May 3, 2007

County of San Luis Obispo
c/o Mr. Frank Honeycutt
1050 Monterey Street
San Luis Obispo, California 93408

Subject: Florence Street LID Demonstration and Pedestrian Safety Improvement Project Draft Preliminary Design Report

Dear Mr. Honeycutt:

We have prepared the following report to evaluate LID and pedestrian safety strategies along Florence Street.

This report is intended to provide a basis for planning developments within the area consistent with good engineering practice and in compliance with the majority of area standards. During final design, additional studies will be required to conform to the final plan and details of the development.

If you have any questions regarding this information, please feel free to call.

Sincerely,

WALLACE GROUP

Cheryl a Lenhardt

Cheryl A. Lenhardt, PE
Civil Engineer

FLORENCE STREET IMPROVEMENTS
DESIGN REPORT

Prepared for
County of San Luis Obispo
c/o Mr. Frank Honeycutt
1050 Monterey Street
San Luis Obispo, CA 93408

WO 300276.01

Submitted by

WALLACE GROUP

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CERTIFICATION

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PROJECT OVERVIEW AND GOALS

This report documents preliminary design concepts for the incorporation of safety and drainage improvements along Florence Street between Toad Creek and Las Tablas Road.

Background

The project proposes to add two 4-foot bike lanes, a 5-foot walkway and an 8-foot traversable bioswale. It will also reduce vehicle travel lanes from 12 feet to 11 feet. A schematic of the proposed project is provided in Figure **1**.

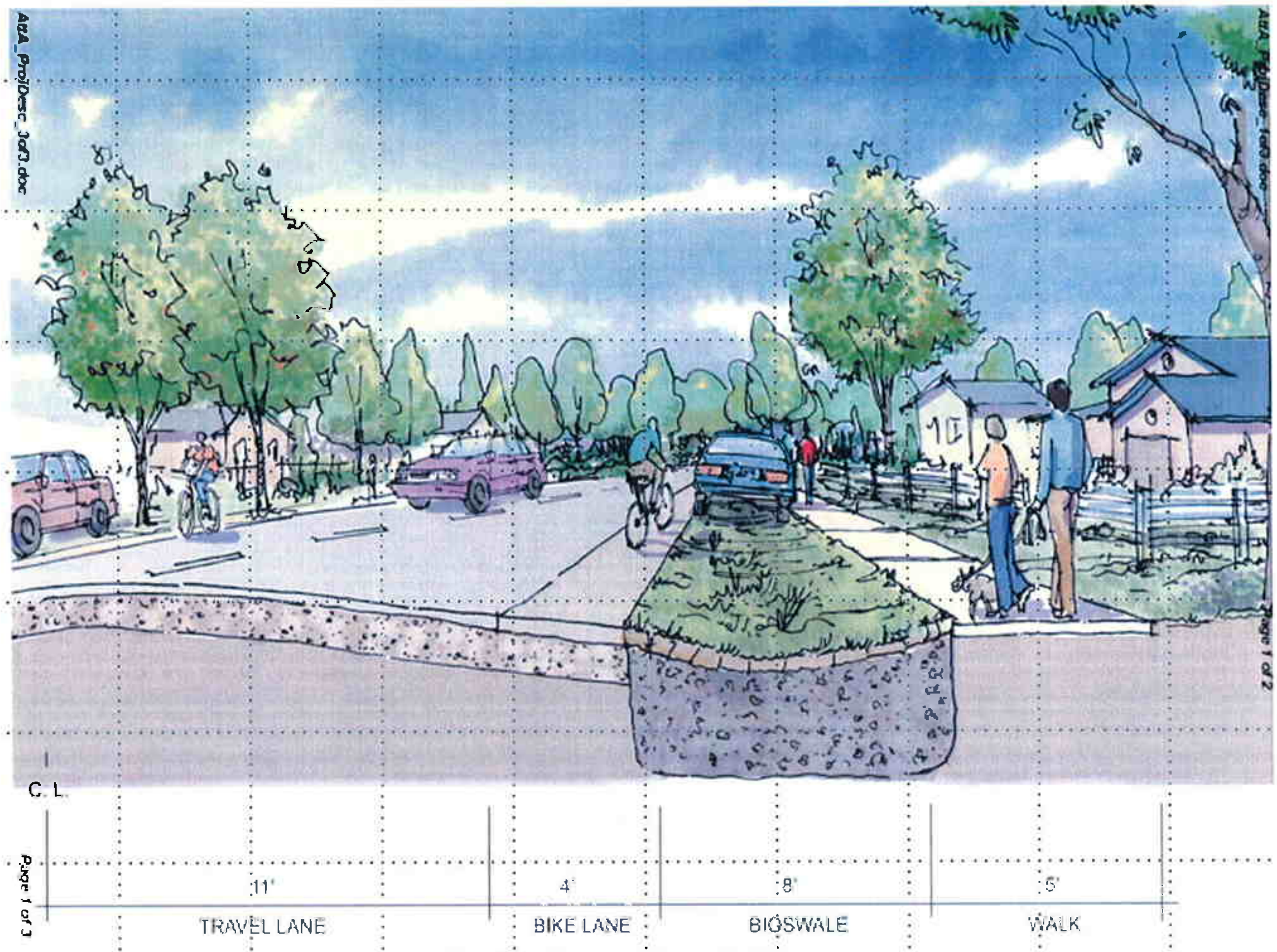


Figure 1 – Proposed Cross-Section

The project is designed to address the following purposes and needs:

1. Provide a safe, all weather, pedestrian path separated from vehicular travel lanes. Florence Street is designated as a school route but the existing (24-foot wide) pavement is not adequate to accommodate the intended demand for vehicles, bicycles, and pedestrians. By installing a pedestrian path along the west side of Florence Street from approximately 200 feet south of Salinas Avenue northward to Las Tablas Road, there will be a complete pedestrian path from the Las Tablas under crossing through to the Templeton elementary and middle schools.

2. Reduce peak storm water runoff and improve storm water quality. Templeton lies within the County's NPDES (MS-4) storm water permit coverage area. The County is mandated to reduce the discharge of pollutants to the maximum extent practicable. Florence Street acts as a drainage "collector" that carries runoff from the surrounding neighborhood to Toad Creek at the southerly limits of this project. Through the incorporation of low impact development techniques, this project is intended to reduce the volume and velocity of runoff while improving the overall quality of the water that drains away from the site. Peak flows will be reduced for the smaller, more frequent storms and to a lesser extent, larger but short duration storm events
3. Maintain the rustic aesthetic character of Templeton. This project is intended to accomplish pedestrian and drainage improvements. By foregoing conventional curb and gutter systems and implementing Low Impact Development (LID) techniques instead, the project will achieve its pedestrian and drainage goals while maintaining the rural feel of the Templeton area.
4. Reduce traffic speed and promote safety. Visual inspection of the average vehicle speed along the Florence Street corridor suggests that vehicles typically exceed the speed associated with a neighborhood school route (25 mph). This project reduces the width of the available travel way to give drivers the perception that the road way requires require more attentive driving. While the apparent road width will be narrowed, the clear recovery zone is actually increased by the incorporation of contrasting colored bike lanes and drivable bioswales.

Funding for this project originates from a grant pursued by the County through the California Regional Water Quality Consolidated grant programs (Proposition 40).

Relevant goals of the RWQCB 2005-06 Consolidated Grant Program for Regional Water Board 3 for this Low Impact Development (LID) implementation demonstration project include:

- Reducing sediment and urban pollutants such as hydrocarbons, metals, fertilizers and other constituents normally found in urban runoff.
- Reducing erosion downstream of the project by reducing runoff volumes and lowering creek velocities.
- Developing a basis for future Implementation of LID design standards
- Demonstrating the viability of LID as a practice on typical local urban projects.

The expected outcomes of the safe routes to school program are:

- Increase bicycle, pedestrian, and traffic safety around schools
- Increase the number of children walking and bicycling to and from schools
- Decrease traffic congestion around schools
- Reduce childhood obesity
- Improve air quality, community safety and involvement

- Improve partnerships among schools, local agencies, parents, community groups, non-profit organizations

The preliminary design concepts provided herein are based on the recommended alternative proposed in the March 23, 2006 Pedestrian Safety Improvement Project Initiation document.

Location Map

The project takes place in the community of Templeton along Florence Street between Las Tablas Road and Toad Creek. A vicinity map is provided in Figure **2**. An aerial map is provided in Appendix **A**.

Figure 2 – Vicinity Map

Runoff within the project limits ultimately discharges to Toad Creek. Toad Creek is a tributary to the (Upper) Salinas River between the confluence of the Nacimiento River and Santa Margarita Lake.

Constraints

The following constraints were identified.

- Pedestrian path must be constructed along the westerly side of Florence Street to tie into existing pedestrian paths.
- Water quality must be improved.
- Drainage improvement is desired but the overall drainage pattern will remain unchanged.
- Existing shallow buried utilities are suspected in the work area and will not be relocated.
- It is intended that all of the improvements will be contained within the existing right-of-way. The project must work around existing private improvements (fences and walls) that encroach into the right of way.
- Plants selected must be low maintenance, non-invasive and be hardy enough to withstand irregular traffic and drought conditions.
- Parking along Florence Street must be provided at some level.

- Irrigation by the County will not be provided, except for plant establishment water to be applied by truck.

This preliminary design document is divided into five parts:

1. Project Overview and Goals
2. Applicable Standards
3. Low Impact Design Components
4. Traffic Safety Components
5. Remaining Issues / Other Opportunities

Final design of the project is expected to be completed in April of 2007 with construction to begin mid-June and completed prior to the start of the 2007-2008 school year.

APPLICABLE COUNTY STANDARDS

Numerous Federal, State and County Standards are applicable to this project. Below are a summary of the most relevant standards that influenced the design of the project. Some project components will require a design exception or waiver to the County standards or design guidelines. These items will be addressed as they come up in the body of this report and will be summarized in the **Remaining Issues / Other Considerations** section of this report.

Clear Zone: Per San Luis Obispo County Public Improvement Standards, "there shall be a clear zone of ten (10) feet, measured from the outside edge of the traveled way, on all roadway public improvements". There shall be no unyielding fixed objects (i.e. trees) within the clear zone. "Yielding fixed objects which may be permitted within the clear zone include landscaping other than trees, and signs mounted on standards with "break-away" provisions." (4.1.7 A)

Preservation of Trees: Per San Luis Obispo County Public Improvement Standards, "existing trees within the area of any roadway public improvement shall be preserved as possible, and as required by the conditions of approval for the subdivision or land use permit". (4.1.7 B)

Sight Distance:
There are two types of sight distance requirements associated with this project.

- Driveway Sight Distance: Based on the San Luis Obispo County Public Improvement Standards, the sight distance for Florence Street (design speed = 35 mph) is 237.5 feet. The line of sight is from a point on the driveway which is 3' high and 8' behind the edge of traveled way, to a point that is 2.5' high and located at midpoint of the traveled way. No obstruction of the line of sight shall be allowed within the vertical clear zone between 2.5' and 8' (A-5a).

- Intersection Sight Distance: According to the California Department of Transportation Highway Design Manual, in determining corner sight distance, a set back distance for the "driver on the crossroad shall be a minimum of 10 feet plus the shoulder width of the major road but not less than 13 feet. Corner sight distance is to be measured from a 3.5-foot height at the location of the driver on the minor road to a 4.25-foot object height in the center of the approaching lane of the major road" (405.1). According to Table 405.1A, the corner sight distance for Florence Street should be 385 feet (based on a design speed of 35 mph).

Geometry

Numerous County, State and Federal standards apply to determine minimum travel way for vehicles, bicyclists and pedestrians. These items are discussed in greater detail in the **Project Safety Components** section of this report.

A summary of additional applicable County Standards is provided in Table **1**.

Table 1 – Applicable County Standards

SECTION	REQUIREMENT
5.2.1	Requires Rational method to be used to define primary design storm and must be indicated on the improvement plans at each drainage structure.
5.2.1B 1	Spread of water in primary design storm does not inundate the traveled way greater than ½ the outside through lane width for roads with design speeds less than 45 mph
5.2.1B 4	No more than 1 cfs shall be allowed to bypass a midblock inlet. No more than 0.3 cfs shall be allowed to go round a curb return at an intersection.
5.2.1B 5	Sheet flow across a road shall not exceed 0.1 cfs
5-1.1 E	All surface drainage shall be conveyed in street gutters and cross-gutters and that any flow that cannot be conveyed within the capacity of these facilities (per section 5.1.1 E) shall be conveyed in culverts.
5-10E	Subsurface basins must have overflow path and freeboard per 5.2.3L

County Standard Details used in the development of the project are provided in Appendix B.

- A-1h Typical Rural Road Section 3001 to 6000 future ADT.
- B-1a Rural Driveway Standard: Asphalt Driveway
- C-1 Expansion & Weakened Plan Joint Requirements
- C-4 Sidewalks
- D-4a Sidewalk Underdrain Commercial
- D-5 Cross Gutter and Spandrel

LOW IMPACT DEVELOPMENT COMPONENTS

This section provides an overview of the Low Impact Development (LID) approach and the data necessary (hydrology, tributary areas, soil types and times of concentration) for use in the analysis of LID project components.

LID is an innovative storm water management approach pioneered by Prince George's County Maryland and more recently adopted in the western states that attempts to mimic a site's predevelopment hydrology through the use of distributed lot-level controls such as infiltration, filtering, storage, evaporation and detention techniques. LID techniques can reduce storm water runoff, pollution and erosion typically associated with development while recharging the groundwater table.

The ability of LID to successfully mimic the site's predevelopment hydrology is a function of the regions climate regimes, the soil's ability to infiltrate runoff, the site's topography, the depth of the groundwater table and the proportion of pervious area able to be maintained on the site.

While LID has the potential to reduce the impacts of development, it also can decrease the direct life-cycle costs for a project by reducing the amount of infrastructure needed to convey stormwater and by decreasing the cost of maintaining stormwater infrastructure.

An LID site would, upon development, discharge and infiltrate the same volume of stormwater, at the same peak rate, duration and frequency and of the same water quality that has been historically discharged from the site.

In new developments, LID focus on site design. The focus would be on fitting the design to the terrain, maintaining existing drainage patterns, identifying the most impervious and sensitive areas within the project limits. The structures would be fit to the topography instead of grading the topography to fit the structures. Other fundamental practices associated with runoff management though the use of LID include thinking small scale (distributing infiltration, storage and interception through the site), using simple, non-structural methods and multi-functional landscapes.

For an already developed site, the data collection steps are limited to the identification of the tributary areas, rainfall patterns, soils, infiltration rates and depth to ground water within the tributary areas.

Figure **3** provides a flow chart used as the basis for evaluating potential low-impact development strategies for the project. The procedure shown was adopted from the Prince George's County LID Hydrologic Analysis Manual.

The Prince George's County, Maryland, Department of Environmental Resources produced two documents, *Low-Impact Development Design Strategies: An Integrated Design Approach* (EPA-841-B-00-003) and *Low-Impact Development Hydrologic Analysis* (EPA-841-B-00-002), that discuss site planning, hydrology, distributed integrated management practice technologies, erosion and sediment control, and public outreach techniques that can reduce storm water runoff from new and existing developments.

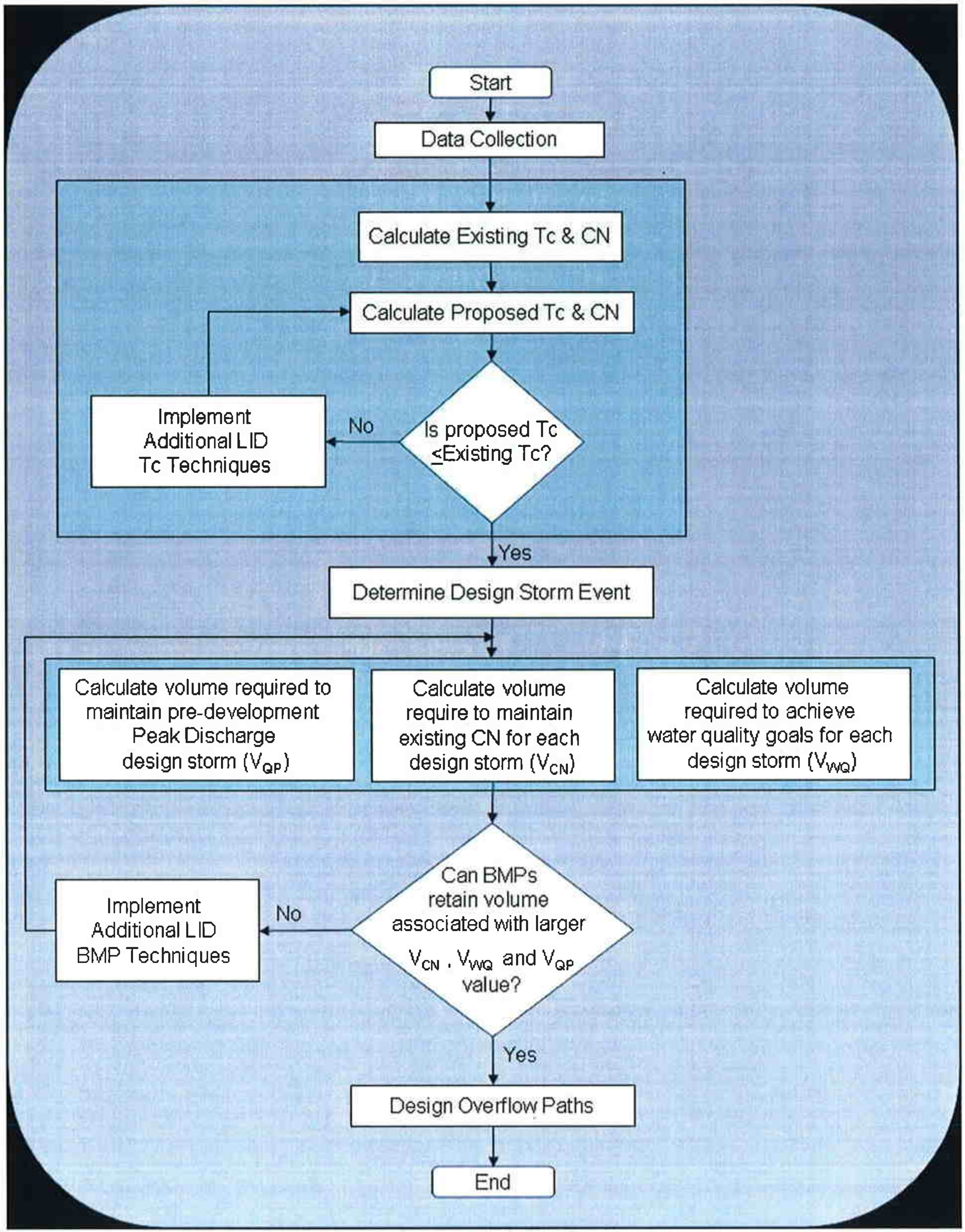


Figure 3 – LID Approach

DATA COLLECTION. The data collection step involves a thorough site study. Areas with highly permeable soils or highly impermeable soils will be identified. The natural drainage patterns will be recorded. The health of the receiving waters will be reviewed. Rainfall intensity rates and depths for the region will be researched. Potential pollutants will be identified. Native and exotic vegetation will be mapped.

The data collection step for a project to be constructed on a previously undisturbed site varies from the steps available for a redevelopment project. For this project, preserving natural drainage patterns or selecting the optimum building site criteria is irrelevant—it has already been developed.

Existing Drainage Patterns

Several site visits were conducted to evaluate existing drainage patterns, potential pollutants and other runoff related issues.

Unraveling Pavement

Stormwater generally flows or sits along the edge of the pavement. As shown in the ~~adjacent~~ pictures below, this saturated condition, combined with parking and crossing the edge of pavement to get into driveways has damaged the edge of pavement.

Figure 4 – Unraveling Pavement Edges

Erosion

As shown in Figure **5**, there is some evidence of erosion along the southbound right shoulder.

Figure 5 – Southbound Right Shoulder Erosion

Exotic, Invasive Species

Pampas Grass is a perennial invasive grass. The plant forms dense, often impenetrable, stands. As it spreads, other desirable vegetation is excluded and it makes access very difficult. It harbors vermin and affects visibility on roads. It also reduces the biodiversity of native ecosystems and their associated scenic, cultural and recreational values.

It is recommended that this exotic, invasive species be removed as part of this project.

Figure 6 – Exotic, Invasive Species

Watershed Description/Delineation

The project watershed area was determined based upon available topographic mapping and verified through field review. The site is within a 7.74-acre watershed shown in Figure **7**. The majority of the site is currently developed.

The downstream limit of the watershed areas was bounded by Salinas Avenue because this project will tie into existing infrastructure once it reaches Salinas avenue.

The tributary area west of Florence Street, shown bounded by pink, is 5.02 acres. It currently flows along the west side of the road and ultimately discharges into Toad Creek (discharge location not shown).

There are two tributary areas on the east side of Florence Street. The 2.22 acres of area bounded by blue is collected along Florence Street but ultimately discharges down Forest Avenue. The remaining 0.50 acres along the east side of Florence Street ultimately ends up in Toad Creek.

Figure 7 – Tributary Areas

Hydrologic Parameters

The average annual rainfall at the project site is between 18 and 20-inches per County Standard drawing H-1. Per County Standard drawing H-2, the time of concentration for the watershed regardless of the type of land use is 10-minutes.

The rainfall intensity rates associated with minimum time of concentration and for a time of concentration for each recurrence intervals of interest were obtained were obtained from Table 3 of the SLO County Department of Public Works Standard Drawings, Drawing H-4. Rainfall depths were obtained from NOAA. Both parameters are provided in Table **2**.

Table 2 – Hydrologic Parameters

Recurrence Interval (Years)	Rainfall Intensity Rate for 10 Min Duration (in/hr)	Rainfall Intensity Rate for 15 Min Duration (in/hr)	Rainfall Depths per NOAA (inches)
2	1.70	1.40	2.5
5	2.30	1.90	3.0
10	2.80	2.40	3.7
25	3.20	2.70	4.5
50	3.70	3.10	5.0
100	4.00	3.40	5.5

Site soils

The majority of soils tributary to the project site are classified as Lockwood (35%) –Concepcion (25%) Complex, 2-9 percent slopes series. Soils closer to Toad Creek are classified as Arbuckle (40%)-San Ysidro (20%) Complex, 2 to 9 percent slopes. A NRCS soil map is provided in Appendix **A**.

Soils to the East of Florence Avenue have been classified by NRCS as belonging to Hydrologic Soil Group B. Soils the south of Salinas Avenue share Hydrologic Soil Group B and C classification. While the vast majority of soils in the Florence area have a "null" designation rating listed for the NRCS classification group. However, boring took place within the "null" designated areas. Resulting percolation test reports for the bore locations within the first two hours of perching indicate that the majority of samples collected share infiltration rates consistent with hydrograph soil group B. See "Infiltration Rate" section for percolation test results.

Depth to Groundwater Table

Exploratory borings were conducted at numerous locations throughout the project limits. None of the borings encountered subsurface water—including the 3 borings that were drilled to 16.5 feet.

Infiltration Rate

To determine the infiltration rate of the soils along Florence Street, several "falling head" percolation tests were conducted. The infiltration rate at each location over time is provided in Table **3** below. Complete test reports and a boring/percolation test location map are available in Appendix **C**.

Table 3 – Summary of Percolation Test

TEST		Final Rate (in/hr)				Comments
NO.	**LOC. ON FLORENCE STREET**	**1**	**2**	**3**	**4**	
2	Northbound right shoulder between Cayucos Ave. and Las Tablas Rd., south of alley.	0.90	0.72	0.36	0.36	Consider underdrain.
3	Southbound right shoulder between Cayucos Ave. and Las Tablas Rd.	6.67	5.45	4.62	7.50	
4	Southbound right shoulder between Forest Ave. and Cayucos Ave..	3.33	0.72	1.09	0.54	
5	Northbound right shoulder between Forest Ave. and Cayucos Ave., north of alley.	0.90	0.72	0.18	0.54	
7	Northbound right shoulder between Forest Ave. and Cayucos Ave., south of alley.	2.14	0.36	0.18	0.54	
9	Southbound right shoulder between Forest Ave. and Cayucos Ave.	60.00	20.00	20.00	30.00	Anomaly. Unexpected results may be attributed to burrows or utility trenches.
10	Southbound right shoulder between Salinas Ave. and Forest Ave., north of alley.	*	*	*	*	Anomaly, too quick to measure. Unexpected results may be attributed to burrows or utility trenches
11	Northbound right shoulder between Salinas Ave. and Forest Ave., south of alley.	0.72	1.62	0.36	1.09	
14	Northbound right shoulder between Salinas Ave. and Forest Ave., south of alley.	2.50	6.00	4.29	0.36	Consider underdrain
15	Southbound right shoulder between Salinas Ave. and Forest Ave., north of alley.	2.73	2.14	1.82	1.25	

Potential Pollutants

Potential pollutants generally associated with residential developments include nutrients (fertilizers, pet waste, etc), pesticides, sediments, trash and debris, oxygen demanding substances (grass clippings, leaves, pet waste, etc), and oil and grease.

Presence of Utilities

Numerous underground utilities area present within the project limits including natural gas, telephone, cable, water and sewer. The final plans will need to be approved by each of these companies. The contact information for each of the companies is provided below:

AT&T	Robert Lopez	546-7003
Southern California Gas Company	Henry Hernandez/Rich Isbel	781-2440
PG&E	Ken Brem	434-4473
Templeton Community Services District		

TIME OF CONCENTRATION AND SCS CURVE NUMBER DETERMINATION

Calculation of the existing time of concentration (Tc) and Soil Conservation Curve Number (CN) are necessary to determine the pre-developed storage volume, peak runoff rate, duration and time to peak. For this project, hydrographs for both the pre-developed and existing conditions were developed for comparison with the proposed project.

The tributary area shown in Figure **7** was analyzed using three different scenarios: Pre-developed, existing and proposed. Although development has changed the size of the tributary area, for comparison sake, the tributary areas are presumed to be the same.

The pre-developed scenario represents the baseline hydrologic condition—the time prior to the site ever being developed. The site is presumed to have been primarily covered with perennial and annual grasses. The existing scenario represents the site in its current condition except that is assumes all lots are developed.

The proposed condition represents the site upon completion of this project. It includes the reduction of impervious area due to the decrease in Florence Street roadway width and the replacement of current impervious driveways with pervious materials. A subset of the proposed condition analysis included evaluation of various storage capabilities. The capability of the site to store runoff is based on the extent and depth available for bio-swales.

Time of Concentration

Times of concentrations are typically shortened as a result of development and shortened times of concentrations result in an increase in peak runoff rates.

Two methods were used to evaluate the project's time of concentration. Table **4** provides a summary of the time of concentrations obtained for each of the methods used. Assumptions were made to establish the drainage patterns (sheet flow, shallow concentrated flow, channel flow) of the pre-developed condition.

Table 4 – Summary of Time of Concentration Methods

METHOD	REMARKS	TIME OF CONCENTRATION (MIN)		
		PRE-DEVELOPED	EXISTING	PROPOSED
SLO County D-3	Nomograph for determining the "Time of Concentration" of Small Drainage Basins (less than 200 acres)	10.2	10.2	10.2
TR-55	Good for small areas with mixed urban conditions.	25	15.7	**18**
	TC selected for design	25	15.7	**18**

The retrofit project increases the time of concentration but does not fully restore the time of concentration to the "pre-developed" condition.

The time of concentration for the proposed project was based on the velocity for the flow rate associated with the County defined primary storm, slope and surface material as runoff travels over and through the bio-swales and native plant gardens.

CN values

The Soil Conservation Service (currently known as NRCS) curve numbers were assigned to the site based on three development conditions: pre-existing, existing and proposed. While new developments typically use a modified CN approach to encourage development away from a sites most pervious soil and to encourage smaller building site footprints, the CN values for this redevelopment project utilized the conventional CN approach (based on an overall land cover type and antecedent moisture condition for the site). The CN values assigned to each development condition are provided in Table **5**.

Table 5 – CN values

DEVELOPMENT CONDITION	CN	COVER TYPE	PERCENT IMPERVIOUS AREA
Pre-Developed	69	Annual and Perennial Grasses, slopes between 2 and 9 percent	0.0
Existing	80	Residential zoning, average lot size of ¼ acre	50.5
Proposed	80	Residential zoning, average lot size of ¼ acre	50.0

The CN of 80 is generally considered high for residential zoning with an average lot size of ¼ acre. However the typical CN value of 75 (for hydrologic Soil Group B) associated with this type of land use assumes a percent impervious of 38 percent. The percent impervious of 50 and 50.5 percent was determined by delineating the roof top and driveway areas relative to the landscaped or open space areas.

The CN value selected was chosen using a comparison of the equivalent Rational Coefficient peak flow rate for a ten year storm and the peak flow rate calculated through a hydrograph analysis. See **hydrograph analysis section** of this report for additional details.

Rational Coefficient Values

Rational Method is required to calculate peak flow rates used to size drainage facilities. Based on the percent impervious area, a Rational Coefficient of 0.5 was used for all proposed conditions peak flow calculations.

LID T_c Techniques

To increase the time of concentration of a developed site, LID practices encourage the disconnection of impervious areas, the increase of surface roughness over which runoff flows and the reduction of slopes to provide for the greatest travel time possible. Ideally, the LID project would have the same or longer time of concentration than that of the undeveloped site.

DESIGN STORM EVENT

The design storm event component consists of choosing the criteria for design. There are three design storms that must be determined:

- Water Quality Treatment Design Storm
- Primary Design Storm
- Secondary Design Storm

Water Quality Treatment Design Storms

Water Quality treatment sizing criteria is based on treating frequent, small storms. Currently there are numerous recommendations for selecting the water quality design storm available in literature. The California Stormwater Quality Association (CASQA) BMP Handbook was consulted to determine the methodology used to size treatment control BMPs incorporated into this project. Within the CASQA handbook, there were two design criteria: flow-based or volume-based.

Flow-based criteria are typically used to size grass strips and swales and must adhere to one of the following:

- 10% of the 50-year peak flow rate for the applicable time of concentration (Factored Flood Flow Approach)
- The flow of runoff produced by a rain event equal to at least two times the 85th percentile hourly rate intensity for the applicable area, based on historical records of hourly rainfall depths (CASQA)
- The flow of runoff resulting from a rain event equal to at least 0.2 in/hour intensity (Uniform Intensity Approach)

Table **6** provides the calculated water quality storm treatment rate and lists the pros and cons associated with each of the design criteria approaches.

Table 6 – Water Quality Storm Design criteria

APPROACH	STORM RATE (CFS)	COMMENT
Factored Flow	0.7	The factored flow is based on intensity-duration-frequency curves that are familiar and available to most engineers. The data used to derive the curves is based on local rainfall conditions. The factored flow is very sensitive to the time of concentration estimate.
CASQA	**	While this method is deemed the most comprehensive method by many agencies because it takes into account drain time, slope and soil sites, the information is often not readily available to agencies or engineers.
Uniform Intensity	0.2	This is the simplistic of the three flow based criteria however it does not take into account local rainfall patterns.
WEF Manual of Practice No. 23	**	Used regression equations of six cities. Does not consider soil type of slope or local rainfall patterns.

**The lack of rainfall data eliminated the CASQA method flow based criteria.

Volume-based criteria are typically used to size basins, wetlands, filters and trenches and must adhere to one of the following:

- Eighty percent of the volume of annual runoff (SWQTF)
- Eighty-fifth percentile 24-hour runoff event based on WEF Manual of Practice No. 23 formula (ASCE)

There were no known sources of hourly rainfall and intensity rainfall data rates for the project area. Therefore it was difficult to determine the volume based criteria on either the SWQTF or ASCE methods. Having no remaining options for the Volume based criteria, other agency standards were consulted. Ultimately, the city of San Luis Obispo volume based design criteria requires treatment of the 1-inch, 24-hour storm. Installing a rain gage in Templeton would allow this information to be provided in the future.

The uniform intensity approach was selected over the factored flow approach because the factored flow approach exceeded the peak runoff of the 2-year storm event by a multiple of three. Water quality treatment philosophies currently target the less frequent storm because sizing treatment control to handle larger storms have not found to be effective. Many of the established criteria are designed to treat the "first flush" storm—the first storm of the year that is usually light (in the Templeton area) and during which the accumulation of pollutants on paved surfaces is washed away. The concentration of pollutants in this first flush is thought to be higher than expected in subsequent rains. Thus, treating the more frequent smaller storms has been found to be effective.

Primary Design Storms

San Luis Obispo County Department of Public Works Public Improvement Standards requires that all drainage systems be design to convey the runoff from the primary design storm with freeboard. The primary storm is based on the drainage area provided in Table 5-1 of Section 5-2. For a project of less than 640 acres, the primary design storm is 25 years. This is the smallest of the available design storms.

Qp(overall) = 10.5 cfs
Qp(west) = 8.0 cfs
Qp(east-a) = 3.6 cfs
Qp(east-b) = 0.8 cfs

Secondary Design Storms

San Luis Obispo County Department of Public Works Public Improvement Standards requires that all drainage systems be design to convey the runoff from the secondary design storm without freeboard. Overland escapes must be provided that are capable of conveying the secondary storm. The secondary storm for this project of 50 years was also based on the tributary drainage area.

Qs(overall) = 12.0 cfs
Qs(west) = 9.3 cfs
Qs(east-a) = 4.1 cfs
Qs(east-b) = 0.9 cfs

LID BMP TECHNIQUES

There are several Best Management Practices (BMPs) that can be implemented to maintain peak runoff rates and volumes including minimizing directly connected impervious areas within catchments and providing for detention/retention. Typical LID BMPs include reducing impervious areas by maintaining permeable surfaces (porous concrete, grass pavers, etc), disconnecting impervious areas to filter strips, grass swales, vegetated buffers, filtering runoff (green roofs, wetlands, bio-swales), increasing the time if takes stormwater for runoff to reach the discharge point and reducing or eliminating pollutants before they get propagated downstream.

Volume Calculations

Once the project Tc and CN have been calculated, the required storage volume necessary to maintain pre-developed runoff patterns can be determined. Initially, the goal is to implement LID components that are capable of restoring the pre and post development times of concentrations.

To identify the required extent of infiltration along the project, an initial reservoir was created using a 35% void ratio and an infiltration rate of 0.5 inches per hour over a 600 foot length. A minimum depth of 5-foot was needed to be able to influence the amount of runoff associated with the 2-year storm. An infiltration trench with these characteristics was able to accept over 3000 cubic feet of runoff before becoming saturated.

Hydrograph Analysis

Hydraflow Hydrographs 2004 program was utilized to evaluate existing, pre and post-development runoff volumes and rates. Common input parameters are listed below.

Runoff method:	SBUH
Rainfall Distribution:	SCS 24-hr, Type 1 Distribution
Hydrograph ordinate time increment:	0.10 hour

Table **7** provides the summary of peak flow rates for each storm return for the overall site.

Table 7 – Hydrographs Peak Flow Rates West Side of Florence Street

HYDROGRAPH ANALYSIS		STORMWATER RUNOFF, CFS				
#	Description	2	10	25	50	100
1	Pre-developed	0.32	1.51	2.57	3.30	4.07
2	Existing Site	1.88	4.28	6.06	7.22	8.39
3	Post-project	1.14	3.98	5.65	6.73	7.83

While the complete hydrograph analysis package is provided in Appendix **E**, Figure **8** provides a graphical representation of the hydrographs for the 2-year event. The red line represents the pre-developed condition. The light blue line represents the existing conditions and the dark blue line represents the post-project conditions.

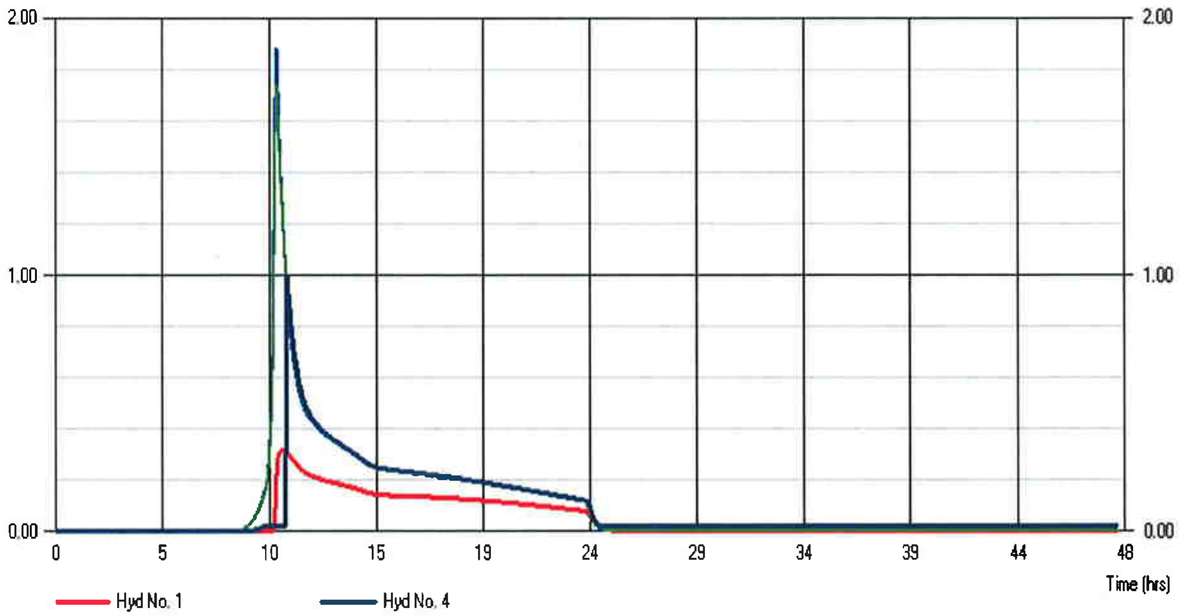


Figure 8 – Hydrograph Comparison (2 year storm event)

Ideally, the post-project would be able to restore (through detention and infiltration) the volume of runoff of the post-developed site to the pre-developed condition. However, given the percentage of impervious area in the watershed, there is inadequate area within the right-of-way to accomplish this. The preliminary infiltration trench is able to store just over 3,000 cubic feet of stormwater.

As shown in Table 8, this is inadequate to contain even the entire 2-year storm event.

Table 8 – Hydrographs Peak Flow Rates West Side of Florence Street

Storm Reoccurrence (year)	STORMWATER VOLUMES (Cubic Feet)		
	Pre-developed	Existing	Required Storage
2	7,669	16,198	8,529
10	19,606	32,737	13,131
25	29,201	44,856	15,655
50	35,668	52,715	17,047
100	42,426	60,742	18,316

There are several best management practices that can be implemented on a house by house basis to improve the volume of stormwater retained on-site such as rain gardens, rain barrels and cisterns.

Infiltrated parking areas/native plant garden Design

The infiltrated parking area was modeled after a combination of infiltration trench and bioswale design concepts. Bioswales rely on physical, biological, and chemical processes to remove pollutants. Surface vegetation reduces the velocity of runoff. The soil matrix acts as a sponge to hold runoff and release it to the underlying native soils over a period of time.

The majority of the criteria listed above originated from the California Stormwater Quality Association Stormwater Best Management Handbook for New Development and Redevelopment. An additional source of information was the publication "Green Technology: The Delaware Urban Runoff Management Approach" of June 2005.

The following design criteria are used to size bioswales:

- The maximum rate accepted to adequately treat the pollutants in the runoff for bioswales is the flow rate that provides a hydraulic residence time of at least 10-minutes for the design storm selected for water quality treatment.
- Depth of water for design storm shall not exceed 4-inches to provide the greatest stormwater contact time with vegetation.
- Grass height of 6-inches using a Manning's n of 0.25. Longer grasses tend to lie down in higher flows providing little stormwater contact with individual blades.
- Side slopes no steeper than 5% to accommodate parking.
- Longitudinal slopes not to exceed 2.5%.

Infiltration trenches are long, narrow, rock-filled trenches with no outlet. They store runoff in the void spaces of a rocks matrix. Infiltration trenches are reportedly highly effective at removing sediment, nutrients, trash, metals, bacteria, oil and grease and organics. The following criteria are used to size infiltration trenches:

- Maximum contributing area to an individual infiltration practices should not exceed 5 acres.
- Trench rock is clear of fines and consists of rock between 1.5 and 2.5-inches in diameter with a media depth between 3 and 8 feet.
- Bottom area wide enough to drain trench within 72-hours.
- Horizontal layer of filter fabric just below the surface of the trench to retain sediment and reduce potential for clogging.

Parking surface. Due to the neighborhood current use of the area designated for infiltrated parking areas was designed to withstand the associated stresses induced by parking cars on top of the permeable paver surface. To allow for a smoother parking surface and to prevent damage to dormant vegetation, the following **three** materials were evaluated for use:

- Bomanite
- Grassblock
- Grasscrete

Each of these materials allows vegetation to grow within a concrete structure where the vehicle load is distributed across the concrete and not the vegetation.

Plastic grids systems were rejected as an alternative surface because vehicle loads would be distributed on the grass crowns. As the grass that will grown in the Templeton area has dormant seasons, vehicle use on the grass surface during the dormant season was anticipated to break off when the grass (thereby killing the grass).

Bomanite is cast in plastic forms with the forms removed as the 5 1/2-inch thick, 3000 psi strength concrete is setting, leaving voids in the concrete to be filled with soils and seeded. It allows 30% of the surface/root zone area open for roots, air and water to pass. The surface is structurally continuous to provide a uniform surface. The uniform surface may make accessing subsurface items such as utilities difficult.


Figure 9 – Bomanite Surfacing

Grassblock creates a surface with the attractive appearance of natural grass combined with the strength of concrete. It incorporates interlocking lugs to increase resistance to displacement under load while also allowing rainwater to pass through it's openings into the sub-grade. They are 1.33-ft x 1.33-ft with depths varying from .27-ft to 0.41-ft. The blocks are interlocked allowing some risk of differential settling but providing easier access to subsurface utilities.


Figure 10 – Grassblock Surfacing

Grasscrete is a cast-on-site cellular structural reinforced concrete system with voids created by plastic forms. It is capable of draining at rates up to 90% that of normal grassland. The residual surface water is held within Grasscrete's natural drainage head thereby controlling the rate of recharge and minimizing the risk of downstream flooding.


Figure 11 – Grasscrete Surfacing

Due to the demonstration aspect of the project, it was decided that all **three** materials would be used. By implementing all three product lines, the County would be able to weigh the pros and cons of each material for potential incorporation into future standards. To create a cohesive, aesthetically pleasing project, each product line use is proposed to be limited to use in a single block.

<u>Plants</u>

Plants are an important component of the project. As run-off works its way through the vegetation, the plants uptake water which reduces the overall volume of runoff leaving a site. Additionally, vegetation stems and leaves help slow the velocity of runoff, trap particles and help break down many chemicals transported in the runoff.

An original plant list of grasses, shrubs, ground covers and small trees suitable for the soil and climate of Templeton were presented to the Templeton Area Advisory Group during their regular meeting in February of 2007. The plants recommended for the project all share a few common characteristics: they are low-maintenance, drought-tolerant, pleasing in appearance and non-invasive.

The drought-tolerant criteria is especially important because there will be no County-provided supplemental water, except by water truck during the initial establishment period. Without water, these plants will go into a dormant state during the dry, hot summer months. Some supplemental summer watering will improve the plants' appearance. A program will be prepared to discuss the care and maintenance of the vegetation associated with this LID project. The long term aesthetics of this project is ultimately dependent of the care provided by the neighborhood.

Several grasses were considered as a cover crop for the infiltrated parking areas. These grasses include Buffalo Grass, Perennial Rye Grass and Red Fescue. Due to the demonstration aspect of the project, it was decided that all three materials would be used. To create a cohesive, aesthetically pleasing project capable of best withstanding the conditions in Templeton, Buffalo Grass will be used in conjunction with Perennial Rye and Red Fescue will be specified separately.

Lollium perenne
(Rye)

Festuca rubra
(Fescue)

Buchloe dactyloides
(Buffalo Grass)

Figure 12 – Plant Pallet Grass Compilation

The following plants were ultimately recommended for the native gardens aspect of the project:

Figure 13 – Plant Pallet Native Garden Planting Compilation

Achellea millefolium 'Island Pink'

Baccharis pilularis

Rosmarinus 'Collingwood Ingram

Ceanothus griseus horizontalis 'Yankee Point'

Convolvulus mauritanicus

Cotoneaster dammeri 'Coral Beauty

Mahonia repens

Pennisetum setaceum 'Eaton Canyon'

Salvia somonensis 'Mrs Beard'

Salvia sonomensis 'Farmer-Bower'

London Plane Trees were specified as replacement trees.

Figure 14 – Plant Pallet Tree Replacement Platanus acerifolia 'London Plane Tree'

The following is the plant list that was presented to the TAAG team in February of 2007.

Shrubs

Dwarf Coyote Brush
Butterfly Bush
Wild Lilac
Western Redbud
Bearberry Cotoneaster
Island Bush Poppy
Long Leaf Mahonia
Chaparral Currant
Rosemary
White and Coral Sages

Ground Covers

Kinnikinnick
Ground morning glory
Island Pink Yarrow

Small Trees

Hollyleaf Cherry

After the TAAG meeting there were further discussions with the County that refined the plant list. The following plants were removed from the plant list: Butterfly Bush, Wild Lilac, Western Redbud, Island Bush Poppy, Chaparral Currant, White Sage, and Hollyleaf Cherry. They were removed at the County's request because plant heights (except for proposed street trees) exceeding 30" with in the right-of-way may become visual obstructions.

The TAAG team identified additional plants for consideration including edible mums, Ficus and small bunch grass. The design team considered the additional plants but did not include the edible mums or Ficus because they require additional water all summer to survive.

Two plants were added to the plant list, London Plane Tree and Dwarf Red Fountain Grass. Three London Plane Trees are proposed for the back of sidewalk adjacent to APN #041-064-033. They will be replacements for the one small Purple Leaf Plum that will be removed as a part of the project.

Plants selected will not interfere with essential sight distance necessary for residences pulling in and out of their driveways and for all travelers making turns on or off of Florence Street. No trees were recommended to be planted within 10 feet of the edge of travel way as this is the minimum required clear recovery zone and a tree would be considered a fixed object if located within that zone.

Stone Reservoir.

The stone reservoir is a critical aspect of the infiltrated parking areas and plant gardens. It provides the volume available to intercept stormwater and hold it until it can infiltrate into the ground. The depth of the stone recharge bed is determined by the amount of stormwater it must hold given that surrounding infiltration rate such that the stormwater will drain within 72 hours of rain event. Typical depths of stone reservoirs range from 12 to 36 inches. The reservoir will consists of clean, uniformly graded course aggregate. The aggregate is wrapped in a geo-textile to prevent the stone from migrating into the native ground and the native ground from filling the voids of the reservoir.

Cross-section

The outer edge of the bioswale is typically held a half inch below the adjacent grade. This prevents the cover crop from blocking the runoff from getting to the bioswale. A typical cross section of the bioswale facility is shown in Figure **15**.

LEGEND:

1. NATIVE GRASSES, MEADOW OR OTHER LOW GROWING DENSE VEGETATION
2. PERMEABLE SOIL COVER
3. CLEAN WASHED UNIFORMLY GRADED COARSE AGGREGATE, AASHTO NO.3
4. NON-WOVEN GEOTEXTILE FILTER FABRIC
5. UNCOMPACTED SUBGRADE

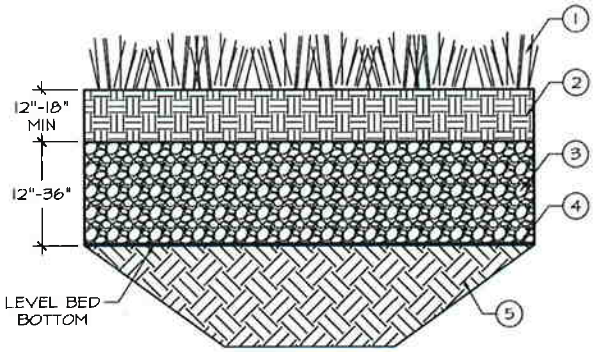


Figure 15 – Typical Cross-Section

Reduced Impervious surfaces

The extent of impervious surfaces within a watershed is often indicative of the health of the watershed. Impervious surfaces consist of concrete, asphalt, roofs, parking lots, etc. Impervious surfaces increase the amount and rate of runoff leaving a site because these surfaces are not able to absorb stormwater. Impervious surfaces absorb and radiate heat at higher rates than pervious surfaces. Additionally, runoff from impervious surfaces may contain large quantities of organic matter (animal wastes, trash, and clippings). These pollutants accumulate on the surface throughout the year and become mobilized during the initial rains of each year.

To reduce the amount of impervious surfaces, this project will replace a portion of asphalt paving along each outer edge of the Florence Street pavement with porous concrete. Additionally, the proposed sidewalks will be constructed of either porous concrete or wooden boardwalks in lieu of traditional impervious concrete. Figure **16** shows a porous concrete sidewalk cross-section.

The proposed surface of the bike lane and sidewalks is a no-fines porous concrete pavement that allows infiltration up to 270 to 450 inches per hour per square foot. Therefore, the porous concrete infiltration rate significantly exceeds the infiltration rate of the project soils.

Porous concrete used in sidewalk applications typically is 4-inches thick and has a minimum strength requirement of 3000 psi while porous concrete that will be driven over is typically 7-inches thick has a has a minimum strength requirement of 5000 psi.

Figure 16 – Porous Concrete Sidewalk Cross-Section (from Washington State Department of Transportation Roadside Manual)

A non-woven geotextile are placed over the native undisturbed soil to prevent the stone reservoir from clogging or having the stones migrate into the soil.

A water barrier geo-textile will be placed the entire length of the bike lane to the depth of the adjacent asphalt concrete to reduce the risk of standing water caused pavement damage. To further reduce the risk of water damage to the adjacent pavement, intermediate stone reservoir channels will be placed at regular intervals. These stone reservoir channels will drain to the adjacent bioswales. The frequency of the stone reservoir channels is based upon the longitudinal steepness of the section.

In some literature, the porous concrete section is cut into the existing grade (no sub grade compaction) as shown in Figure **17**.

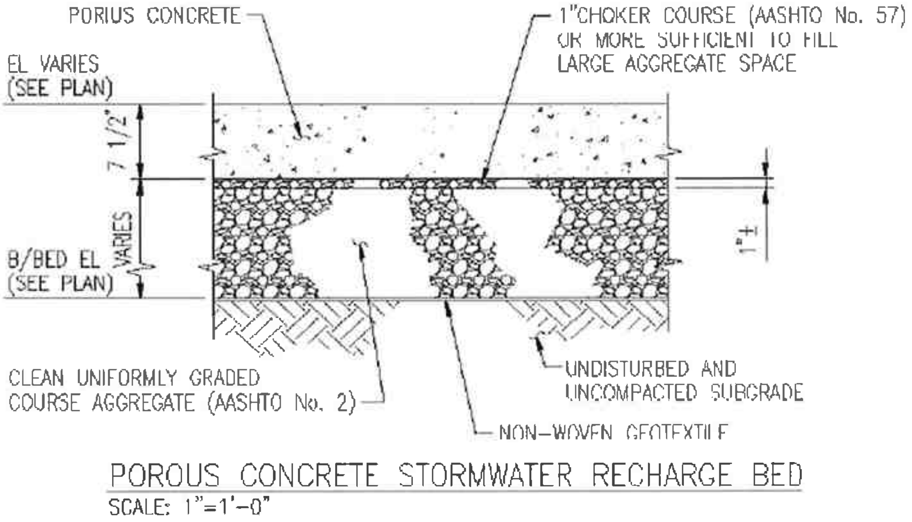


Figure 17 – Porous Concrete Bike Path Cross-Section

In other literature, the sub grade is compacted.

At locations where existing, critical roots are located within proposed sidewalk excavation zones, the porous concrete section will be placed on existing grade to avoid root injury. The sidewalk will be placed without excavating beyond the top 2-inches of the existing grade to minimize injury to the roots.

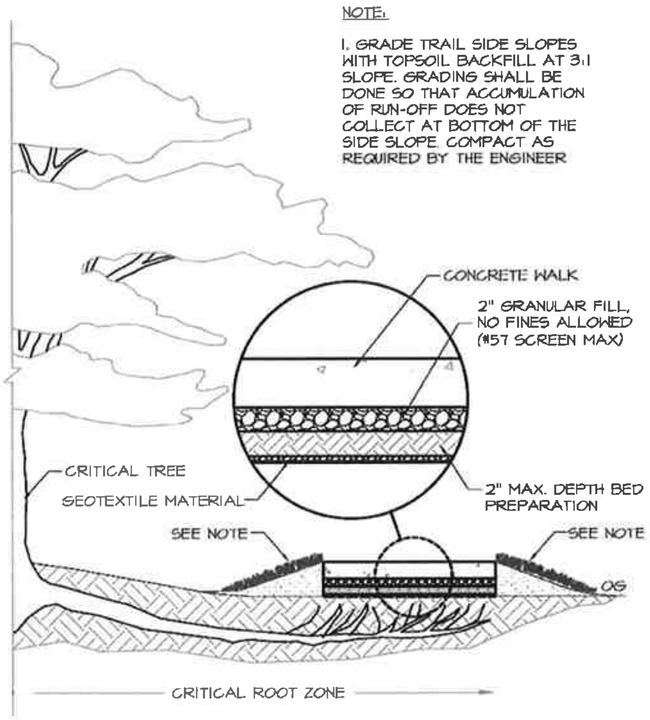


Figure 18 – Sidewalk installation in tree root zones

OVERLAND FLOW PATHS

The last step of the LID process involves the calculation and verification that runoff velocities, volumes, depths and spread widths do not cause erosion or other hazards to the public.

Ultimately the system reaches discharges into Toad Creek. Runoff from the western half of Florence Avenue travels overland on the northern bank of Toad Creek. Runoff from the eastern half of Florence Avenue between Las Tablas and Cayucos Avenue travels east on Cayucos Avenue. Runoff from the eastern half of Florence Avenue on the southern limits of the project drains overland on the northern bank of Toad Creek along the east side of the road.

Overflow for each treatment cell occurs overland. The County typically requires concrete ribbon gutters at intersections where stormwater will cross overland. However, this project will capture and retain all nuisance water and the majority of the low volume, high frequency storm events. Therefore, this project proposes to forego the installation of concrete ribbon gutters at all intersections along the entire length of the project.

FlowMaster was used to evaluate the spread width associated with the primary storm. Per County Standard, the water cannot spread to more than half of the traveled way. Because the bioswale must also allow vehicle parking, its carrying capacity is severely limited. The street grade will also remain unchanged by this project. Of the three worst case spread width scenarios analyzed, none were able to carry the primary storm and maintain a 5.5-foot travel way. The maximum depth of water within the entire traveled way during the 25-year design storm is 0.4-inches.

The maximum velocity in the infiltrated parking areas and native garden ares is 2.4 feet per second (fps). Grass lined channels can typically withstand intermittent flows with velocities up to 4 fps and sustained flows with velocities of 2.6 fps. It is also not anticipated that this project will discharge at a higher rate than that of what currently exists. A field visit of all discharge location indicates that there are currently no signs of erosion.

PROJECT SAFETY COMPONENTS

To improve the safety along Florence Street for all users, several safety enhancing features were investigated:

1. Separating pedestrians from vehicles
2. Providing dedicated right-of-way for bicyclists
3. Implementation of traffic calming strategies
4. Providing access to sidewalk facilities for all users
5. Removing fixed objects within the ROW
6. Adhering to all stopping and sight distance requirements
7. Controlling Traffic during construction

The traffic history, accident data, design speed and design criteria provided below are as originally reported in the Project Initiation Document "Pedestrian Safety Improvements Florence Street, Templeton (Low-Impact Design Demonstration Project)" of March 23, 2006.

Traffic History

A) Volumes on Florence Street have been monitored as follows:
  1) 2002 Circulation Model = 3830 ADT;
  2) September 1999 = 1768 ADT
  3) April. 1993 = 1421 ADT
  4) July 1993 – 1105 ADT
  5) Build Out Estimate = 5500 ADT and 550 PHT;

B) Pedestrian counts are not available.

C) Accident data: See Attachment D of original PID report.

D) Design speed is 35 mph.

Design Criteria

ADT = 5500
V = 35 mph
TI (mainline) = 7.0
Lane Width = 11 feet
Bike lane Width = 4 feet
Sidewalk Width = 6 feet (at curb face)
= 5 feet (if detached)

Separation of Pedestrians from Vehicles

A five foot wide sidewalk is proposed along the west side of Florence Street from approximately 200 feet south of Salinas Avenue northward to Las Tablas Road. This will provide for a continuous pedestrian path from the Las Tablas under crossing to the pedestrian bridge at Toad Creek.

Florence Street is designated as a school route but the existing (24-foot wide) pavement is not adequate to accommodate the intended demand for vehicles, bicycles, and pedestrians. The sidewalk will be an all-weather surface that complies with the following
ADA guidelines (ADAAG Proposed Accessibility Guidelines for Public ROW):

Max allowable running cross slope	2.0%
Minimum clearance width	3 ft
Max. Allowable vertical change in level	0.24-in
Min. Allowable vertical clearance (overhead)	6.66 ft

Shrubs and bushes adjacent to or along the sidewalk alignment will be pruned to allow adequate clearance. Vegetation not conducive to pruning and incompatible with the sidewalk will be removed.

A sidewalk under drain will be installed to collect and convey the concentrated flow leaving the Chevron Station located on the southwest corner of Florence Street and Las Tablas Avenue.

The proposed sidewalks do not meet all of the County Standards provided in Drawing C-4 because they are made from porous concrete or HDPE plastic material.

Providing Dedicated Right-of-Way for Preferential use of by Bicyclists

Construction of dedicated bike lanes will better accommodate cyclists and provide for more predictable movements by all road users. This project proposes to construct a 4-foot wide Class II bike path. The bike path will consist of tinted porous concrete to clearly differentiate the vehicular traveled way from the bicyclists traveled way.

The American Association of state Highway and Transportation Officials (AASHTO) requires a minimum operating space of 4 feet for any facility designed for the exclusive or preferential use by bicyclists. When parking is permitted, the combined width of the bike path and parking areas must more than twelve feet or the bike lane must be widened.

The proposed bike lane is fully compliant with California Department of Transportation Highway Design Manual Chapter 1000 “Bikeway Planning and Design” and is consistent with the County Bikeways Plan and with the eight essential goals and Chapter 5 “Non-Motorized Transportation” of San Luis Obispo Council of Governments Regional Transportation Plan.

Implementation of Traffic Calming Strategies

Successful traffic calming strategies, strategies that aim to slow down or reduce traffic, typically involve three components: engineering, education and enforcement.

Examples of the education component include the installation of interactive signs (such as a speed trailer) and well publicized safety campaigns (Arrive alive, etc).
Examples of the enforcement component include routine patrols of the route by county sheriff personnel. The recommendations provided herein focus on the engineering component to traffic calming. However, for greatest success, all three components are needed.

Examples of engineering components include physical measures such as speed humps, speed tables, raised crosswalks, raised intersections and textured pavements, roundabouts, traffic circles, chicanes, lateral shifts and chokers, curb extensions and center island narrowing or driver’s perception of a reduced natural speed by requiring more attentive driving such as planting trees along the roadside, installing bollards or planters at intersections, adding bike lanes, rumble strips or parking along the roadside and/or the reduction of available traveled way width.

This project reduces the travel way from 12 feet to 11 feet. This is less than the minimum width required per County Standard A-1h “Typical Rural Road Section 3001 to 6000 future ADT”. Because the adjacent bikeway and bioswale is a structural section along the same plane as the traveled way, errant vehicles have use of a full required recovery area but not the perception of it. With the bike lane and the bioswale having a different color and texture than the paved roadway, it is expected that the roadway will appear narrower and subsequently encourage lower traffic speeds without losing the safety benefits of a wider roadway.

Several commonly request methods of controlling speeds are not recommended in this report. These items and the rationale for not recommending them (as excerpted from the City of Livermore web site) are listed below:

Stop signs are not successful in slowing traffic except near the stop sign. Drivers try to make up for the delay by speeding up between stop controlled intersections. This quick acceleration increases noise and air pollution near the signs. Stop signs are only appropriate for establishing right-of-way.

Furthermore, SLO County installs stop signs are locations that meet the stop sign warrants as established by Caltrans. The warrants (criteria) for a stop sign are provided below:

1. Where traffic signals are warranted and urgently needed, the multiway stop may be an interim measure that can be installed quickly to control traffic while arrangements are being made for the signal installations.
2. A collision problem, as indicated by five or more reported collisions within a 12 month period of a type susceptible of correction by a multiway stop installation. Such collisions include right and left turn collisions as well as right angle collisions.
3. Minimum traffic volumes;
    a) The total vehicular volume entering the intersection from all approaches must average at least 500 vehicles per hour for any 8 hours of an average day, and
    b) The combined vehicular and pedestrian volume from the minor street or highway must average at least 200 units per hour for the same 8 hour, with an average delay to minor street vehicular traffic of at least 30 seconds per vehicle during the maximum hour, but
    c) When the 85th percentile approach speed exceeds 40 mi/hr, the minimum vehicular volume warrant is 70% of the above requirements

The reach of Florence Street between Las Tablas and Toad Creek does not meet the above warrants.

"**Slow Children at Play**" signs are often requested on residential streets. These signs tend to create a false sense of security for parents and children who believe the signs provide an added degree of protection from motorists. If signs encourage parents with children to believe they have an added degree of protection, which the signs do not and can not provide, a great disservice results. Children should not be encouraged to play within the roadway. Although these signs used to be common on public streets, they are no longer approved by the State of California or the Federal Highway Administration as official traffic control devices.

Lowering of the speed limit is often requested by citizens in an effort to slow traffic. Before and after studies have shown that there is no significant change in prevailing speeds when the speed limit is changed. Drivers will continue to travel at speeds they feel are safe and prudent despite the posted limit. The posting of the appropriate speed limit simplifies the job of law enforcement officers, since most of the traffic is voluntarily moving at the posted speed. Blatant speeders are easily spotted, safe drivers are not penalized, and patrol officers aren't asked to enforce unrealistic and arbitrary speed limits.

Providing Access to Sidewalk Facilities for all Users

Title II regulations under the Americans with Disabilities act (ADA) require communities to apply specific access design standards when constructing or altering pedestrian facilities. The act calls for curb ramps to be provided wherever an accessible route crosses a curb and detectable warning systems to alert udders of the boundary between the sidewalk and the street.

Curb ramps. The majorities of intersections along Florence Street are at grade and will not require ADA ramps. However, there are potential grade conflicts along the pedestrian path at the exiting southwest corner of the intersection of Salinas with Florence Street. Accordingly it is recommended that the existing curb return be upgraded to comply with ADA requirements.

The proposed sidewalk does not meet all of the County Standards provided in Drawing C-5. As there will be no curb and gutter associated with this project, the project won't comply with County Standard Drawing C-2. The project will comply with the following curb ramp criteria:

Max slope of curb ramps	8.33%
Maximum Cross-slope of Curb Ramps	2 %
Maximum Slope of Flared Sides	10 %
Minimum Ramp Width	3 ft
Minimum Landing Length	3 ft

Detectable warning systems. Per FHWA Memorandum of May 6, 2002, "Detectable warnings are an Americans with Disabilities Act (ADA) requirement in the current Americans with Disabilities Act Accessibility Guidelines (ADAAG) for the use of detecting the boundary between the sidewalk and the street....and are required when constructing and altering curb ramps." Since 2001, detectable warning systems are also required at flush intersections.

This alert system consists of a surface distinguishable underfoot and by cane and has contrasting color to reduce the likelihood of visually impaired individuals inadvertently entering the street.

Truncated warning domes typically fall into one of three categories: inset, glued, or stamped, depending in part on whether the project involves new construction or a retrofit. Inset products are those that are pressed into fresh concrete or recessed into the cutout portion of an existing sidewalk. Glued-on products are those that involve applying flexible mats of domes onto an existing sidewalk using an adhesive while stamped concrete systems involve imparting the dome texture on a fresh concrete surface using stamping tools.

Because porous concrete lacks the fines that are included in tradition sidewalk concrete, the surface is rougher than impervious concrete. Some communities require that the ADA ramp be made of non-porous concrete while other accepts truncated domes that are applied on porous concrete through adhesives.

There are several adhesive truncated dome manufactures that indicate that their product is acceptable for porous surfaces and compliant with Americans with Disabilities Act, Accessibility Guidelines (ADAAG), and California State Accessibility Standards (CSAS).

Removal of all Fixed Objects within the ROW
County Standard 4.1.7A specifies that a 10-foot clear zone, measured from the outside edge of the traveled way be maintained.

An arborist completed a site analysis of the trees within the ROW along Florence Street. There were four distinct tree areas. One tree is recommended for removal. None of the other trees evaluated appeared diseased, near the end of the life or problematic enough to warrant their removal.

A summary of his specific observations is provided below:

- The plum located at Station 2+53.09, Right, appears to be struggling. This species of tree is not amendable to pruning its lower branches and will be an obstacle on the sidewalk. It is recommended that this tree be removed.

- The grouping of assorted trees on the west side of Florence Street and in front of APN No. 041-065-018 (Station 5+50 to 6+50, Rt) essentially define the house they front. The grouping consists of a Giant Sequoia, a couple of Incense Cedars and a few Coast Redwoods. They are in fair to good health. Removing these trees would drastically change the character of the house.

- There are two Hackberries present in front of APN 041-103-009 (Station 7+50 to 8+00, Lt). These trees are traditional street trees and are in fair to good health.

- Two healthy Siberian Elms are present between Stations 9+00 and 9+50, Lt. While these trees are not in of themselves considered high value, they are the dominant trees on the street due to their stature. Additionally these trees have a historical significance in the region. Removal of these trees would negatively impact the character of the street.

To preserve as many trees as possible (as well as other items in the ROW such as fences), the road alignment was analyzed. Following the San Luis Obispo County Department of Public Works standards, an alignment was created that avoided the trees and fences within the ROW and provided a smooth path for motor vehicles. The typical curve radius used in the alignment is 4000 feet which exceeds the minimum curve radius of 1100 feet in Standard Drawing A-2 for an urban street.

Adhering to all Stopping and Sight Distance Requirements
Shrubbery chosen for native plant garden and parking areas adheres to the Counties sight and stopping criteria. Additionally, driveways that extend into the ROW will be upgraded to comply with the rural driveway geometry specified in County Standard B-1a. However, the structural section will be composed of porous concrete instead of asphalt concrete.

Adequate Traffic Control during the Course of Construction.
The work is proposed to take place during the summer of 2007.

During construction, through traffic will be re-routed to Eddy Street. Notification to emergency responders, school officials and residents will be provided in advance of the work. Parking restrictions associated with the work area will be posted 5-days in advance.

At the end of each shift the Contractor shall backfill and drop offs greater than 3-inches, with native material placed against the excavation at a slope no steeper than 4:1 (H:V). Delineators acceptable for night work will be placed along the edge of the work zone in accordance with MUTCD standards.

Contractor limited to opening up one half street at a time.

Neighbors will be notified 5-days in advance prior to the construction of porous concrete sidewalks or driveways in front of their properties. An accelerator will be used to reduce concrete curing time to 7 days.

The Contractor will be required to maintain two 10-foot traffic lanes (one in each direction) during the school commute times (7:30 to 9:00 am and 2:00 pm to 6 pm).

OTHER ISSUES / REMAINING OPPORTUNITIES

This section expands upon the issues, concerns and opportunities previously raised in the body of the report.

Conflicts with Applicable Standards

C-2	No curb and gutter
C-5	Porous Concrete
D-5	No Concrete Ribbon Gutters
A-1h	Reduced Travel Way Width from Rural Road
H-2	County Standard drawing Nomograph does not encourage disconnection

Conflicts with Applicable Specifications

5.1.1.B	Use of Rational Method for peak flow calculations
5.2.1 B1	Spread encroachment not to exceed half the outside through lane width
5.2.2 I	Primary Storm Freeboard not equal to 20% of maximum storage depth

Water Quality

WQ Design Storm

There were no known sources of hourly rainfall and intensity rainfall data rates for the project area. Therefore it was difficult to determine the volume based criteria on either the SWQTF or ASCE methods or the flow based criteria using the CASQA method. It is recommended that the County develop and publish hourly rainfall and intensity rainfall data rates for each region in the County.

Parking infiltration areas/Native Garden Vegetation

The plants associated with the bioswale and native gardens features of the project were selected in part because they are drought tolerant. These plants must survive to be able to provide water quality benefits. Without irrigation, these plants are likely to struggle until established and during long, dry periods thereafter. It is recommended that supplemental irrigation be provided during plant establishment (through water truck spraying for example) and that a campaign to promote the care and watering of these plants be championed with the neighbors benefiting from them.

Treatment Train

To further reduce the amount of runoff, better conserve water as a resource, as provide as much water quality benefit as possible, neighbors could be encouraged to install rain gardens. These items help to detain as much of their property water as possible on site. They also assist in the replenishment of the groundwater table.

Excavation Limits

To keep the trees healthy, it is recommended that excavation around the roots be restricted to at least six feet from the outer edge of their trunks along the top 18-inches (the critical root zone) under the drip line, minimally, or to 1.5 times the distance from the trunk to the drip line, ideally.

Obstacles

Mailbox relocation

Mailboxes currently are grouped at two locations. These existing locations are off of the road and provide ample space to park to deliver and pick up mail. The new locations are adjacent to designated parking areas but access may be limited if others park in the adjacent parking area.

Trees and stumps

Trees adjacent to the proposed sidewalk that have low lying branches but that were not conducive to pruning were specified for removal. The lower branches could impede progress and create a hazardous situation for visually impaired individuals.

The roots systems of the trees within originally proposed excavation areas were evaluated on a case by case basis. Planned excavation areas were eliminated (reducing site storage capacity) at locations where trees had critical shallow roots that could not be pruned. At other locations, the special provisions will require an arborist be on-site to prune conflicting roots.

A stump within the right of way was specified for removal to allow more area for infiltration. The stump was already cut low to the ground and did not provide log habitat.

Maintenance

Utilities

The concrete surfacing of the parking areas will have to be removed and replaced to access sub surface utilities. To remove the concrete layer of a latticed surface, the lattice will need to be saw cut while individual tiled areas can be removed as units.

Best Management Practices

The maintenance requirements are necessary to ensure that the best management practices specified is functioning as designed.

- Porous concrete
  Annually, porous concrete surface should be vacuum-swept and then hosed down with a high pressure hose to keep pores free of sediment.
- Permeable Pavements
  - Inspect semi-annually or after extreme weather events to ensure water infiltrates into the surface. Remove and replace clogged infiltration gravels as necessary.
  - Check for surface erosion.
  - Verify grass is surviving. Seed bare areas as necessary.
  - Inspect at least once a decade the infiltration capabilities of the sub surface gravel storage bed and replaced as needed.
  - Removed silts and trash as accumulated.

Construction

Traffic Control

During construction, one way traffic control will be required. Due to the extent of excavation required, it is unlikely that the contractor will be able to excavate and complete appropriate backfill materials in a single shift. The contractor will have to protect the excavation areas upon completion of the shift. Pervious parking surfacing that is formed and poured on site will require concrete curing time. During the concrete curing time, no traffic will be allowed to use that surface. The designs will limit the use of poured concrete products to areas where side street access is readily accessible. Additionally, the design team will explore the potential to use a concrete accelerator in the porous concrete used for the bike paths.

Proximity of fences, signs & pavement to excavation area

The excavation depth adjacent to structures such as fences, signs and pavements in the sandy soil may undermine these structures during construction. Allowing for the angle of repose for the soil, greatly reduces the available stormwater storage volume.

Parking

The entire stretch of Florence Street between Los Tablas Road and Salinas Avenue was previously available for parking. Upon completion of the project, the same stretch of road will have 29 parking opportunities. The remainder of the locations will be used as native garden areas. Parking spots were sized in accordance to County Standards.

Sub grade Compaction

Literature searches are conflicting on the issue of porous concrete sub grade compaction. It is proposed that a stretch of the porous concrete bike path and sidewalk be compacted while another stretch of porous concrete bike path and sidewalk not be compacted. The performance (both structurally and in terms of infiltration rate capabilities) of each stretch of porous concrete bike path and sidewalk could later be compared for future "lessons learned" on the project.

Presence of Utilities

Numerous underground utilities area present within the project limits including natural gas, telephone, cable, water and sewer. The final plans will need to be approved by each of these companies. The project proposes to utilize subsurface recharge beds to retain smaller storms. These recharge beds are wrapped in fabric and consists of clean rock. While they will extend beyond the depth of the utilities, they are not in of themselves in conflict with the utilities. None the less, it will be important to protect the utilities will constructing the project.

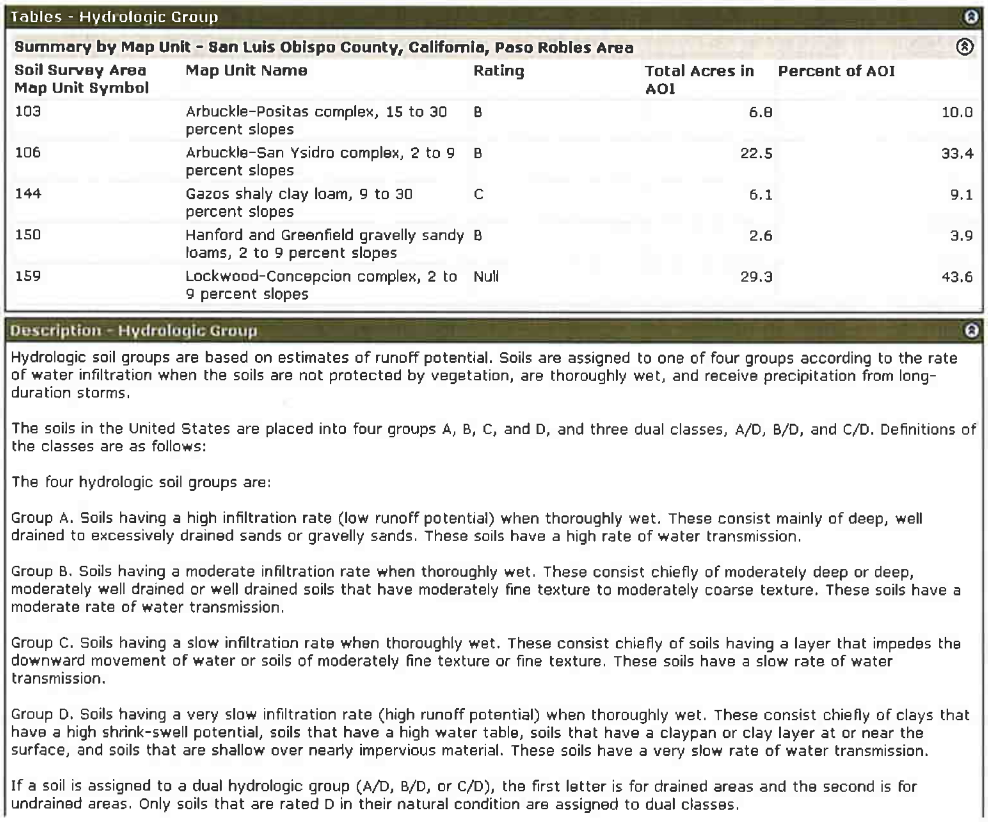
Schedule

In order to build this project prior the winter of 2007, this project must be designed and provided to the County for 90% Review by April 23, 2007 and ready to advertise by May 21, 2007. Construction should be completed prior to the on-set of 2007 rainy season.

CONCLUSION

The LID approaches recommended in this report do not restore the hydrologic functions of the post-developed site to its pre-developed condition. However, they do capture the first 0.94-inches of each independent storm that reaches the native gardens or parking infiltration areas, as well as the majority of nuisance flows. These flows will be collected, treated and infiltrated into the ground water table as a result of this project.

APPENDIX A



Tables - Hydrologic Group

Summary by Map Unit - San Luis Obispo County, California, Paso Robles Area

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Total Acres in AOI	Percent of AOI
103	Arbuckle-Positas complex, 15 to 30 percent slopes	B	6.8	10.0
106	Arbuckle-San Ysidro complex, 2 to 9 percent slopes	B	22.5	33.4
144	Gazos shaly clay loam, 9 to 30 percent slopes	C	6.1	9.1
150	Hanford and Greenfield gravelly sandy loams, 2 to 9 percent slopes	B	2.6	3.9
159	Lockwood-Concepcion complex, 2 to 9 percent slopes	Null	29.3	43.6

Description - Hydrologic Group

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

The soils in the United States are placed into four groups A, B, C, and D, and three dual classes, A/D, B/D, and C/D. Definitions of the classes are as follows:

The four hydrologic soil groups are:

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

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

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

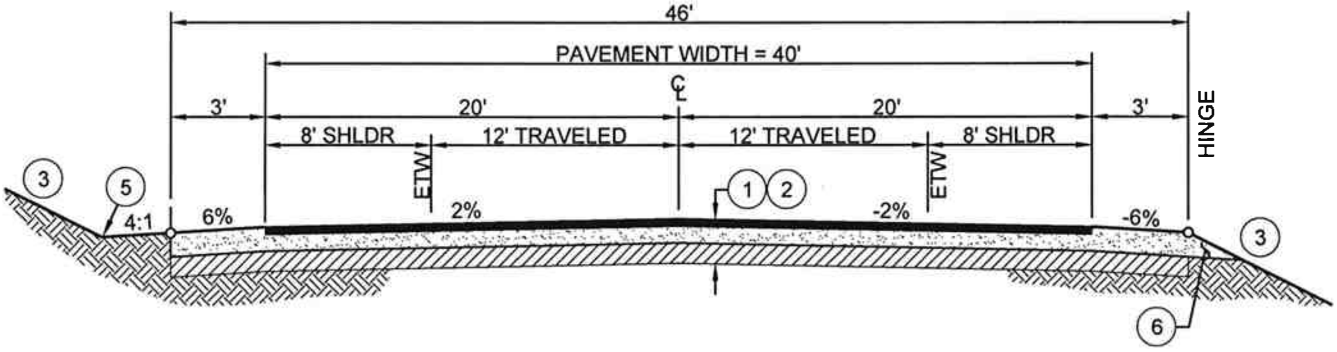
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over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

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

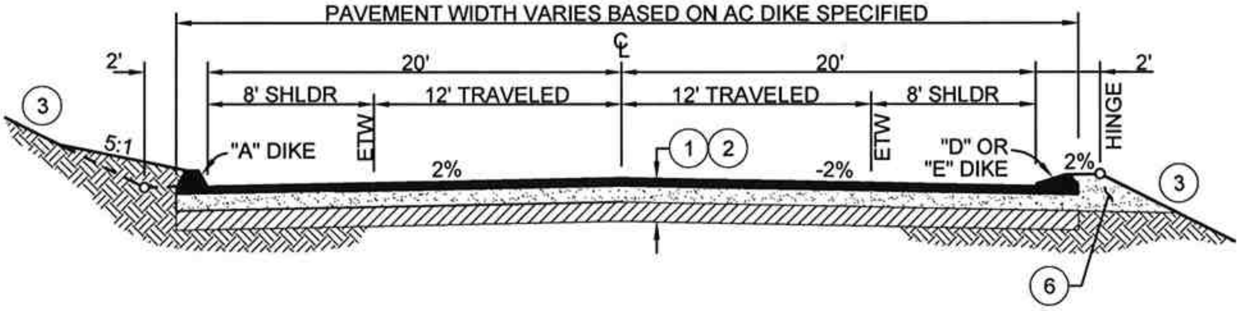
APPENDIX B

Revisions

Description	Approved	Date	Description	Approved	Date



I: WHERE AC DIKE IS NOT REQUIRED



II: WHERE AC DIKE IS REQUIRED ④

NOTES:

1. THE STRUCTURAL ROAD SECTION SHALL BE DETERMINED AT THE TIME OF CONSTRUCTION BASED ON THE SUBGRADE R-VALUE AND THE TRAFFIC INDEX (TI) AS PROVIDED BY THE DEPARTMENT, AND IN NO CASE SHALL THE ZONE OF COMPACTION BE LESS THAN 2.5-FEET IN THICKNESS. THE ROAD SECTION SHALL BE APPROVED BY THE DEPARTMENT PRIOR TO CONSTRUCTION.
2. TYPICAL SECTION SHALL BE:
   - ■ ASPHALT CONCRETE PER THE DESIGN STANDARDS TO 95% RELATIVE COMPACTION, OVER
   - ░ CLASS II AGGREGATE BASE TO 95% RELATIVE COMPACTION, OVER
   - ▨ 12" MINIMUM SUBGRADE TO 95% RELATIVE COMPACTION
3. CUT AND FILL SLOPES SHALL NOT EXCEED 2 HORIZONTAL:1 VERTICAL (OR 3h:1v IN NATIVE SAND) WITHOUT PRIOR APPROVAL BY THE DEPARTMENT.
4. ASPHALT DIKE SHALL BE REQUIRED BY THE DEPARTMENT WHERE NEEDED TO CONTROL DRAINAGE OR EROSION AND ON LONGITUDINAL GRADES OF 3% OR GREATER. TYPE "A" DIKE SHALL BE USED WHEN THE ROADWAY IS BELOW EXISTING OR FINISHED SURFACE. TYPE "D" OR "E" DIKE SHALL BE REQUIRED IN CONDITIONS WHERE THE ROADWAY IS ABOVE OR LEVEL WITH EXISTING OR FINISHED SURFACE.
5. THE PROJECT ENGINEER SHALL ACCOMMODATE FOR ROADSIDE DRAINAGE SUCH THAT IT DOES NOT ERODE THE AGGREGATE SHOULDER. THE SIDE SLOPE OF ANY DRAINAGE SWALE DIRECTLY ADJACENT TO THE EDGE OF ROADWAY SHALL NOT EXCEED 4h:1v. DESIGN AND CONSTRUCTION SHALL BE TO THE SATISFACTION OF THE DEPARTMENT.
6. THE AGGREGATE BASE MATERIAL SHALL EXTEND TO THE EDGE OF THE FILL SLOPE (CHOKER) TO ALLOW FOR STRUCTURAL ROAD SECTION DRAINAGE.
7. A STRIPING AND SIGNAGE PLAN SHALL BE REQUIRED BY THE DEPARTMENT WHEN BIKE LANES, NO PARKING ZONES, SIGNAGE, AND PAVEMENT MARKINGS ARE A REQUIRED COMPONENT OF THE IMPROVEMENTS.

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS

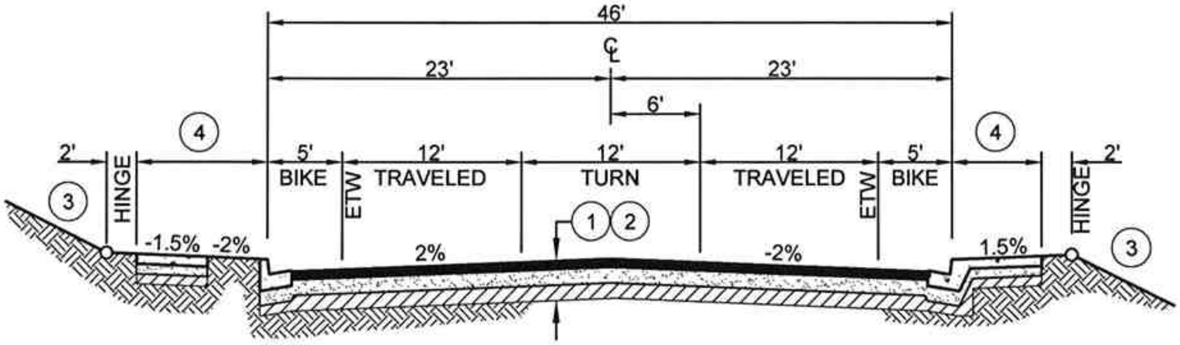
TYPICAL RURAL ROAD SECTION

3001 TO 6000 FUTURE ADT

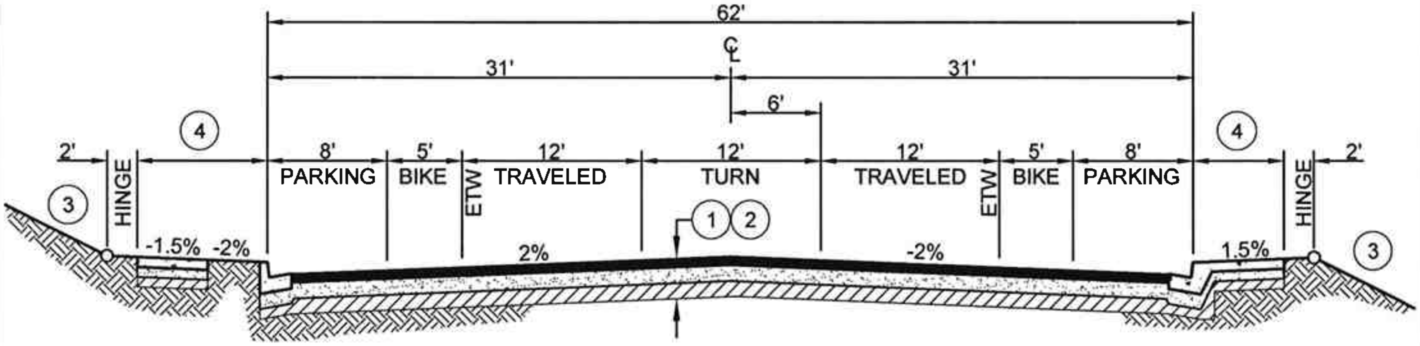
Scale: NTS
Issued: Aug. 2006
Drawing No: A-1h
Sheet No: 1 OF 1

Revisions

Description	Approved	Date	Description	Approved	Date



I: 5001 TO 16000 FUTURE ADT WITHOUT PARKING



II: 5001 TO 16000 FUTURE ADT WITH PARKING

NOTES:

1. THE STRUCTURAL ROAD SECTION SHALL BE DETERMINED AT THE TIME OF CONSTRUCTION BASED ON THE SUBGRADE R-VALUE AND THE TRAFFIC INDEX (TI) AS PROVIDED BY THE DEPARTMENT, AND IN NO CASE SHALL THE ZONE OF COMPACTION BE LESS THAN 2.5-FEET IN THICKNESS. THE ROAD SECTION SHALL BE APPROVED BY THE DEPARTMENT PRIOR TO CONSTRUCTION.
2. TYPICAL SECTION SHALL BE:
   - ■ ASPHALT CONCRETE PER THE DESIGN STANDARDS TO 95% RELATIVE COMPACTION, OVER
   - ░ CLASS II AGGREGATE BASE TO 95% RELATIVE COMPACTION, OVER
   - ▨ 12" MINIMUM SUBGRADE TO 95% RELATIVE COMPACTION

   SUBGRADE AND AGGREGATE BASE COMPACTION REQUIREMENTS SHALL EXTEND TO THE BACK OF CURB OR TO THE BACK OF ATTACHED SIDEWALK (WHICHEVER CONDITION IS APPLICABLE).
3. CUT AND FILL SLOPES SHALL NOT EXCEED 2 HORIZONTAL:1 VERTICAL (OR 3h:1v IN NATIVE SAND) WITHOUT PRIOR APPROVAL BY THE DEPARTMENT.
4. ATTACHED OR DETACHED SIDEWALK TYPE AND WIDTH PER STANDARD DRAWING C-4 OR AS REQUIRED BY THE PROJECT CONDITIONS OF APPROVAL OR AREA SPECIFIC PLAN.
5. OTHER FACILITIES SUCH AS LANDSCAPING, TRANSIT STOP FACILITIES, PEDESTRIAN, EQUESTRIAN, AND BICYCLE FACILITIES MAY BE REQUIRED BY THE DESIGN STANDARDS.
6. LANDSCAPE, IRRIGATION, AND MAINTENANCE OF MEDIANS AND PARKWAYS SHALL BE ADDRESSED IN THE APPROVED PROJECT PLANS. A LOCAL FUNDING SOURCE MUST BE IDENTIFIED.
7. WHERE APPLICABLE, ALL IMPROVEMENTS SHALL BE CONSISTENT WITH THE RESPECTIVE COMMUNITY DESIGN PLAN AS ADOPTED BY THE BOARD OF SUPERVISORS.
8. A STRIPING AND SIGNAGE PLAN SHALL BE REQUIRED BY THE DEPARTMENT WHEN BIKE LANES, NO PARKING ZONES, SIGNAGE, AND PAVEMENT MARKINGS ARE A REQUIRED COMPONENT OF THE IMPROVEMENTS.

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS
TYPICAL URBAN STREET SECTION
5,001 to 16,000 FUTURE ADT WITHOUT PARKING
5,001 TO 16,000 FUTURE ADT WITH PARKING

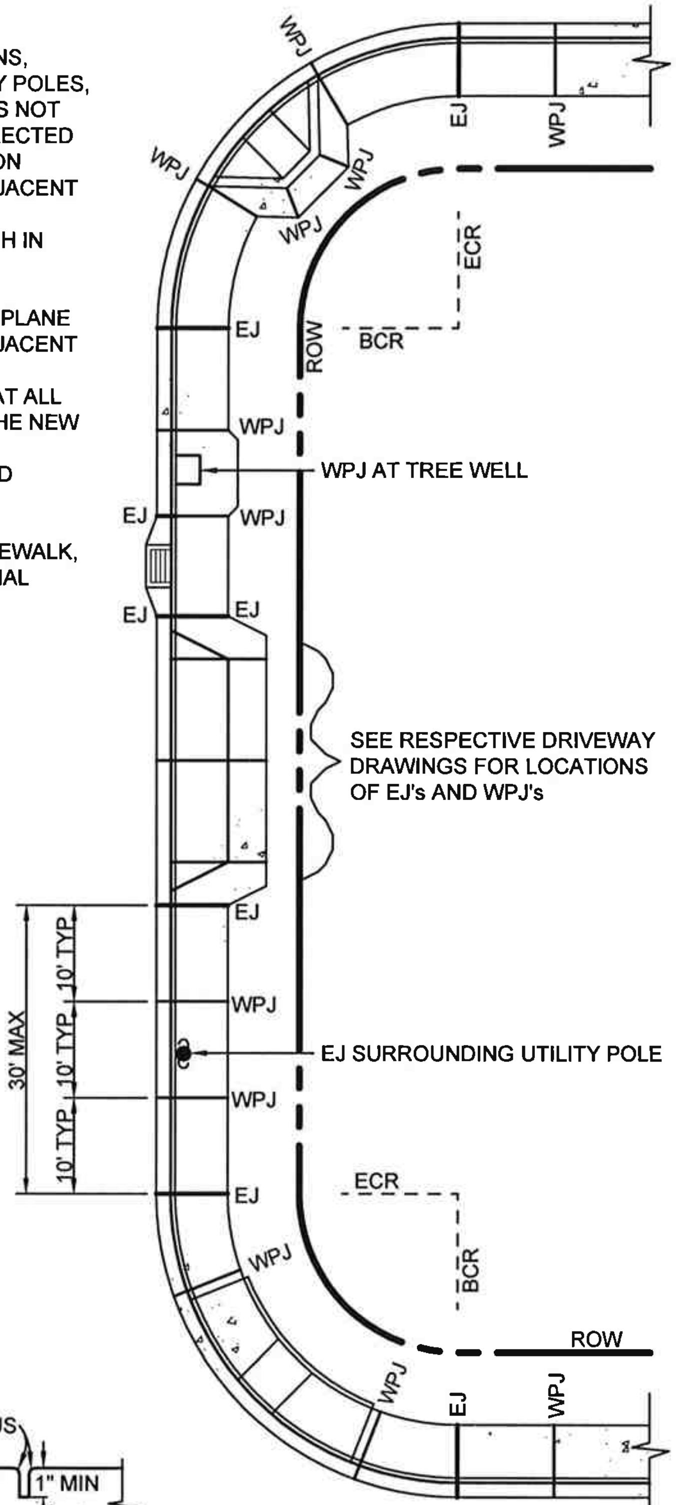
Scale: NTS	Issued: Aug. 2006
Drawing No: A-2d	
Sheet No: 1 OF 1	

Revisions

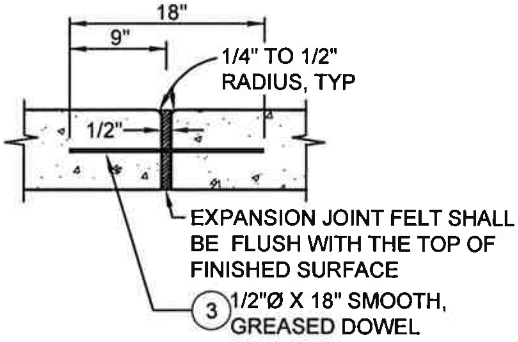
Description	Approved	Date	Description	Approved	Date

NOTES:

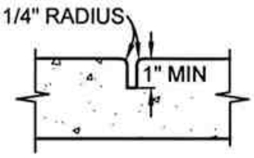
1. EXPANSION JOINTS (EJ) SHALL BE PLACED AT CURB RETURNS, DRIVEWAYS, STORM DRAIN CATCH BASINS, AROUND UTILITY POLES, AT LONGITUDINAL CURB GUTTER AND SIDEWALK INTERVALS NOT TO EXCEED 30-FEET, AND AT ALL OTHER LOCATIONS AS DIRECTED BY THE DEPARTMENT. THE INTERVALS BETWEEN EXPANSION JOINTS SHALL VARY TO ALLOW MATCHING OF JOINTS IN ADJACENT EXISTING IMPROVEMENTS AS APPLICABLE.
2. WEAKENED PLANE JOINTS (WPJ) SHALL BE A MINIMUM 1-INCH IN DEPTH AND PLACED AT LONGITUDINAL CURB GUTTER AND SIDEWALK INTERVALS NOT EXCEEDING 10-FEET BETWEEN EXPANSION JOINTS. THE INTERVALS BETWEEN WEAKENED PLANE JOINTS SHALL VARY TO ALLOW MATCHING OF JOINTS IN ADJACENT EXISTING IMPROVEMENTS AS APPLICABLE.
3. 1/2"Ø x 18" SMOOTH, GREASED DOWELS SHALL BE PLACED AT ALL EXPANSION JOINTS, ONE IN THE NEW CURB FACE, ONE IN THE NEW GUTTER, AND AT 18-INCHES ON CENTER IN NEW SIDEWALK.
4. WHEN PLACED IN SIDEWALKS, BOTH EXPANSION JOINTS AND WEAKENED PLANE JOINTS SHALL EXTEND THROUGH THE ADJACENT CURB AND GUTTER.
5. REFER TO RESPECTIVE IMPROVEMENT (CURB, GUTTER, SIDEWALK, RAMP, DRIVEWAY, ETC) STANDARD DRAWING FOR ADDITIONAL CONSTRUCTION INFORMATION.



REFER TO DRAWING R-3 FOR
REPAIR OF EXISTING SIDEWALKS



EXPANSION JOINT ①



WEAKENED PLANE JOINT ②

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS

EXPANSION & WEAKENED PLANE JOINT REQUIREMENTS

Scale: NTS

Issued: Aug. 2006

Drawing No: C-1

Sheet No: 1 OF 1

Revisions

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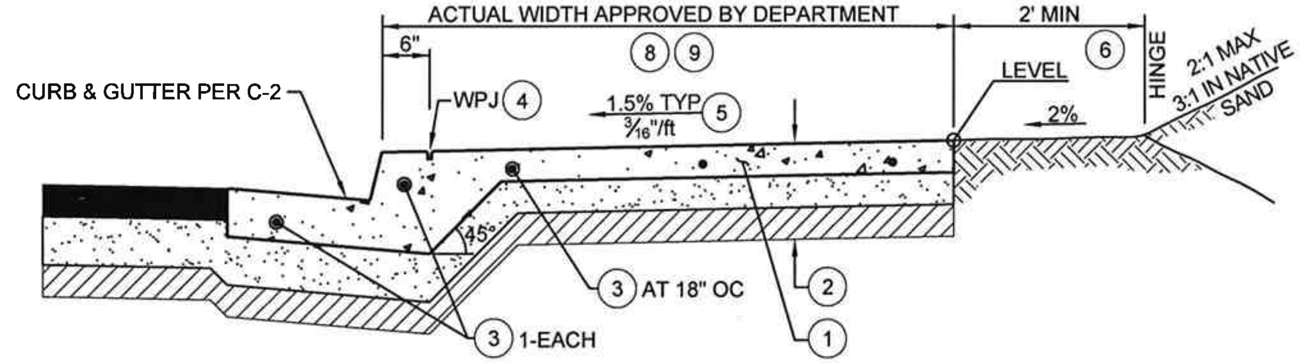
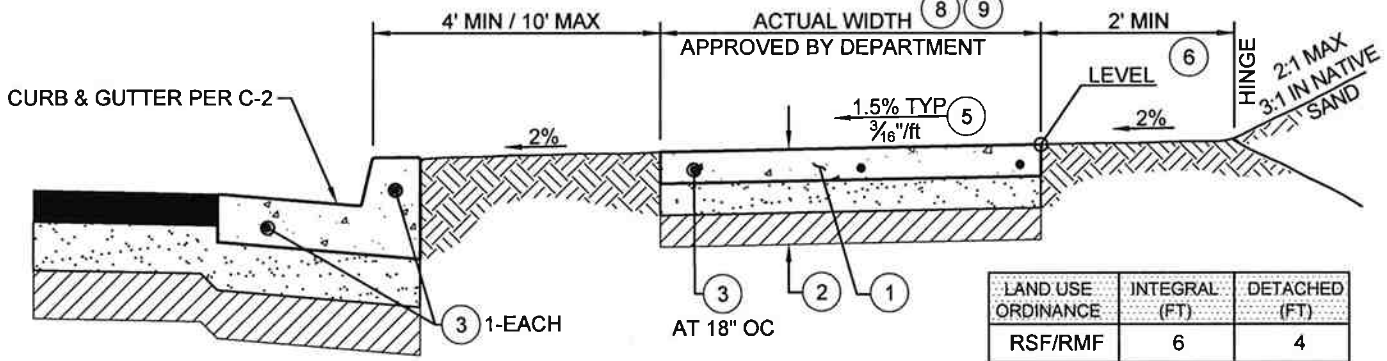


INTEGRAL SIDEWALK (MONOLITHIC)

(SEE OPTIONAL JOINT DETAIL)



DETACHED OR MEANDERING SIDEWALK

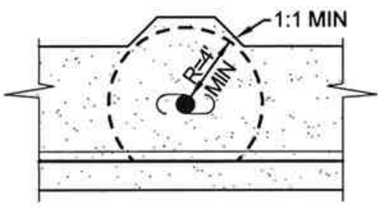
LAND USE ORDINANCE	INTEGRAL (FT)	DETACHED (FT)
RSF/RMF	6	4
CR	10	6
CS	6	4
OP	8	4
IND	6	4

SIDEWALK WIDTH TABLE

NOTES:

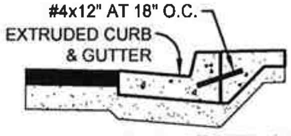
1. CONCRETE SIDEWALK SHALL BE PORTLAND CEMENT CONCRETE CONFORMING TO THE DESIGN STANDARDS. CONCRETE CURING SHALL BE BY PIGMENTED CURING COMPOUND METHOD USING WHITE PIGMENT TYPE.
2. TYPICAL SECTION SHALL BE:
   - ▒ 4-INCH MIN PCC (6-INCH OR 8-INCH WHEN WITHIN A DRIVEWAY), OVER
   - ░ 4-INCH MIN CLASS II AGGREGATE BASE TO 95% RELATIVE COMPACTION, OVER
   - ▨ 12-INCH MIN SUBGRADE TO 95% RELATIVE COMPACTION

   IF THE R-VALUE OF THE NATIVE MATERIAL IS 55 OR GREATER THEN THE 4-INCH OF AGGREGATE BASE MAY BE SUBSTITUTED WITH COMPACTED NATIVE MATERIAL.
3. EXPANSION JOINTS (EJ) SHALL BE CONSTRUCTED AT LONGITUDINAL INTERVALS NOT EXCEEDING 30-FEET. 1/2"Ø x 18" SMOOTH, GREASED DOWELS SHALL BE PLACED IN THE EJ, ONE IN CURB FACE, ONE IN GUTTER, AND AT 18-INCHES ON CENTER IN SIDEWALKS PER STANDARD DRAWING C-1.
4. WEAKENED PLANE JOINTS (WPJ) SHALL BE CONSTRUCTED BETWEEN EXPANSION JOINTS AT LONGITUDINAL INTERVALS NOT EXCEEDING 10-FEET, AND AT 6-INCHES BEHIND THE CURB FACE FOR ATTACHED SIDEWALKS PER STANDARD DRAWING C-1.
5. THE CROSS SLOPE OF THE SIDEWALK SHALL NOT EXCEED 2% (1/4-INCH PER 12-INCHES), 1.5% (3/16-INCH PER 12-INCHES) IS RECOMMENDED.
6. THE 2-FOOT BENCH IS NOT REQUIRED FOR ADJOINING SLOPES OF 5h:1v OR FLATTER.
7. ALTHOUGH THE PROJECT CONDITIONS OF APPROVAL OR THE AREA SPECIFIC PLAN MAY REQUIRE AN ALTERNATIVE SIDEWALK CONFIGURATION, THE CONSTRUCTION SPECIFICATIONS OF THIS STANDARD SHALL APPLY.
8. THE SIDEWALK SHALL BE WIDENED WHERE REQUIRED TO ALLOW FOR A 4-FOOT CLEAR PASSAGE AROUND ALL ABOVE GRADE OBSTACLES LOCATED WITHIN THE SIDEWALK.
9. WATER PURVEYOR METER BOXES ARE ALLOWED WITHIN THE SIDEWALK PROVIDED THAT ALL LIDS AND LIDS WITH A.M.R. SYSTEMS ARE SET FLUSH WITH THE SIDEWALK.
10. ALL UTILITY VAULTS AND LIDS MUST BE LOCATED OUTSIDE OF THE SIDEWALK OR HAVE PRIOR DEPARTMENT APPROVAL FOR LOCATION WITHIN THE SIDEWALK. UTILITY LIDS WITHIN THE SIDEWALK SHALL HAVE A NON-SLIP SURFACE.



SIDEWALK SHALL BE WIDENED BEHIND ALL ABOVE GRADE OBSTACLES TO PROVIDE A 4-FEET MINIMUM CLEARANCE.

⑧ SIDEWALK WIDENING DETAIL



WHEN EXTRUDED CURB & GUTTER IS USED EXTRUDING MACHINE MUST BE CAPABLE OF PLACING A DENSE GRADE OF CONCRETE. SIDEWALK PORTION MUST BE PLACE WITHIN 1 HOUR OF EXTRUDED CURB & GUTTER UNLESS OPTIONAL JOINT IS USED.

OPTIONAL JOINT DETAIL

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS

SIDEWALKS

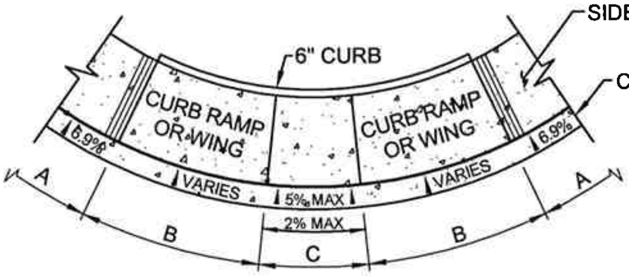
Scale: NTS	Issued: Aug. 2006
Drawing No: C-4	
Sheet No: 1 OF 1	

Revisions

Description	Approved	Date	Description	Approved	Date

CURB RAMP NOTES:

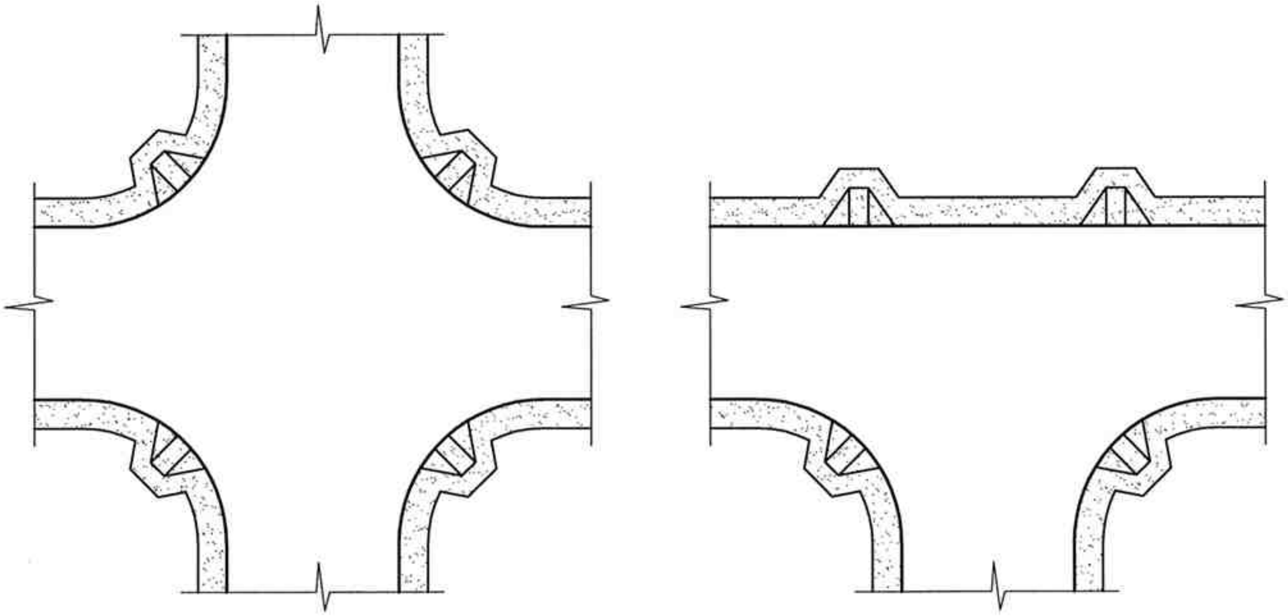
1. ALL CURB RAMPS FOR NEW CONSTRUCTION, RETROFIT, AND REPLACEMENT SHALL CONFORM TO THE LATEST DEPARTMENT ADOPTED STATE STANDARD PLANS. CONTACT THE DEPARTMENT FOR THE LATEST ADOPTED STANDARD.
2. NEW SIDEWALKS AND PATHS SHALL BE PROVIDED WITH CURB RAMPS AT ALL INTERSECTIONS.
3. MID-BLOCK CURB RAMPS ARE DISCOURAGED AND SHALL REQUIRE PRIOR DEPARTMENT APPROVAL.
4. THE PROJECT ENGINEER SHALL DETAIL EACH CURB RAMP ON THE PLANS. MINIMUM DETAIL REQUIREMENTS SHALL INCLUDE DIMENSIONS, SLOPES, AND SPOT ELEVATIONS.
5. THE DEPARTMENT MAY GRANT EXCEPTIONS TO THESE STANDARDS ON AN INDIVIDUAL BASIS. THE DEPARTMENT ADA COORDINATOR SHALL REVIEW AND PROVIDE PRIOR APPROVAL OF ALL EXCEPTIONS.



NOTES:

A. GUTTER CROSS SLOPE = 1-1/4" IN 18" = 6.9%
B. GUTTER CROSS SLOPE TRANSITION ZONE (VARIES)
C. GUTTER CROSS SLOPE = 7/8" IN 18" = 4.9% (5% MAX)
LONGITUDINAL SLOPE = 2% MAX

TYPICAL GUTTER TRANSITION AT CURB RAMP



TYPICAL CURB RAMP PLACEMENT

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS

CURB RAMPS

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Issued: Aug. 2006

Drawing No: C-5

Sheet No: 1 OF 1

Revisions

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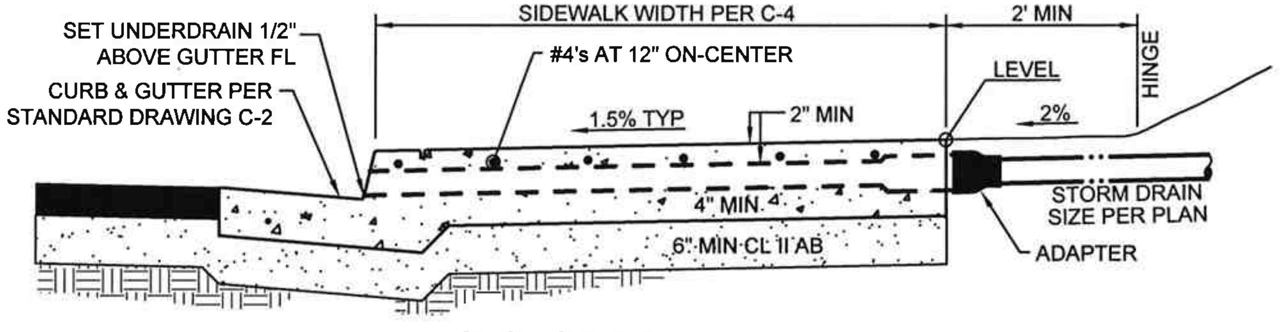
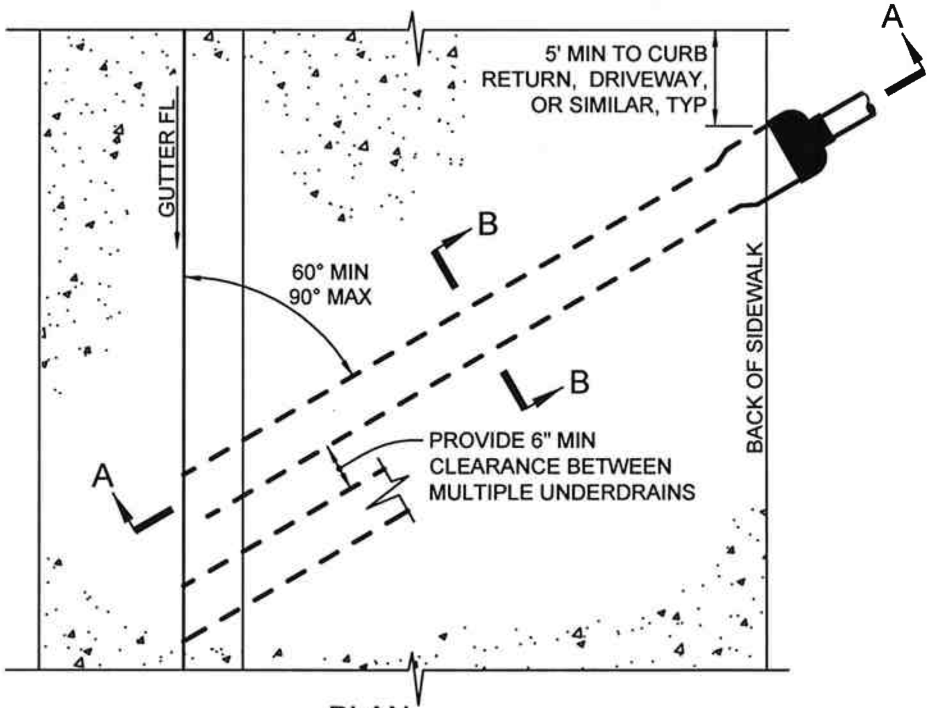


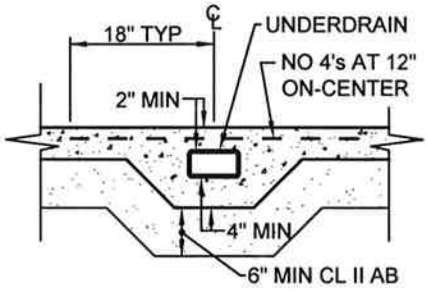
SECTION A-A
SHOWN AT 90°



PLAN

NOTES:

1. THE UNDERDRAIN SHALL BE A 3-INCH TALL BY 5-INCH WIDE (MINIMUM) RECTANGULAR CAST IRON CONDUIT, ALHAMBRA A-470 OR DEPARTMENT APPROVED EQUAL. THE DESIGN WIDTH SHALL BE DETERMINED BY THE PROJECT ENGINEER AND SHOWN ON THE PLANS.
2. THE UNDERDRAIN SHALL BE SET FLUSH WITH THE CURB FACE AND PLACED 1/2" ABOVE THE GUTTER FLOWLINE.
3. THE SLOPE OF THE UNDERDRAIN SHALL MATCH THE SIDEWALK CROSS SLOPE.
4. UNDERDRAIN SHALL NOT BE LOCATED CLOSER THAN 5-FEET TO A DRIVEWAY OR CURB RETURN.
5. MULTIPLE DRAINS SHALL HAVE 6-INCH MINIMUM CLEARANCE WITH MAXIMUM OF 3 DRAINS PER 10-FEET OF SIDEWALK.
6. REVERSE SIDEWALK UNDERDRAINS SHALL BE SET 1-INCH BELOW THE DESIGN GUTTER FLOWLINE, AND 3-FOOT GUTTER TRANSITIONS SHALL BE PROVIDED EITHER SIDE OF THE UNDERDRAIN. THE DESIGN ENGINEER SHALL DETAIL REVERSE UNDERDRAINS ON THE PLANS.



SECTION B-B

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS

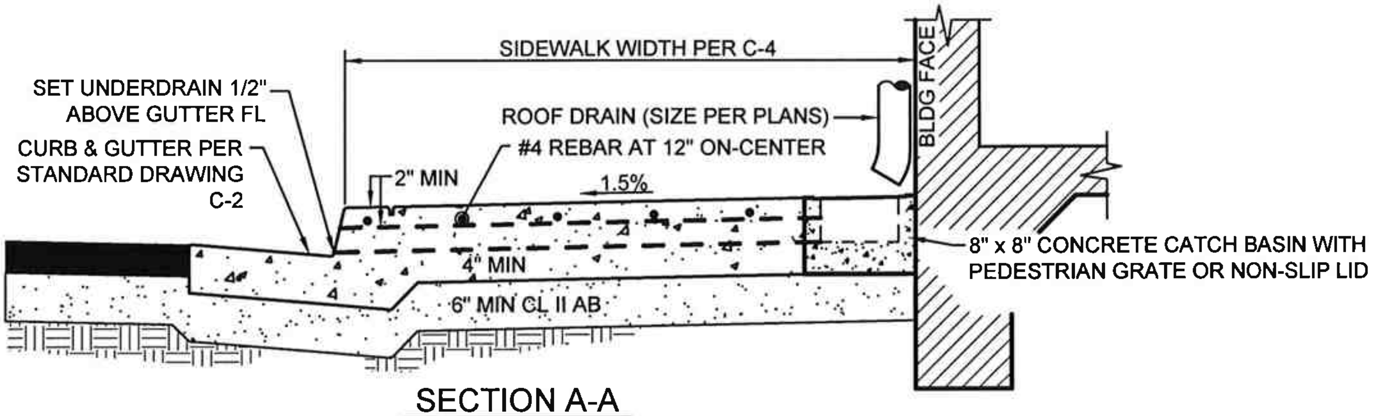
SIDEWALK UNDERDRAIN

RESIDENTIAL

Scale: NTS
Issued: Aug. 2006
Drawing No: D-4
Sheet No: 1 OF 1

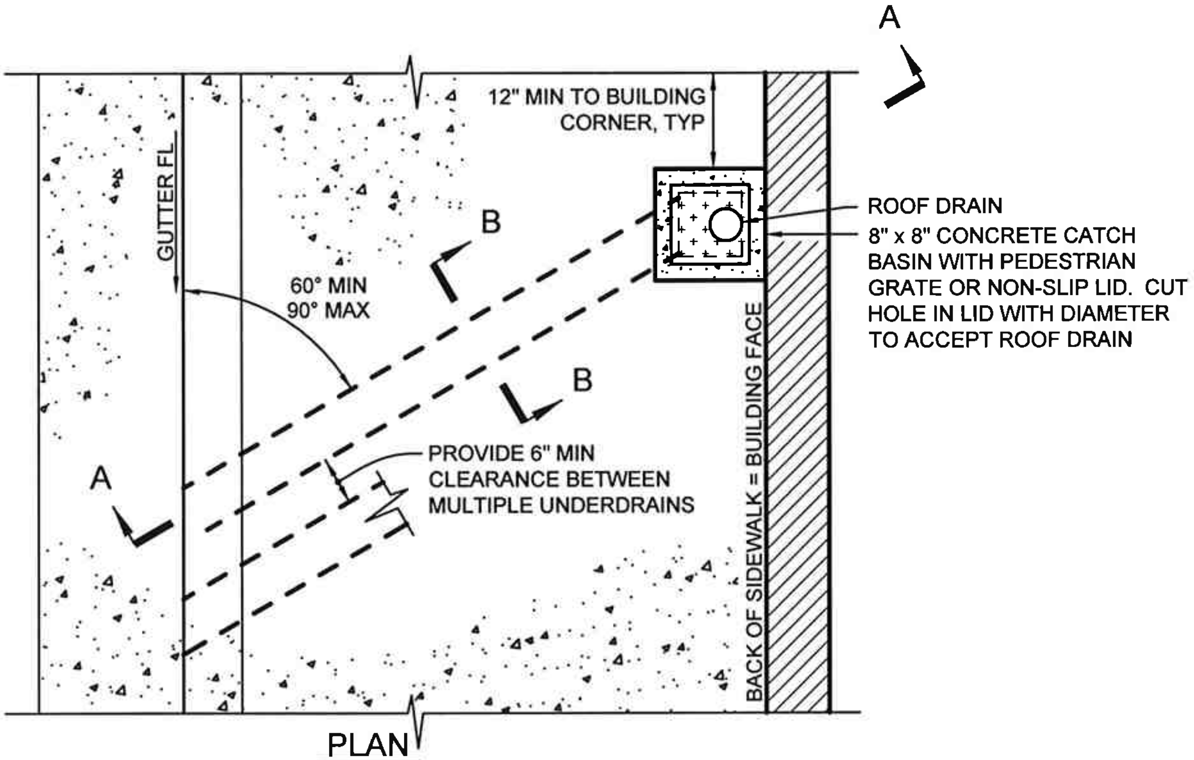
Revisions

Description	Approved	Date	Description	Approved	Date



SECTION A-A

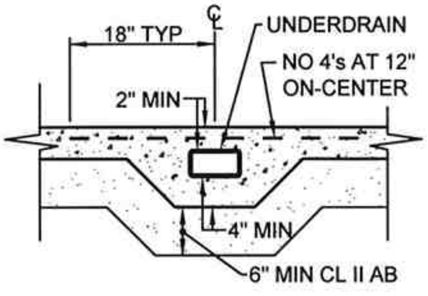
SHOWN AT 90°



PLAN

NOTES:

1. THE UNDERDRAIN SHALL BE A 3-INCH TALL BY 5-INCH WIDE (MINIMUM) RECTANGULAR CAST IRON CONDUIT, ALHAMBRA A-470 OR DEPARTMENT APPROVED EQUAL. THE DESIGN WIDTH SHALL BE DETERMINED BY THE PROJECT ENGINEER AND SHOWN ON THE PLANS.
2. THE UNDERDRAIN SHALL BE SET FLUSH WITH THE CURB FACE AND PLACED 1/2-INCH ABOVE THE GUTTER FLOWLINE.
3. THE SLOPE OF THE UNDERDRAIN SHALL MATCH THE SIDEWALK CROSS SLOPE.
4. UNDERDRAIN SHALL NOT BE LOCATED CLOSER THAN 5-FEET TO A DRIVEWAY OR CURB RETURN.
5. MULTIPLE DRAINS SHALL HAVE 6-INCH MINIMUM CLEARANCE WITH MAXIMUM OF 3 DRAINS PER 10-FEET OF SIDEWALK.
6. ALL JUNCTION BOXES SHALL HAVE A PEDESTRIAN RATED GRATE OR NON-SLIP LID AND BE APPROVED BY THE DEPARTMENT.



SECTION B-B

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS

SIDEWALK UNDERDRAIN

COMMERCIAL (ZERO SETBACK)

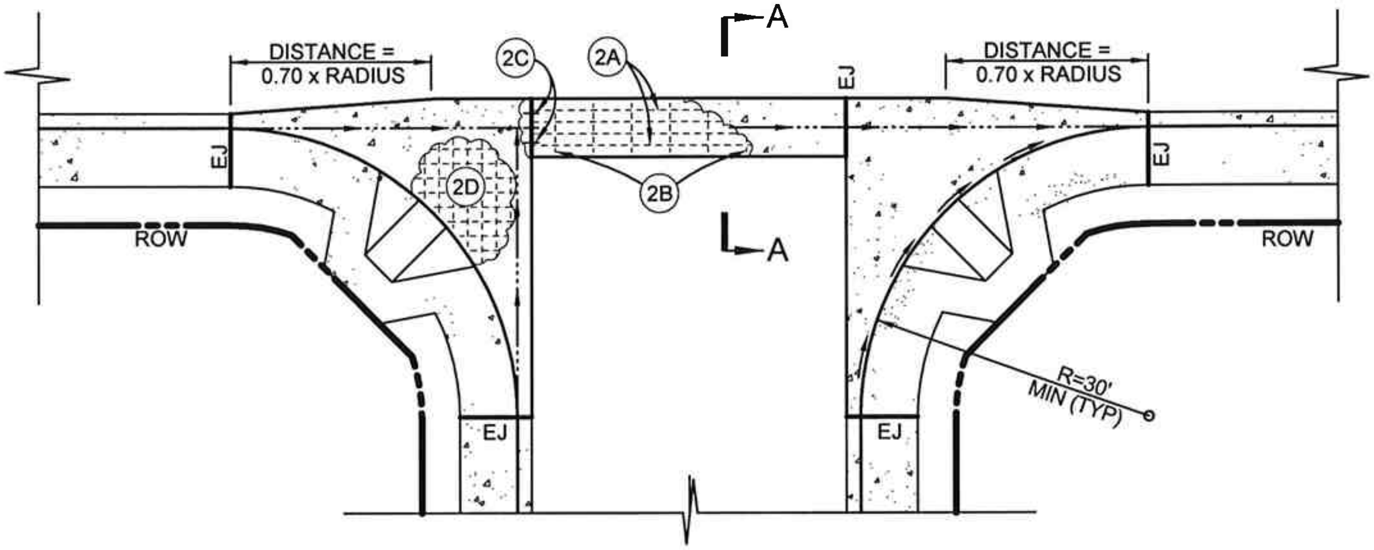
Scale:	Issued:
NTS	Aug. 2006

Drawing No: D-4a

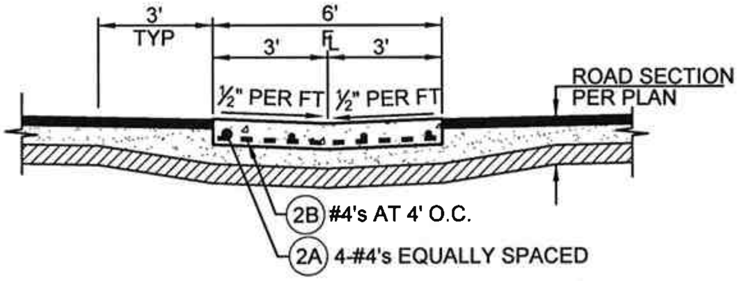
Sheet No: 1 OF 1

Revisions

Description	Approved	Date	Description	Approved	Date



PLAN VIEW



SECTION A-A

NOTES:

1. TYPICAL CROSS GUTTER & SPANDREL SECTION SHALL BE:
   - ▨ 8" MINIMUM PORTLAND CONCRETE CEMENT PER THE DESIGN STANDARDS, OVER
   - ▨ 6" MINIMUM CLASS II AGGREGATE BASE (OR MATCH ROAD SECTION) TO 95% RELATIVE COMPACTION, OVER
   - ▨ 12" MINIMUM SUBGRADE TO 95% RELATIVE COMPACTION
2. TYPICAL CROSS GUTTER & SPANDREL REINFORCEMENT SHALL BE:
   - 2A. (4) #4 REBAR CONTINUOUS & EQUALLY SPACED
   - 2B. #4 REBAR AT 4' ON CENTER
   - 2C. EXPANSION JOINT WITH (3) 1/2"Ø x 36" SMOOTH GREASED DOWELS (TYP BOTH SIDES)
   - 2D. #4 REBAR AT 18" ON CENTER ALL WAYS (3" CLEAR FROM ALL EDGES, TYPICAL)

   IN ALL CASES, DOBIES SET 2-INCHES ABOVE FINISHED AGGREGATE BASE SHALL BE USED TO SUPPORT REINFORCEMENT.
3. CONCRETE SHALL BE PORTLAND CEMENT CONCRETE CONFORMING TO THE DESIGN STANDARDS. CONCRETE CURING SHALL BE BY PIGMENTED CURING COMPOUND METHOD USING WHITE PIGMENT TYPE.
4. CURB RAMPS SHALL BE INSTALLED PER STANDARD DRAWING C-5.
5. UNDER NO CIRCUMSTANCES SHALL UTILITY LIDS AND CONCRETE COLLARS BE LOCATED WITHIN THE CROSS GUTTER OR SPANDREL.

SAN LUIS OBISPO COUNTY DEPARTMENT OF PUBLIC WORKS

CROSS GUTTER & SPANDREL

Scale: NTS
Issued: Aug. 2006
Drawing No: D-5
Sheet No: 1 OF 1

APPENDIX C

Earth Systems Pacific

4378 Santa Fe Road
San Luis Obispo, CA 93401-8116
(805) 544-3276 • FAX (805) 544-1786
E-mail: esc@earthsys.com

January 9, 2006

File No.: SL-15188-SA

Mr. Frank Honeycutt
San Luis Obispo County, Department of Public Works
County Government Center, Room 207
San Luis Obispo, CA 93408

PROJECT: FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
TEMPLETON, CALIFORNIA
WBS 300276.01

SUBJECT: Report of Exploratory Borings, Laboratory Testing and Percolation Test Results

REF:
1) Request for Proposal, Exploratory Borings and Percolation Testing, Florence Avenue Pedestrian Improvements, by Frank Honeycutt, County of San Luis Obispo, Department of Public Works, e-mail dated November 29, 2006
2) Drilling and Percolation Testing Work Scope and Cost Estimate, Revised for Traffic Control and Laboratory Testing, by Earth systems Pacific, dated December 13, 2006
3) Manual of Septic Tank Practice, U.S. Department of Health, Education and Welfare, Public Health Service, 1967

Dear Mr. Honeycutt:

As authorized, we have completed exploratory borings, laboratory testing and percolation tests for this project. We understand that storm water drainage accumulates along the shoulder of Florence Avenue in this general area; in conjunction with planned sidewalk improvements, the County is considering the installation of bioswales to discharge the drainage into the subsurface. The bioswales are expected to have depths of 1 to 2 feet below the top of pavement. We understand that the information contained in this report will be utilized by the client and others in the design of the bioswales.

As per your initial request (Ref. No. 1) and our discussions at the site on December 13, 2006, with Cheryl Lenhardt of Wallace Group, our work scope (Ref. No. 2) consisted of the drilling and logging of 16 borings on the east and west shoulders of Florence Avenue. The plan regarding boring locations, depths and the borings to be tested for percolation was provided in Ref. No. 1. Several of the borings were moved from the initially planned locations to accommodate potential conflicts with existing underground utility lines. Six of the borings were drilled to 15 feet, logged and intermittently sampled, and were then backfilled upon completion. Ten of the borings were drilled to depths ranging from 2.5 to 5.0 feet; these borings were also logged, a 3-inch diameter perforated pipe was installed in each, and the annular spaces around the pipes were filled with gravel. These borings were then filled with water, and prepared for percolation testing on the days following drilling.

Drilling operations were conducted by representatives of this firm on December 19, 2006. The borings were 8 inches in diameter; they were drilled with a Mobile B-53 drill rig. The approximate locations of the borings are indicated on the attached Boring/Percolation Test Location Map. Subsurface conditions encountered in all of the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-00. Logs of the borings are also attached. Three samples of the soils encountered in the borings were selected for particle size analysis testing (ASTM D 422-02 and 1140-00); results of these tests are also attached.

Percolation testing was performed on December 20 and 21, 2006. As discussed, the borings were filled to near the top of the perforated pipe, and the percolation rate was monitored as the drop in the water level verses time. Attached are Percolation Test Reports that provide the field data, and a percolation rate for each test interval, based on a correction factor of 1.33 relating surface area to volume of the 8-inch drilled boring as compared to the standard 12-inch square, 12-inch deep percolation test hole, originally proposed in Ref. No. 3. Following completion of testing, the perforated pipes were removed and the borings were backfilled to match the grade of the adjacent areas.

It should be noted that, although the materials encountered in Borings 9 and 10 appeared to be similar to those found in the other borings, the percolation rates for these borings were extremely fast when compared to the others. Considering the proximity of Borings 9 and 10 to existing underground utility lines, it is possible that more permeable trench backfill material was present in the boring sidewalls which contributed to the faster percolation rates. Therefore, when analyzing the data, the data for Borings 9 and 10 should probably be considered anomalous, rather than indicative of faster percolation in a specific area.

Thank you for the opportunity to have been of service. If there are any questions concerning this letter, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

Frederick J. Potthast
No. GE 2269
Exp. 03/31/08

Fred J. Potthast, G.E.

Date Signed: 1/9/07

Attachments: Boring/Percolation Test Location Map (1 sheet)
Boring Logs (16 pages)
Particle Size Analysis Test Results (3 pages)
Percolation Test Reports (11 pages)

Copy to: Wallace Group, Attn: Ms. Cheryl Lenhardt

Doc. No.: 0612-157.RPT/ab

END

Location (Approx.)

Earth Systems Pacific

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

Boring No. 1
PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM	▒	SILTY SAND: brown, medium dense, moist, trace gravel to 1.0" diameter (older alluvium)					
2.5		▒		2.5–4.0	●			9 28 26
3		▒	trace gravel to 3.0" diameter					
5	CL	▨	SANDY LEAN CLAY: brown, stiff, moist					
10		▨		10.0–11.5	●			4 5 9
10.5		▨	grey brown, increasing sand content					
15		▨		15.0–16.5	●			5 10 12
15.5		▨	very stiff, some gravel to ½" diameter					
16.5			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Boring No. 2

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND: dark brown, medium dense, moist, trace gravel to 1.5" diameter (older alluvium)					
1								
2			increasing silt content					
	CL		SANDY LEAN CLAY: light brown, medium stiff, moist					
3								
4			End of Boring @ 2.5' No subsurface water encountered					
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Boring No. 3

PAGE 1 OF 1

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM	▨	SILTY SAND: brown, medium dense, moist, trace gravel to 1.5" diameter (older alluvium)					
1		▨						
2		▨	trace cobbles to 6.0" diameter, increasing sand content					
3								
4			End of Boring @ 3.0' No subsurface water encountered					
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

				SAMPLE DATA				
DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SANDY SILT: dark brown, medium stiff, moist, trace gravel to 2.0" diameter (older alluvium)	0.0–2.0	○			
3			increasing gravel content					
4	CL		SANDY LEAN CLAY: brown, medium stiff, moist					
5			End of Boring @ 5.0' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

Boring No. 5
PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND: brown, medium dense, moist, trace gravel to 2.0" diameter (older alluvium)					
1								
2								
3	CL		SANDY LEAN CLAY: light brown, stiff, moist					
4								
5			End of Boring @ 4.0' No subsurface water encountered					
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

Boring No. 6

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND: brown, medium dense, moist (older alluvium)					
2	CL		SANDY LEAN CLAY: brown, stiff, moist, trace gravel to 2.0" diameter	2.0–5.0	○			
5			SANDY SILTSTONE: brown, moderately hard (Monterey formation)	5.0–6.5	●			13 27 29
15			soft	15.0–16.5	●			5 6 10
17			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 7

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND WITH GRAVEL: brown, dense, moist, gravel to 2.5" diameter (older alluvium)					
2			cobbles to 4.0" diameter					
3	CL		SANDY LEAN CLAY: light brown, stiff, moist					
			End of Boring @ 3.0' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 8

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND WITH GRAVEL: brown, medium dense, moist, gravel to 2.0" diameter (older alluvium)	1.5–2.5	○			
				2.5–4.0	●			4 5 6
3	CL		SANDY LEAN CLAY: light brown, stiff, moist	5.0–10.0	○			
10			SANDY SILTSTONE: light brown, soft, moist, weathered (Monterey formation)	10.0–11.5	●			21 9 15
				15.0–16.5	●			8 12 13
16.5			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 9

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

DEPTH (feet)	USCS CLASS	SYMBOL	FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS Templeton, California WBS 300276.01 SOIL DESCRIPTION	SAMPLE DATA INTERVAL (feet)	SAMPLE DATA SAMPLE TYPE	SAMPLE DATA DRY DENSITY (pcf)	SAMPLE DATA MOISTURE (%)	SAMPLE DATA BLOWS PER 6 IN.
0		■	GRASS					
1	SM	▒	SILTY SAND: brown, medium dense, moist (older alluvium)					
2								
3	CL	▧	SANDY LEAN CLAY: dark brown, medium stiff, moist					
4			End of Boring @ 4.0' No subsurface water encountered					
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 10

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	CL	▨	SANDY LEAN CLAY: dark brown, stiff, moist, trace gravel to 2.0" diameter (older alluvium)					
1		▨						
2		▨	increasing gravel content					
3			End of Boring @ 2.5' No subsurface water encountered					
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 11

PAGE 1 OF 1

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND WITH GRAVEL: yellow brown, medium dense, moist, gravel to 2.5" diameter (older alluvium)	0.0–2.5	○			
1								
2			dark brown, increasing gravel content					
3			End of Boring @ 2.5' No subsurface water encountered					
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 12

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND: brown, medium dense, moist, trace gravel to 2.5" diameter (older alluvium)					
			dark brown	1.5–2.5	○			
				2.5–3.5	●			26 50/5.0"
3			SANDY SILTSTONE: brown, soft, moist, weathered (Monterey Formation)					
6.5			Refusal @ 6.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

Boring No. 13

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE DATA: SAMPLE TYPE	SAMPLE DATA: DRY DENSITY (pcf)	SAMPLE DATA: MOISTURE (%)	SAMPLE DATA: BLOWS PER 6 IN.
0	SM		SILTY SAND WITH GRAVEL: brown, medium dense, moist, gravel to 2.0" diameter (older alluvium)					
1								
2			increasing gravel content					
3								
4			SANDY SILTSTONE: brown, moderately hard, moist (Monerey formation)	4.0-4.5	●			50/2.0"
5			Refusal @ 4.5' No subsurface water encountered					
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 14

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM	▨	SILTY SAND WITH GRAVEL: brown, medium dense, moist, gravel to 2.0" diameter (older alluvium)					
1		▨						
2		▨						
3		▨	yellow brown, increasing silt content, decreasing gravel content					
4			End of Boring @ 3.5' No subsurface water encountered					
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 15

PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND WITH GRAVEL: brown, medium dense, moist (older alluvium)					
1								
2			dark brown					
3								
4			SANDY SILTSTONE: brown, very soft, moist, weathered (Monterey formation)					
5								
6			End of Boring @ 5.0' No subsurface water encountered					
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

Boring No. 16
PAGE 1 OF 1
JOB NO.: SL-15188-SA
DATE: 12/19/06

FLORENCE AVENUE PEDESTRIAN IMPROVEMENTS
Templeton, California
WBS 300276.01

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SM		SILTY SAND: dark brown, medium dense, moist, trace gravel to 1.5" diameter (older alluvium)	0.0–2.0	○			
3			SANDY SILTSTONE: light brown, very soft, moist, weathered (Monterey formation)					
5				5.0–6.5	●			14 23 40
7			brown					
15				15.0–16.5	●			16 45 50/5.0"
16.5			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Florence Avenue
Pedestrian Improvements

SL-15188-SA

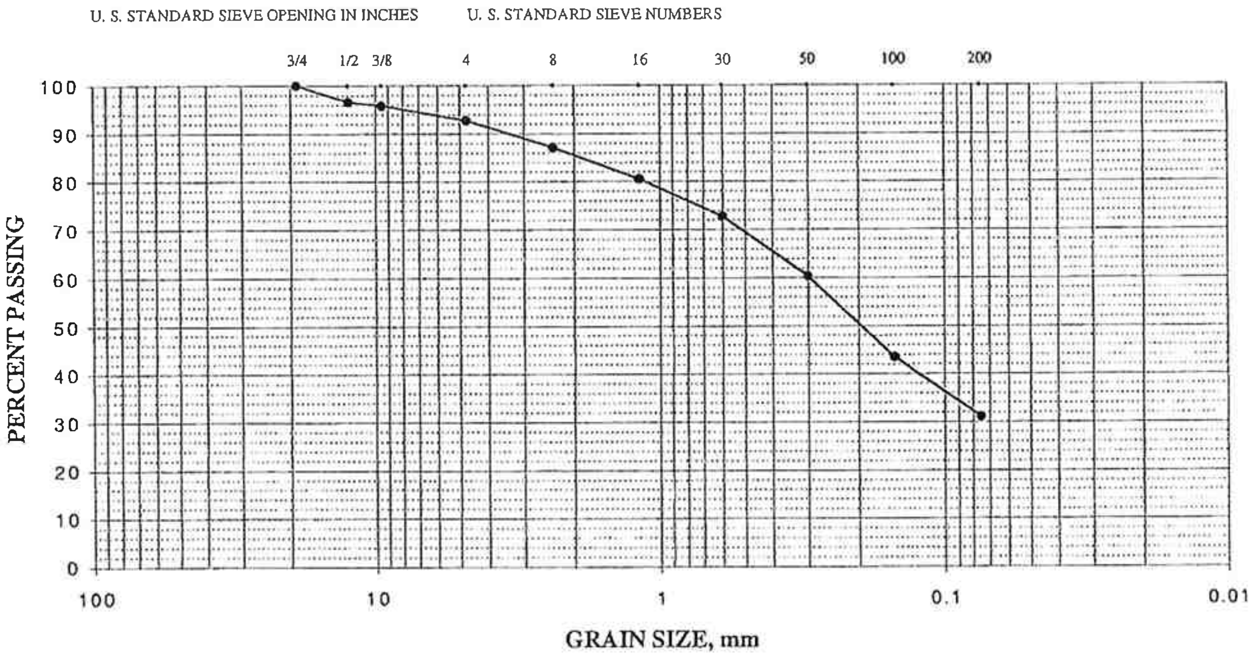
PARTICLE SIZE ANALYSIS

ASTM D 422-02; D 1140-02

Boring #1 @ 2.5 - 4.0'
Silty Sand (SM)

January 9, 2007

Sieve size	% Retained	% Passing
3/4" (19-mm)	0	100
1/2" (12.5-mm)	3	97
3/8" (9.5-mm)	4	96
#4 (4.75-mm)	7	93
#8 (2.36-mm)	13	87
#16 (1.18-mm)	19	81
#30 (600-µm)	27	73
#50 (300-µm)	40	60
#100 (150-µm)	56	44
#200 (75-µm)	69	31



Florence Avenue
Pedestrian Improvements

SL-15188-SA

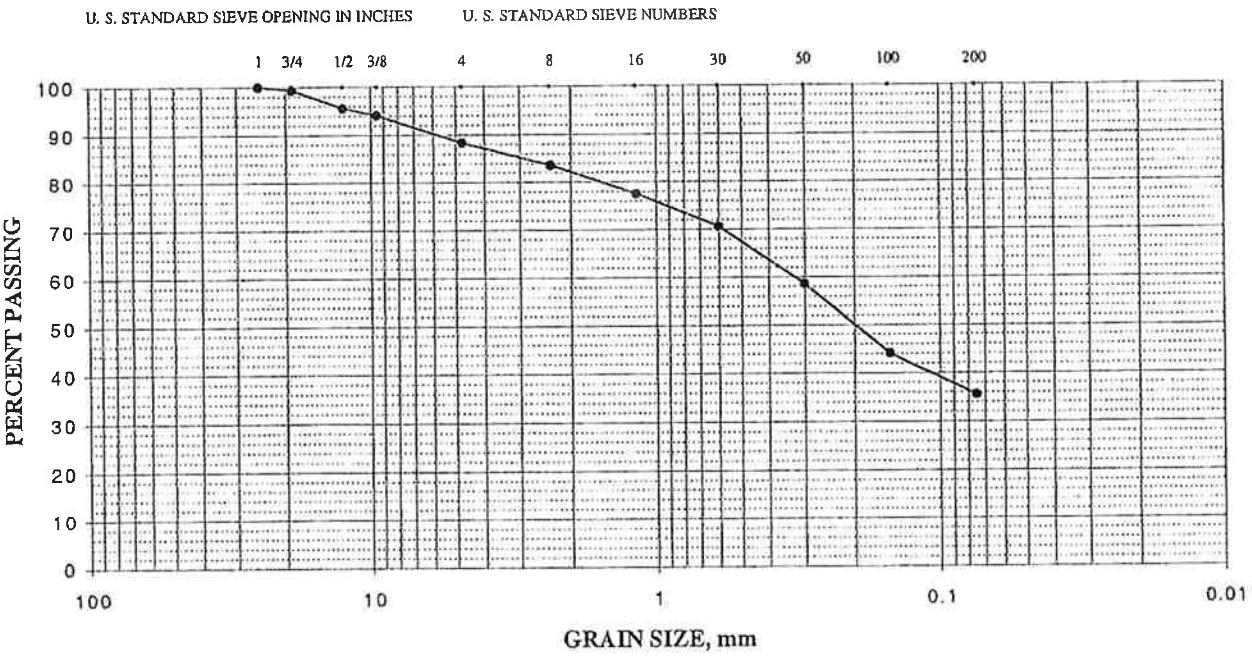
PARTICLE SIZE ANALYSIS

ASTM D 422-02; D 1140-02

Boring #4 @ 0.0 - 2.0'
Silty Sand (SM)

January 9, 2007

Sieve size	% Retained	% Passing
1" (25-mm)	0	100
3/4" (19-mm)	1	99
1/2" (12.5-mm)	4	96
3/8" (9.5-mm)	6	94
#4 (4.75-mm)	12	88
#8 (2.36-mm)	16	84
#16 (1.18-mm)	22	78
#30 (600-µm)	29	71
#50 (300-µm)	41	59
#100 (150-µm)	56	44
#200 (75-µm)	64	36



Florence Avenue
Pedestrian Improvements

SL-15188-SA

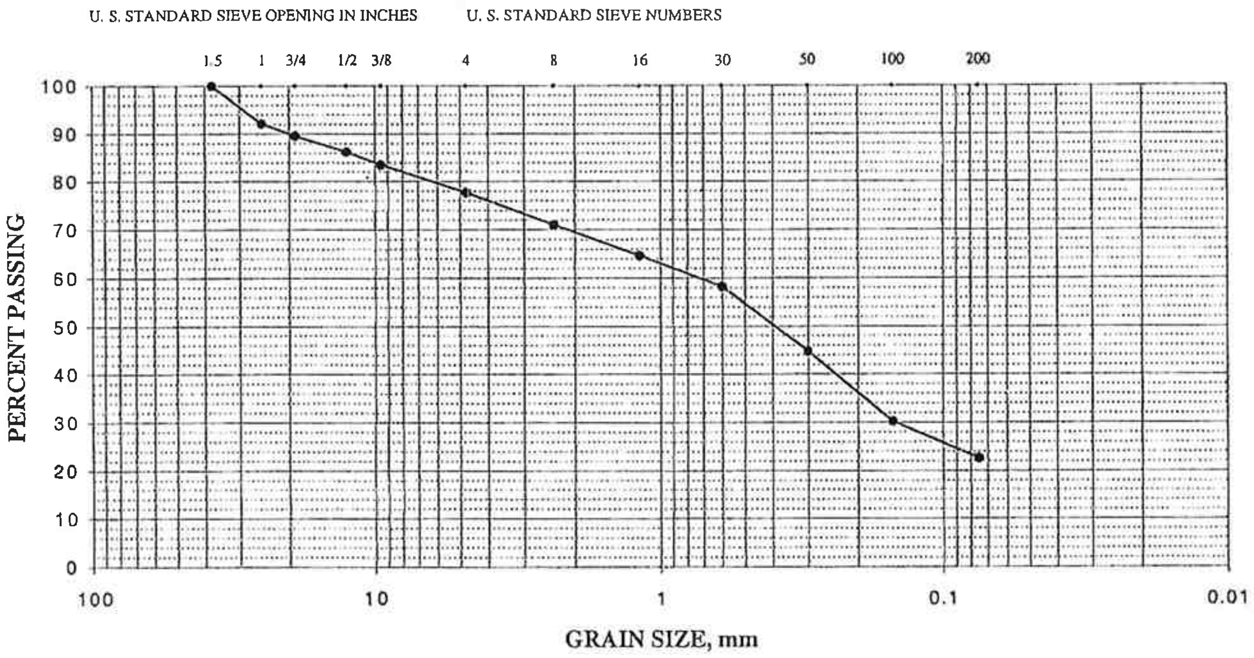
PARTICLE SIZE ANALYSIS

ASTM D 422-02; D 1140-02

Boring #8 @ 1.5 - 2.5'
Silty Sand with Gravel (SM)

January 9, 2007

Sieve size	% Retained	% Passing
1.5" (37.5-mm)	0	100
1" (25-mm)	8	92
3/4" (19-mm)	10	90
1/2" (12.5-mm)	14	86
3/8" (9.5-mm)	17	83
#4 (4.75-mm)	22	78
#8 (2.36-mm)	29	71
#16 (1.18-mm)	35	65
#30 (600-µm)	42	58
#50 (300-µm)	55	45
#100 (150-µm)	70	30
#200 (75-µm)	77	23



PERCOLATION TEST REPORT

PAGE 1 OF 1

PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:**	**12/19/2006**
		DATE TESTED:	**12/20/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**P. Texiera**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**2**	**DEPTH:**	**2.5 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
9:30 AM	---	0.12	---	---	---	---
10:00 AM	30	0.30	0.18	14	1.33	18
10:30 AM	30	0.35	0.05	50	1.33	67
11:00 AM	30	0.36	0.01	250	1.33	333
11:30 AM	30	0.40	0.04	62	1.33	83
12:00 PM	30	0.44	0.04	63	1.33	83
12:30 PM	30	0.46	0.02	125	1.33	166
1:00 PM	30	0.47	0.01	250	1.33	333
1:30 PM	30	0.49	0.02	125	1.33	166

PERCOLATION TEST REPORT

PAGE 1 OF 1

PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:**	**12/19/2006**
		DATE TESTED:	**12/20/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**L. Vidal**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**3**	**DEPTH:**	**3.0 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
9:35 AM	---	0.30	---	---	---	---
10:05 AM	30	0.60	0.30	8	1.33	11
10:35 AM	30	0.98	0.38	7	1.33	9
11:05 AM	30	1.35	0.37	7	1.33	9
11:35 AM	30	1.65	0.30	8	1.33	11
	REFILL					REFILL
11:36 AM	---	0.30	---	---	---	---
12:05 PM	29	0.50	0.20	12	1.33	16
12:35 PM	30	0.75	0.25	10	1.33	13
1:05 PM	30	0.91	0.16	16	1.33	21
3:35 AM	30	1.35	0.44	6	1.33	8

PERCOLATION TEST REPORT

PAGE 1 OF 1

PROJECT:	Florence Avenue Pedestrian Improvements Templeton, California	**DATE DRILLED:** **DATE TESTED:**	12/19/2006 12/20/2006
DRILLED BY:	P. Texiera		
TESTED BY:	L. Vidal	**DIAMETER:**	8 inches
TEST LOCATION:	4	**DEPTH:**	5.0 feet

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
9:20 AM	---	0.48	---	---	---	---
9:50 AM	30	0.68	0.20	13	1.33	17
10:05 AM	15	0.78	0.10	13	1.33	17
10:35 AM	30	0.96	0.18	14	1.33	18
11:05 AM	30	0.98	0.02	125	1.33	166
11:35 AM	30	1.02	0.04	62	1.33	83
12:05 PM	30	1.06	0.04	62	1.33	83
12:35 PM	30	1.12	0.06	42	1.33	55
1:05 PM	30	1.17	0.05	50	1.33	67
1:35 PM	30	1.20	0.03	83	1.33	111

PERCOLATION TEST REPORT

PAGE 1 OF 1

PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:**	**12/19/2006**
		DATE TESTED:	**12/20/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**P. Texiera**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**5**	**DEPTH:**	**4.0 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
9:30 AM	---	0.60	---	---	---	---
10:00 AM	30	0.65	0.05	50	1.33	66
10:30 AM	30	0.70	0.05	50	1.33	67
11:00 AM	30	0.76	0.06	42	1.33	55
11:30 AM	30	0.80	0.04	62	1.33	83
12:00 PM	30	0.85	0.05	50	1.33	67
12:30 PM	30	0.86	0.01	250	1.33	333
1:00 PM	30	0.88	0.02	125	1.33	166
1:30 PM	30	0.91	0.03	83	1.33	111

PERCOLATION TEST REPORT

PAGE 1 OF 1

PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:**	**12/19/2006**
		DATE TESTED:	**12/20/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**P. Texiera**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**7**	**DEPTH:**	**3.0 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
9:15 AM	---	0.46	---	---	---	---
9:30 AM	15	0.47	0.01	125	1.33	166
10:00 AM	30	0.48	0.01	250	1.33	333
10:30 AM	30	0.60	0.12	21	1.33	28
11:00 AM	30	0.62	0.02	125	1.33	166
11:30 AM	30	0.64	0.02	125	1.33	166
12:00 PM	30	0.65	0.01	250	1.33	333
12:30 PM	30	0.66	0.01	250	1.33	333
1:00 PM	30	0.67	0.01	250	1.33	333
1:30 PM	30	0.70	0.03	83	1.33	111

PERCOLATION TEST REPORT

PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:** **DATE TESTED:**	**12/19/2006** **12/20/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**L. Vidal**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**9**	**DEPTH:**	**4.0 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
9:15 AM	---	0.72	---	---	---	---
9:18 AM	3	1.72	1.00	0.3	1.33	0.3
9:25 AM	7	3.28	1.56	0.4	1.33	0.5
9:27 AM	2	3.50	0.22	1	1.33	1
	REFILL					**REFILL**
9:32 AM	---	0.50	---	---	---	---
9:40 AM	8	2.36	1.86	0.4	1.33	0.5
9:45 AM	5	3.34	0.98	0.4	1.33	0.6
	REFILL					**REFILL**
10:02 AM	---	0.48	---	---	---	---
10:10 AM	8	1.44	0.96	1	1.33	1
10:20 AM	10	2.22	0.78	1	1.33	1
10:30 AM	10	3.34	1.12	1	1.33	1
10:33 AM	3	3.46	0.12	2	1.33	3
	REFILL					**REFILL**
10:51 AM	---	0.46	---	---	---	---
11:00 AM	9	1.10	0.64	1	1.33	2
11:10 AM	10	1.62	0.52	2	1.33	2
11:20 AM	10	2.02	0.40	2	1.33	3
11:30 AM	10	2.82	0.80	1	1.33	1
11:40 AM	10	3.38	0.56	1	1.33	2
11:45 AM	5	3.46	0.08	5	1.33	7

PERCOLATION TEST REPORT

PAGE 2 OF 2

PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:**	**12/19/2006**
		DATE TESTED:	**12/20/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**L. Vidal**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**9**	**DEPTH:**	**4.0 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
11:55 AM	---	0.54	---	---	---	---
12:05 PM	10	1.30	0.76	1.1	1.33	1
12:15 PM	10	1.78	0.48	1.7	1.33	2
12:25 PM	10	2.18	0.40	2	1.33	3
12:35 PM	10	2.88	0.70	1	1.33	2
12:45 PM	10	3.18	0.30	3	1.33	4
12:55 PM	10	3.34	0.16	5.2	1.33	7
	REFILL					**REFILL**
1:05 PM	---	0.84	---	---	---	---
1:15 PM	10	1.42	0.58	1.4	1.33	2
1:25 PM	10	1.88	0.46	2	1.33	2
1:35 PM	10	2.22	0.34	2	1.33	3
1:45 PM	10	3.24	1.02	1	1.33	1

PERCOLATION TEST REPORT

PAGE 1 OF 1

PROJECT:	Florence Avenue Pedestrian Improvements Templeton, California	**DATE DRILLED:**	12/19/2006
		DATE TESTED:	12/21/2006
DRILLED BY:	P. Texiera		
TESTED BY:	P. Texiera	**DIAMETER:**	8 inches
TEST LOCATION:	10	**DEPTH:**	2.5 feet

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
REFILLED BORING 10 WITH 18 TO 24 INCHES OF WATER MULTIPLE						
TIMES, AND ALL WATER PERCOLATED AWAY IN LESS THAN 15 SECONDS.						
PERCOLATION RATE TOO FAST TO BE MEASURED.						

PERCOLATION TEST REPORT

PAGE 1 OF 1

PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:** **DATE TESTED:**	**12/19/2006** **12/21/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**P. Texiera**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**11**	**DEPTH:**	**2.5 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
8:30 AM	---	0.20	---	---	---	---
9:00 AM	30	0.26	0.06	42	1.33	55
9:30 AM	30	0.30	0.04	63	1.33	83
10:00 AM	30	0.36	0.06	42	1.33	55
10:30 AM	30	0.45	0.09	28	1.33	37
11:00 AM	30	0.60	0.15	17	1.33	22
11:30 AM	30	0.62	0.02	125	1.33	166
12:00 PM	30	0.65	0.03	83	1.33	111
12:30 PM	30	0.71	0.06	42	1.33	55
1:00 PM	30	0.76	0.05	50	1.33	66
1:30 PM	30	0.80	0.04	62	1.33	83

PERCOLATION TEST REPORT

PROJECT:	Florence Avenue Pedestrian Improvements Templeton, California	**DATE DRILLED:**	12/19/2006
		DATE TESTED:	12/21/2006
DRILLED BY:	P. Texiera		
TESTED BY:	P. Texiera	**DIAMETER:**	8 inches
TEST LOCATION:	14	**DEPTH:**	3.5 feet

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
8:30 AM	---	0.46	---	---	---	---
9:00 AM	30	0.71	0.25	10	1.33	13
9:30 AM	30	0.85	0.14	18	1.33	24
10:00 AM	30	1.00	0.15	17	1.33	22
10:30 AM	30	1.35	0.35	7	1.33	10
11:00 AM	30	1.71	0.36	7	1.33	9
11:30 AM	30	1.95	0.24	10	1.33	14
12:00 PM	30	2.10	0.15	17	1.33	22
12:30 PM	30	2.12	0.02	125	1.33	166
1:00 PM	30	2.17	0.05	50	1.33	67
1:30 PM	30	2.21	0.04	62	1.33	83

PERCOLATION TEST REPORT

PAGE 1 OF 1

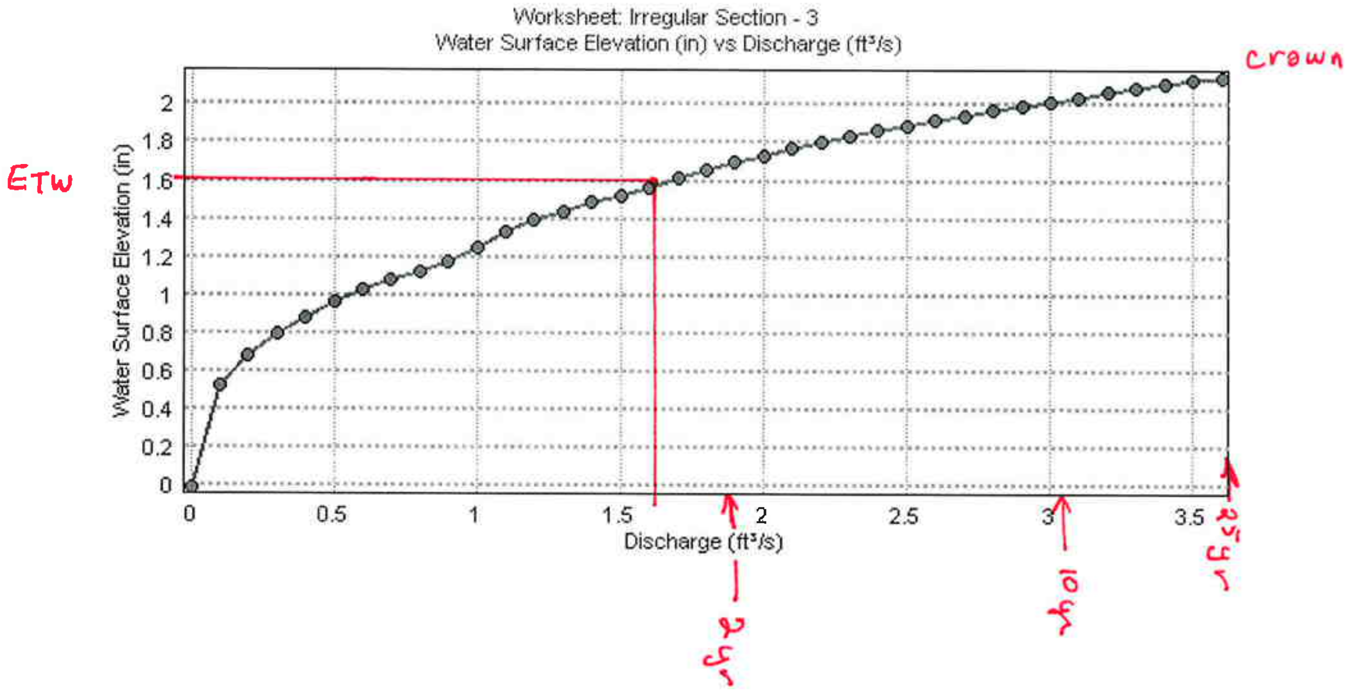
PROJECT:	**Florence Avenue Pedestrian Improvements Templeton, California**	**DATE DRILLED:**	**12/19/2006**
		DATE TESTED:	**12/21/2006**
DRILLED BY:	**P. Texiera**		
TESTED BY:	**P. Texiera**	**DIAMETER:**	**8 inches**
TEST LOCATION:	**15**	**DEPTH:**	**5.0 feet**

TIME	INTERVAL, MINUTES	READING, FEET	INTERVAL, FEET	INITIAL RATE, MIN./INCH	CORR. FACTOR	FINAL RATE, MIN./INCH
8:30 AM	---	0.60	---	---	---	---
9:00 AM	30	0.83	0.23	11	1.33	14
9:30 AM	30	0.98	0.15	17	1.33	22
10:00 AM	30	1.11	0.13	19	1.33	26
10:30 AM	30	1.23	0.12	21	1.33	28
11:00 AM	30	1.35	0.12	21	1.33	28
11:30 AM	30	1.45	0.10	25	1.33	33
12:00 PM	30	1.55	0.10	25	1.33	33
12:30 PM	30	1.62	0.07	36	1.33	48
1:00 PM	30	1.69	0.07	36	1.33	48
1:30 PM	30	1.75	0.06	42	1.33	55

APPENDIX D

NW corner Florence at Cayucos

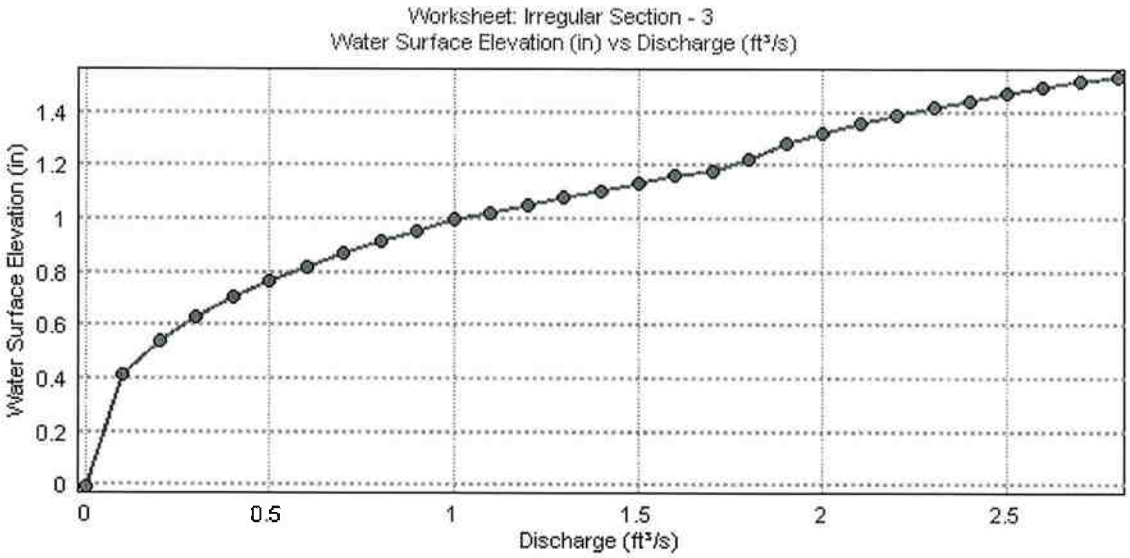
Rating Curve Plot



1 - 11^+ ft travel lane available

NE Corner Florence at Cayucos

Rating Curve Plot

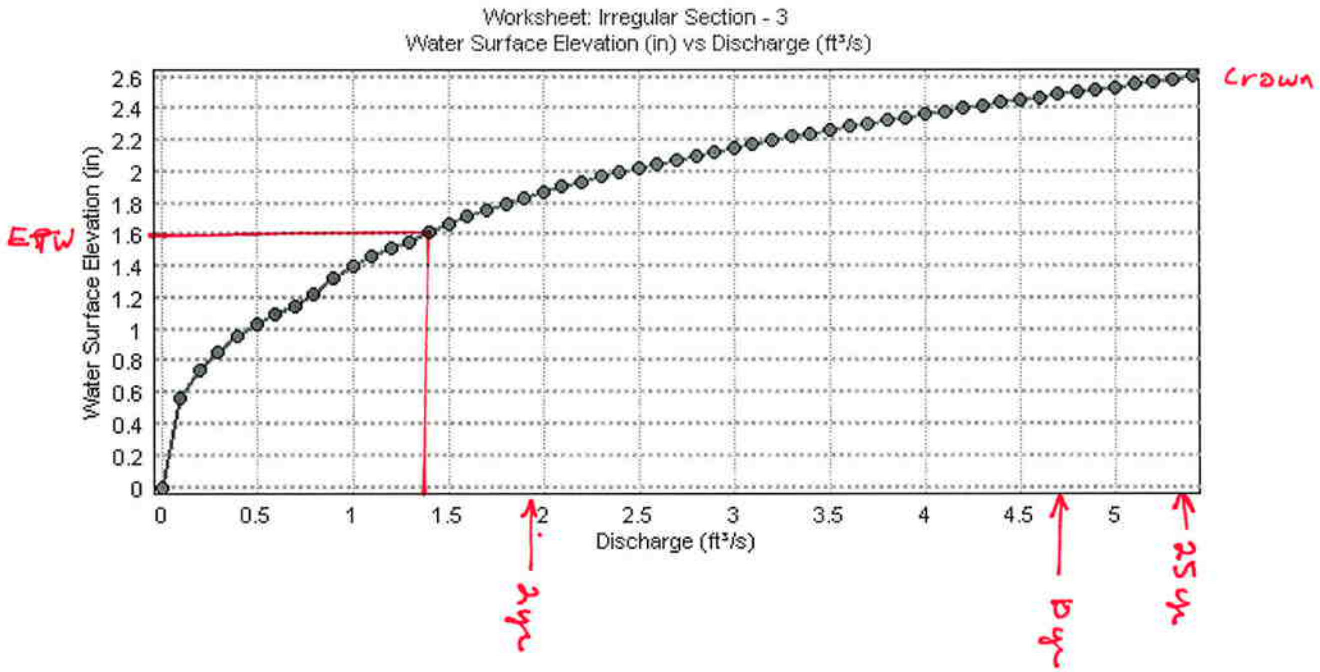


2.5 ok

11' available

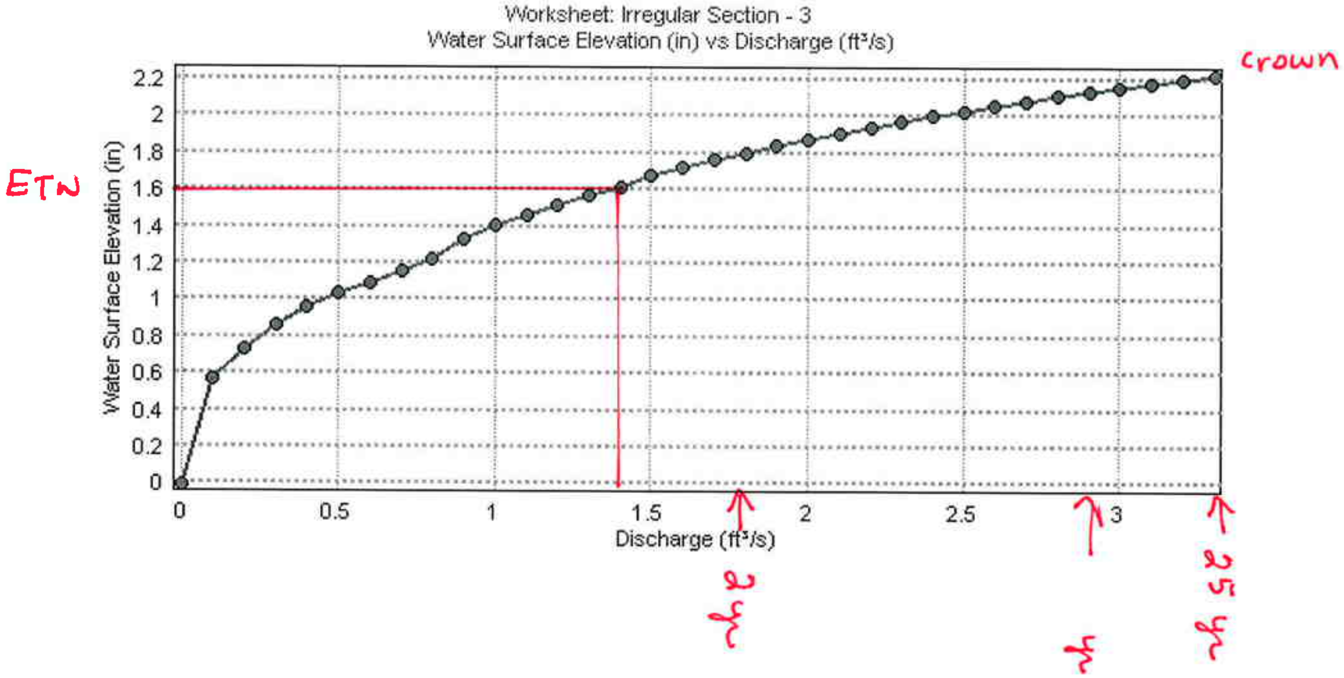
NW corner Florence and Forest

Rating Curve Plot



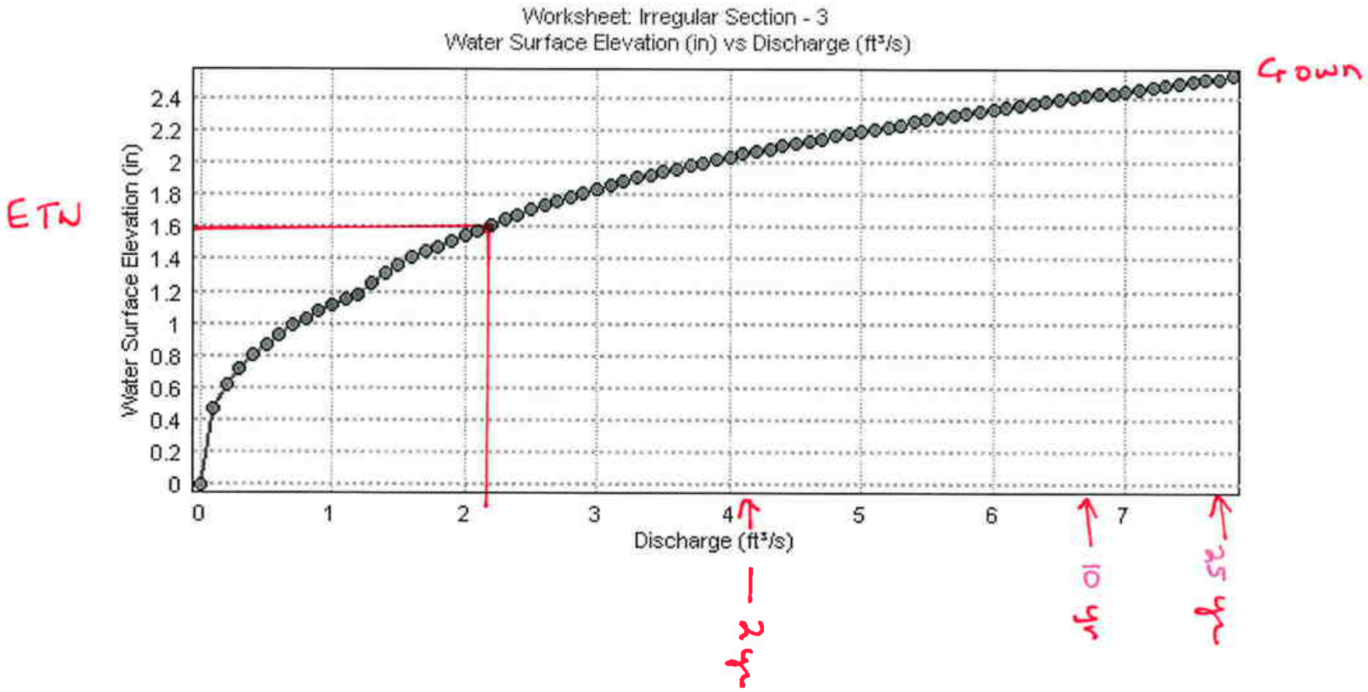
NE corner @ Forest

Rating Curve Plot



NW Corner Florence @ Salinas

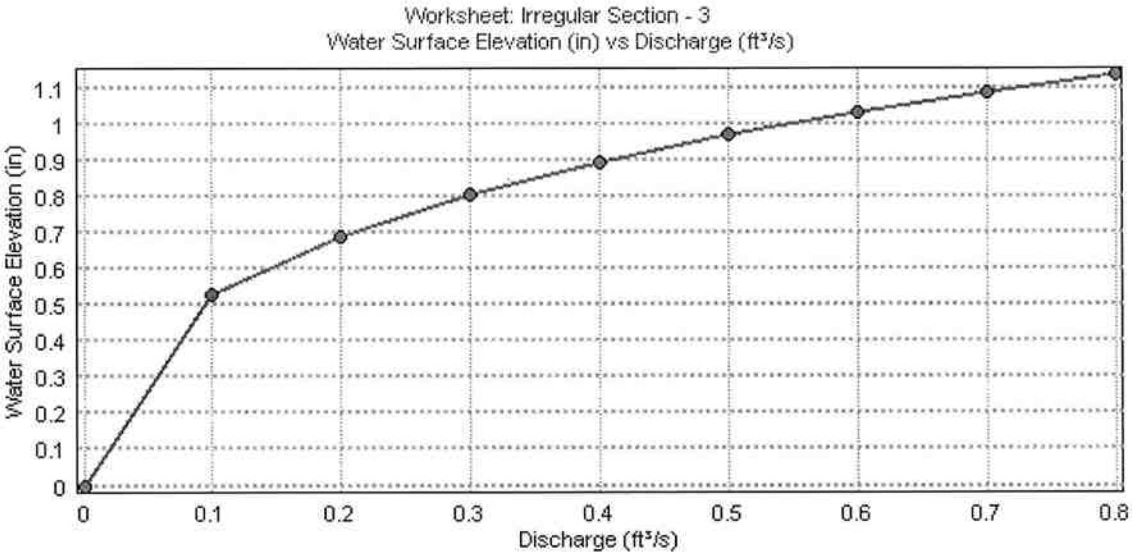
Rating Curve Plot



1 - 11+' travel lane available

NE Corner Florence @ Salinas

Rating Curve Plot



25 yr ok

NE Corner Florence @ Cayucos

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01510	ft/ft
Discharge	2.82	ft³/s

Section Definitions

Station (ft)	Elevation (in)
0+00.00	2.70
0+15.00	1.58
0+20.00	1.20
0+20.00	1.00
0+25.00	0.00
0+29.00	1.00
0+29.00	1.20
0+33.00	1.60
0+44.00	2.70

V = 1.72 fps

@ Q_{25} of 3.63 cfs

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00.00, 2.70)	(0+15.00, 1.58)	0.025
(0+15.00, 1.58)	(0+20.00, 1.20)	0.015
(0+20.00, 1.20)	(0+29.00, 1.20)	0.015
(0+29.00, 1.20)	(0+33.00, 1.60)	0.015
(0+33.00, 1.60)	(0+44.00, 2.70)	0.013

NE corner @ Forest

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01010	ft/ft
Discharge	3.31	ft^3/s

Section Definitions

Station (ft)	Elevation (in)
0+00.00	2.70
0+15.00	1.58
0+20.00	1.20
0+20.00	1.00
0+25.00	0.00
0+29.00	1.00
0+29.00	1.20
0+33.00	1.60
0+44.00	2.70

V = 1.54 fps

@ Q_{25} of 5.41 cfs

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00.00, 2.70)	(0+15.00, 1.58)	0.025
(0+15.00, 1.58)	(0+20.00, 1.20)	0.015
(0+20.00, 1.20)	(0+29.00, 1.20)	0.015
(0+29.00, 1.20)	(0+33.00, 1.60)	0.015
(0+33.00, 1.60)	(0+44.00, 2.70)	0.013

NW Corner Florence @ Salinas

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02510	ft/ft
Discharge	2.82	ft³/s

Section Definitions

Station (ft)	Elevation (in)
0+00.00	2.70
0+15.00	1.58
0+20.00	1.20
0+20.00	1.00
0+25.00	0.00
0+29.00	1.00
0+29.00	1.20
0+33.00	1.60
0+44.00	2.70

V = 2.39 fps

@ Q_{25} of 7.86 cfs

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00.00, 2.70)	(0+15.00, 1.58)	0.025
(0+15.00, 1.58)	(0+20.00, 1.20)	0.015
(0+20.00, 1.20)	(0+29.00, 1.20)	0.015
(0+29.00, 1.20)	(0+33.00, 1.60)	0.015
(0+33.00, 1.60)	(0+44.00, 2.70)	0.013

NE Corner Florence @ Salinas

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01460	ft/ft
Discharge	0.80	ft³/s

Section Definitions

Station (ft)	Elevation (in)
0+00.00	2.70
0+15.00	1.58
0+20.00	1.20
0+20.00	1.00
0+25.00	0.00
0+29.00	1.00
0+29.00	1.20
0+33.00	1.60
0+44.00	2.70

V=1.68 fps

at Q_{25} of 0.8 cfs

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00.00, 2.70)	(0+15.00, 1.58)	0.025
(0+15.00, 1.58)	(0+20.00, 1.20)	0.015
(0+20.00, 1.20)	(0+29.00, 1.20)	0.015
(0+29.00, 1.20)	(0+33.00, 1.60)	0.015
(0+33.00, 1.60)	(0+44.00, 2.70)	0.013

NW corner Florence at Cayucos

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01510	ft/ft
Discharge	2.82	ft³/s

Section Definitions

Station (ft)	Elevation (in)
0+00.00	2.70
0+15.00	1.58
0+20.00	1.20
0+20.00	1.00
0+25.00	0.00
0+29.00	1.00
0+29.00	1.20
0+33.00	1.60
0+44.00	2.70

$V = 1.71$ fps
at Q_{25} of 3.63 cfs

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00.00, 2.70)	(0+15.00, 1.58)	0.025
(0+15.00, 1.58)	(0+20.00, 1.20)	0.015
(0+20.00, 1.20)	(0+29.00, 1.20)	0.015
(0+29.00, 1.20)	(0+33.00, 1.60)	0.015
(0+33.00, 1.60)	(0+44.00, 2.70)	0.013

APPENDIX E

Table of Contents

2 - Year

5 - Year

10 - Year

25 - Year

50 - Year

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100 - Year

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SBUH Runoff	——	——	0.32	——	0.73	1.51	2.57	3.30	4.07	Pre-developed site
2	SBUH Runoff	——	——	1.88	——	2.83	4.28	6.06	7.22	8.39	Existing Site
3	SBUH Runoff	——	——	1.74	——	2.63	3.99	5.65	6.73	7.83	Proposed Project
4	Reservoir	3	——	1.00	——	2.19	3.98	5.65	6.73	7.83	Bioswale/Infiltration

Proj. file: Florence Street.gpw

Monday, Mar 19 2007, 3:00 AM

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SBUH Runoff	0.32	1	616	7,669	—	—	—	Pre-developed site
2	SBUH Runoff	1.88	1	599	16,198	—	—	—	Existing Site
3	SBUH Runoff	1.74	1	599	16,198	—	—	—	Proposed Project
4	Reservoir	1.00	1	626	14,696	3	104.61	3,321	Bioswale/Infiltration

Florence Street.gpw | Return Period: 2 Year | Monday, Mar 19 2007, 3:00 AM

Hydrograph Plot

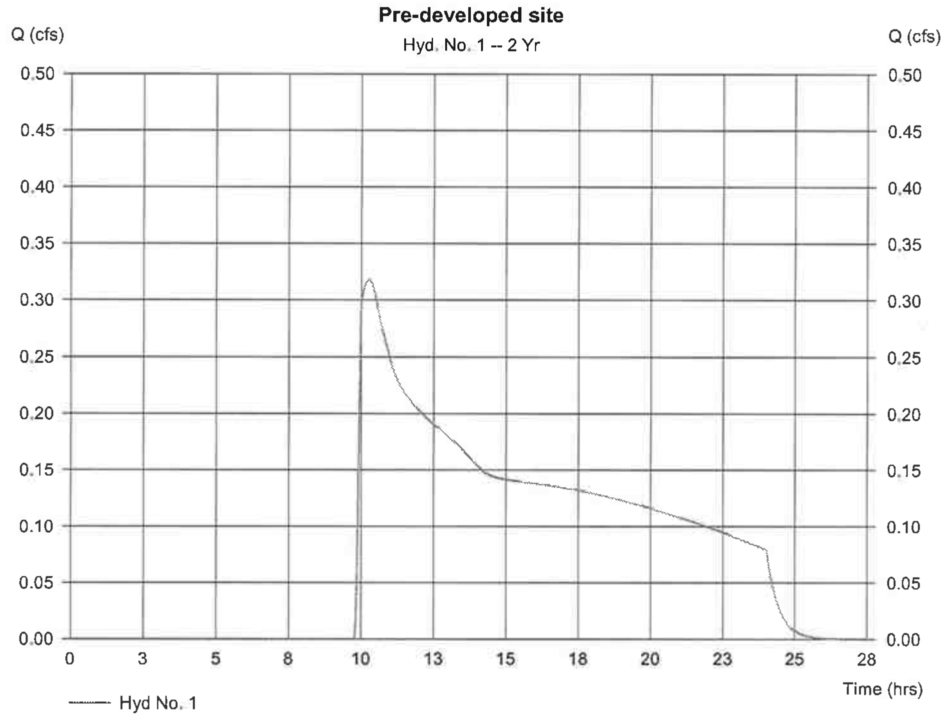
Hyd. No. 1

Pre-developed site

Hydrograph type = SBUH Runoff
Storm frequency = 2 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = TR55
Total precip. = 2.50 in
Storm duration = 24 hrs

Peak discharge = 0.32 cfs
Time interval = 1 min
Curve number = 69
Hydraulic length = 1315 ft
Time of conc. (Tc) = 25.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 7,669 cuft


Pre-developed site

Hyd. No. 1 -- 2 Yr

TR55 Tc Worksheet

Hyd. No. 1

Pre-developed site

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	2.50		0.00		0.00		
Land slope (%)	=	1.50		0.00		0.00		
Travel Time (min)	**=**	**12.44**	**+**	**0.00**	**+**	**0.00**	**=**	**12.44**
Shallow Concentrated Flow								
Flow length (ft)	=	1219.00		0.00		0.00		
Watercourse slope (%)	=	1.00		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	1.61		0.00		0.00		
Travel Time (min)	**=**	**12.59**	**+**	**0.00**	**+**	**0.00**	**=**	**12.59**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 25.00 min

Hydrograph Plot

Monday, Mar 19 2007, 3:0 AM

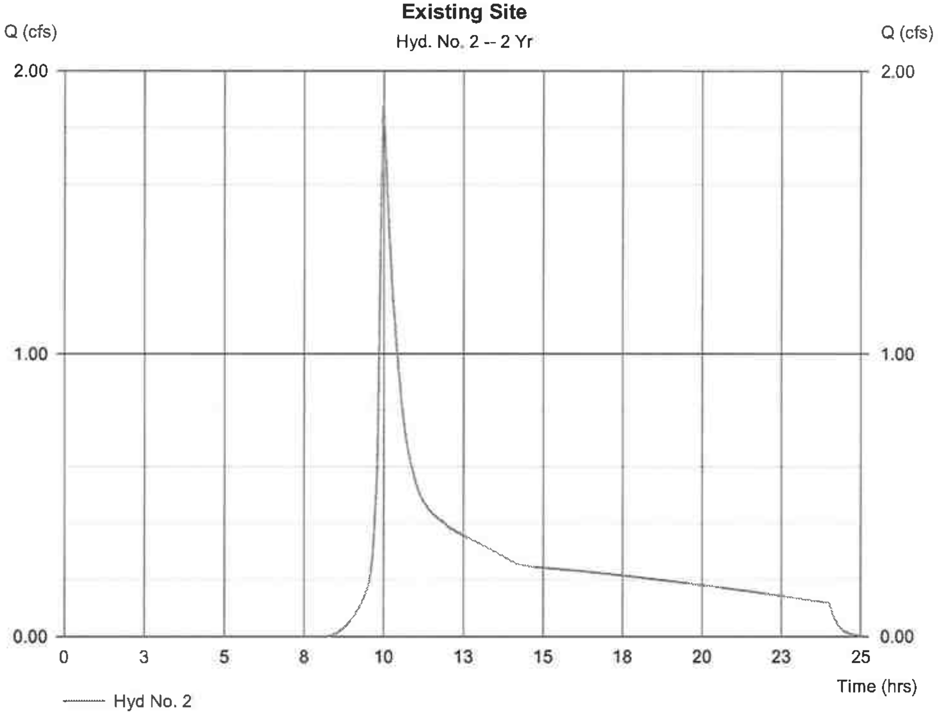
Hyd. No. 2

Existing Site

Hydrograph type = SBUH Runoff
Storm frequency = 2 yrs
Drainage area = 5.020 ac
Basin Slope = 1.4 %
Tc method = TR55
Total precip. = 2.50 in
Storm duration = 24 hrs

Peak discharge = 1.88 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1319 ft
Time of conc. (Tc) = 15.70 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 16,198 cuft



TR55 Tc Worksheet

Hyd. No. 2

Existing Site

Description	**A**		**B**		**C**		**Totals**
Sheet Flow							
Manning's n-value	= 0.090		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.50		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 10.19**	**+**	**0.00**	**+**	**0.00**	**=**	**10.19**
Shallow Concentrated Flow							
Flow length (ft)	= 1169.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 3.52		0.00		0.00		
Travel Time (min)	**= 5.53**	**+**	**0.00**	**+**	**0.00**	**=**	**5.53**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... **15.70 min**

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

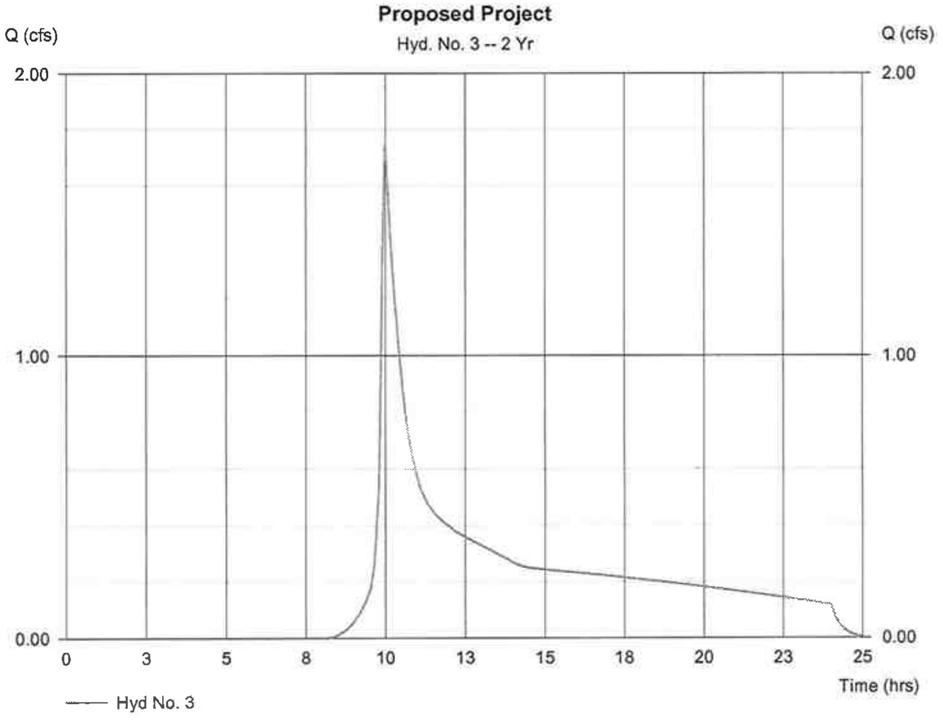
Hyd. No. 3

Proposed Project

Hydrograph type = SBUH Runoff
Storm frequency = 2 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = USER
Total precip. = 2.50 in
Storm duration = 24 hrs

Peak discharge = 1.74 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1315 ft
Time of conc. (Tc) = 18.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 16,198 cuft


Proposed Project

Hyd. No. 3 -- 2 Yr

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

Hyd. No. 4

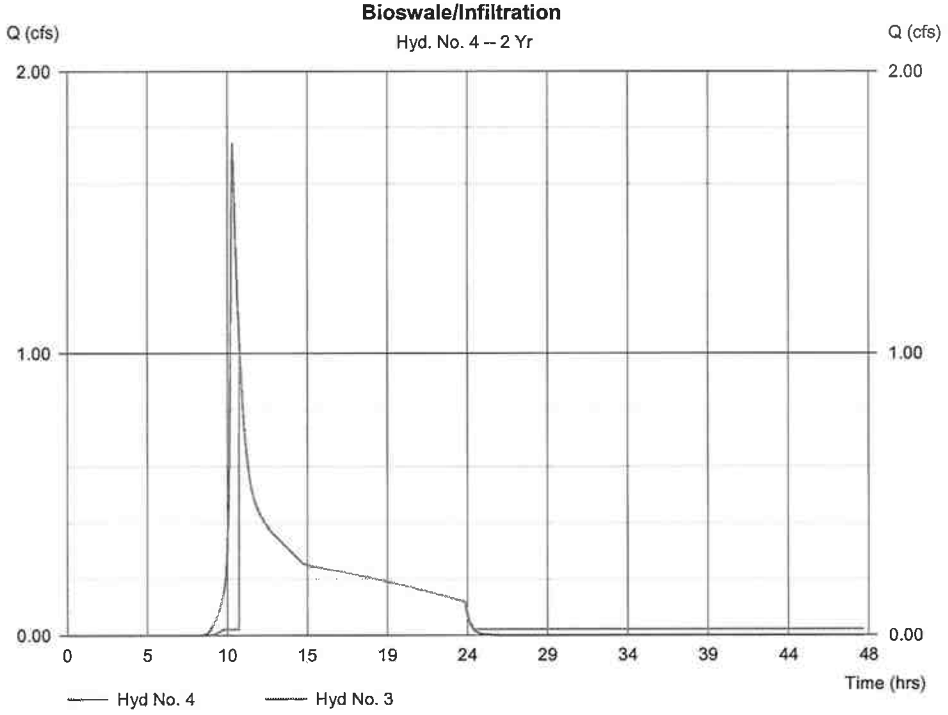
Bioswale/Infiltration

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 3
Reservoir name = 3' x 5' x 600 Bioswale

Peak discharge = 1.00 cfs
Time interval = 1 min
Max. Elevation = 104.61 ft
Max. Storage = 3,321 cuft

Storage Indication method used.

Hydrograph Volume = 14,696 cuft


Bioswale/Infiltration

Hyd. No. 4 -- 2 Yr

Pond Report

Hydraflow Hydrographs by Intelisolve Monday, Mar 19 2007, 3:0 AM

Pond No. 1 - 3' x 5' x 600 Bioswale

Pond Data

Bottom LxW = 600.0 x 3.0 ft Side slope = 0.0:1 Bottom elev. = 100.00 ft Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	100.00	1,800	0	0
0.25	100.25	1,800	180	180
0.50	100.50	1,800	180	360
0.75	100.75	1,800	180	540
1.00	101.00	1,800	180	720
1.25	101.25	1,800	180	900
1.50	101.50	1,800	180	1,080
1.75	101.75	1,800	180	1,260
2.00	102.00	1,800	180	1,440
2.25	102.25	1,800	180	1,620
2.50	102.50	1,800	180	1,800
2.75	102.75	1,800	180	1,980
3.00	103.00	1,800	180	2,160
3.25	103.25	1,800	180	2,340
3.50	103.50	1,800	180	2,520
3.75	103.75	1,800	180	2,700
4.00	104.00	1,800	180	2,880
4.25	104.25	1,800	180	3,060
4.50	104.50	1,800	180	3,240
4.75	104.75	1,800	180	3,420
5.00	105.00	1,800	180	3,600

(*40.00% voids applied)

Culvert / Orifice Structures

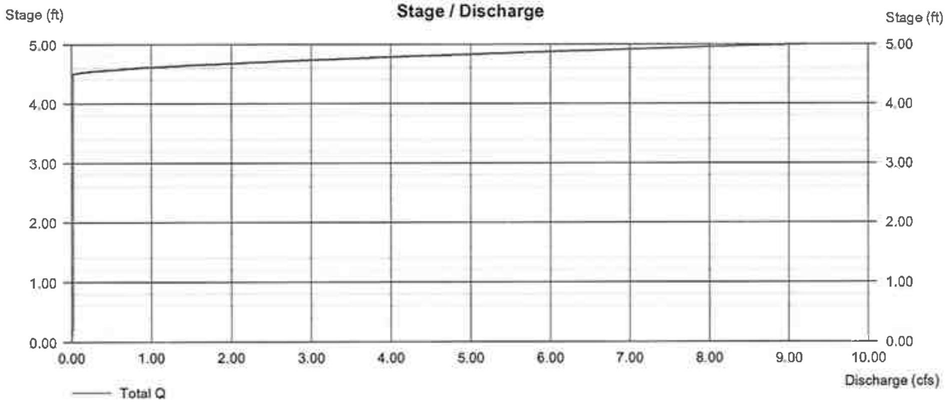
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 104.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.500 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.


Stage / Discharge

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SBUH Runoff	0.73	1	601	12,204	----	------	------	Pre-developed site
2	SBUH Runoff	2.83	1	599	22,778	----	------	------	Existing Site
3	SBUH Runoff	2.63	1	599	22,778	----	------	------	Proposed Project
4	Reservoir	2.19	1	607	21,270	3	104.69	3,377	Bioswale/Infiltration

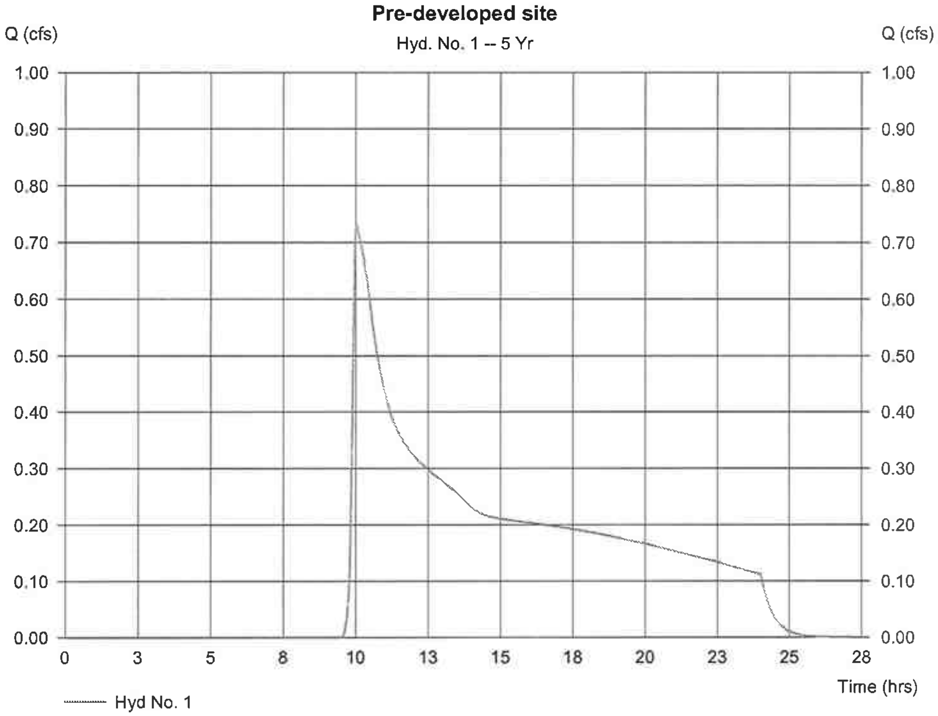
Hydrograph Plot

Hyd. No. 1

Pre-developed site

Hydrograph type	= SBUH Runoff	Peak discharge	= 0.73 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 5.020 ac	Curve number	= 69
Basin Slope	= 2.6 %	Hydraulic length	= 1315 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.00 min
Total precip.	= 3.00 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= N/A

Hydrograph Volume = 12,204 cuft



TR55 Tc Worksheet

Hyd. No. 1

Pre-developed site

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.50	0.00	0.00	
Land slope (%)	= 1.50	0.00	0.00	
Travel Time (min)	**= 12.44**	**+ 0.00**	**+ 0.00**	**= 12.44**
Shallow Concentrated Flow				
Flow length (ft)	= 1219.00	0.00	0.00	
Watercourse slope (%)	= 1.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 1.61	0.00	0.00	
Travel Time (min)	**= 12.59**	**+ 0.00**	**+ 0.00**	**= 12.59**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc .... 25.00 min

Hydrograph Plot

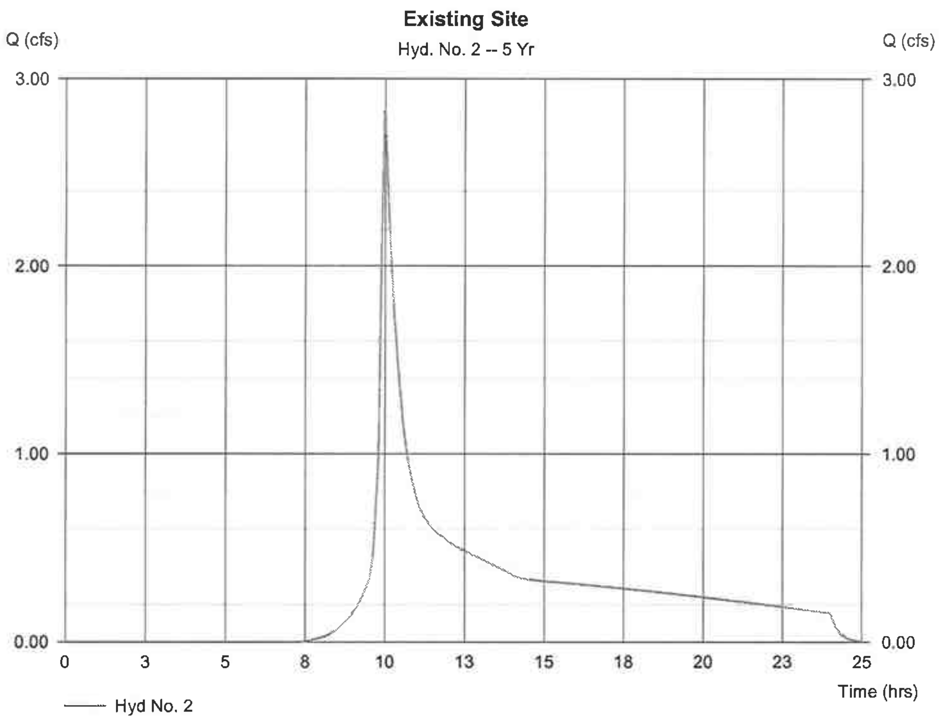
Hyd. No. 2

Existing Site

Hydrograph type = SBUH Runoff
Storm frequency = 5 yrs
Drainage area = 5.020 ac
Basin Slope = 1.4 %
Tc method = TR55
Total precip. = 3.00 in
Storm duration = 24 hrs

Peak discharge = 2.83 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1319 ft
Time of conc. (Tc) = 15.70 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 22,778 cuft



TR55 Tc Worksheet

Hyd. No. 2

Existing Site

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.090		0.011		0.011		
Flow length (ft)	=	150.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	2.50		0.00		0.00		
Land slope (%)	=	2.00		0.00		0.00		
Travel Time (min)	**=**	**10.19**	**+**	**0.00**	**+**	**0.00**	**=**	**10.19**
Shallow Concentrated Flow								
Flow length (ft)	=	1169.00		0.00		0.00		
Watercourse slope (%)	=	3.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	3.52		0.00		0.00		
Travel Time (min)	**=**	**5.53**	**+**	**0.00**	**+**	**0.00**	**=**	**5.53**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 15.70 min

Hydrograph Plot

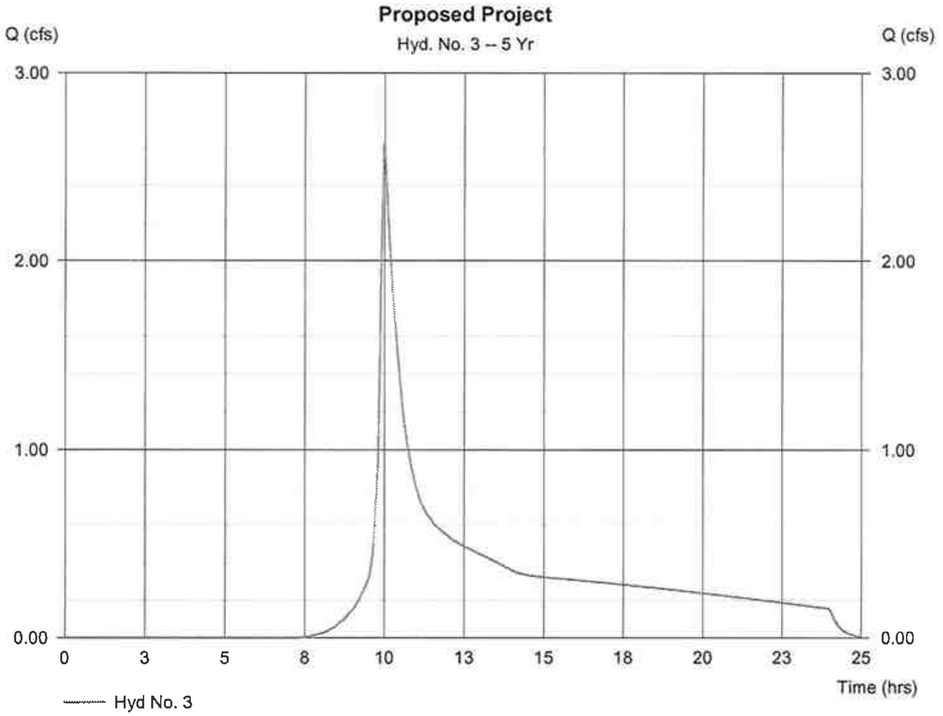
Hyd. No. 3

Proposed Project

Hydrograph type = SBUH Runoff
Storm frequency = 5 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = USER
Total precip. = 3.00 in
Storm duration = 24 hrs

Peak discharge = 2.63 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1315 ft
Time of conc. (Tc) = 18.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 22,778 cuft



Hydrograph Plot

Hyd. No. 4

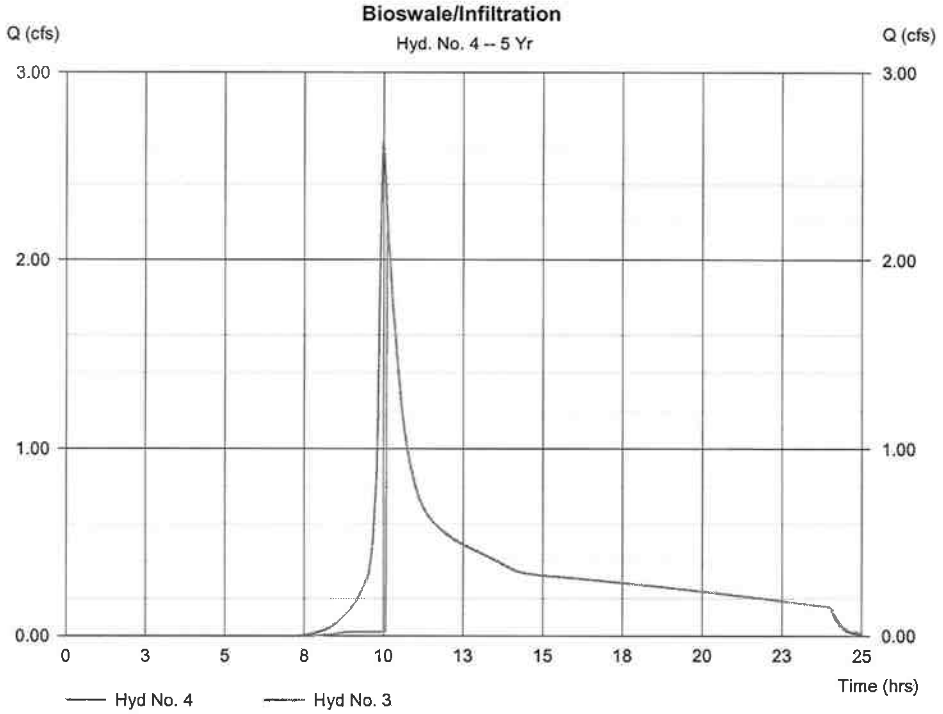
Bioswale/Infiltration

Hydrograph type = Reservoir
Storm frequency = 5 yrs
Inflow hyd. No. = 3
Reservoir name = 3' x 5' x 600 Bioswale

Peak discharge = 2.19 cfs
Time interval = 1 min
Max. Elevation = 104.69 ft
Max. Storage = 3,377 cuft

Storage Indication method used.

Hydrograph Volume = 21,270 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Monday, Mar 19 2007, 3:0 AM

Pond No. 1 - 3' x 5' x 600 Bioswale

Pond Data

Bottom LxW = 600.0 x 3.0 ft   Side slope = 0.0:1   Bottom elev. = 100.00 ft   Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	100.00	1,800	0	0
0.25	100.25	1,800	180	180
0.50	100.50	1,800	180	360
0.75	100.75	1,800	180	540
1.00	101.00	1,800	180	720
1.25	101.25	1,800	180	900
1.50	101.50	1,800	180	1,080
1.75	101.75	1,800	180	1,260
2.00	102.00	1,800	180	1,440
2.25	102.25	1,800	180	1,620
2.50	102.50	1,800	180	1,800
2.75	102.75	1,800	180	1,980
3.00	103.00	1,800	180	2,160
3.25	103.25	1,800	180	2,340
3.50	103.50	1,800	180	2,520
3.75	103.75	1,800	180	2,700
4.00	104.00	1,800	180	2,880
4.25	104.25	1,800	180	3,060
4.50	104.50	1,800	180	3,240
4.75	104.75	1,800	180	3,420
5.00	105.00	1,800	180	3,600

(*40.00% voids applied)

Culvert / Orifice Structures

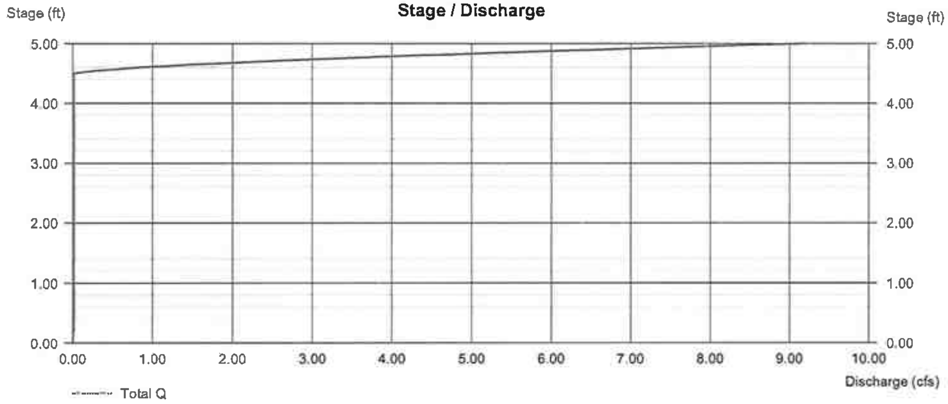
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 104.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.500 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SBUH Runoff	1.51	1	600	19,606	—	—	—	Pre-developed site
2	SBUH Runoff	4.28	1	599	32,737	—	—	—	Existing Site
3	SBUH Runoff	3.99	1	599	32,737	—	—	—	Proposed Project
4	Reservoir	3.98	1	599	31,222	3	104.78	3,445	Bioswale/Infiltration

Florence Street.gpw

Return Period: 10 Year

Monday, Mar 19 2007, 3:00 AM

Hydrograph Plot

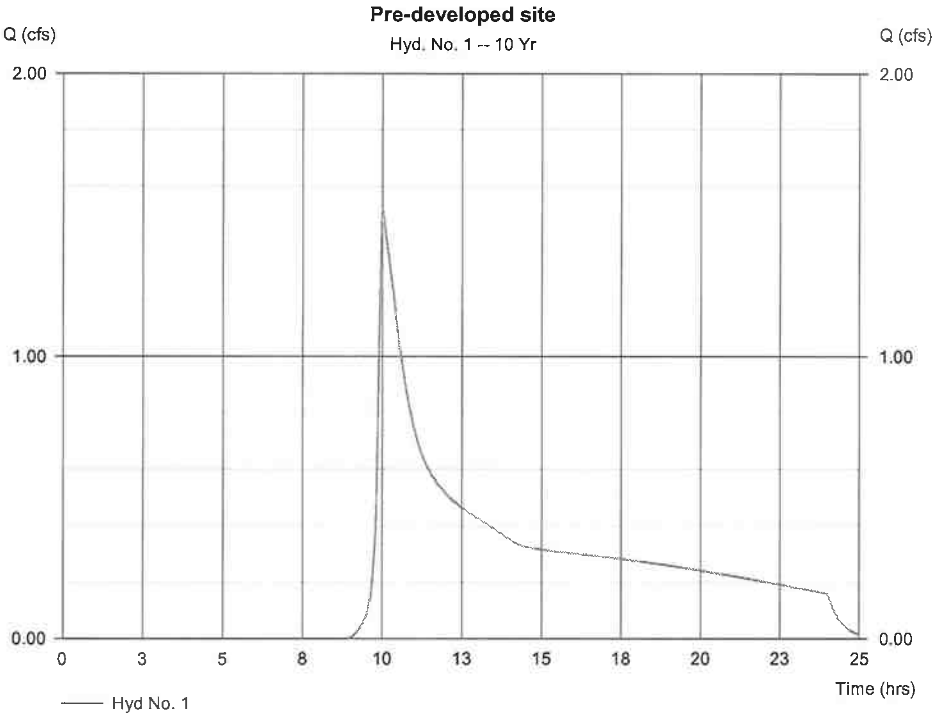
Hyd. No. 1

Pre-developed site

Hydrograph type = SBUH Runoff
Storm frequency = 10 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = TR55
Total precip. = 3.70 in
Storm duration = 24 hrs

Peak discharge = 1.51 cfs
Time interval = 1 min
Curve number = 69
Hydraulic length = 1315 ft
Time of conc. (Tc) = 25.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 19,606 cuft



TR55 Tc Worksheet

Hyd. No. 1

Pre-developed site

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.50	0.00	0.00	
Land slope (%)	= 1.50	0.00	0.00	
Travel Time (min)	**= 12.44**	**+ 0.00**	**+ 0.00**	**= 12.44**
Shallow Concentrated Flow				
Flow length (ft)	= 1219.00	0.00	0.00	
Watercourse slope (%)	= 1.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 1.61	0.00	0.00	
Travel Time (min)	**= 12.59**	**+ 0.00**	**+ 0.00**	**= 12.59**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Total Travel Time, Tc				**25.00 min**

Hydrograph Plot

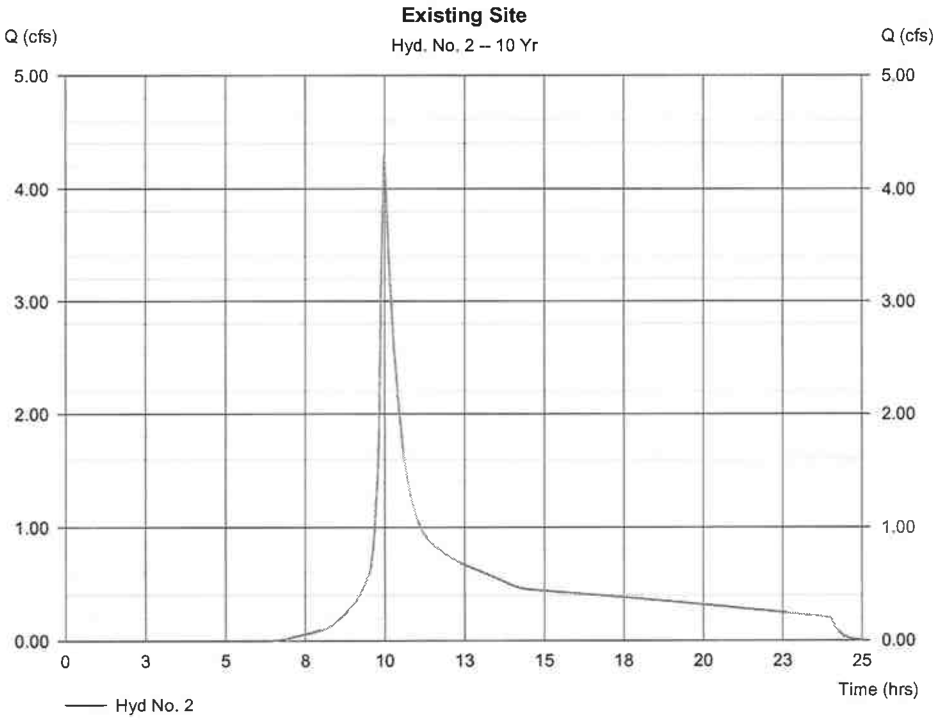
Hyd. No. 2

Existing Site

Hydrograph type = SBUH Runoff
Storm frequency = 10 yrs
Drainage area = 5.020 ac
Basin Slope = 1.4 %
Tc method = TR55
Total precip. = 3.70 in
Storm duration = 24 hrs

Peak discharge = 4.28 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1319 ft
Time of conc. (Tc) = 15.70 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 32,737 cuft



TR55 Tc Worksheet

Hyd. No. 2

Existing Site

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.090	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.50	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
Travel Time (min)	**= 10.19 +**	**0.00 +**	**0.00 =**	**10.19**
Shallow Concentrated Flow				
Flow length (ft)	= 1169.00	0.00	0.00	
Watercourse slope (%)	= 3.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	= 3.52	0.00	0.00	
Travel Time (min)	**= 5.53 +**	**0.00 +**	**0.00 =**	**5.53**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00 +**	**0.00 +**	**0.00 =**	**0.00**
Total Travel Time, Tc				**15.70 min**

Hydrograph Plot

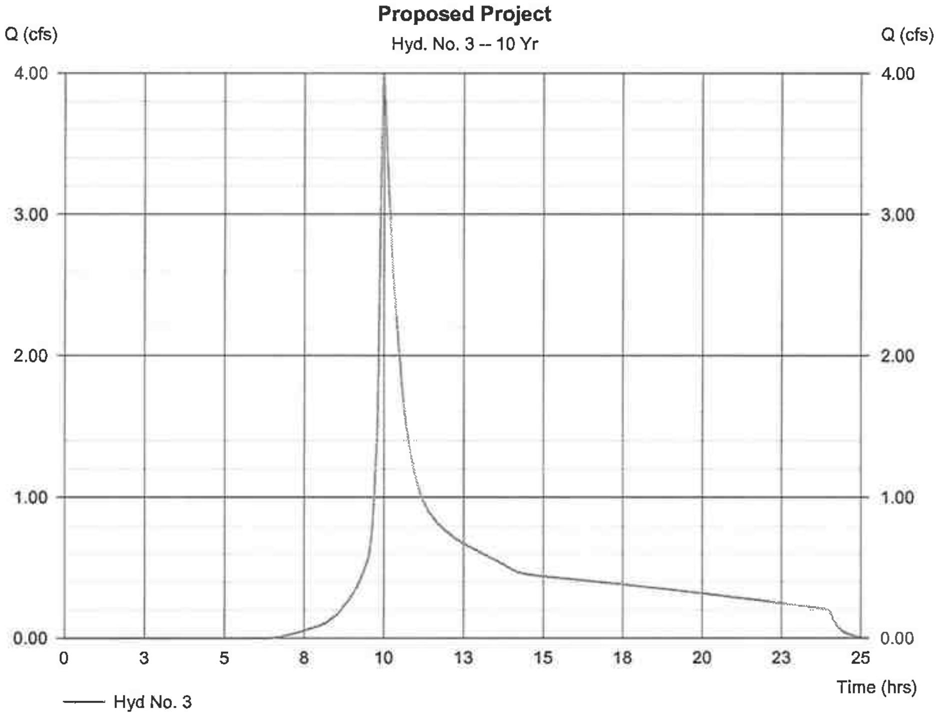
Hyd. No. 3

Proposed Project

Hydrograph type = SBUH Runoff
Storm frequency = 10 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = USER
Total precip. = 3.70 in
Storm duration = 24 hrs

Peak discharge = 3.99 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1315 ft
Time of conc. (Tc) = 18.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 32,737 cuft



Hydrograph Plot

Hyd. No. 4

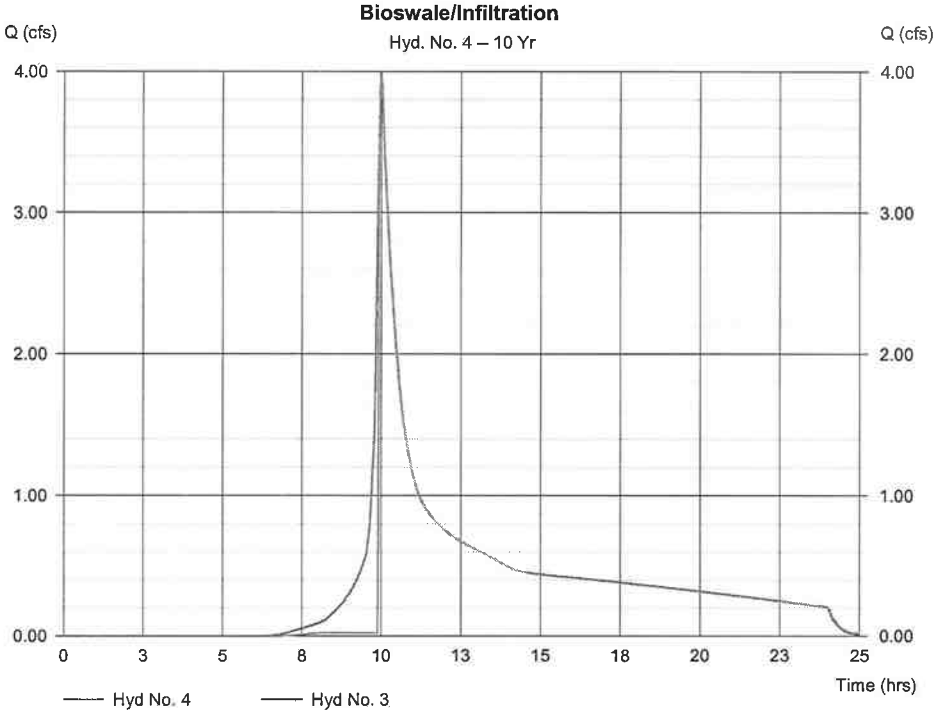
Bioswale/Infiltration

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 3
Reservoir name = 3' x 5' x 600 Bioswale

Peak discharge = 3.98 cfs
Time interval = 1 min
Max. Elevation = 104.78 ft
Max. Storage = 3,445 cuft

Storage Indication method used.

Hydrograph Volume = 31,222 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

Pond No. 1 - 3' x 5' x 600 Bioswale

Pond Data

Bottom LxW = 600.0 x 3.0 ft   Side slope = 0.0:1   Bottom elev. = 100.00 ft   Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)* (*40.00% voids applied)
0.00	100.00	1,800	0	0
0.25	100.25	1,800	180	180
0.50	100.50	1,800	180	360
0.75	100.75	1,800	180	540
1.00	101.00	1,800	180	720
1.25	101.25	1,800	180	900
1.50	101.50	1,800	180	1,080
1.75	101.75	1,800	180	1,260
2.00	102.00	1,800	180	1,440
2.25	102.25	1,800	180	1,620
2.50	102.50	1,800	180	1,800
2.75	102.75	1,800	180	1,980
3.00	103.00	1,800	180	2,160
3.25	103.25	1,800	180	2,340
3.50	103.50	1,800	180	2,520
3.75	103.75	1,800	180	2,700
4.00	104.00	1,800	180	2,880
4.25	104.25	1,800	180	3,060
4.50	104.50	1,800	180	3,240
4.75	104.75	1,800	180	3,420
5.00	105.00	1,800	180	3,600

Culvert / Orifice Structures

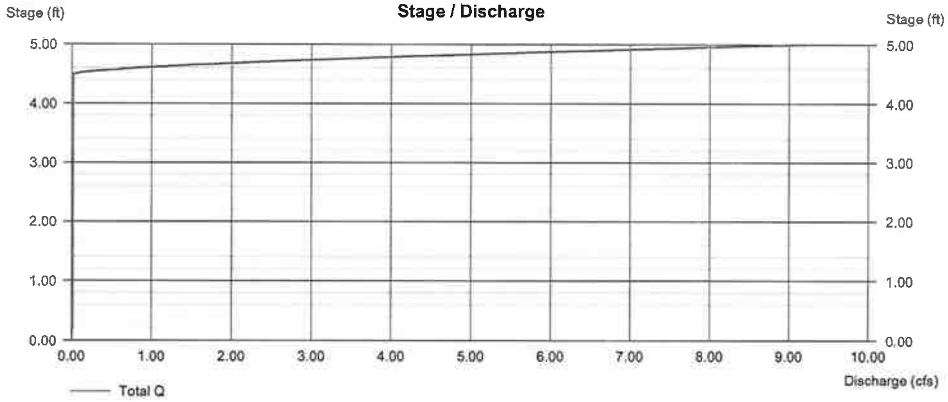
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 104.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	—	—	—
Multi-Stage	= No	No	No	No

Exfiltration = 0.500 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SBUH Runoff	2.57	1	600	29,201	—	—	—	Pre-developed site
2	SBUH Runoff	6.06	1	598	44,856	—	—	—	Existing Site
3	SBUH Runoff	5.65	1	599	44,856	—	—	—	Proposed Project
4	Reservoir	5.65	1	599	43,336	3	104.86	3,499	Bioswale/Infiltration

Hydrograph Plot

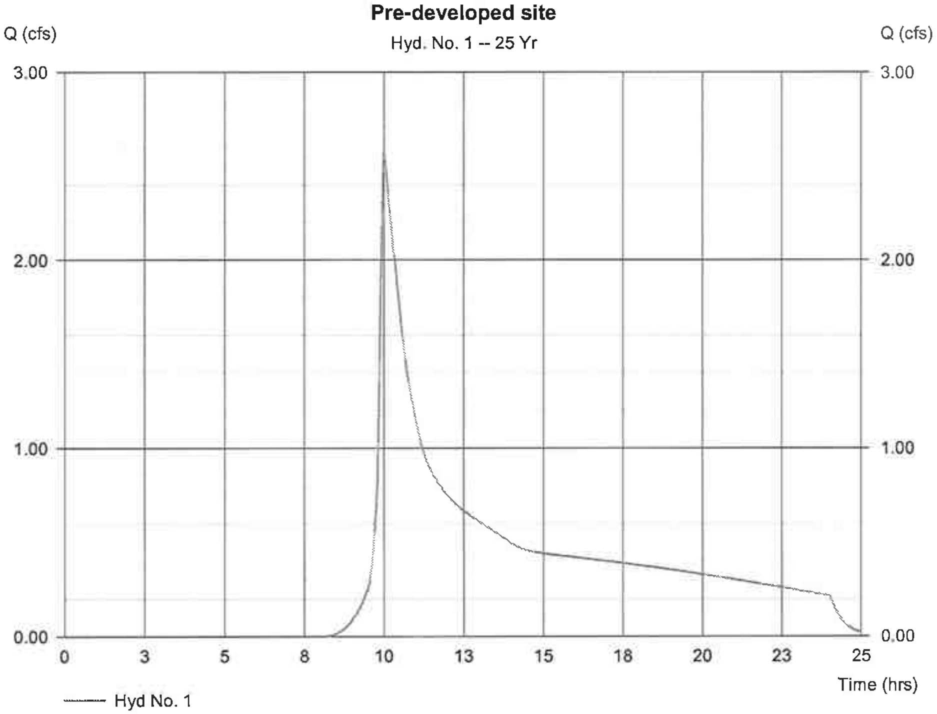
Monday, Mar 19 2007, 3:0 AM

Hyd. No. 1

Pre-developed site

Hydrograph type	= SBUH Runoff	Peak discharge	= 2.57 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 5.020 ac	Curve number	= 69
Basin Slope	= 2.6 %	Hydraulic length	= 1315 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.00 min
Total precip.	= 4.50 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= N/A

Hydrograph Volume = 29,201 cuft



TR55 Tc Worksheet

Hyd. No. 1

Pre-developed site

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.50	0.00	0.00	
Land slope (%)	= 1.50	0.00	0.00	
Travel Time (min)	**= 12.44**	**+ 0.00**	**+ 0.00**	**= 12.44**
Shallow Concentrated Flow				
Flow length (ft)	= 1219.00	0.00	0.00	
Watercourse slope (%)	= 1.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 1.61	0.00	0.00	
Travel Time (min)	**= 12.59**	**+ 0.00**	**+ 0.00**	**= 12.59**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc .... 25.00 min

Hydrograph Plot

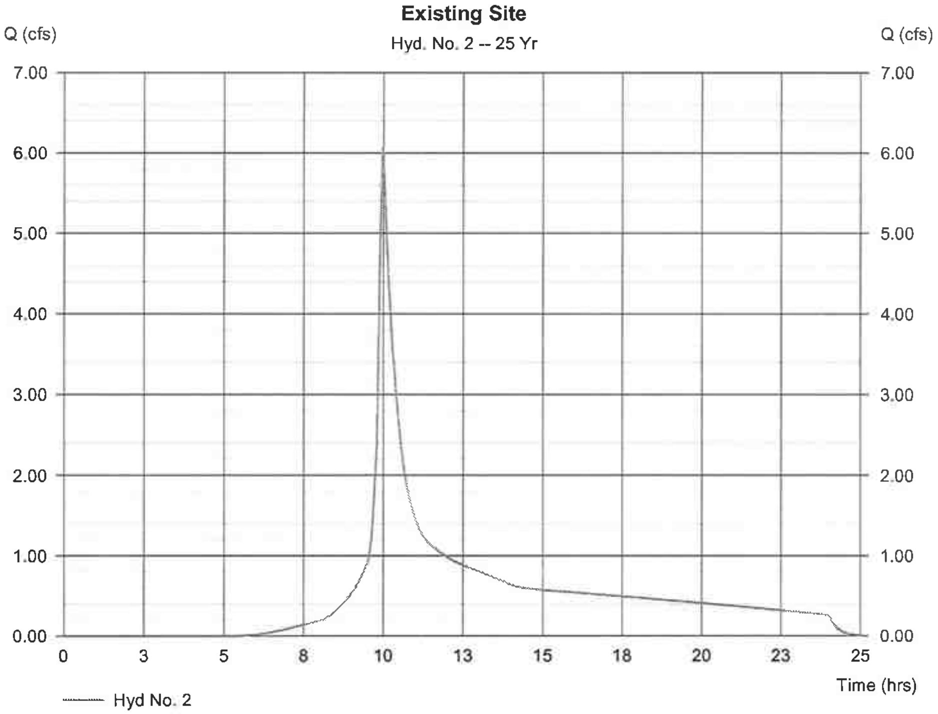
Hyd. No. 2

Existing Site

Hydrograph type = SBUH Runoff
Storm frequency = 25 yrs
Drainage area = 5.020 ac
Basin Slope = 1.4 %
Tc method = TR55
Total precip. = 4.50 in
Storm duration = 24 hrs

Peak discharge = 6.06 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1319 ft
Time of conc. (Tc) = 15.70 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 44,856 cuft



TR55 Tc Worksheet

Hyd. No. 2

Existing Site

Description	**A**		**B**		**C**		**Totals**
Sheet Flow							
Manning's n-value	= 0.090		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.50		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 10.19**	**+**	**0.00**	**+**	**0.00**	**=**	**10.19**
Shallow Concentrated Flow							
Flow length (ft)	= 1169.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 3.52		0.00		0.00		
Travel Time (min)	**= 5.53**	**+**	**0.00**	**+**	**0.00**	**=**	**5.53**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 15.70 min

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

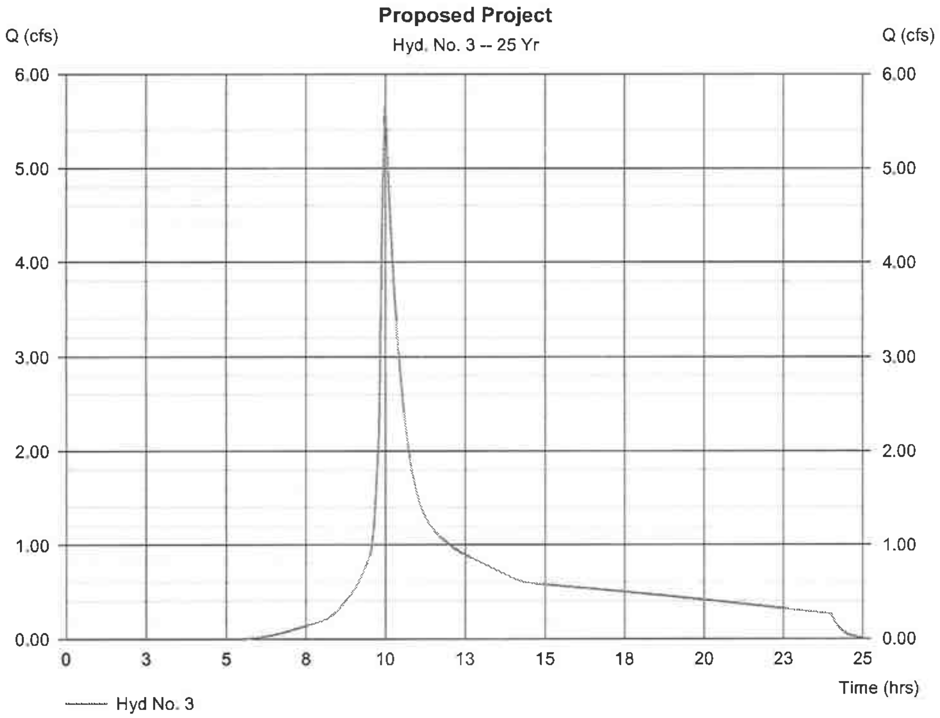
Hyd. No. 3

Proposed Project

Hydrograph type = SBUH Runoff
Storm frequency = 25 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = USER
Total precip. = 4.50 in
Storm duration = 24 hrs

Peak discharge = 5.65 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1315 ft
Time of conc. (Tc) = 18.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 44,856 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

Hyd. No. 4

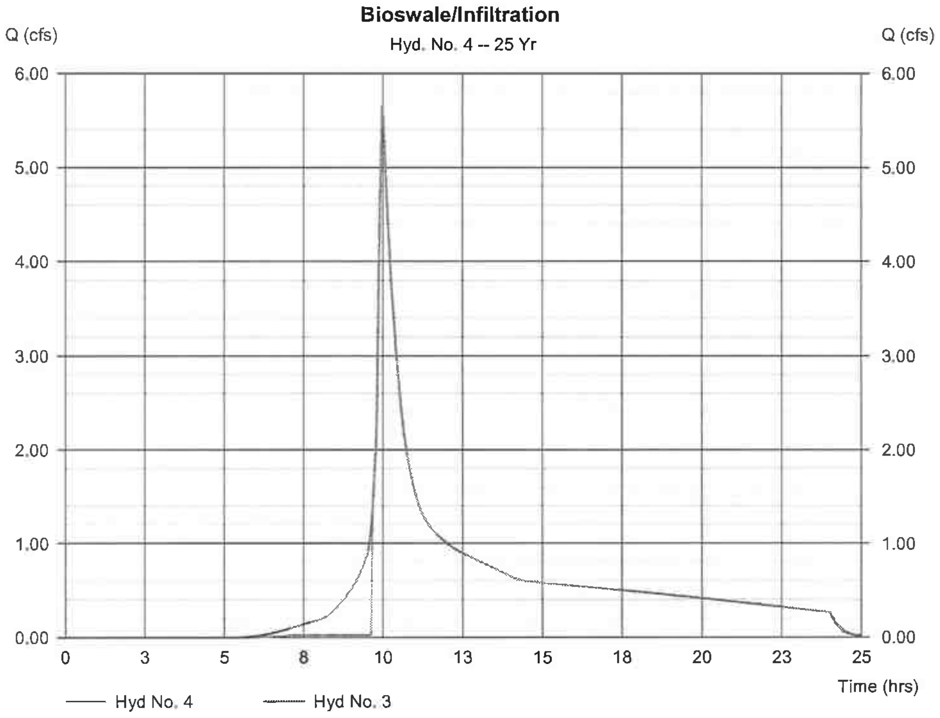
Bioswale/Infiltration

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 3
Reservoir name = 3' x 5' x 600 Bioswale

Peak discharge = 5.65 cfs
Time interval = 1 min
Max. Elevation = 104.86 ft
Max. Storage = 3,499 cuft

Storage Indication method used.

Hydrograph Volume = 43,336 cuft



Pond Report

Hydraflow Hydrographs by Intellisolve — Monday, Mar 19 2007, 3:0 AM

Pond No. 1 - 3' x 5' x 600 Bioswale

Pond Data

Bottom LxW = 600.0 x 3.0 ft Side slope = 0.0:1 Bottom elev. = 100.00 ft Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	100.00	1,800	0	0
0.25	100.25	1,800	180	180
0.50	100.50	1,800	180	360
0.75	100.75	1,800	180	540
1.00	101.00	1,800	180	720
1.25	101.25	1,800	180	900
1.50	101.50	1,800	180	1,080
1.75	101.75	1,800	180	1,260
2.00	102.00	1,800	180	1,440
2.25	102.25	1,800	180	1,620
2.50	102.50	1,800	180	1,800
2.75	102.75	1,800	180	1,980
3.00	103.00	1,800	180	2,160
3.25	103.25	1,800	180	2,340
3.50	103.50	1,800	180	2,520
3.75	103.75	1,800	180	2,700
4.00	104.00	1,800	180	2,880
4.25	104.25	1,800	180	3,060
4.50	104.50	1,800	180	3,240
4.75	104.75	1,800	180	3,420
5.00	105.00	1,800	180	3,600

(*40.00% voids applied)

Culvert / Orifice Structures

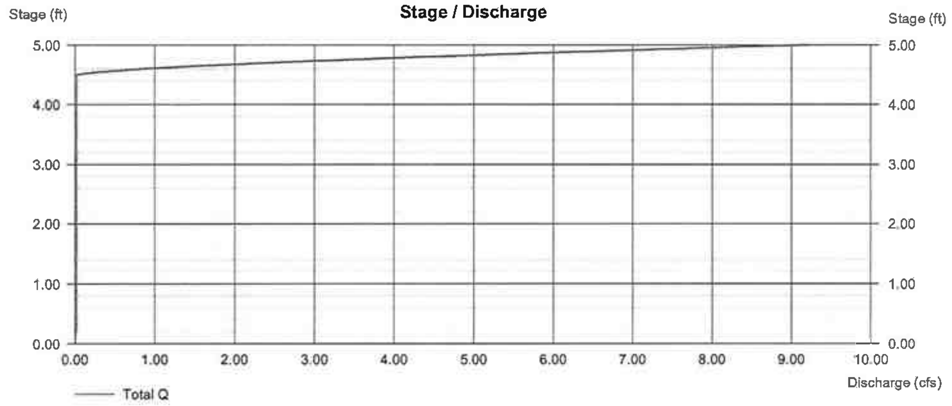
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 104.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	—	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.500 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SBUH Runoff	3.30	1	599	35,668	—	------	------	Pre-developed site
2	SBUH Runoff	7.22	1	598	52,715	—	------	------	Existing Site
3	SBUH Runoff	6.73	1	599	52,715	—	------	------	Proposed Project
4	Reservoir	6.73	1	599	51,193	3	104.91	3,532	Bioswale/Infiltration

Florence Street.gpw

Return Period: 50 Year

Monday, Mar 19 2007, 3:00 AM

Hydrograph Plot

Monday, Mar 19 2007, 3:0 AM

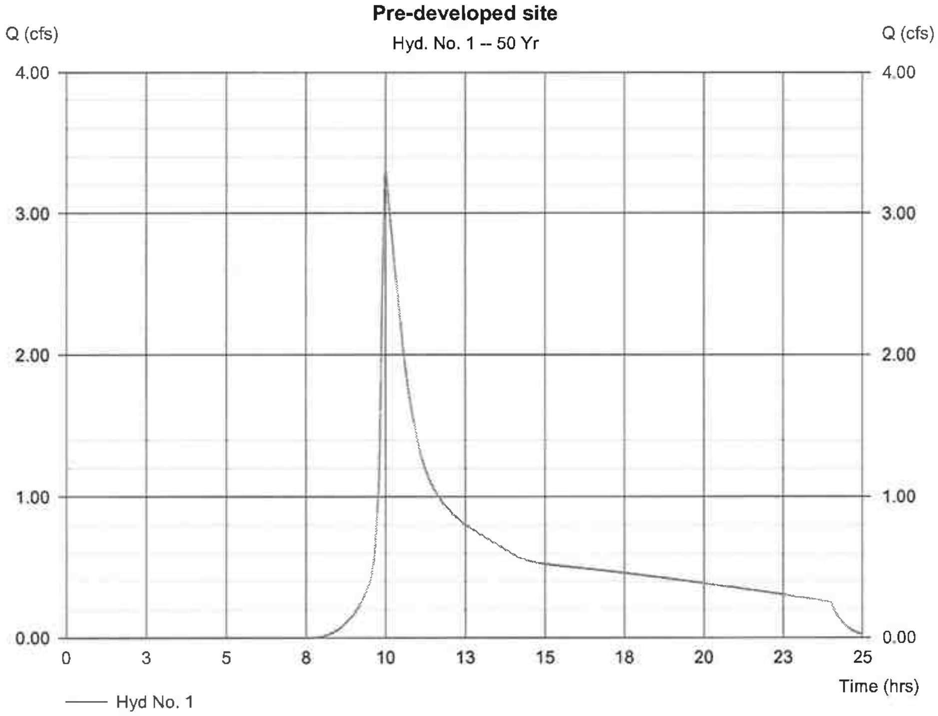
Hyd. No. 1

Pre-developed site

Hydrograph type = SBUH Runoff
Storm frequency = 50 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = TR55
Total precip. = 5.00 in
Storm duration = 24 hrs

Peak discharge = 3.30 cfs
Time interval = 1 min
Curve number = 69
Hydraulic length = 1315 ft
Time of conc. (Tc) = 25.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 35,668 cuft


Pre-developed site

Hyd. No. 1 -- 50 Yr

TR55 Tc Worksheet

Hyd. No. 1

Pre-developed site

Description	**A**		**B**		**C**		**Totals**
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.50		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 12.44**	**+**	**0.00**	**+**	**0.00**	**=**	**12.44**
Shallow Concentrated Flow							
Flow length (ft)	= 1219.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 1.61		0.00		0.00		
Travel Time (min)	**= 12.59**	**+**	**0.00**	**+**	**0.00**	**=**	**12.59**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**25.00 min**

Hydrograph Plot

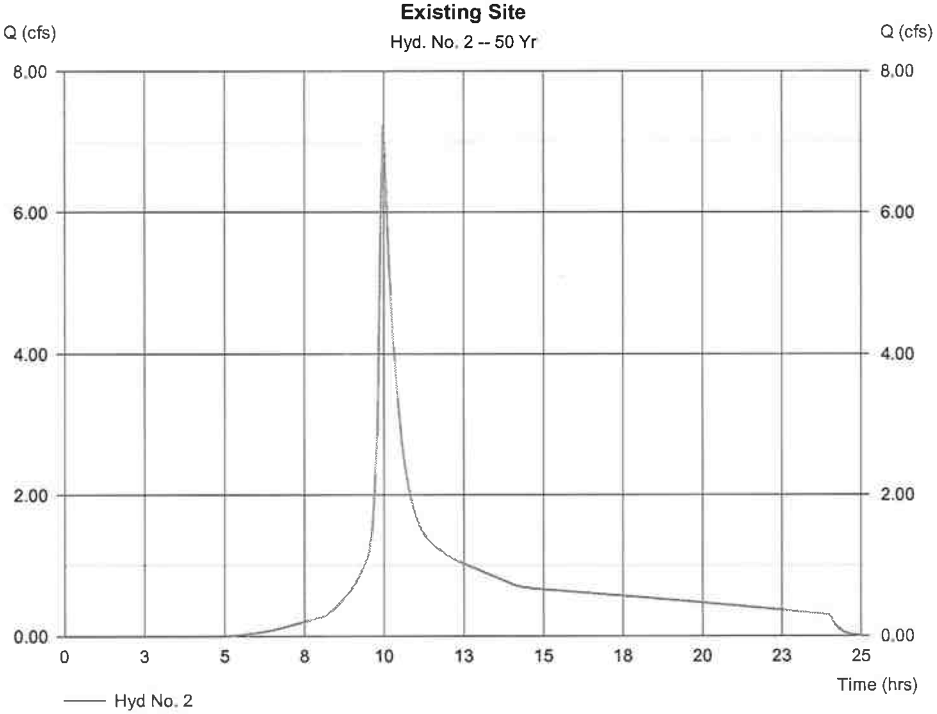
Hyd. No. 2

Existing Site

Hydrograph type = SBUH Runoff
Storm frequency = 50 yrs
Drainage area = 5.020 ac
Basin Slope = 1.4 %
Tc method = TR55
Total precip. = 5.00 in
Storm duration = 24 hrs

Peak discharge = 7.22 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1319 ft
Time of conc. (Tc) = 15.70 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 52,715 cuft



TR55 Tc Worksheet

Hyd. No. 2

Existing Site

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.090	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.50	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
Travel Time (min)	**= 10.19**	**+ 0.00**	**+ 0.00**	**= 10.19**
Shallow Concentrated Flow				
Flow length (ft)	= 1169.00	0.00	0.00	
Watercourse slope (%)	= 3.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	= 3.52	0.00	0.00	
Travel Time (min)	**= 5.53**	**+ 0.00**	**+ 0.00**	**= 5.53**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Total Travel Time, Tc				**15.70 min**

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

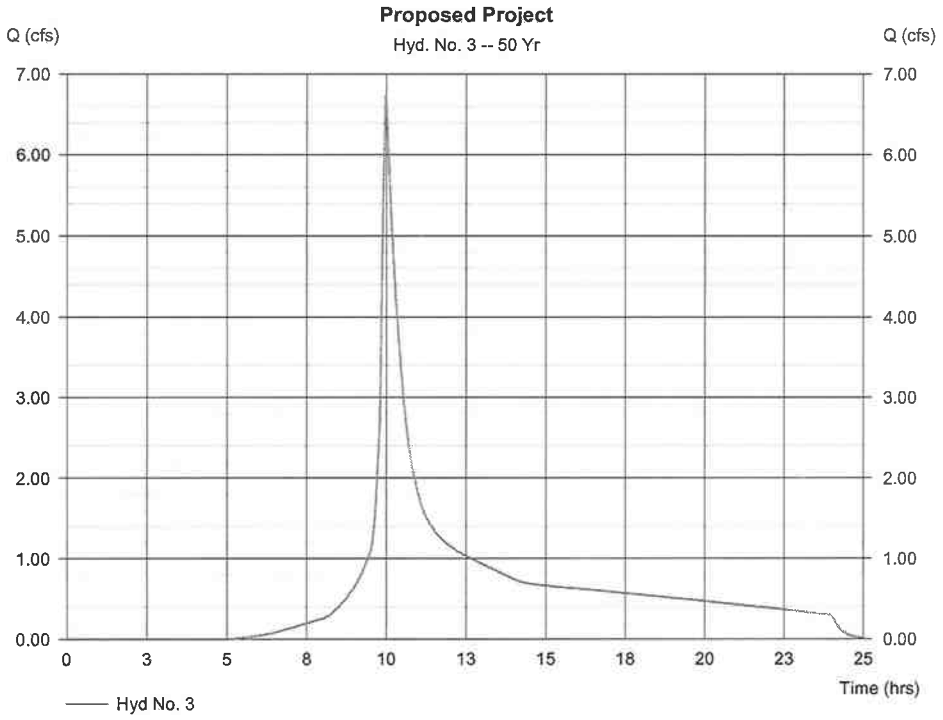
Hyd. No. 3

Proposed Project

Hydrograph type = SBUH Runoff
Storm frequency = 50 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = USER
Total precip. = 5.00 in
Storm duration = 24 hrs

Peak discharge = 6.73 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1315 ft
Time of conc. (Tc) = 18.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 52,715 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

Hyd. No. 4

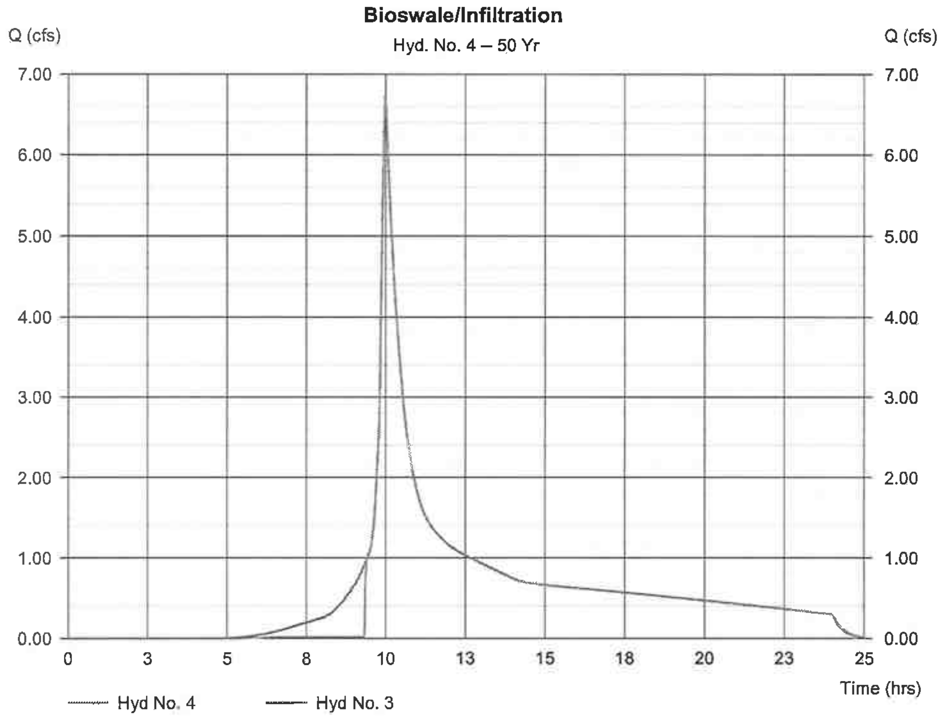
Bioswale/Infiltration

Hydrograph type = Reservoir
Storm frequency = 50 yrs
Inflow hyd. No. = 3
Reservoir name = 3' x 5' x 600 Bioswale

Peak discharge = 6.73 cfs
Time interval = 1 min
Max. Elevation = 104.91 ft
Max. Storage = 3,532 cuft

Storage Indication method used.

Hydrograph Volume = 51,193 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

Pond No. 1 - 3' x 5' x 600 Bioswale

Pond Data

Bottom LxW = 600.0 x 3.0 ft   Side slope = 0.0:1   Bottom elev. = 100.00 ft   Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)*
0.00	100.00	1,800	0	0
0.25	100.25	1,800	180	180
0.50	100.50	1,800	180	360
0.75	100.75	1,800	180	540
1.00	101.00	1,800	180	720
1.25	101.25	1,800	180	900
1.50	101.50	1,800	180	1,080
1.75	101.75	1,800	180	1,260
2.00	102.00	1,800	180	1,440
2.25	102.25	1,800	180	1,620
2.50	102.50	1,800	180	1,800
2.75	102.75	1,800	180	1,980
3.00	103.00	1,800	180	2,160
3.25	103.25	1,800	180	2,340
3.50	103.50	1,800	180	2,520
3.75	103.75	1,800	180	2,700
4.00	104.00	1,800	180	2,880
4.25	104.25	1,800	180	3,060
4.50	104.50	1,800	180	3,240
4.75	104.75	1,800	180	3,420
5.00	105.00	1,800	180	3,600

(*40.00% voids applied)

Culvert / Orifice Structures

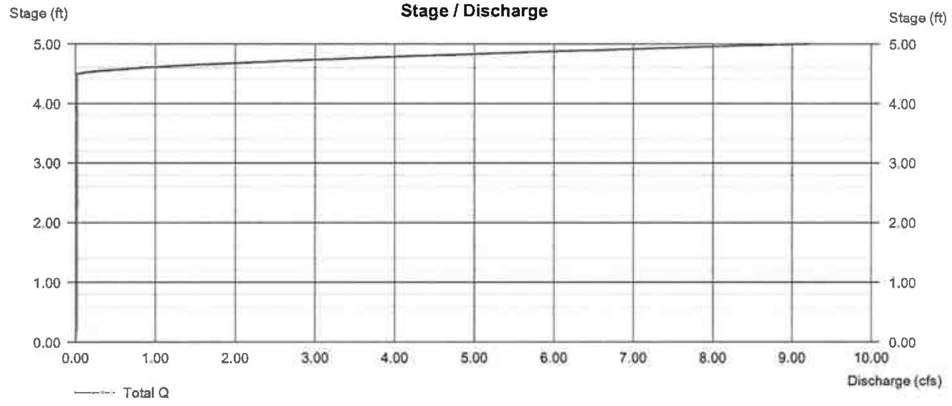
	[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 104.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.500 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.


Stage / Discharge

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SBUH Runoff	4.07	1	599	42,426	—	—	—	Pre-developed site
2	SBUH Runoff	8.39	1	598	60,742	—	—	—	Existing Site
3	SBUH Runoff	7.83	1	599	60,742	—	—	—	Proposed Project
4	Reservoir	7.83	1	599	59,217	3	104.95	3,563	Bioswale/Infiltration

Florence Street.gpw	Return Period: 100 Year	Monday, Mar 19 2007, 3:00 AM

Hydrograph Plot

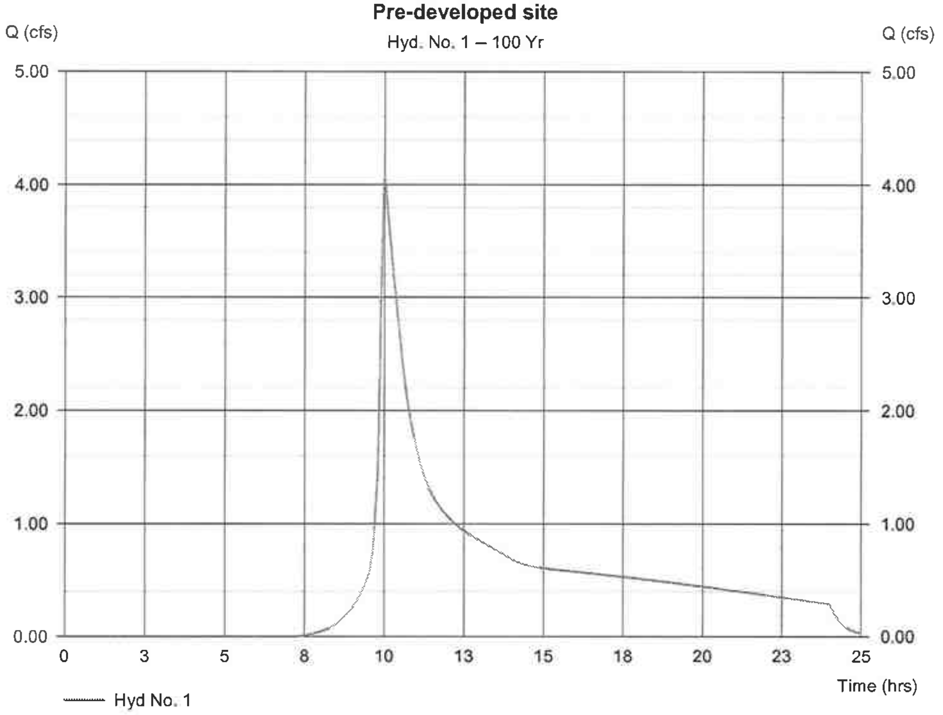
Hyd. No. 1

Pre-developed site

Hydrograph type = SBUH Runoff
Storm frequency = 100 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = TR55
Total precip. = 5.50 in
Storm duration = 24 hrs

Peak discharge = 4.07 cfs
Time interval = 1 min
Curve number = 69
Hydraulic length = 1315 ft
Time of conc. (Tc) = 25.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 42,426 cuft


Pre-developed site

Hyd. No. 1 – 100 Yr

TR55 Tc Worksheet

Hyd. No. 1

Pre-developed site

Description	**A**		**B**		**C**		**Totals**
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.50		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 12.44**	**+**	**0.00**	**+**	**0.00**	**=**	**12.44**
Shallow Concentrated Flow							
Flow length (ft)	= 1219.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 1.61		0.00		0.00		
Travel Time (min)	**= 12.59**	**+**	**0.00**	**+**	**0.00**	**=**	**12.59**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 25.00 min

Hydrograph Plot

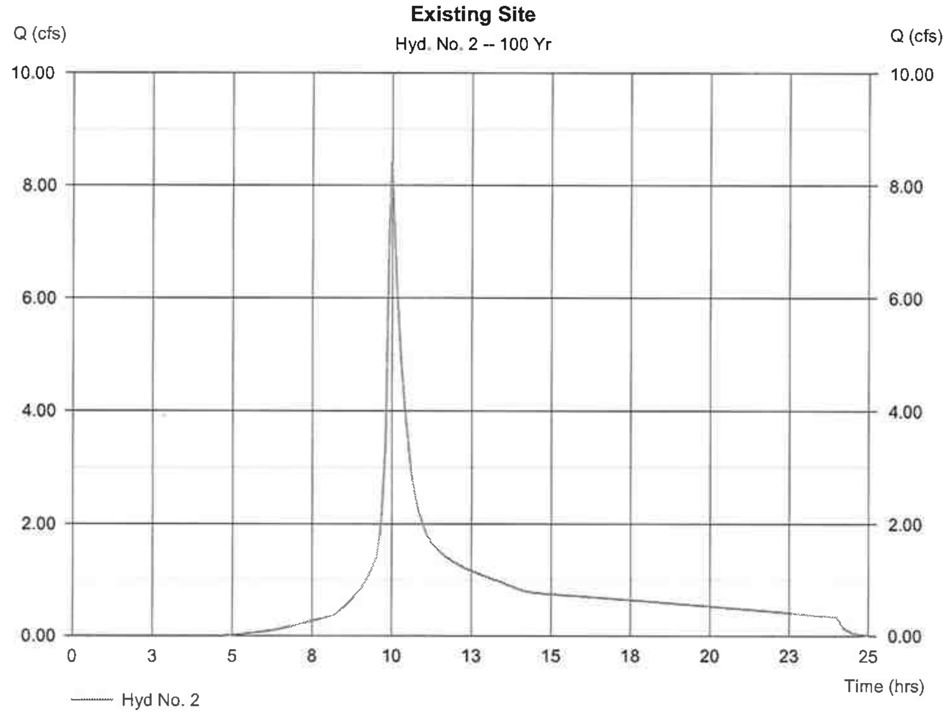
Hyd. No. 2

Existing Site

Hydrograph type = SBUH Runoff
Storm frequency = 100 yrs
Drainage area = 5.020 ac
Basin Slope = 1.4 %
Tc method = TR55
Total precip. = 5.50 in
Storm duration = 24 hrs

Peak discharge = 8.39 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1319 ft
Time of conc. (Tc) = 15.70 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 60,742 cuft



TR55 Tc Worksheet

Hyd. No. 2

Existing Site

<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>		<u>Totals</u>
Sheet Flow							
Manning's n-value	= 0.090		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.50		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 10.19**	**+**	**0.00**	**+**	**0.00**	**=**	**10.19**
Shallow Concentrated Flow							
Flow length (ft)	= 1169.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 3.52		0.00		0.00		
Travel Time (min)	**= 5.53**	**+**	**0.00**	**+**	**0.00**	**=**	**5.53**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**15.70 min**

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve　Monday, Mar 19 2007, 3:0 AM

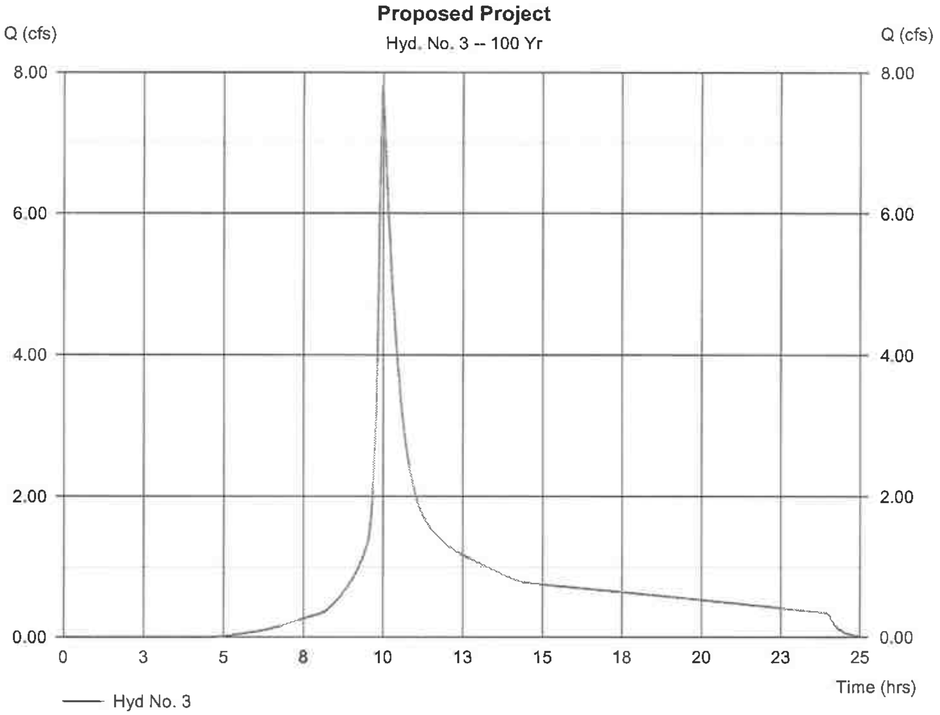
Hyd. No. 3

Proposed Project

Hydrograph type = SBUH Runoff
Storm frequency = 100 yrs
Drainage area = 5.020 ac
Basin Slope = 2.6 %
Tc method = USER
Total precip. = 5.50 in
Storm duration = 24 hrs

Peak discharge = 7.83 cfs
Time interval = 1 min
Curve number = 80
Hydraulic length = 1315 ft
Time of conc. (Tc) = 18.00 min
Distribution = Type I
Shape factor = N/A

Hydrograph Volume = 60,742 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve　Monday, Mar 19 2007, 3:0 AM

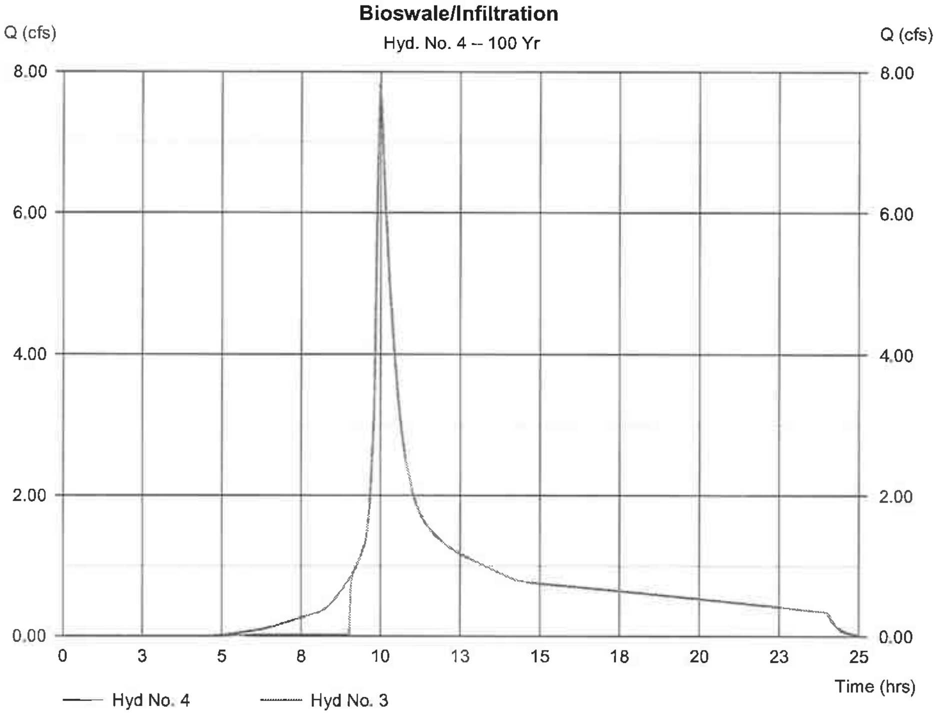
Hyd. No. 4

Bioswale/Infiltration

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 3
Reservoir name = 3' x 5' x 600 Bioswale

Peak discharge = 7.83 cfs
Time interval = 1 min
Max. Elevation = 104.95 ft
Max. Storage = 3,563 cuft

Storage Indication method used.　Hydrograph Volume = 59,217 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Monday, Mar 19 2007, 3:0 AM

Pond No. 1 - 3' x 5' x 600 Bioswale

Pond Data

Bottom LxW = 600.0 x 3.0 ft   Side slope = 0.0:1   Bottom elev. = 100.00 ft   Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)*	Total storage (cuft)* (*40.00% voids applied)
0.00	100.00	1,800	0	0
0.25	100.25	1,800	180	180
0.50	100.50	1,800	180	360
0.75	100.75	1,800	180	540
1.00	101.00	1,800	180	720
1.25	101.25	1,800	180	900
1.50	101.50	1,800	180	1,080
1.75	101.75	1,800	180	1,260
2.00	102.00	1,800	180	1,440
2.25	102.25	1,800	180	1,620
2.50	102.50	1,800	180	1,800
2.75	102.75	1,800	180	1,980
3.00	103.00	1,800	180	2,160
3.25	103.25	1,800	180	2,340
3.50	103.50	1,800	180	2,520
3.75	103.75	1,800	180	2,700
4.00	104.00	1,800	180	2,880
4.25	104.25	1,800	180	3,060
4.50	104.50	1,800	180	3,240
4.75	104.75	1,800	180	3,420
5.00	105.00	1,800	180	3,600

Culvert / Orifice Structures

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

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 104.50	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	—	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.500 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.