible to disperse these flows to the downgradient hillside.



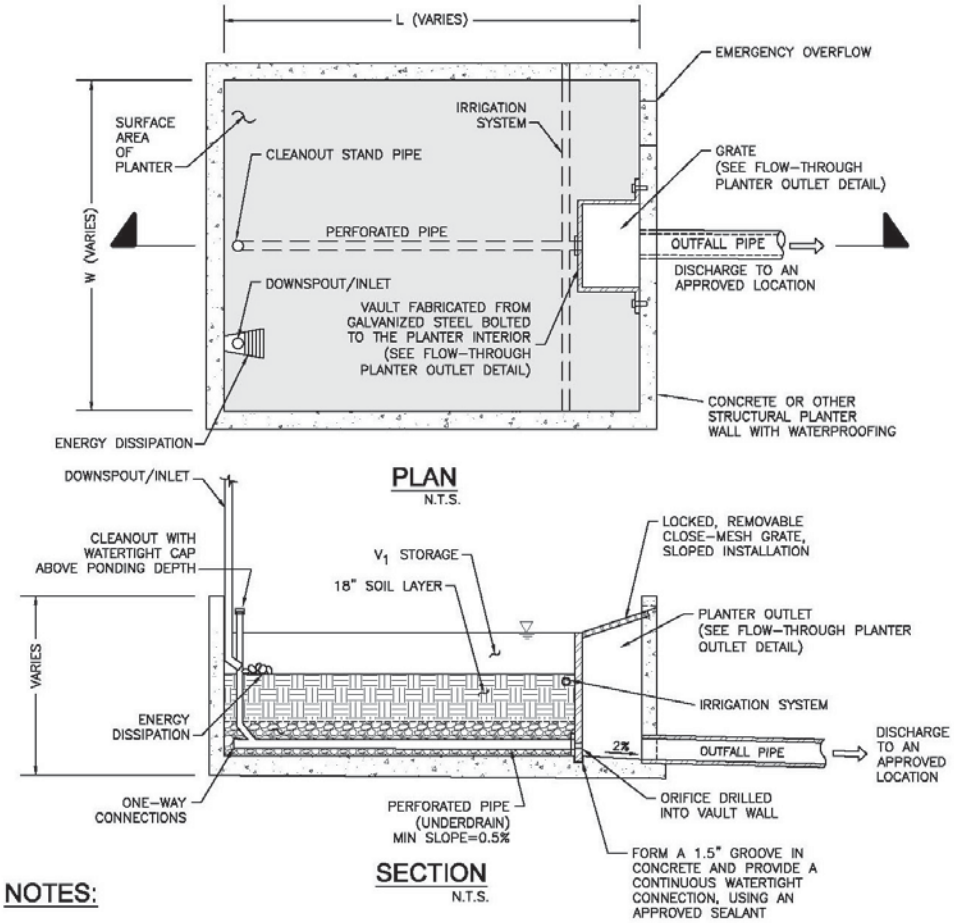
Flow-through planter on the
plaza level of a podium-style development.



Flow-through planter built into a hillside.
Flows from the underdrain and overflow must be
directed in accordance with local requirements.

4.8.4 Design Checklist for Flow-through Planter

- ❒ Reservoir depth is 4-6" minimum.
- ❒ 18" depth “loamy sand” soil mix with minimum long-term infiltration rate of 5"/hour.
- ❒ Area of soil mix meets or exceeds minimum.
- ❒ “Class 2 perm” drainage layer.
- ❒ No filter fabric.
- ❒ Perforated pipe underdrain with outlet located flush or nearly flush with planter bottom. Connection with sufficient head to storm drain or discharge point.
- ❒ Underdrain has a clean-out port consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ Location and footprint of facility are shown on site plan and landscaping plan.
- ❒ Planter is set level.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ Irrigation system with connection to water supply.



NOTES:

1. FLOW-THROUGH PLANTER SHALL BE SIZED TO MEET CCCWP CRITERIA FOR TREATMENT AND/OR FLOW CONTROL.
2. MINIMUM SURFACE AREA OF PLANTER IS 4% OF TRIBUTARY IMPERVIOUS AREA FOR TREATMENT ONLY DESIGN. FOR FLOW CONTROL AND TREATMENT, REFER TO CCCWP SIZING TOOL CRITERIA.
3. SHAPE OF PLANTER CAN VARY TO MEET PROJECT DESIGN REQUIREMENTS AND LOCATION.
4. CLASS 2 PERMEABLE MATERIAL
5. DOWNSPOUTS/INLET PIPES REQUIRE ENERGY DISSIPATION.
6. USE COUNTY APPROVED ADDITIVE MIXTURE FOR WATERPROOFING CONCRETE.
7. PLANTINGS: SEE CCCWP RECOMMENDED PLANT LIST AND GUIDELINES.
8. PLANTER DESIGN MAY REQUIRE STRUCTURAL ENGINEERING DESIGN.
9. AREA = W x L (ABOVE). EXCLUDES AREA OF VAULT

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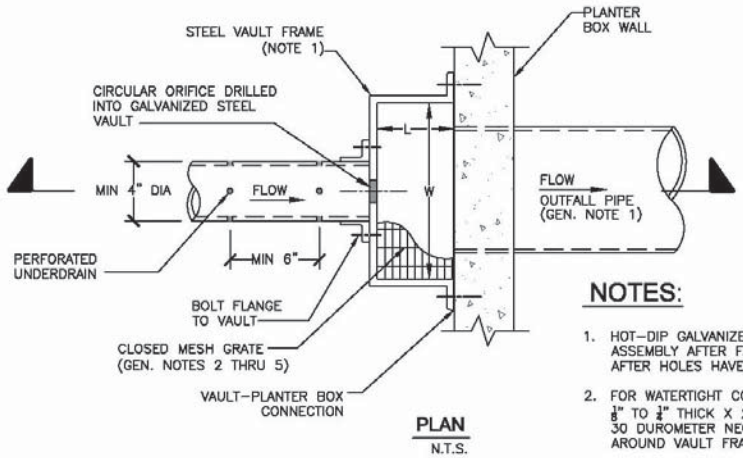
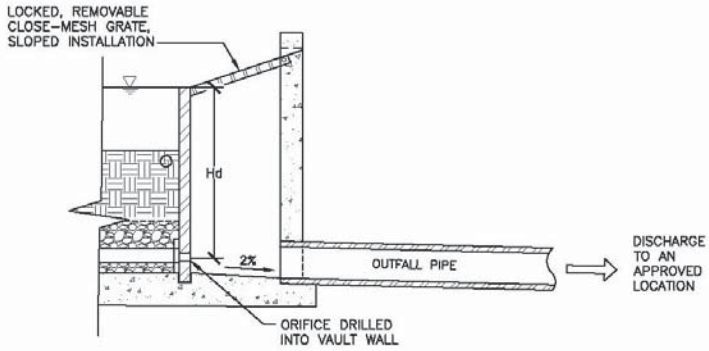
Flow-Through Planter Detail



PLAN
N.T.S.

NOTES:

1. HOT–DIP GALVANIZE ENTIRE FRAME ASSEMBLY AFTER FABRICATION AND AFTER HOLES HAVE BEEN DRILLED.
2. FOR WATERTIGHT CONNECTION, INSTALL $\frac{1}{8}$" TO $\frac{1}{4}$" THICK X 2" WIDE CONTINUOUS 30 DUROMETER NEOPRENE GASKET, ALL AROUND VAULT FRAME.



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GENERAL OUTLET DETAIL NOTES:

1. OUTFALL PIPE SHALL BE SIZED TO CONVEY DESIGN STORM PER CCCWP DESIGN CRITERIA.
2. GRATE SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
3. GRATE SHALL BE STAINLESS STEEL, ALUMINUM OR STEEL. STEEL GRATES SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER PAINTED AFTER GALVANIZING.
4. GRATE SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
5. STRUCTURAL DESIGN OF GRATE SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF GRATE.

Flow-Through Planter Outlet Detail