APPENDIX H

Hydrology and Water

THE VILLAGE AT LOOMIS

LOOMIS, CA

Preliminary Drainage Report

OCTOBER 2014

TLA
ENGINEERING & PLANNING

TABLE OF CONTENTS

Vicinity Map

1.0 EXECUTIVE SUMMARY
Figure A, Pre and Post Development On-Site Storm Runoff Summary
Figure B, Pre and Post Development 100-year Floodplain Limit Map
Figure C

2.0 INTRODUCTION
2.1 Statement of Purpose
2.2 Project Description

3.0 EXISTING DRAINAGE PLANS AND FLOOD PLAIN STUDIES
3.1 General

4.0 METHODOLOGY
4.1 Design Criteria
4.2 Computer Modeling and Software
4.3 Design Precipitation
4.4 Watershed Parameters
4.5 Detention Basins

5.0 STORM DRAINAGE ANALYSIS
5.1 Objectives
5.2 Analysis Overview
5.3 Predevelopment Watershed
5.4 Post-Development Watershed
5.5 Detention Basins
5.6 Comparative Analysis

6.0 100-YEAR FLOOD PLAIN ANALYSIS
6.1 Objectives
6.2 Analysis Overview
6.3 FEMA Floodplain Mapping
6.4 Predevelopment Floodplain
6.5 Post-Development Floodplain
6.6 Design Storm Flows
6.7 Comparative Analysis

7.0 STORMWATER QUALITY
7.1 Objectives
7.2 Analysis Overview
7.3 Good Housekeeping
7.4 Treatment BMP's

8.0 FINDINGS AND RECOMMENDATIONS

8.1 Findings

8.11 Storm Water
8.12 Floodplain
8.13 Stormwater Quality

8.2 Site Development Recommendations

8.21 Storm Drainage
8.22 Floodplain
8.23 Stormwater Quality

APPENDIX "A" STORM DRAINAGE

A.1 Pre Development Watershed HEC-HMS Results 2, 10 &100-yr events

A.2 Post Development Watershed HEC-HMS Results 2, 10 &100-yr events
Detention Pond Hydrograph and Data 2, 10 &100-yr events
Detention Pond Elevation-Area and Stage-Discharge Tables

A.3 Rainfall Hyetographs 2, 10 and 100-year Design Storms
Post Development On-Site Watershed Sub-basin Parameters
Pre Development On-Site Watershed Sub-basin Parameters
Pre Development Off-Site Watershed Sub-basin Parameters
USDA/SCS Soil Map
Chart F.1 Overland Slope and Length
Figure A1, Pre-Development Watershed Map
Figure A2, Post-Development Watershed Map
Figure A3, Off-Site Watershed Map Land Cover Areas
Figure A4, Off-Site Watershed Map Basin Drainage and Connectivity

APPENDIX "B" FLOODPLAIN ANALYSIS

B.1 Pre Development HEC-RAS Result Table, Profile and Section Plots, 100-yr event
Pre Development Drainage Tabulation

B.2 Post Development HEC-RAS Result Table, Profile and Section Plots, 100-yr event
Post Development Drainage Tabulation

B.3 Rating Table for Existing I-80 culvert
Figure B1, Pre-Development 100-year Floodplain
Figure B2, Post-Development 100-year Floodplain
FEMA FIRMette Map FM06061C0418F

APPENDIX "C" STORM WATER QUALITY

C.1 Preliminary Water Quality Treatment Areas
Sizing Criteria, MS4/General Permit, Excerpt
Typical Details, Storm water BMP's
Typical Detail, "Contech" CDS Separator
Figure C1, Storm Water treatment Areas, Phase 1
Figure C2, Storm Water treatment Areas, Phase 2
Figure C3, Storm Water treatment Areas, Phase 3

HEC-HMS and HEC-RAS Computer Disk (Rear Cover)

FILE NAME	DESCRIPTION
Loomis prelim	Folder, HEC-RAS pre and post development floodplain model
Loomis prelim	Folder, HEC-HMS pre and post development hydrology model

THE VILLAGE AT LOOMIS

FIGURE 1

N

N.T.S.

TLA
ENGINEERING & PLANNING
1528 EUREKA ROAD, SUITE 100
ROSEVILLE, CA 95661 916.786.0685

EXHIBIT

File: L:\1proj\12xx\1221\dwg\Drainage\2014 REPORT\D1221PROJLOC.dwg Sep 29, 2014 – 11:09am

1.0 EXECUTIVE SUMMARY

(Refer to Figures A and B)
The purpose of this report is for the determination of on-site and off-site storm drainage impacts relative to the proposed "Village at Loomis" residential/mixed-use development. The primary focuses are changes in stormwater generated by the project and any potential changes to the existing FEMA floodplain that bisects the site.

The proposed project will consist of 303 single family dwelling units in a mix of lot sizes that vary from 2,000 square feet to 4,000+ square feet, 138 multi-family dwelling units at a density of 20-25 dwelling units per acre, 7 acres of general commercial, and 11 acres of parks and open space. The project site is currently undeveloped and covered with a native grass/woods combination.

Projected storm water runoff impacts were analyzed at six primary off-site points of discharge (POD) immediately effected by storm water exiting the project site. These locations were identified as points A, B, C, D, E and F. No other areas of significant on-site runoff or impacts were noted.

Projected storm water floodplain impacts were limited to the upper fork of Secret Ravine, which flows across the project site. This tributary is currently mapped by FEMA as zone "AE"; areas subject the 1 percent (100-year) storm event with determined base flood elevations. No other areas of the project site were subject to FEMA mapped floodplains or unusual/obvious inundation.

The findings of this report are as follows:

1. Storm Drainage Impacts: (see Figure "A")
   (1) Points of discharge A, C, and F all show a minimum 10 percent decreases in post-development stormwater runoff versus pre development for 2, 10 and 100-year storm events. Point B shows no increase to slight decrease in post development runoff. Points D and E show zero runoff post development, as these areas will be routed into the proposed Doc Barnes Drive drainage system
   (2) Point A will show a significant decrease in runoff to the existing 66 inch culvert at I-80. This is due to the ponding/reservoir effect of the proposed Doc Barnes Drive.
   (3) Watershed basins at points of discharge B, C and F show significant increases in site runoff and will require stormwater detention to mitigate peak flow to sub-pre development levels per requirements set forth in the Placer County Stormwater Management Manual (SWMM). Detention will be provided in the form of open ponds at locations on Figures A1, this report.

2. Floodplain Impacts: (see Figure "B")
   (1) The post development project will not adversely alter upstream or downstream water surface elevations or increase limits of flooding for the 1 percent (100-year) storm event. Water surface elevations upstream of project site in Sun Knoll residential subdivision and adjacent residential areas will remain similar to predevelopment conditions and will not increase.
   (2) Downstream water surface elevations will be decreased by approximately 0.2 feet.
   Due to ponding effects of the proposed Doc Barnes Drive, water surface elevations immediately on-site upstream of said road will increase by approximately 0.3 feet

average up to 975 feet upstream Doc Barnes Drive. All other water surface elevations on-site remain unaffected.

3. Stormwater Quality (See Figure C)
   (1) The proposed project has adequate area and is suitable to implement post development water quality measures based on a treatment area of 4 percent new impervious area, per Town of Loomis standards.
   (2) The proposed project will incorporate low impact development standards and treat all stormwater runoff from new impervious surfaces. Proposed treatment methods include bioretention, vegetative swales, and hydrodynamic separators.
   (3) A separate Stormwater Prevention Plan (SWPPP) will be required for all construction activities.

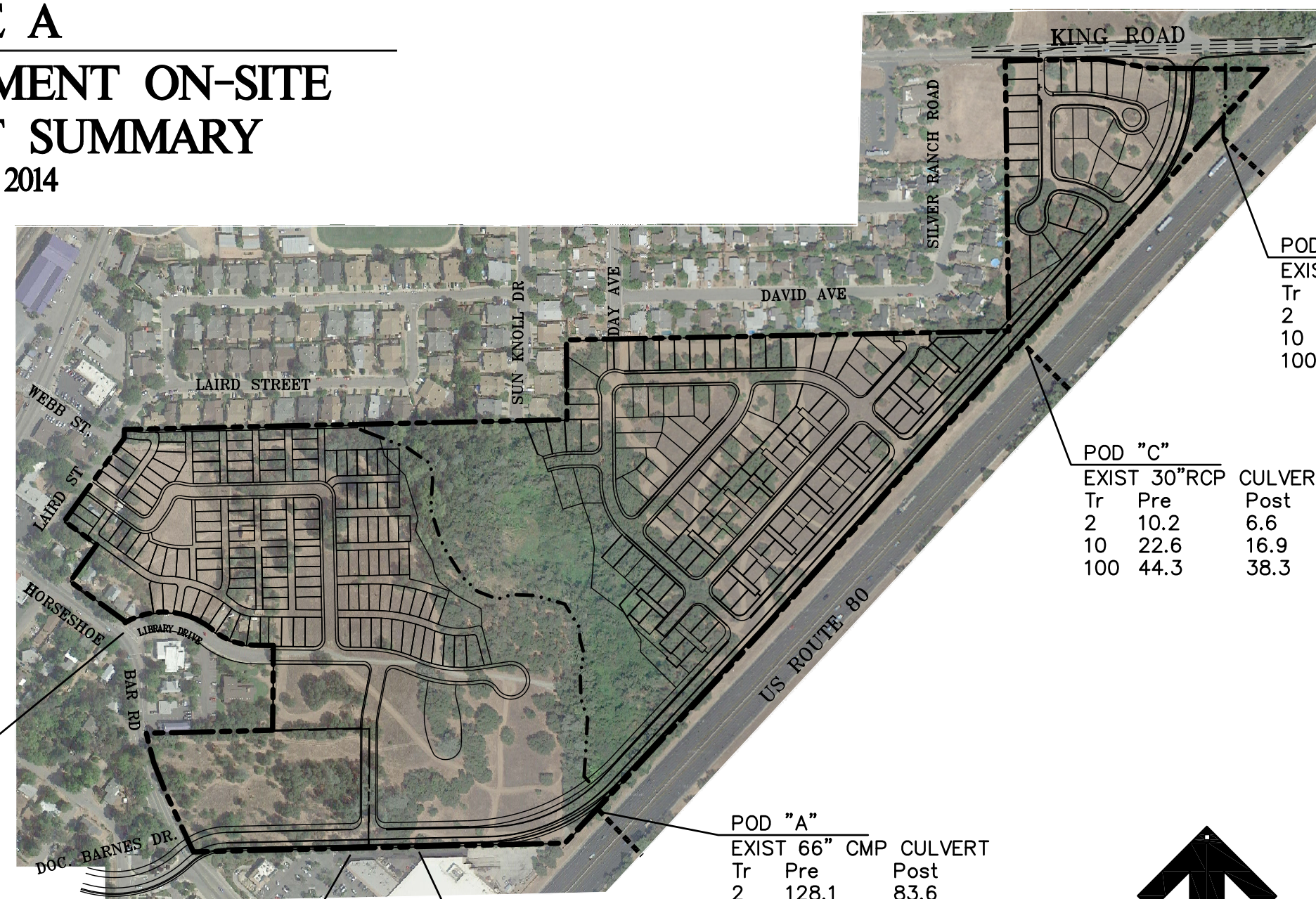
THE VILLAGE AT LOOMIS

FIGURE A

PRE/POST-DEVELOPMENT ON-SITE STORM RUNOFF SUMMARY

OCTOBER 2014

NOTES:
1. ALL FLOWS IN CUBIC FEET PER SECOND.
2. POD = POINT OF DISCHARGE
3. Tr = STORM RECURRENCE INTERVAL (YEARS)



POD "B"
EXIST 48"RCP CULVERT

Tr	Pre	Post
2	32.5	32.5
10	80	79.8
100	162.7	162.3

POD "C"
EXIST 30"RCP CULVERT

Tr	Pre	Post
2	10.2	6.6
10	22.6	16.9
100	44.3	38.3

POD "F"
EXIST DRAINAGE INLET

Tr	Pre	Post
2	1.2	1.0
10	3.2	2.8
100	6.8	6.1

POD "A"
EXIST 66" CMP CULVERT

Tr	Pre	Post
2	128.1	83.6
10	290.5	240.5
100	549.1	492.7

POD "E"
EXIST DRAINAGE INLET

Tr	Pre	Post
2	1.5	0
10	3.5	0
100	7.0	0

POD "D"
EXIST DRAINAGE INLET

Tr	Pre	Post
2	0.7	0
10	2.8	0
100	7.0	0

NOTE: POD D & E ARE REDIRECTED INTO POD A SUB BASIN DRAINAGE SYSTEM

N

400 0 200 400 800

SCALE: 1" = 400

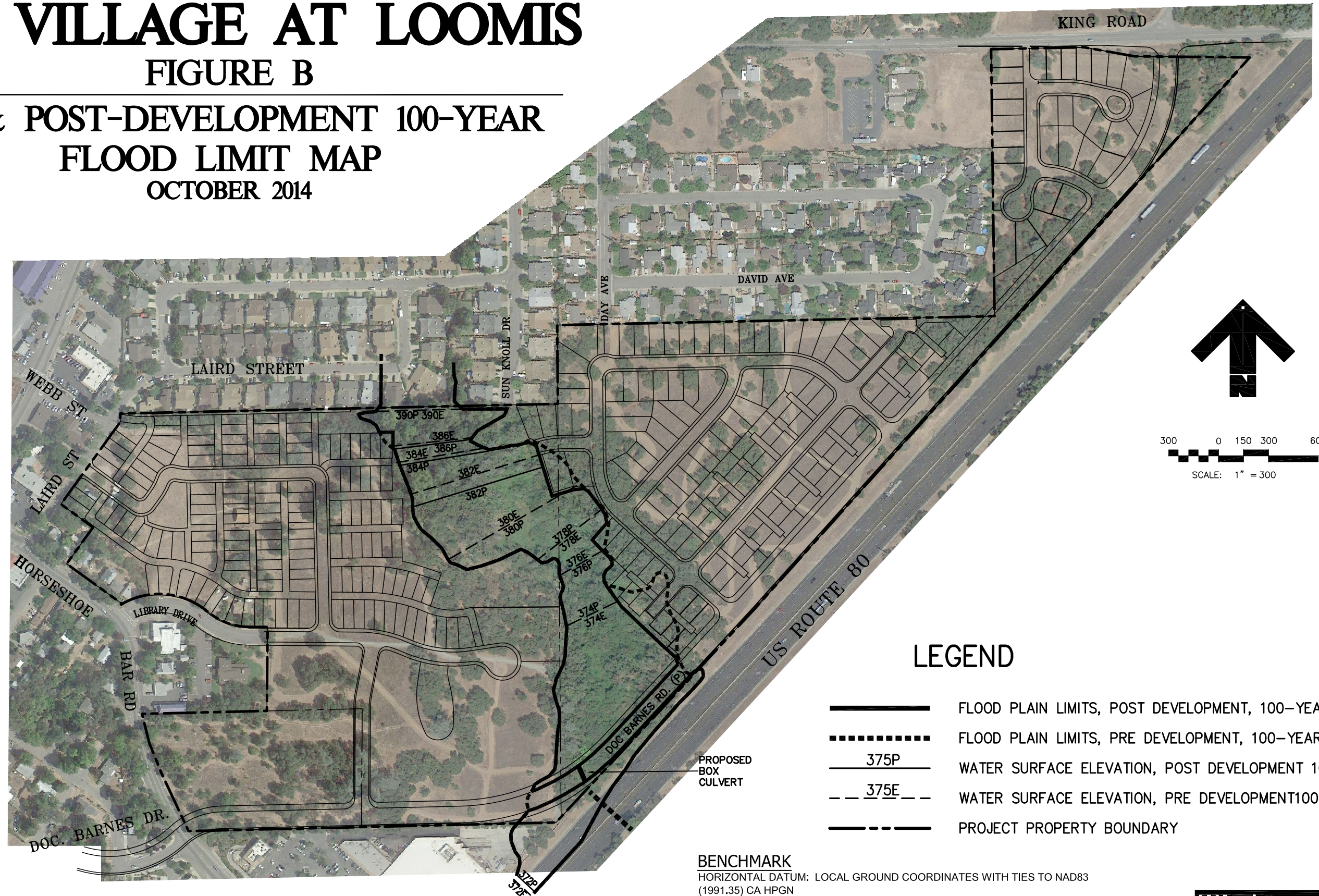
TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

THE VILLAGE AT LOOMIS

FIGURE B

PRE & POST-DEVELOPMENT 100-YEAR FLOOD LIMIT MAP

OCTOBER 2014



LEGEND

———	FLOOD PLAIN LIMITS, POST DEVELOPMENT, 100-YEAR
- - - - -	FLOOD PLAIN LIMITS, PRE DEVELOPMENT, 100-YEAR
375P	WATER SURFACE ELEVATION, POST DEVELOPMENT 100-YEAR
375E	WATER SURFACE ELEVATION, PRE DEVELOPMENT100-YEAR
——— - - ———	PROJECT PROPERTY BOUNDARY

BENCHMARK

HORIZONTAL DATUM: LOCAL GROUND COORDINATES WITH TIES TO NAD83 (1991.35) CA HPGN
VERTICAL DATUM: NGVD29 BASED ON BENCH MARK USGS BM W45 (PID JS0766)
ELEV: 398.65
DESCRIPTION: TOP OF PILLAR FOUNDATION AT NORTHWEST ENTRANCE TO ROCKLIN LOOMIS MUNICIPAL UTILITIES DISTRICT BUILDING.

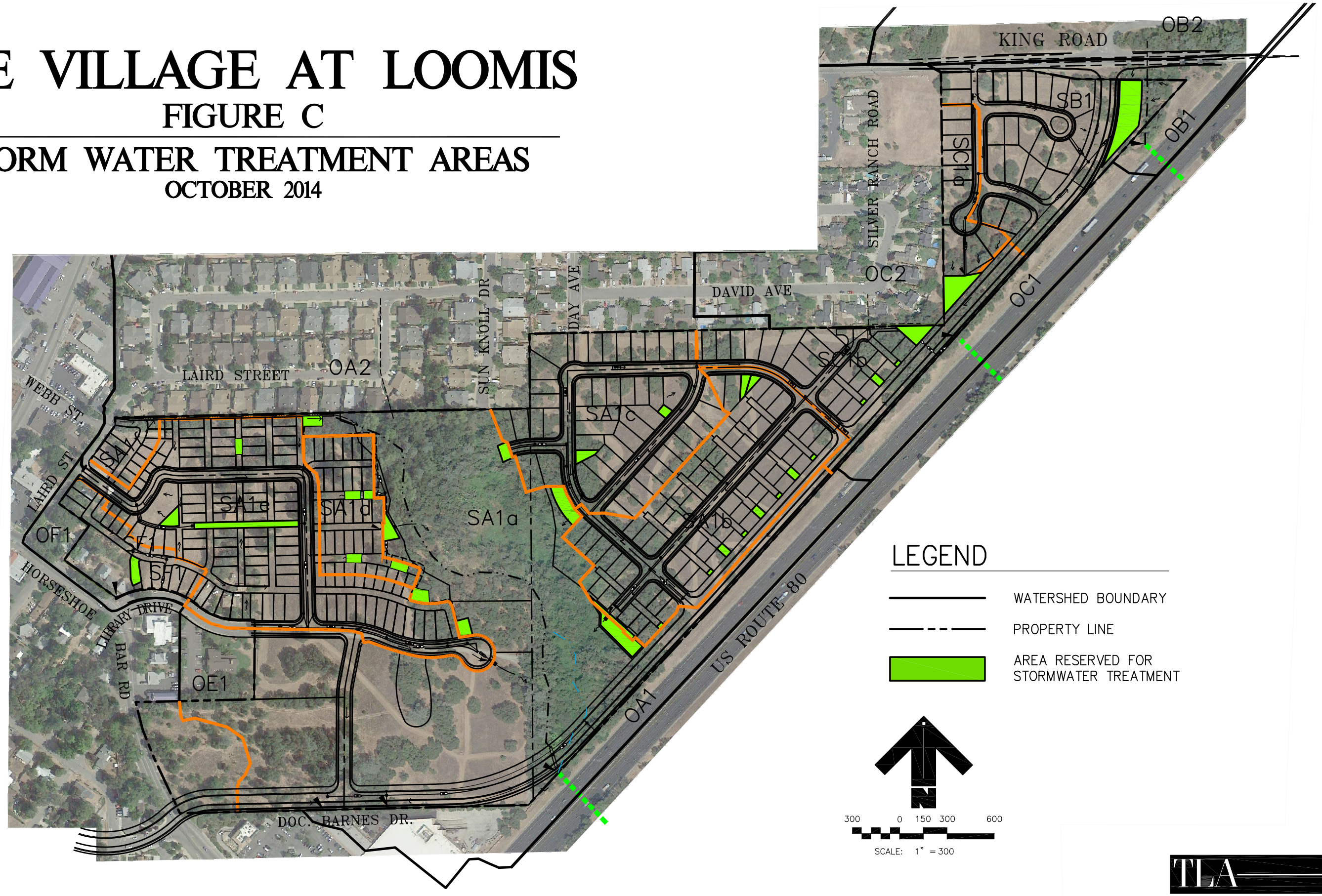
TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

THE VILLAGE AT LOOMIS

FIGURE C

STORM WATER TREATMENT AREAS

OCTOBER 2014



TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

L:\1proj\12xx\1221\dwg\Drainage\2014 REPORT\D1221WQ-ONSITE.dwg Oct 17, 2014 - 3:18pm - sfritz

2.0 INTRODUCTION

2.1 Statement of Purpose

The purpose of this report is for the determination of on-site and off-site storm drainage impacts relative to the proposed Village at Loomis development project. The primary focuses are changes in stormwater quantities generated by the project and any potential changes to the existing FEMA floodplain (and water surface elevations) that bisects the site. This report also addresses engineering elements of post-development water quality requirements as implemented and outlined in the Town of Loomis Stormwater Management Plan (SWMP).

This report supersedes a previous report prepared by Terrance E. Lowell and Associates, Inc. dated August 2006.

2.2 Project Description

The proposed project is situated within the limits of the Town of Loomis, and is to the northeast of the intersection of Horseshoe Bar Road and Interstate Highway 80 (I-80), and is approximately 66 acres in size. The land will be subdivided to include three subdivisions and will consist of 303 single family dwelling units in a mix of lot sizes that vary from 2,000 square feet to 4,000+ square feet, 138 multi-family dwelling units at a density of 20-25 dwelling units per acre, 7 acres of general commercial, and 11 acres of parks and open space. The entire project site is located within the Dry Creek Watershed.

3.0 EXISTING DRAINAGE PLANS AND FLOOD PLAIN STUDIES

3.1 General

The following hydrology and floodplain reports and design studies have been completed that are relative to this project:

"Update to the Dry Creek Watershed Flood Control Plan," dated November 2011, by Placer County Flood Control District, prepared by CES, RBF;

"Dry Creek Watershed Flood Control Plan", dated 1992, by Placer County Flood Control District and Sacramento Water Agency "Town of Loomis Drainage Master Plan," dated 2001, by West Yost & Associates;

"Flood Insurance Study," Placer County California and Incorporated Areas, 06061CV001/2, Volumes 1 and 2, dated November 21 2001, FEMA

4.0 METHODOLOGY

4.1 Design Criteria

Existing and proposed system drainage flows and facilities are calculated and will be designed in accordance with:

1. The Placer County Flood Control and Water Conservation District's Stormwater Management Manual, version February 1994 & October 1997 amendments (SWMM);

2. Town of Loomis; Land Development Manual and Construction Standards;
3. Town of Loomis; Stormwater Management Plan
4. Industry standard practice.

The SWMM is relative to all watersheds studied. It provides methodology and criteria for the design of facilities and detention facility sizing, and rainfall amounts and distribution for use in ungauged drainage basins.

The SWMM requires post-project objective flows for 2-year, 10-year and 100-year storm events to be less than pre-project flow conditions unless master drainage plans indicate otherwise. The 1992 Dry Creek study does not propose any new policies for mitigation, but recommends, in certain areas of the Dry Creek Watershed, detention facilities be built in any future developments. Figure 5-2 of the Dry Creek Study shows that this project is within the area where detention is recommended.

Drainage facilities will be designed to conform to the post-project SWMM flow requirements unless otherwise noted.

4.2 Computer Modeling and Software

Runoff Analysis:
The Army Corps of Engineers HEC- HMS 4.0 hydrologic modeling system program was used to calculate the peak flows for the 2, 10 and 100-year storm events. Placer County Design Precipitation Program (PDP) was used to generate design storm data. Watershed sub-basin areas were calculated using standard AutoCAD drafting techniques. Army Corps of Engineers HEC-DSSvue was used to print graphs and tabular data not readily possible with HEC-HMS.

Floodplain Analysis:
For Floodplain modeling, Army Corps of Engineers HEC-RAS 4.1 software was used.

4.3 Design Precipitation

(See Appendix "A" for rainfall hyetographs.)
Precipitation is based on the SWMM depth-duration-frequency versus elevation tables prepared for Placer County. Precipitation input into the 2, 10 and 100-year design storms were developed using the (PDP). An elevation of 385 feet was used for determination of the rainfall amounts for all basins studied. To determine maximum potential runoff, a storm duration of 24-hours was selected. As none of the three primary watershed sub-basins (A, B and C) exceed one square mile, storm centering procedures were not used, as outlined in the SWMM.

4.4 Watershed Parameters

Runoff Potential:
Sub-basin areas, watershed boundaries and land use cover was determined using Google Map Images, site aerial topography, exhibit mapping from the 2011 Dry Creek Study, West Yost master plan drawings, and site reconnaissance. Off-site land use density, impervious area and infiltration factors were based on information shown in Table F.2 of the 2011 Dry Creek Study, which combined Placer County General Plan and Table 5-4 SWMM data. The soil hydrologic characteristics were determined using information obtained from U.S. Dept. of Agriculture/Soils Conservation Service (USDA/SCS) soil profile maps of the area (see Appendix A) Overall impervious area varied from 5 percent (undeveloped) to 85 percent. Undeveloped areas were assumed to be 5 percent minimum to include incidental roadways, minor paving/structures, etc.

For the general watershed, an initial abstraction (loss rate) of zero inches (0.00") is used for pervious and impervious areas. This is a requirement of the SWMM and would be the case for an area that has been subject to prior storms and the ground and depressions already saturated.

Drainage Patterns/Hydraulic Connectivity:
Sub-basin Hydraulic connection was based on West Yost Master Plan drawings, aerial/satellite images and site reconnaissance. Where possible, actual data were used in areas with well-defined/mapped natural and manmade drainage structure. However, in many locations the surface drainage pattern was relatively irregular and indeterminate. In these situations, an idealized connectivity was used to better model drainage patterns.

Kinematic Wave and Routing Parameters:
Per the SWMM, watershed hydrologic modeling is required to use the Kinematic Wave method. Kinematic Wave methodology requires the input of surface sheet flow and channel/pipe routing parameters. Where possible, (such as on-site) actual parameters were used. Given the varied surface cover and relatively large areas involved, parameters used off-site were not necessarily site specific, but were typical values seen with certain land covers. Overland slope parameters off-site were based on Chart F.1 of the 2011 Dry Creek Study, which calibrated runoff parameters to actual stream gauge data given watershed impervious area, and would be seen as superior to rough estimation. Channel routing involved the use of Muskingum-Cunge or Kinematic Wave methods as applicable.

For Kinematic Wave input, the following were used for friction values for pre and post-project conditions both on and off-site:

Sheet flow:	Impervious	n = 0.20 Paved/Industrial/commercial
	Pervious	n = 0.30 Medium residential
		n = 0.40 Rural residential
		n = 0.60 to 0.80 Open space/parks
Channel flow:	Impervious	n = 0.015 concrete, paved
		n = 0.20 blown concrete (irrig. channels)
	Pervious	n = 0.04 to 0.08 depending on location & use
CMP:		n = 0.024
Concrete/smooth id Plastic/steel		n = 0.015

4.5 Detention Basins
Per SWMM requirements (figure 7-1) a 10 percent reduction in on-site post development runoff versus pre development will need to be realized in design discharge for 2, 10 and 100-year storm events. Ten year water surface elevations are to be no greater than 4.5 feet above bottom of pond, and 100-year water surface elevations are to be less than 5.5 feet bottom of pond. Excepting sub-basin A, outfall design will involve a generic stage-discharge performance curve that will stage 2, 10, 100-year and high flow discharge. These generic outfall curves are non-specific to a particular type of outfall and will be used for estimating preliminary detention pond volumes. Sub-basin A outfall rating is based on HEC-RAS modeling for a preliminary box culvert sizing. Detention volumes will be based on the design water surface elevation criteria listed above, and will be roughly based on basin

locations shown on the preliminary grading plan. Actual design of detention ponds and outfalls will occur with actual construction document phase.

5.0 STORM DRAINAGE ANALYSIS

5.1 Objectives

The purpose of this section is for the comparative analysis of pre and post development storm drainage peak flow runoff relative to the development of the project site. Runoff has been computed at key downstream locations to determine off-site impacts of proposed development and required mitigation measures. Tentative runoff detention volumes will also be calculated for feasibility and preliminary design purposes.

5.2 Analysis Overview

Storm water runoff impacts were analyzed at six primary points of discharge (POD) immediately effected and exiting downstream of the project site. These locations were identified as points A, B, C, D, E and F (see Figures A1 and A2). Points A, B and C correspond to culvert inlets located off-site along Interstate 80 within State of California right-of-way. These culverts receive considerable drainage, mostly upstream and off-site, but with significant contribution from on-site areas. Points D and E are existing inlets located within the Raley's shopping center and connected to a private storm drain system that discharges ultimately into the 66 inch culvert at point "A." These inlets receive drainage almost entirely from on-site project areas. Point F is a storm drain inlet located at the northerly corner of the intersection of Laird Street and Library Drive. This inlet receives drainage from both on and off-site areas (Laird and Library Drive).

5.3 Predevelopment Watershed

(Refer to Figures A2-A4)

Off-site runoff potential:

The off-site watershed is approximately 392 acres of medium density residential, rural residential, commercial/industrial, parks and undeveloped open space. Overall imperviousness is approximately 50 percent, and overall development level is moderate and appears close to full build out. Soil type is almost exclusively SCS type B (moderate infiltration) with some type D soils (low infiltration) Off-site drainage pattern is primarily through two moderately defined drainage basins (sub-basins A and B). The pre-project drainage basin areas and labels are shown on Figures A2 (on-site) and A3 (off-site). The sub-basin characteristics are included in Appendix A. The total on and off-site watershed combined is approximately 481 acres.

Off-site drainage pattern:

Overall drainage is through a combination of man-made ditches, irrigation canals and at the downstream residential reaches of sub-basin A, large diameter storm drains. More recent developed areas (sub-basins C and portions of A) follow typical patterns of curb and gutter with inlets and storm drains. Rural and older industrial areas (portions of A and B) seem to follow a pattern of shallow surface flow and small ditches and appear be somewhat indeterminate at higher flows.

Existing detention structures/ponds and irrigation canals:

Both sub-basins A and B have a number of small man-made farm ponds within watershed limits. The peak flow attenuation effect of these ponds is indeterminate without detailed calculations, and for the purposes of peak flow modeling, ignored. The off-site watershed is also bisected by two Placer County Water Agency (PCWA) canals: The Eastside Canal and Lyal canal both discharge into sub-basin A and during

the winter storm season, both canals act as storm water conveyance structures. Due to the effect of weirs and spillways, inflow or intercepted flow from these canals is not considered a significant factor as inflow/outflow appears to balance and stay within the respective sub-basins.

Problematic Areas:
As mentioned earlier in this report a significant section of sub-basin A is subject to significant surface flooding (FEMA zone AE), mostly due to large areas of existing impermeable surfaces and limited capacity of the existing drainage system converging together. Runoff exceeding storm drain capacity becomes surface flow and appears to migrate down gradient into the project site, covering a relatively large area. Surface ponding/storage appears widespread and the potential for tangible peak flow attenuation (reduction) very likely. Due to the difficulty in modeling this effect correctly, it was not included in the runoff calculations, making the design calculations presented in this report somewhat conservative. No other problematic areas in the other sub-basins (B, C, D, E and F) were noted or obvious from inspection.

On-site:
The on-site project area is currently undeveloped excepting a small area of rural residential development on the west edge of the site. Existing land cover is native grass land or combination wood/grassland. Overall imperviousness is approximately zero to 5 percent. Drainage pattern is by overland flow that migrates to a large swampy area through the middle of the site that is also a FEMA zone AE flood plain, as mentioned above in "problematic areas."

5.4 Post-Development Watershed
Off-site:
The off-site watershed remains unchanged in the post-development condition.

On-site:
Runoff potential:
As proposed, the land will be subdivided into approximately 303 single family residential lots, with approximately 138 multifamily housing units, and mixed use commercial and office space. Overall land cover will be medium to high density residential, with a large area left as undeveloped open space. Overall land cover imperviousness will be increased up to 50 percent approximately.

Drainage Pattern:
Overall drainage pattern for the proposed developed areas will be by a standard curb, gutter and storm drain system. Excepting sub-basins D and E which will be collected into the Doc Barnes Drive storm drain all other sub-basins will retain similar land areas and point of discharge.

5.5 Detention Basins
To mitigate increases in post-development runoff, detention ponds will be needed at sub-basins A, B, C and F. For sub-basin A, detention will be in the form of a backwater onto the existing natural drainage depression upstream from Doc Barnes Drive. Box culvert said road at Secret Ravine tributary will function as a metering outfall. Detention pond B would be designed to function "off-line" and not connected to upstream off-site flows. Detention Pond C would be designed "on-line" to accept upstream off-site storm flow, and is proposed to collect drainage from sub-basins SC1a and SC1b, combined. Detention pond at sub-basin F is designed as a standard pond.

5.6 Comparative Analysis

To evaluate impacts of the proposed project pre and post development runoff is tabulated below. Post development runoff includes peak flow reduction effect of proposed detention basins. All flows are in cubic feet per second (CFS); Detention volumes accommodate 2 to 100-year design storm events.

TABLE 5.6

POST DEVELOPMENT VERSUS PRE DEVELOPMENT STORM RUNOFF

POINT OF DISCHARGE	STORM RECURENCE INTERVAL (YRS) 2	10	100	DETENTION VOLUME (acre-feet)
A POST	83.6	240.5	492.7	9.1
A PRE	128.1	290.5	549.1	
NET	-35%	-17%	-10%	
B POST	32.5	79.8	162.3	1.0
B PRE	32.5	80.0	162.7	
NET (1)	-0%	-0.002%	-0.003%	
C POST	7.0	19.4	39.9	0.8
C PRE	10.2	22.6	44.3	
NET	-31%	-14%	-10%	
D POST	0.0	0.0	0.0	Not req'd
D PRE	0.7	2.8	7.0	
NET (2)	-100%	-100%	-100%	
E POST	0.0	0.0	0.0	Not req'd
E PRE	1.5	3.5	7.0	
NET (2)	-100%	-100%	-100%	
F POST	1.0	2.8	6.1	0.1
F PRE	1.2	3.2	6.8	
NET	-17%	-13%	-10%	

NOTES:

(1) Detention is off-line, overall net flows include 31.8-159 cfs off-site non detained flow. On-site (sub-basin SB1) Net varies -41% to -92% reduction in peak flow.

(2) Post development sub-basins D and E redirected into Doc Barnes Drive storm drain and will be consolidated into greater sub-basin A.

6.0 100-YEAR FLOOD PLAIN ANALYSIS

6.1 Objectives

The purpose of this section is for the comparative analysis of the effects of development upon the limits and water surface elevations (WSE) of the existing pre development 100-year floodplain. Locations will be: immediately upstream of project site, on-site, and immediately downstream of the project site. This analysis will detail the following conditions:

1. Determine pre development floodplain limits and water surface elevations based on higher resolution topography, revised higher resolution cross sections, and site specific pre development storm runoff flows.
2. Determine post development floodplain limits and water surface elevations based on the revised predevelopment floodplain with flood plain encroachments per post development site grading plan and mitigated post development storm runoff flows.

6.2 Analysis Overview

Analysis is broken down into the following parts: floodplain modeling parameters and determination of flood flow for both pre and post development conditions.

6.3 FEMA Floodplain Mapping

(Refer to FEMA FIRMette, Appendix "B")

A portion of the project site is crossed by the Loomis tributary of secret Ravine and is currently mapped by FEMA as zone "AE"; areas subject the 1 percent (100-year) storm event with determined base flood elevations. No other areas of the project site were subject to FEMA mapped floodplains or unusual/obvious inundation.

6.4 Pre Development Floodplain

(Refer to Figure B2)

The entire project site is located within the Dry Creek Watershed drainage basin, off the Loomis tributary of Secret Ravine. The total project watershed is approximately 481 acres.

On-site:

Currently on-site floodplain intersects project site roughly at the intersection of Sun Knoll Drive and Northerly property line and exits at the south east corner adjacent to the Raley's shopping center. Floodplan terrain is moderate with a relatively well defined natural outer flood banks/channel. The ordinary main (low flow) channel is also natural, but appears less defined with ponding and other swampy areas. Vegetation within the floodplain is heavy and obscures much of the floodplain storm. Hydraulic impedance of this vegetation is high. A somewhat conservative Manning's roughness factor of 0.10 is estimated for both main and overbank channel on-site.

Off-site:

Upstream of the project site the floodplain flows through the residential area immediately north of the project site. This flow is a combination of contained stormdrain discharge (54" RCP) and uncontained off-site surface flow. Limits of this flooding are somewhat defined but is subject to a number of structure obstructions (houses, fences) and would be very difficult to define. Downstream of the project site flood flow diverges at the existing 66 inch CMP culvert located at I-80 approximately 150 feet north-easterly of the Raley's shopping center. The remainder of flow not contained within the

culvert migrates off-site along the southern side of I-80 roadway in a southwesterly direction. *(Refer to FEMA FIRMette, Appendix "B")*

6.5 Post-Development Floodplain

(Refer to Figure B1)

As proposed, this project will involve mass grading building pads and roadways on both sides of the existing on-site floodplain. The proposed grading will encroach on the easterly side of the existing floodplain and the construction of the proposed Doc Barnes Drive will encroach on the floodplain parallel to I-80 along the southerly property line. No other grading work is proposed within the existing floodplain. Tentatively three 5 feet high by 10 feet wide box culverts are proposed for Doc Barnes Drive to permit storm flows to pass with minimal water surface impacts. Floodplain encroachments were modeled in HEC-RAS as blocked obstructions; Doc Barnes Drive was modeled as a culvert and roadway

6.6 Design Storm Flows

Design storm flows for floodplain analysis are taken directly from the project design flows calculated in Section 5.0 above for sub-basin A, pre and post development 100-year storm event. Post development storm flows include effect of the upstream ponding of Doc Barnes Drive. Both pre and post development flows diverge at the existing 66 inch CMP culvert at I-80 with the remainder surface flow off the project site to the southwest along I-80. The projects drainage does not change the potential for having surface flow on or adjacent to I-80 because the 66 inch CMP culvert under I-80 is too small for the current 100-year storm flow. The upstream 100-year storm flow reaching the I-80 culvert will to be reduced by approximately 56 cfs, with the construction of Doc Barnes Drive and its resultant detention.

Modeling flows are as follows (all flows CFS):
(Refer to Section 5.0)

Table 6.5 Floodplain Modeling Flows
Interval: 100-year

RAS station	Pre development	Post development	Comments
4000	475	475	Flow entering site from OA2
3865	529	487	Flow from sub-basin SA1
2680	313(1)	-	Flow exiting site overland
2600	-	257(2)	Flow exiting site overland

Notes:

(1) 313 = 549 (Outfall A, pre dev.) -236 (66"CMP diversion)
(2) 257 = 493 (Outfall A, post dev.) -236 (66"CMP diversion)
Refer to Appendix B for 66 inch culvert data, estimated at 236 cfs at inlet WSE =372.0

6.7 Comparative Analysis

Table 6.6 Off and On-site Water Surface Elevations at Key Locations
Interval: 100-years

RAS Station	Description	Development Status		
		Pre	Post	Change
4000	Off-site N'ly Subdivision	390.0	390.0	no change
3980	On-site near N'ly PL	389.9	389.7	-0.2'
2570	On-site, S'ly terminus	372.7	372.5	-0.2'
2470	Off-site, Raley's/I-80	372.6	372.4	-0.2

7.0 STORMWATER QUALITY

7.1 Objective

The purpose of this section is to address the post-development stormwater quality. The Town of Loomis is a regulated Small MS4 under the State's NPDES permit. As such, it is required to regulate the stormwater runoff of new development within its jurisdiction. The project proposes to use a combination of low impact development (LID) and Best Management Practices (BMPs) to minimize of pollutants entering the drainage system and being discharged from the site. This will be accomplished with a combination of "good housekeeping" practices and mechanical and biological treatment facilities.

A separate construction SWPPP will be required for all construction activities but is outside the scope of this report.

7.2 Analysis Overview

The first objective of good stormwater quality management is to maintain natural habit. The project does this by maintaining the existing natural drainage swale bisecting the site. A smaller drainage way at the east end of the site will also be maintained in its current state. In all, approximately 9 acres will be preserved in its natural state. Good housekeeping is the primary BMP to controlling stormwater pollution and will be incorporated in various forms throughout the development. Finally, treatment BMPs will be installed to ensure that all new impervious area will have some form of water quality treatment prior to discharging from the site. The BMPs will be sized in accordance with the current City, County, and State guidelines and the California Storm water Quality Association (CASQA) manual.

7.3 Good Housekeeping

The project incorporates grassy swales, detention basins, detached downspouts and landscape strips all to promote infiltration of stormwater and to reduce the volume of runoff reaching the drainage system. Proper signage and inlet makings will be incorporated to inform residents and visitors that all drains flow to the creeks and dumping, or disposal of waste in the drains is not allowed. All drains will be stamped NO DUMPING, DRAINS TO CREEK or a similar approved

message. Project CC&Rs should also address the proper disposal of household items, procedures for draining swimming pools and spas, and pollution prevention within the parks and open spaces. Additionally, if in-lot treatment is proposed, an operation and maintenance manual should be included.

7.4 Treatment BMPs

The project propose to use multiple types of BMPs within the on-site drainage system. These include, but are not limited to bioretention basins, vegetative swales, flow-through planters, and hydrodynamic separators. For bioretention and flow-through planters, an area of 4 percent of the new impervious area has been assumed for sizing. This is an accepted sizing method in the current MS4 permits baring a more detailed analysis of each sub-shed area. The treatment devices will be sized by flow rate or treatment volume. The design storm will be the volume or flow rate of the 85th percentile storm, or an intensity of 0.20 inch/hour.

Bioretention basins will be utilized as the primary method of treatment when feasible. As stated above, areas of at least 4 percent of the new impervious area have been reserved for potential water quality treatment.

At this time, the final product for each area has not been determined, so final design of the bioretention basins has not been completed. The final design will be included for the construction documents for the project. At that time, local in-lot BMPs may be incorporated to reduce the size or number of bioretention basins located throughout the development. For example, flow-through planters and front yard basins could be incorporated into unit design, reducing the need for additional treatment to the public streets.

Bioretention is not always the most appropriate treatment BPM. It is land intensive, highly dependent upon ability to capture surface flows in shallow drains. It is not desired adjacent to roads and structures where saturated soil can have a negative impact on foundations and pavement, and not appropriate with certain soils or areas of high ground water or soil contamination. Additionally, its benefit will need to be evaluated against the impacts of additional grading and tree removal. These factors will be utilized in final determination of treatment methods and basin locations.

When bioretention is not recommended or is not feasible, other methods of treatment will be used. The project proposes underground separator vaults such as the CDS or Vortecnics units. These are primarily proposed for sites where surface flow to a basin is not possible, and in the portions of the public roadways where there are no basins available for treatment (Doc Barns Road adjacent to the Caltrans right of way).

For the purpose of this report, the tentative map and the preliminary grading and drainage plan, there are recommended areas reserved for stormwater treatment based upon the 4 percent rule. This will ensure there is adequate area reserved for the installation of BMPs. The final method of treatment for each area will be determined at time of final design.

8.0 FINDINGS AND RECOMMENDATIONS

8.1 Findings

8.11 Storm Drainage

- Post development project will not increase storm drainage runoff rates for 2, 10 and 100-year storm events at off-site Points of Discharge A, B, C, D, E and F with local detention basins within the project as proposed (see below).

- Project site will require local storm drainage detention basins to mitigate increases in site runoff rates. These basins will need to be located at sub-basins A, B, C and F. refer to Table 5.6 in this report for preliminary design volumes.

8.12 Floodplain

- Post development project will not adversely change off-site floodplain limits or water surface elevations for 2, 10, and 100-year storm events

- Post-development project will decrease downstream water surface elevations approximately 0.2 feet for 100-year design storm event.

- Water surface elevations immediately on-site upstream of said road will be increased slightly by approximately 0.3'average up to 975' upstream Doc Barnes Drive. All other water surface elevations on-site remain unaffected or slightly lower than the pre development floodplain elevations.

- Post development water surface elevations on-site and upstream Doc Barnes Drive will not increase the water surface elevations in the Sun Knolls subdivision.

8.13 Stormwater Quality

- Proposed project has adequate area and is suitable to implement post development water quality measures based on a treatment area of 4 percent new impervious area, per Town of Loomis standards.

8.2 Site Development Recommendations

8.21 Storm Drainage

- On-site drainage structures shall be designed to Town of Loomis design standards.

- Detention ponds design in this report is conceptual only, and for feasibility and preliminary design purposes only. All proposed hydraulic structures referenced in this report will require final design at time of construction documents and/or Federal Emergency Management Agency (FEMA) Conditional Letter of Map Revision (CLOMR) mapping as applicable.

8.22 Floodplain:

- Building pads should be elevated a minimum 1.0 foot above post-development calculated 100-year water surface elevation.

- Finish grade at lowest point on Doc Barnes Drive should not permit overtopping for 100-year design storm.

- Vegetation removal within channel should be kept to a minimum as to avoid altering hydraulic and erosive properties of existing floodplain and channel.

8.23 Stormwater Quality:

- The project should incorporate low impact development standards and treat all stormwater runoff from new impervious surfaces. Proposed treatment methods include bioretention, vegetative swales, and hydrodynamic separators.

- Good housekeeping measures will be included in all aspects of the project from site development to home ownership.

- A separate Stormwater Prevention Plan (SWPPP) will be required for all construction activities.

END

APPENDIX "A" STORM DRAINAGE

APPENDIX A.1

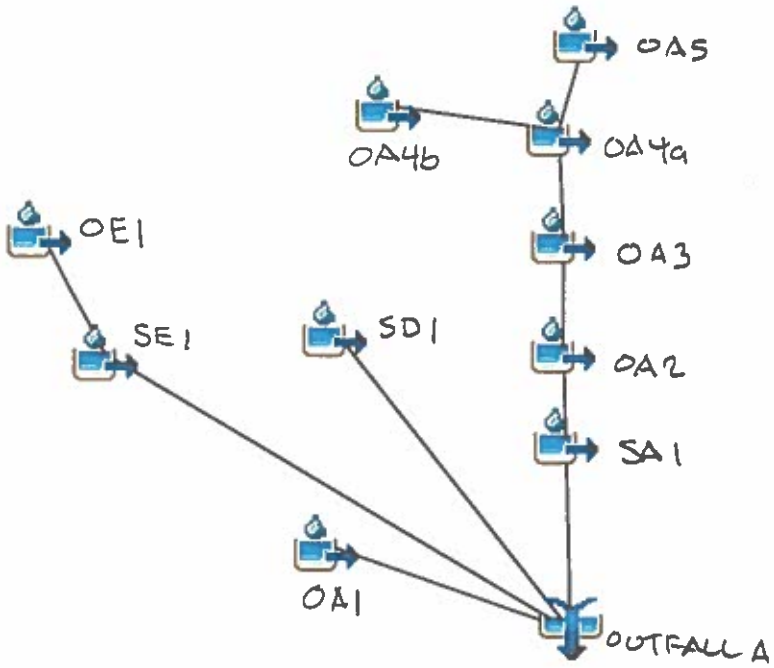
- Pre Development Watershed HEC-HMS Results 2, 10 &100-yr events

HEC-HMS

Project : LOOMIS PRELIM

Basin Model : Pre A

Sep 27 18:40:43 PDT 2014



Project: LOOMIS PRELIM Simulation Run: Pre A 2

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre A
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	27Sep2014, 18:43:56	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OA5	0.0727	31.9	15Jun2006, 12:05	5.83
OA4b	0.0331	16.2	15Jun2006, 12:10	2.93
OA4a	0.1998	61.6	15Jun2006, 12:10	14.16
OA3	0.2773	89.3	15Jun2006, 12:10	20.33
OA2	0.3686	116.7	15Jun2006, 12:15	26.47
SA1	0.4319	123.3	15Jun2006, 12:20	27.65
OA1	0.0089	5.1	15Jun2006, 12:05	0.93
OE1	0.0023	1.2	15Jun2006, 12:10	0.23
SE1	0.0079	1.5	15Jun2006, 12:15	0.35
SD1	0.0064	0.7	15Jun2006, 12:30	0.11
OUTFALL A	0.4551	128.1	15Jun2006, 12:20	29.04

Project: LOOMIS PRELIM Simulation Run: Pre A 10

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre A
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	27Sep2014, 18:43:53	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OA5	0.0727	70.8	15Jun2006, 12:05	9.73
OA4b	0.0331	36.0	15Jun2006, 12:05	4.78
OA4a	0.1998	138.1	15Jun2006, 12:05	24.10
OA3	0.2773	197.2	15Jun2006, 12:10	34.29
OA2	0.3686	259.3	15Jun2006, 12:10	44.15
SA1	0.4319	278.9	15Jun2006, 12:15	46.88
OA1	0.0089	11.2	15Jun2006, 12:05	1.49
OE1	0.0023	2.4	15Jun2006, 12:10	0.37
SE1	0.0079	3.5	15Jun2006, 12:15	0.63
SD1	0.0064	2.8	15Jun2006, 12:20	0.26
OUTFALL A	0.4551	290.5	15Jun2006, 12:15	49.26

Project: LOOMIS PRELIM Simulation Run: Pre A 100

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre A
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24h
Compute Time:	27Sep2014, 18:43:54	Control Specifications:	24hr5min

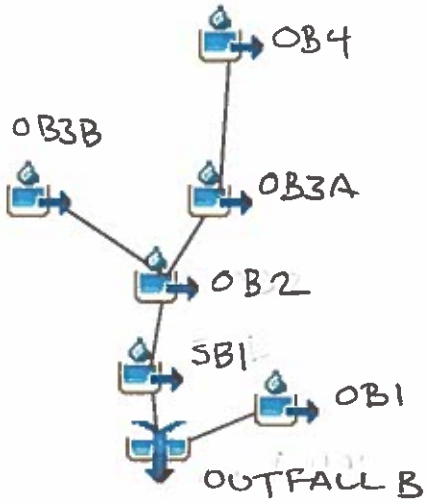
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OA5	0.0727	120.3	15Jun2006, 12:05	14.67
OA4b	0.0331	69.3	15Jun2006, 12:05	7.11
OA4a	0.1998	278.4	15Jun2006, 12:05	37.46
OA3	0.2773	382.6	15Jun2006, 12:05	52.80
OA2	0.3686	474.7	15Jun2006, 12:10	67.94
SA1	0.4319	528.7	15Jun2006, 12:15	73.16
OA1	0.0089	20.1	15Jun2006, 12:05	2.19
OE1	0.0023	4.5	15Jun2006, 12:05	0.54
SE1	0.0079	7.0	15Jun2006, 12:10	1.03
SD1	0.0064	6.5	15Jun2006, 12:15	0.49
OUTFALL A	0.4551	549.1	15Jun2006, 12:15	76.87

HEC-HMS

Project : LOOMIS

Basin Model : Pre B

Sep 24 06:07:28 PDT 2014



Project: LOOMIS Simulation Run: Pre B 2

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre B
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	24Sep2014, 05:37:00	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OB4	0.0672	5.9	15Jun2006, 12:25	2.2
OB3b	0.1066	12.9	15Jun2006, 12:25	4.2
OB3a	0.0206	6.9	15Jun2006, 12:15	1.6
OB2	0.2263	31.8	15Jun2006, 12:30	10.1
SB1	0.2289	31.9	15Jun2006, 12:35	10.1
OB1	0.0037	2.4	15Jun2006, 12:05	0.4
OUTFALL B	0.2326	32.5	15Jun2006, 12:35	10.5

Project: LOOMIS Simulation Run: Pre B 10

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre B
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	24Sep2014, 05:36:57	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OB4	0.0672	14.8	15Jun2006, 12:15	4.3
OB3b	0.1066	31.8	15Jun2006, 12:20	7.8
OB3a	0.0206	15.6	15Jun2006, 12:10	2.6
OB2	0.2263	78.3	15Jun2006, 12:25	18.1
SB1	0.2289	78.9	15Jun2006, 12:25	18.2
OB1	0.0037	4.5	15Jun2006, 12:05	0.6
OUTFALL B	0.2326	80.0	15Jun2006, 12:25	18.9

Project: LOOMIS Simulation Run: Pre B 100

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre B
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24h
Compute Time:	24Sep2014, 05:36:58	Control Specifications:	24hr5min

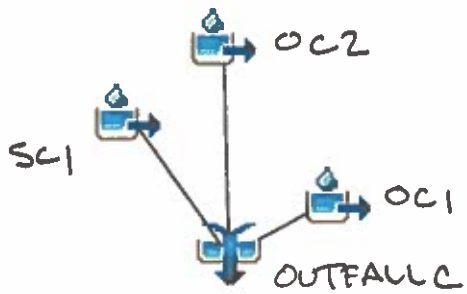
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OB4	0.0672	33.1	15Jun2006, 12:10	7.2
OB3b	0.1066	66.8	15Jun2006, 12:15	12.8
OB3a	0.0206	29.7	15Jun2006, 12:10	3.8
OB2	0.2263	159.0	15Jun2006, 12:20	29.2
SB1	0.2289	160.8	15Jun2006, 12:20	29.4
OB1	0.0037	8.8	15Jun2006, 12:00	0.9
OUTFALL B	0.2326	162.7	15Jun2006, 12:20	30.3

HEC-HMS

Project : LOOMIS

Basin Model : Pre C

Sep 24 06:07:41 PDT 2014



Project: LOOMIS Simulation Run: Pre C 2

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre C
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	24Sep2014, 05:43:53	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OC2	0.0185	6.9	15Jun2006, 12:10	1.5
SC1	0.0026	0.3	15Jun2006, 12:30	0.0
OC1	0.0056	3.6	15Jun2006, 12:05	0.6
OUTFALL C	0.0267	10.2	15Jun2006, 12:05	2.1

Project: LOOMIS Simulation Run: Pre C 10

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre C
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	24Sep2014, 05:43:51	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OC2	0.0185	14.7	15Jun2006, 12:10	2.4
SC1	0.0026	1.2	15Jun2006, 12:20	0.1
OC1	0.0056	7.3	15Jun2006, 12:05	1.0
OUTFALL C	0.0267	22.6	15Jun2006, 12:05	3.5

Project: LOOMIS Simulation Run: Pre C 100

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre C
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24h
Compute Time:	24Sep2014, 05:43:52	Control Specifications:	24hr5min

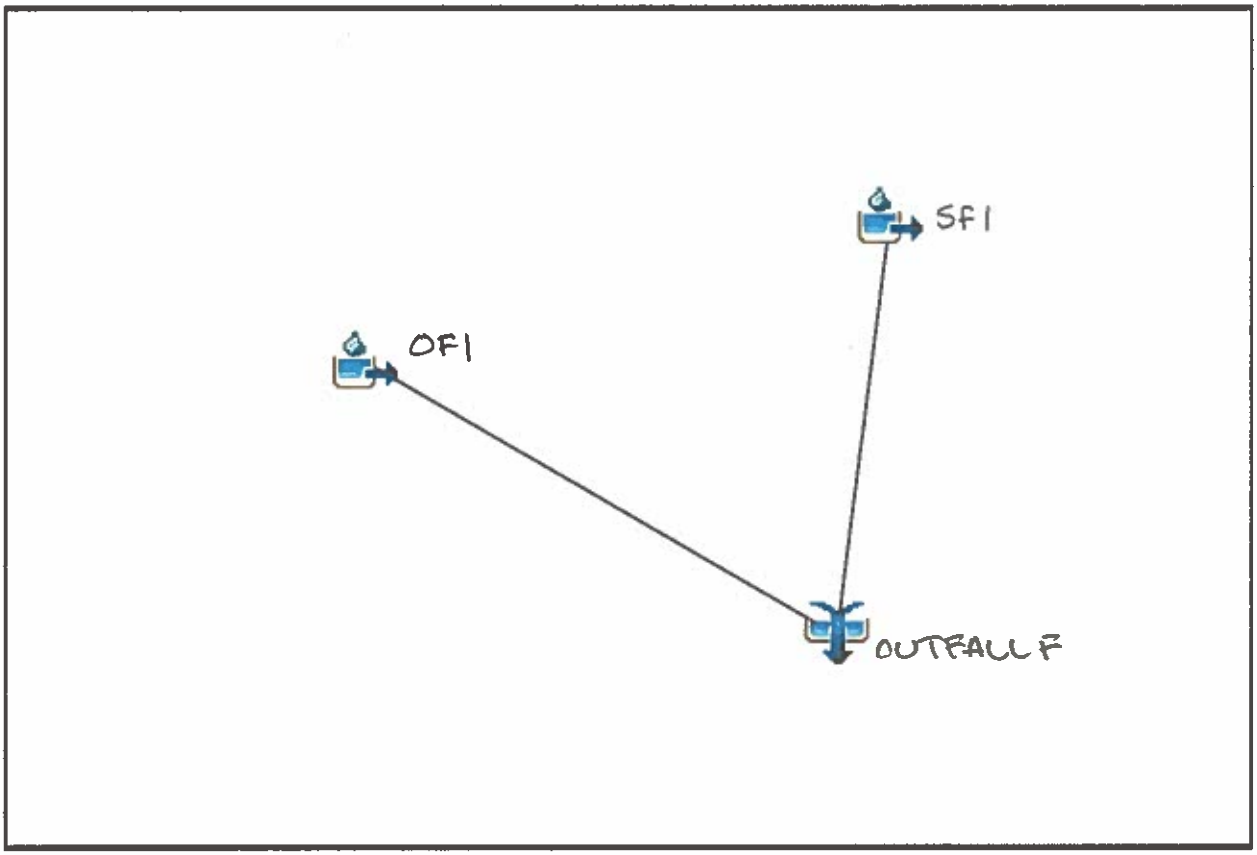
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OC2	0.0185	30.0	15Jun2006, 12:05	3.8
SC1	0.0026	2.8	15Jun2006, 12:15	0.2
OC1	0.0056	12.1	15Jun2006, 12:05	1.4
OUTFALL C	0.0267	44.3	15Jun2006, 12:05	5.4

HEC-HMS

Project : LOOMIS

Basin Model : Pre F

Sep 24 06:08:28 PDT 2014



Project: LOOMIS Simulation Run: Pre F 2

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	24Sep2014, 05:50:57	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
SF1	0.0044	0.5	15Jun2006, 12:25	0.1
OF1	0.0016	0.7	15Jun2006, 12:10	0.1
OUTFALL F	0.0060	1.2	15Jun2006, 12:15	0.2

Project: LOOMIS Simulation Run: Pre F 10

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	24Sep2014, 05:50:56	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
SF1	0.0044	1.8	15Jun2006, 12:25	0.2
OF1	0.0016	1.5	15Jun2006, 12:10	0.2
OUTFALL F	0.0060	3.2	15Jun2006, 12:10	0.4

Project: LOOMIS Simulation Run: Pre F 100

Start of Run:	15Jun2006, 00:05	Basin Model:	Pre F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24h
Compute Time:	24Sep2014, 05:50:57	Control Specifications:	24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
SF1	0.0044	4.1	15Jun2006, 12:15	0.4
OF1	0.0016	2.7	15Jun2006, 12:05	0.4
OUTFALL F	0.0060	6.8	15Jun2006, 12:10	0.7

APPENDIX A.2

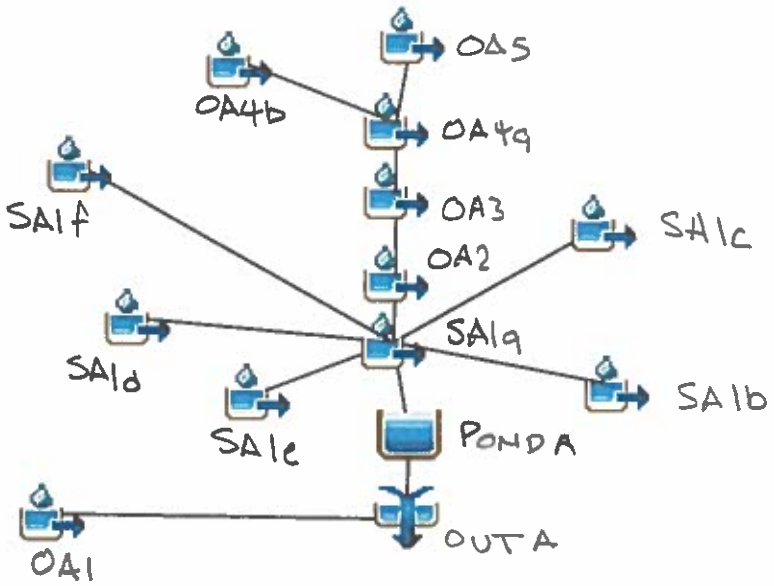
- Post Development Watershed HEC-HMS Results 2, 10 &100-yr events
- Detention Pond Hydrograph and Data 2, 10 &100-yr events
- Detention Pond Elevation-Area and Stage-Discharge Tables

HEC-HMS

Project : LOOMIS

Basin Model : Post A

Sep 25 12:55:28 PDT 2014



Project: LOOMIS PRELIM Simulation Run: Post A 2

Start of Run: 15Jun2006, 00:05 Basin Model: Post A
End of Run: 17Jun2006, 00:00 Meteorologic Model: 2yr24hr
Compute Time: 27Sep2014, 18:30:12 Control Specifications: 24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OA5	0.0727	31.9	15Jun2006, 12:05	5.83
OA4b	0.0331	16.2	15Jun2006, 12:10	2.93
OA4a	0.1998	61.6	15Jun2006, 12:10	14.16
OA3	0.2773	89.3	15Jun2006, 12:10	20.33
OA2	0.3686	116.7	15Jun2006, 12:15	26.47
SA1e	0.0152	6.4	15Jun2006, 12:10	1.25
SA1b	0.0120	4.9	15Jun2006, 12:10	0.95
SA1c	0.0109	4.6	15Jun2006, 12:10	0.90
SA1d	0.0034	1.4	15Jun2006, 12:10	0.28
SA1f	0.0011	0.5	15Jun2006, 12:10	0.09
SA1a	0.4503	140.4	15Jun2006, 12:20	31.49
DP A	0.4503	82.3	15Jun2006, 12:45	31.49
OA1	0.0089	5.1	15Jun2006, 12:05	0.93
OUTFALL A	0.4592	83.6	15Jun2006, 12:45	32.41

Project: LOOMIS PRELIM Simulation Run: Post A 10

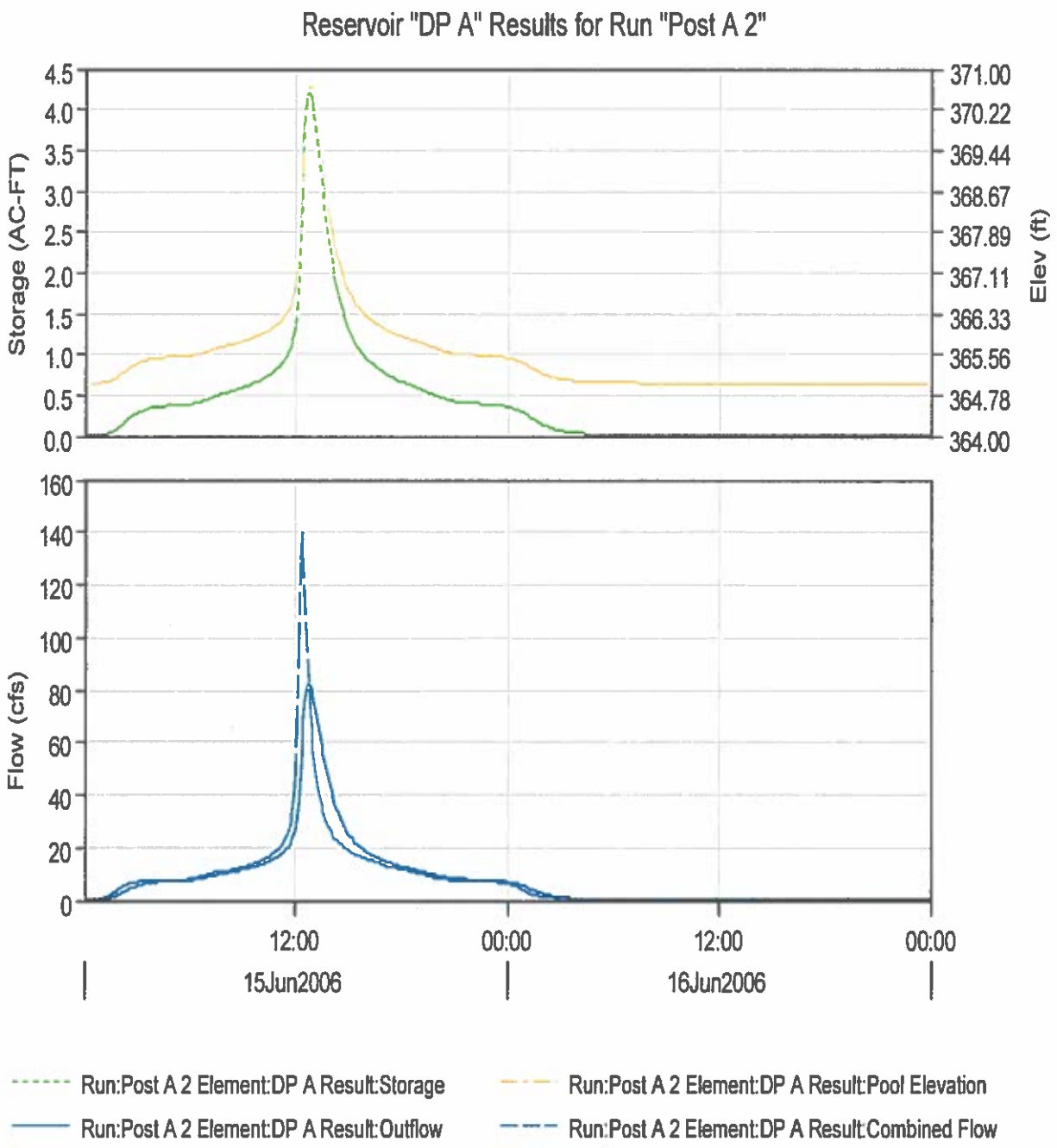
Start of Run: 15Jun2006, 00:05 Basin Model: Post A
End of Run: 17Jun2006, 00:00 Meteorologic Model: 10yr24hr
Compute Time: 27Sep2014, 18:30:08 Control Specifications: 24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OA5	0.0727	70.8	15Jun2006, 12:05	9.73
OA4b	0.0331	36.0	15Jun2006, 12:05	4.78
OA4a	0.1998	138.1	15Jun2006, 12:05	24.10
OA3	0.2773	197.2	15Jun2006, 12:10	34.29
OA2	0.3686	259.3	15Jun2006, 12:10	44.15
SA1e	0.0152	14.0	15Jun2006, 12:05	2.06
SA1b	0.0120	11.0	15Jun2006, 12:05	1.57
SA1c	0.0109	10.0	15Jun2006, 12:05	1.48
SA1d	0.0034	3.1	15Jun2006, 12:05	0.46
SA1f	0.0011	1.0	15Jun2006, 12:10	0.15
SA1a	0.4503	314.0	15Jun2006, 12:15	52.75
DP A	0.4503	237.4	15Jun2006, 12:25	52.75
OA1	0.0089	11.2	15Jun2006, 12:05	1.49
OUTFALL A	0.4592	240.5	15Jun2006, 12:25	54.24

Project: LOOMIS PRELIM Simulation Run: Post A 100

Start of Run: 15Jun2006, 00:05 Basin Model: Post A
End of Run: 17Jun2006, 00:00 Meteorologic Model: 100yr24h
Compute Time: 27Sep2014, 18:30:10 Control Specifications: 24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OA5	0.0727	120.3	15Jun2006, 12:05	14.67
OA4b	0.0331	69.3	15Jun2006, 12:05	7.11
OA4a	0.1998	278.4	15Jun2006, 12:05	37.46
OA3	0.2773	382.6	15Jun2006, 12:05	52.80
OA2	0.3686	474.7	15Jun2006, 12:10	67.94
SA1e	0.0152	27.9	15Jun2006, 12:05	3.08
SA1b	0.0120	21.9	15Jun2006, 12:05	2.36
SA1c	0.0109	20.0	15Jun2006, 12:05	2.21
SA1d	0.0034	6.2	15Jun2006, 12:05	0.69
SA1f	0.0011	2.0	15Jun2006, 12:05	0.22
SA1a	0.4503	586.3	15Jun2006, 12:10	81.41
DP A	0.4503	487.3	15Jun2006, 12:20	81.41
OA1	0.0089	20.1	15Jun2006, 12:05	2.19
OUTFALL A	0.4592	492.7	15Jun2006, 12:20	83.60


Reservoir "DP A" Results for Run "Post A 2"
Storage (AC-FT)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Elev (ft)
371.00
370.22
369.44
368.67
367.89
367.11
366.33
365.56
364.78
364.00
Flow (cfs)
160
140
120
100
80
60
40
20
0
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post A 2 Element:DP A Result:Storage
Run:Post A 2 Element:DP A Result:Pool Elevation
Run:Post A 2 Element:DP A Result:Outflow
Run:Post A 2 Element:DP A Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post A 2

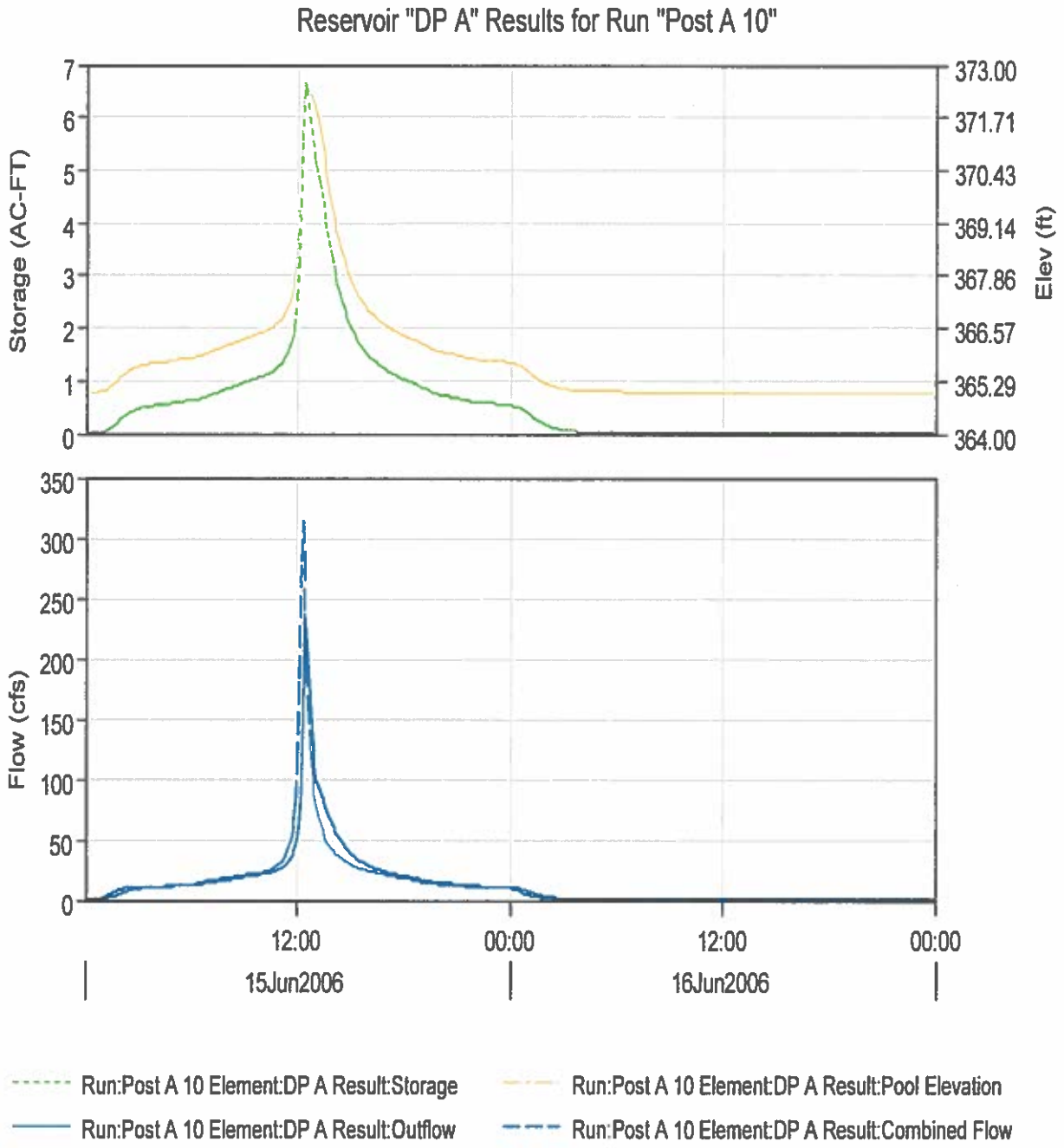
Reservoir: DP A

Start of Run:	15Jun2006, 00:05	Basin Model:	Post A
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	27Sep2014, 18:30:12	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	140.4 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:20
Peak Discharge:	82.3 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:45
Inflow Volume:	31.49 (AC-FT)	Peak Storage:	4.19 (AC-FT)
Discharge Volume:	31.49 (AC-FT)	Peak Elevation:	370.7 (FT)


Reservoir "DP A" Results for Run "Post A 10"
Storage (AC-FT)
Elev (ft)
7
6
5
4
3
2
1
0
373.00
371.71
370.43
369.14
367.86
366.57
365.29
364.00
Flow (cfs)
350
300
250
200
150
100
50
0
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post A 10 Element:DP A Result:Storage
Run:Post A 10 Element:DP A Result:Pool Elevation
Run:Post A 10 Element:DP A Result:Outflow
Run:Post A 10 Element:DP A Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post A 10

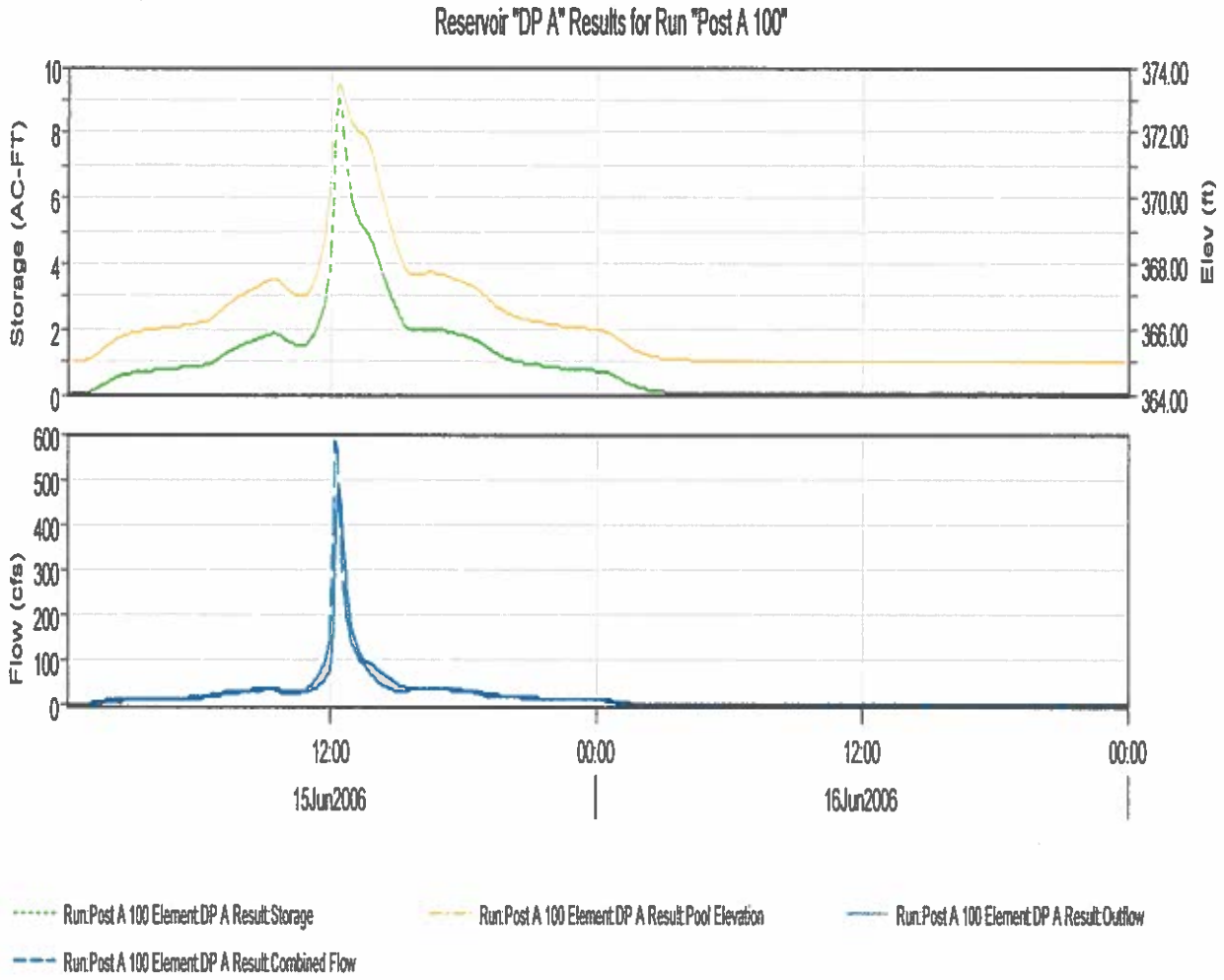
Reservoir: DP A

Start of Run:	15Jun2006, 00:05	Basin Model:	Post A
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	27Sep2014, 18:30:08	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	314.0 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:15
Peak Discharge:	237.4 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:25
Inflow Volume:	52.75 (AC-FT)	Peak Storage:	6.63 (AC-FT)
Discharge Volume:	52.75 (AC-FT)	Peak Elevation:	372.5 (FT)


Reservoir "DP A" Results for Run "Post A 100"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post A 100 Element:DP A Result:Storage
Run:Post A 100 Element:DP A Result:Pool Elevation
Run:Post A 100 Element:DP A Result:Outflow
Run:Post A 100 Element:DP A Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post A 100

Reservoir: DP A

Start of Run:	15Jun2006, 00:05	Basin Model:	Post A
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24hr
Compute Time:	27Sep2014, 18:30:10	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	586.3 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:10
Peak Discharge:	487.3 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:20
Inflow Volume:	81.41 (AC-FT)	Peak Storage:	9.07 (AC-FT)
Discharge Volume:	81.41 (AC-FT)	Peak Elevation:	373.5 (FT)

(3) 5'x10' RCB w/ HDWL Ke=0.5 IE 365.0/364.5

HEC-RAS Plan: CVT RATE River: SECRET RAVINE Reach: LOOMIS TRIB

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOOMIS TRIB	2800	PF 1	600.00	365.00	373.85	366.91	373.86	0.000004	0.23	2345.37	508.44	0.02
LOOMIS TRIB	2800	PF 2	500.00	365.00	373.50	366.71	373.50	0.000003	0.20	2168.89	492.57	0.02
LOOMIS TRIB	2800	PF 3	400.00	365.00	373.15	366.49	373.15	0.000003	0.18	1996.35	476.55	0.01
LOOMIS TRIB	2800	PF 4	300.00	365.00	372.78	366.24	372.78	0.000002	0.14	1823.09	462.91	0.01
LOOMIS TRIB	2800	PF 5	200.00	365.00	372.38	365.96	372.38	0.000001	0.11	1640.10	450.22	0.01
LOOMIS TRIB	2800	PF 6	100.00	365.00	371.90	365.61	371.90	0.000000	0.06	1429.54	436.50	0.01
LOOMIS TRIB	2760		Culvert									

RATING TABLE
PONDING UPSTREAM PROPOSED CULVERTS
AT DOC BARNES RD

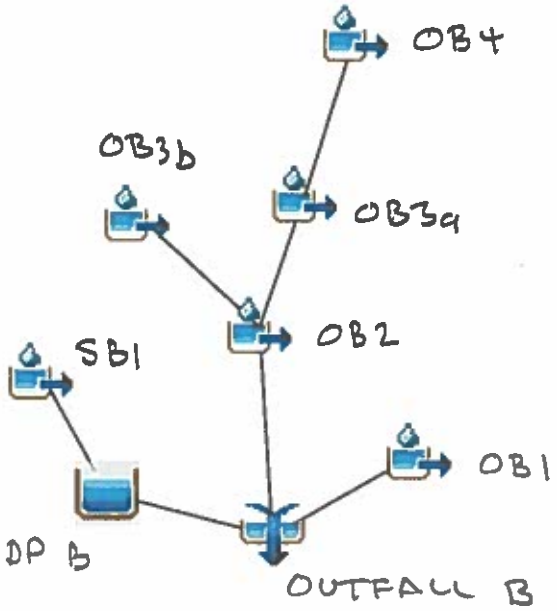
Ordinate	ELEVATION	POND A POSTD... AREA TABLE
Labels		
Units	FT	ACRE
Type	UNT	UNT
1	365.00	0.0000000
2	366.00	0.0010000
3	367.00	0.0020000
4	368.00	0.0320000
5	369.00	0.5120000
6	370.00	0.9760000
7	371.00	1.5610000
8	372.00	2.2869999
9	373.00	2.6730001
10	374.00	3.1020000
11	375.00	3.6120000
12	376.00	4.1100001

HEC-HMS

Project : LOOMIS

Basin Model : Post B

Sep 24 06:25:11 PDT 2014



Project: LOOMIS PRELIM Simulation Run: Post B 2

Start of Run:	15Jun2006, 00:05	Basin Model:	Post B
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	29Sep2014, 23:20:59	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OB4	0.0672	5.9	15Jun2006, 12:25	2.21
OB3b	0.1066	12.9	15Jun2006, 12:25	4.21
OB3a	0.0206	6.9	15Jun2006, 12:15	1.55
OB2	0.2263	31.8	15Jun2006, 12:30	10.05
SB1	0.0085	3.4	15Jun2006, 12:10	0.67
DP B	0.0085	0.2	15Jun2006, 23:10	0.16
OB1	0.0037	2.4	15Jun2006, 12:05	0.39
OUTFALL B	0.2385	32.5	15Jun2006, 12:30	10.60

Project: LOOMIS PRELIM Simulation Run: Post B 10

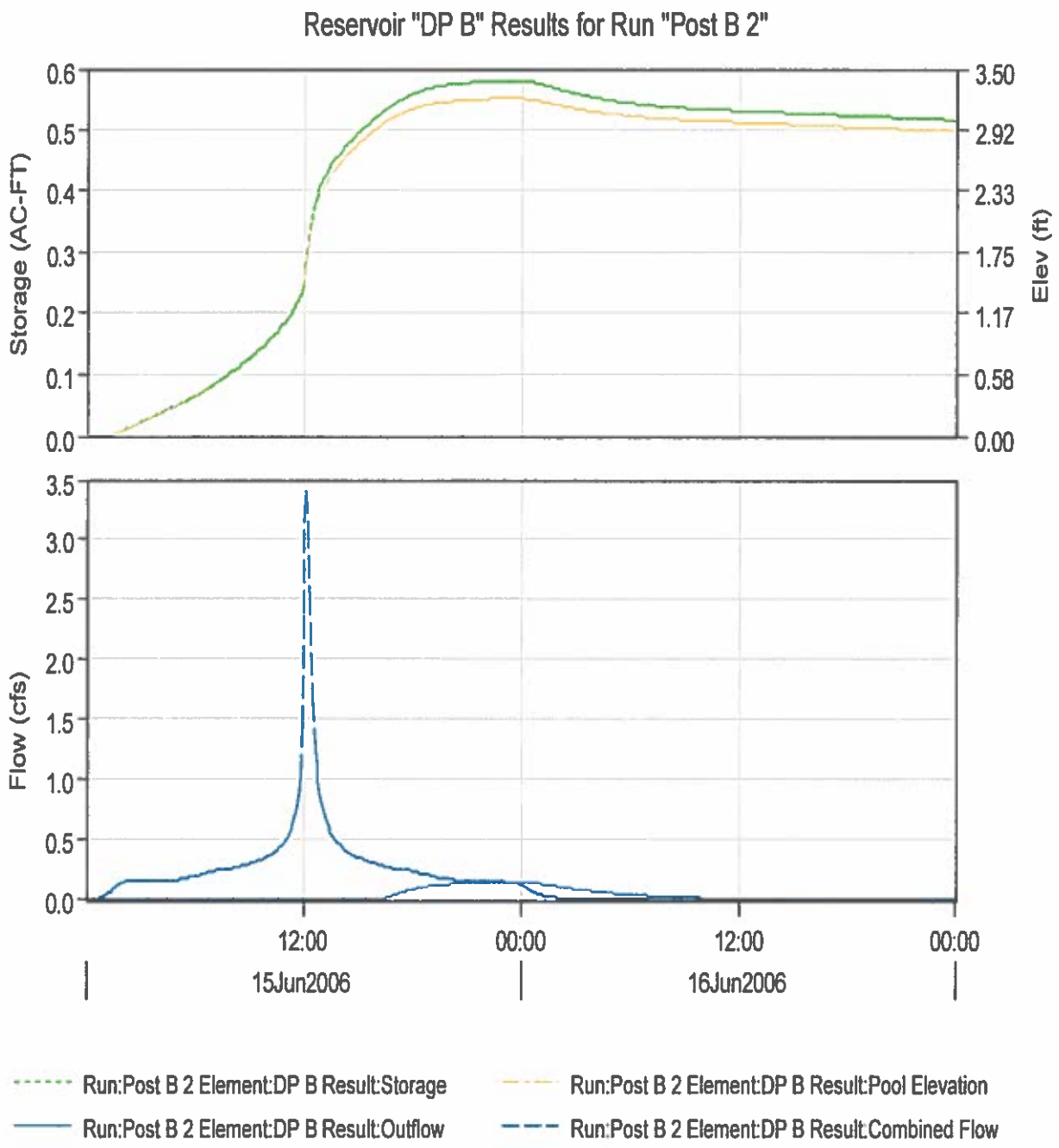
Start of Run: 15Jun2006, 00:05 Basin Model: Post B
End of Run: 17Jun2006, 00:00 Meteorologic Model: 10yr24hr
Compute Time: 29Sep2014, 23:20:01 Control Specifications: 24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OB4	0.0672	14.8	15Jun2006, 12:15	4.26
OB3b	0.1066	31.8	15Jun2006, 12:20	7.78
OB3a	0.0206	15.6	15Jun2006, 12:10	2.57
OB2	0.2263	78.3	15Jun2006, 12:25	18.14
SB1	0.0085	7.9	15Jun2006, 12:05	1.12
DP B	0.0085	0.6	15Jun2006, 14:40	0.60
OB1	0.0037	4.5	15Jun2006, 12:05	0.63
OUTFALL B	0.2385	79.8	15Jun2006, 12:25	19.37

Project: LOOMIS PRELIM Simulation Run: Post B 100

Start of Run: 15Jun2006, 00:05 Basin Model: Post B
End of Run: 17Jun2006, 00:00 Meteorologic Model: 100yr24h
Compute Time: 29Sep2014, 23:19:35 Control Specifications: 24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OB4	0.0672	33.1	15Jun2006, 12:10	7.23
OB3b	0.1066	66.8	15Jun2006, 12:15	12.78
OB3a	0.0206	29.7	15Jun2006, 12:10	3.81
OB2	0.2263	159.0	15Jun2006, 12:20	29.16
SB1	0.0085	15.1	15Jun2006, 12:05	1.62
DP B	0.0085	1.6	15Jun2006, 13:00	1.10
OB1	0.0037	8.8	15Jun2006, 12:00	0.91
OUTFALL B	0.2385	162.3	15Jun2006, 12:20	31.17


Reservoir "DP B" Results for Run "Post B 2"
Storage (AC-FT)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Elev (ft)
3.50
2.92
2.33
1.75
1.17
0.58
0.00
Flow (cfs)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post B 2 Element:DP B Result:Storage
Run:Post B 2 Element:DP B Result:Pool Elevation
Run:Post B 2 Element:DP B Result:Outflow
Run:Post B 2 Element:DP B Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post B 2

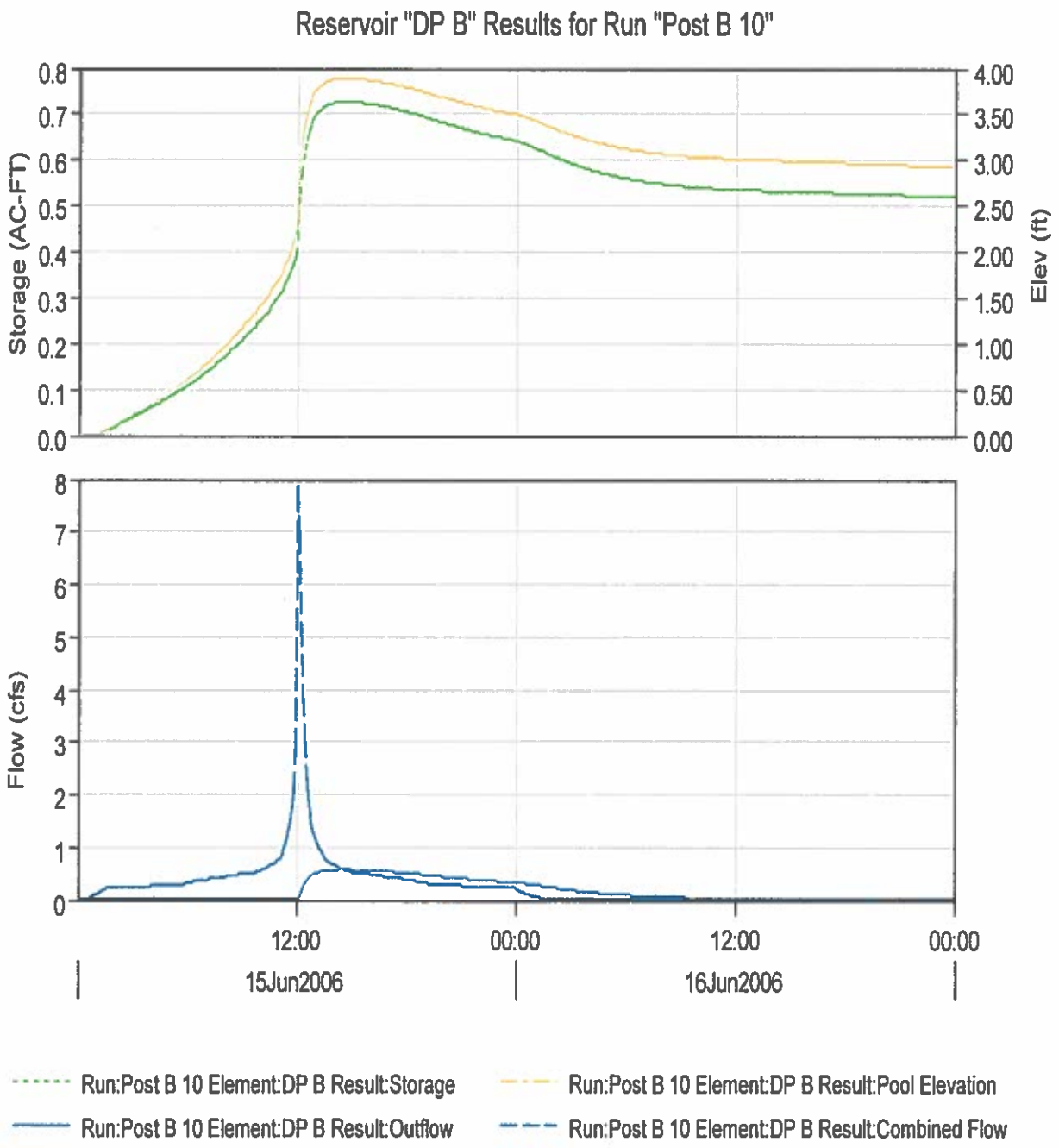
Reservoir: DP B

Start of Run:	15Jun2006, 00:05	Basin Model:	Post B
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	29Sep2014, 23:20:59	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	3.4 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:10
Peak Discharge:	0.2 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 23:10
Inflow Volume:	0.67 (AC-FT)	Peak Storage:	0.58 (AC-FT)
Discharge Volume:	0.16 (AC-FT)	Peak Elevation:	3.2 (FT)


Reservoir "DP B" Results for Run "Post B 10"
Storage (AC-FT)
Elev (ft)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Flow (cfs)
8
7
6
5
4
3
2
1
0
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post B 10 Element:DP B Result:Storage
Run:Post B 10 Element:DP B Result:Pool Elevation
Run:Post B 10 Element:DP B Result:Outflow
Run:Post B 10 Element:DP B Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post B 10

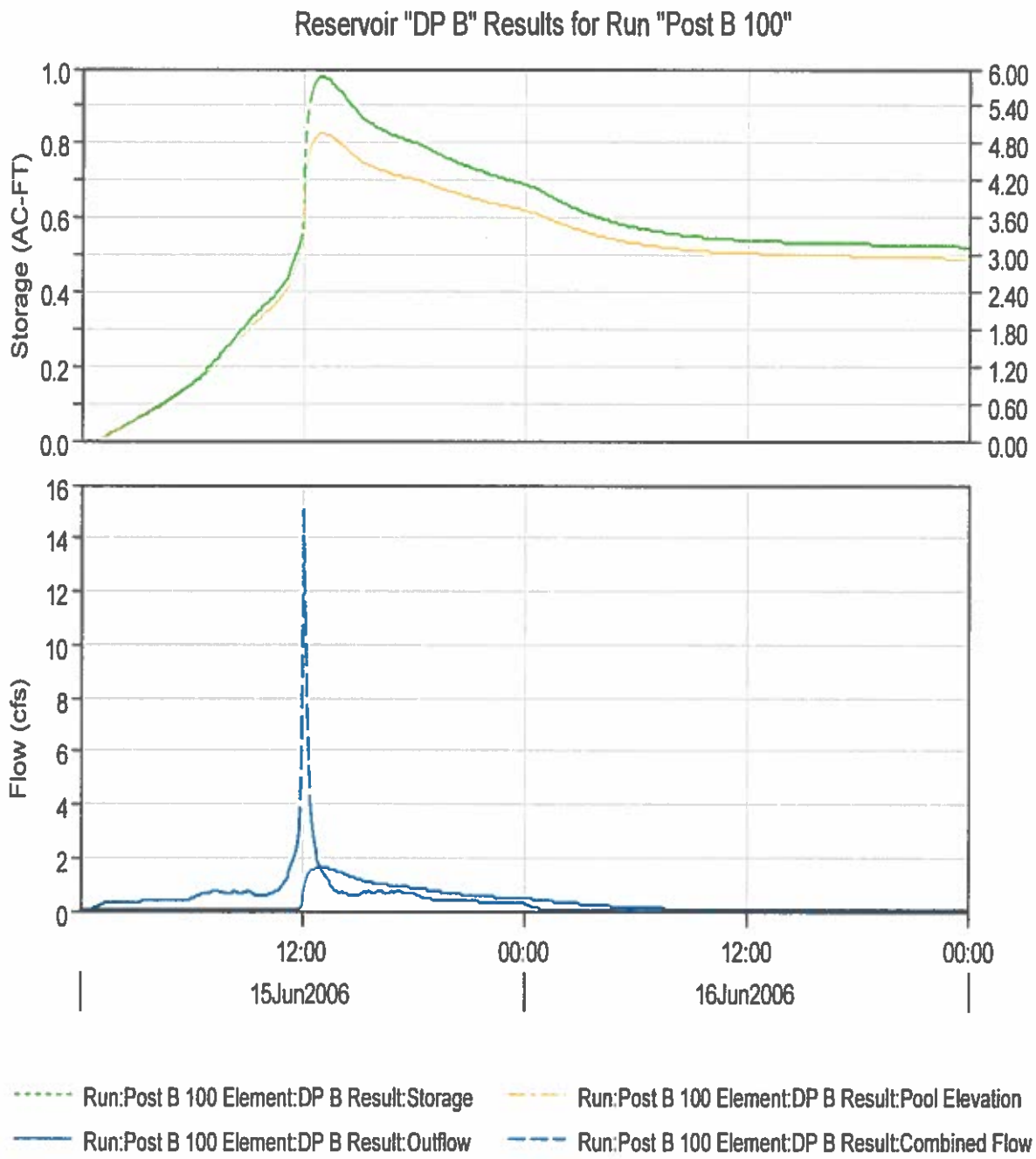
Reservoir: DP B

Start of Run:	15Jun2006, 00:05	Basin Model:	Post B
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	29Sep2014, 23:20:01	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	7.9 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:05
Peak Discharge:	0.6 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 14:40
Inflow Volume:	1.12 (AC-FT)	Peak Storage:	0.73 (AC-FT)
Discharge Volume:	0.60 (AC-FT)	Peak Elevation:	3.9 (FT)


Reservoir "DP B" Results for Run "Post B 100"
Storage (AC-FT)
Elev (ft)
1.0
0.8
0.6
0.4
0.2
0.0
6.00
5.40
4.80
4.20
3.60
3.00
2.40
1.80
1.20
0.60
0.00
Flow (cfs)
16
14
12
10
8
6
4
2
0
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post B 100 Element:DP B Result:Storage
Run:Post B 100 Element:DP B Result:Pool Elevation
Run:Post B 100 Element:DP B Result:Outflow
Run:Post B 100 Element:DP B Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post B 100

Reservoir: DP B

Start of Run:	15Jun2006, 00:05	Basin Model:	Post B
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24hr
Compute Time:	29Sep2014, 23:19:35	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	15.1 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:05
Peak Discharge:	1.6 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 13:00
Inflow Volume:	1.62 (AC-FT)	Peak Storage:	0.98 (AC-FT)
Discharge Volume:	1.10 (AC-FT)	Peak Elevation:	5.0 (FT)

RATING TABLE
ELEVATION-AREA
DP B

Ordinate	ELEVATION	DP B AREA TABLE
Labels		
Units	FT	ACRE
Type	UNT	
1	0.00000	0.149
2	6.00000	0.267

RATING TABLE
STAGE-DISCHARGE
DP B

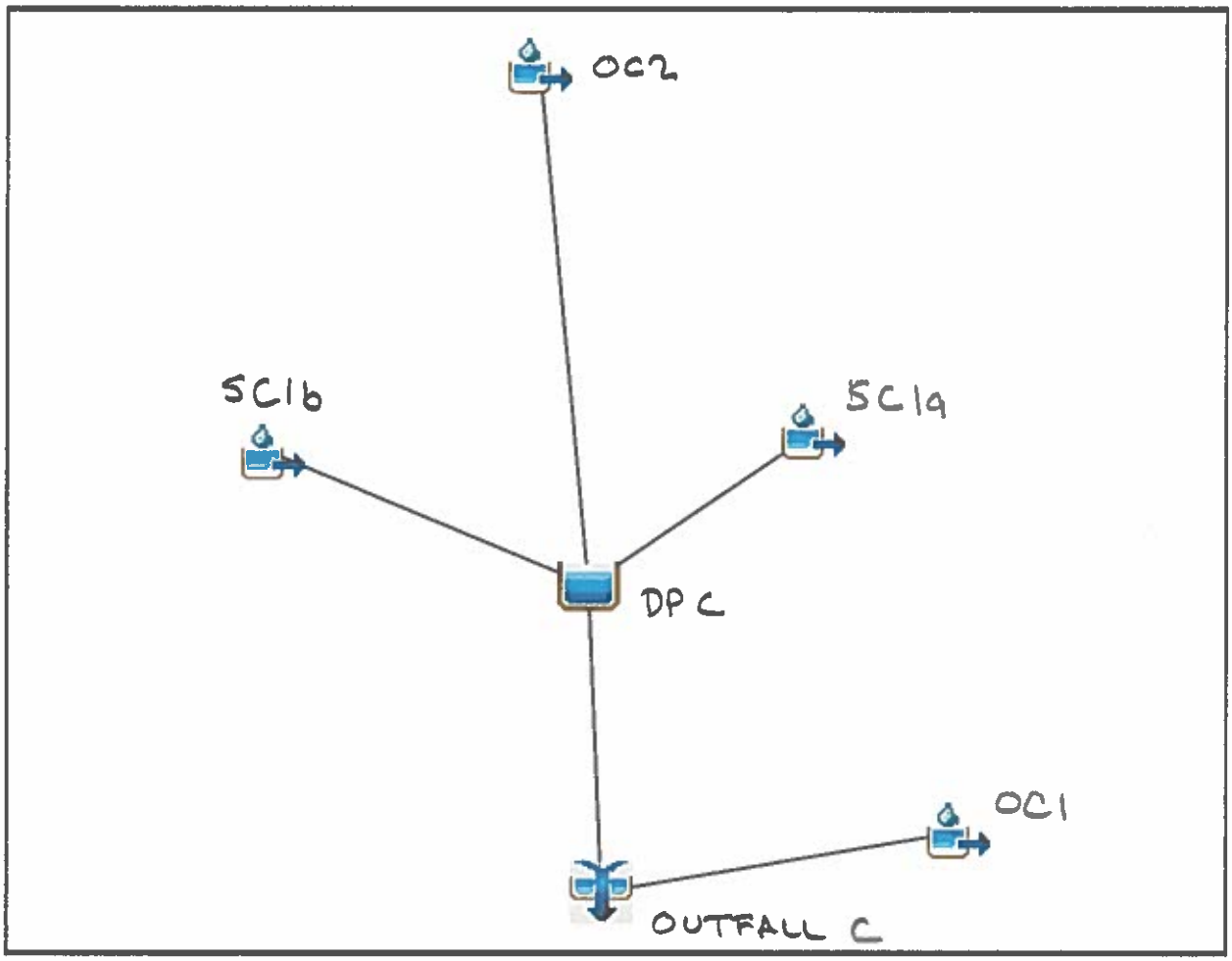
Ordinate	STAGE	C GENERIC OUTFALL FLOW TABLE
Labels		
Units	FT	CFS
Type	UNT	UNT
1	0.0000	0.00000
2	5.0000	1.30000
3	6.0000	8.00000

HEC-HMS

Project : LOOMIS PRELIM

Basin Model : Post C

Sep 29 23:47:32 PDT 2014



Project: LOOMIS PRELIM Simulation Run: Post C 2

Start of Run: 15Jun2006, 00:05 Basin Model: Post C
End of Run: 17Jun2006, 00:00 Meteorologic Model: 2yr24hr
Compute Time: 02Oct2014, 11:15:49 Control Specifications: 24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OC2	0.0185	6.9	15Jun2006, 12:10	1.45
SC1b	0.0070	2.9	15Jun2006, 12:10	0.56
SC1a	0.0027	1.2	15Jun2006, 12:10	0.22
DP Cb	0.0282	5.4	15Jun2006, 12:40	2.23
OC1	0.0056	3.6	15Jun2006, 12:05	0.60
OUTFALL C	0.0338	6.6	15Jun2006, 12:10	2.83

Project: LOOMIS PRELIM Simulation Run: Post C 10

Start of Run: 15Jun2006, 00:05 Basin Model: Post C
End of Run: 17Jun2006, 00:00 Meteorologic Model: 10yr24hr
Compute Time: 02Oct2014, 11:15:48 Control Specifications: 24hr5min

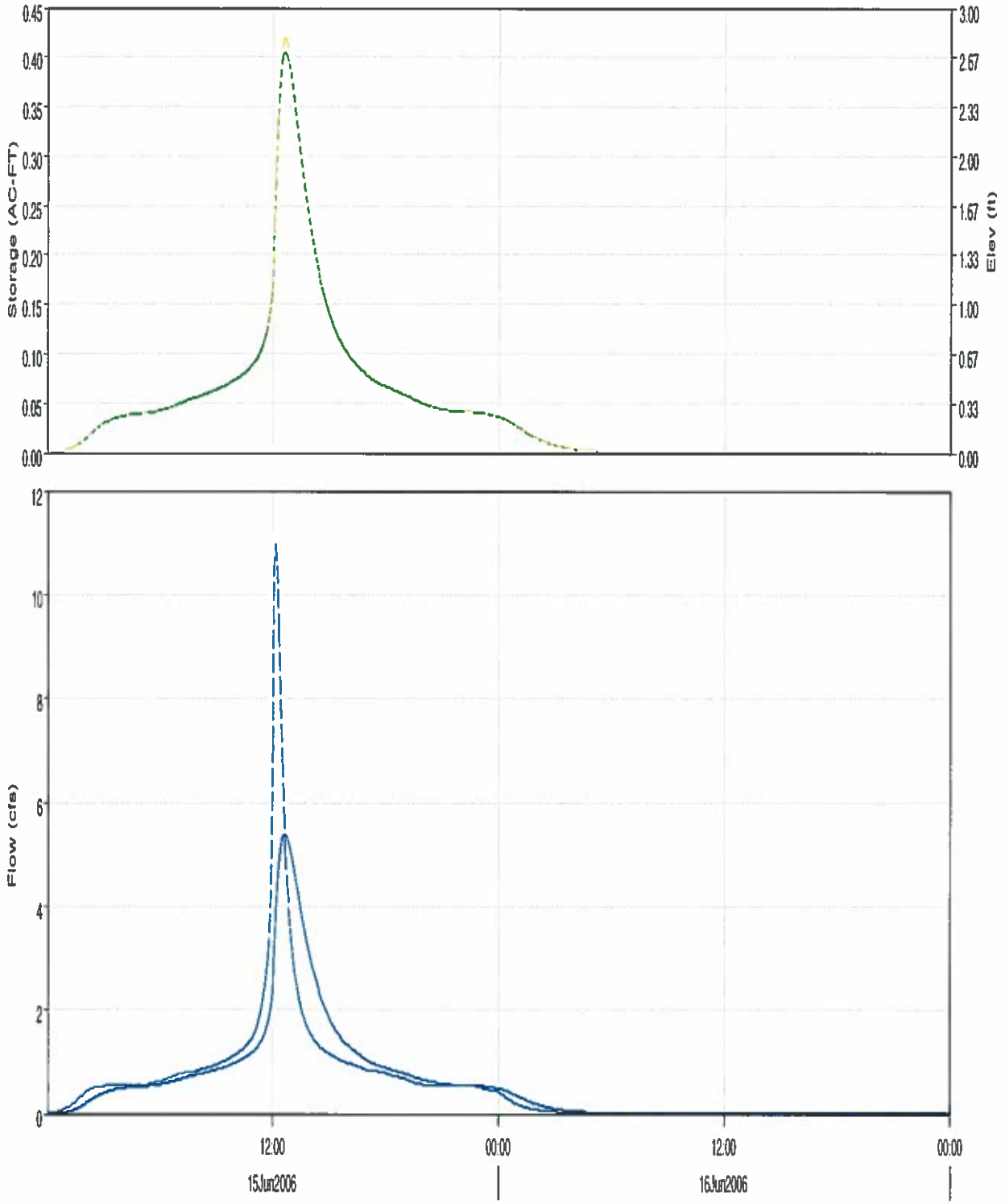
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OC2	0.0185	14.7	15Jun2006, 12:10	2.44
SC1b	0.0070	6.5	15Jun2006, 12:05	0.92
SC1a	0.0027	2.6	15Jun2006, 12:05	0.37
DP Cb	0.0282	14.7	15Jun2006, 12:20	3.73
OC1	0.0056	7.3	15Jun2006, 12:05	0.96
OUTFALL C	0.0338	16.9	15Jun2006, 12:20	4.69

Project: LOOMIS PRELIM Simulation Run: Post C 100

Start of Run: 15Jun2006, 00:05 Basin Model: Post C
End of Run: 17Jun2006, 00:00 Meteorologic Model: 100yr24hr
Compute Time: 02Oct2014, 11:15:49 Control Specifications: 24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
OC2	0.0185	30.0	15Jun2006, 12:05	3.81
SC1b	0.0070	12.9	15Jun2006, 12:05	1.38
SC1a	0.0027	5.1	15Jun2006, 12:05	0.57
DP Cb	0.0282	32.9	15Jun2006, 12:15	5.76
OC1	0.0056	12.1	15Jun2006, 12:05	1.41
OUTFALL C	0.0338	38.3	15Jun2006, 12:10	7.18

Reservoir "DP C" Results for Run "Post C 2"



Run:Post C 2 Element:DP C Result:Storage

Run:Post C 2 Element:DP C Result:Pool Elevation

Run:Post C 2 Element:DP C Result:Outflow

Run:Post C 2 Element:DP C Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post C 2
Reservoir: DP C

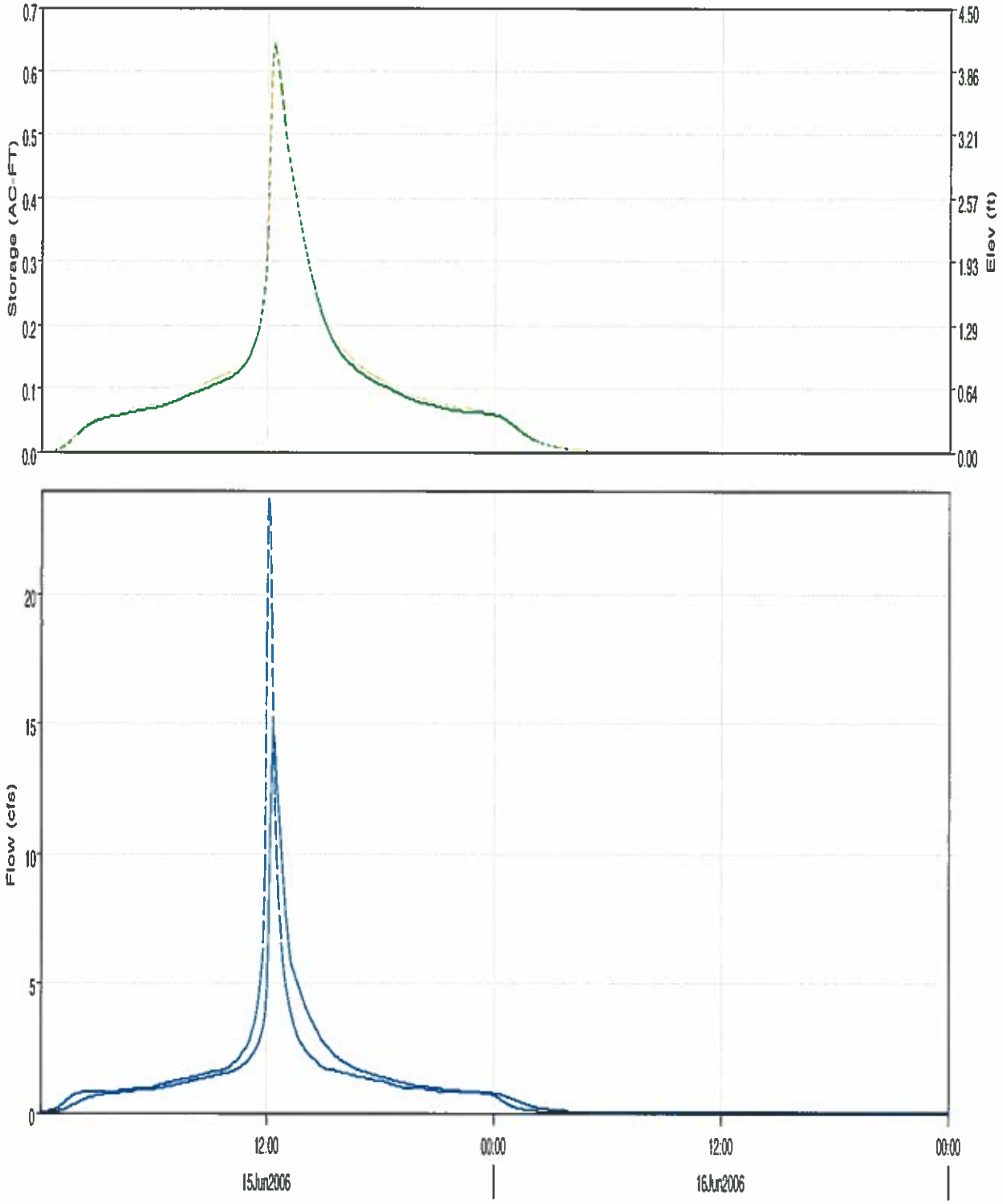
Start of Run:	15Jun2006, 00:05	Basin Model:	Post C
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	02Oct2014, 11:34:52	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	11.0 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:10
Peak Discharge:	5.4 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:40
Inflow Volume:	2.23 (AC-FT)	Peak Storage:	0.40 (AC-FT)
Discharge Volume:	2.23 (AC-FT)	Peak Elevation:	2.8 (FT)

Reservoir "DP C" Results for Run "Post C 10"



Project: LOOMIS PRELIM Simulation Run: Post C 10
Reservoir: DP C

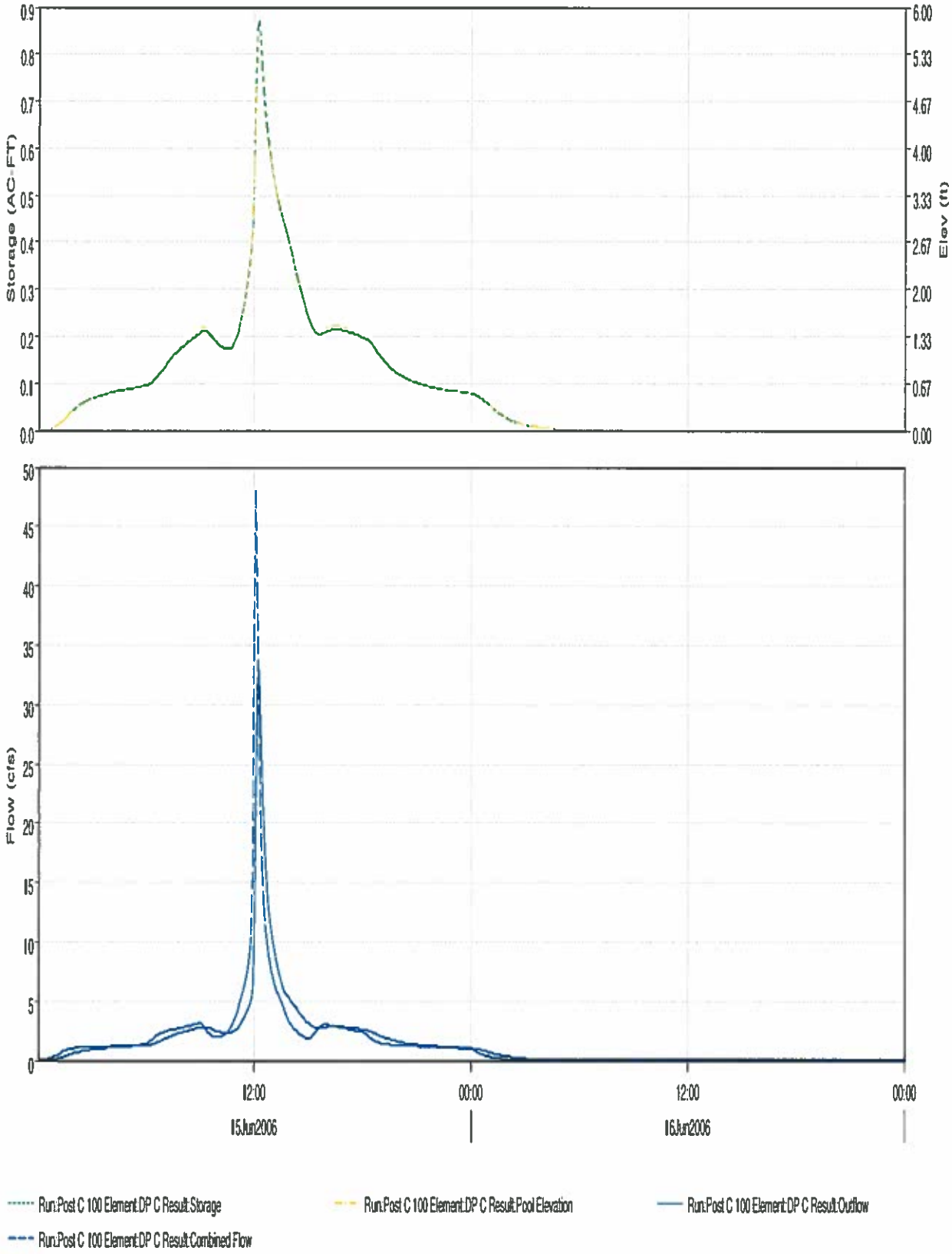
Start of Run:	15Jun2006, 00:05	Basin Model:	Post C
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	02Oct2014, 11:34:51	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	23.7 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:05
Peak Discharge:	14.7 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:20
Inflow Volume:	3.73 (AC-FT)	Peak Storage:	0.64 (AC-FT)
Discharge Volume:	3.73 (AC-FT)	Peak Elevation:	4.1 (FT)

Reservoir "DP C" Results for Run "Post C 100"



Project: LOOMIS PRELIM Simulation Run: Post C 100
Reservoir: DP C

Start of Run:	15Jun2006, 00:05	Basin Model:	Post C
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24hr
Compute Time:	02Oct2014, 11:34:51	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	48.0 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:05
Peak Discharge:	32.9 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:15
Inflow Volume:	5.76 (AC-FT)	Peak Storage:	0.87 (AC-FT)
Discharge Volume:	5.76 (AC-FT)	Peak Elevation:	5.3 (FT)

RATING TABLE
ELEVATION-AREA
DP C

Ordinate	ELEVATION	DP C AREA TABLE
Labels		
Units	FT	ACRE
Type	UNT	
1	0.0000	0.122
2	6.0000	0.217

RATING TABLE
ELEVATION-DISCHARGE
DP C

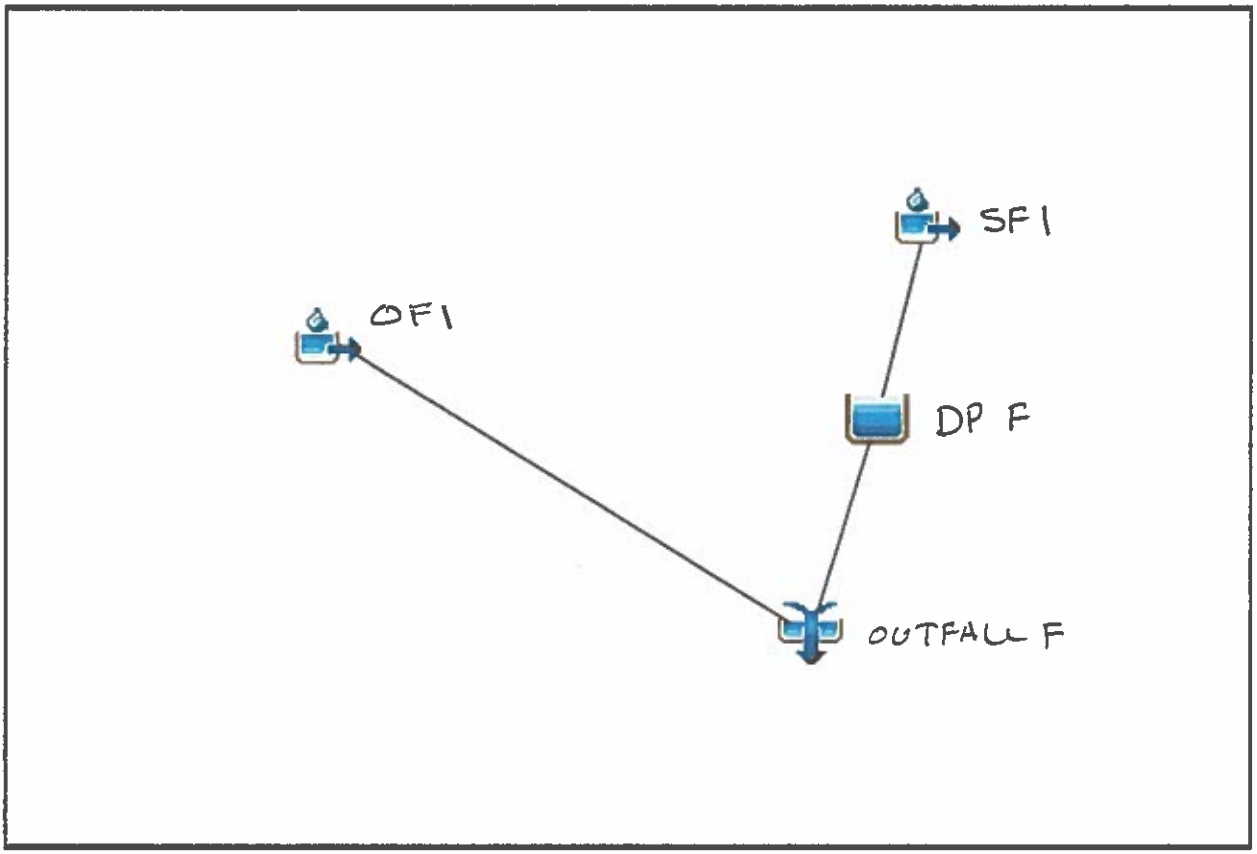
Ordinate	STAGE	C GENERIC OUTFALL FLOW TABLE
Labels		
Units	FT	CFS
Type	UNT	UNT
1	0.0000	0.00000
2	5.0000	1.30000
3	6.0000	8.00000

HEC-HMS

Project : LOOMIS

Basin Model : Post F

Sep 25 06:42:51 PDT 2014



Project: LOOMIS PRELIM Simulation Run: Post F 2

Start of Run:	15Jun2006, 00:05	Basin Model:	Post F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	29Sep2014, 22:50:31	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
SF1	0.0028	1.3	15Jun2006, 12:05	0.26
DP F	0.0028	0.5	15Jun2006, 12:35	0.26
OF1	0.0016	0.7	15Jun2006, 12:10	0.15
OUTFALL F	0.0044	1.0	15Jun2006, 12:15	0.41

Project: LOOMIS PRELIM Simulation Run: Post F 10

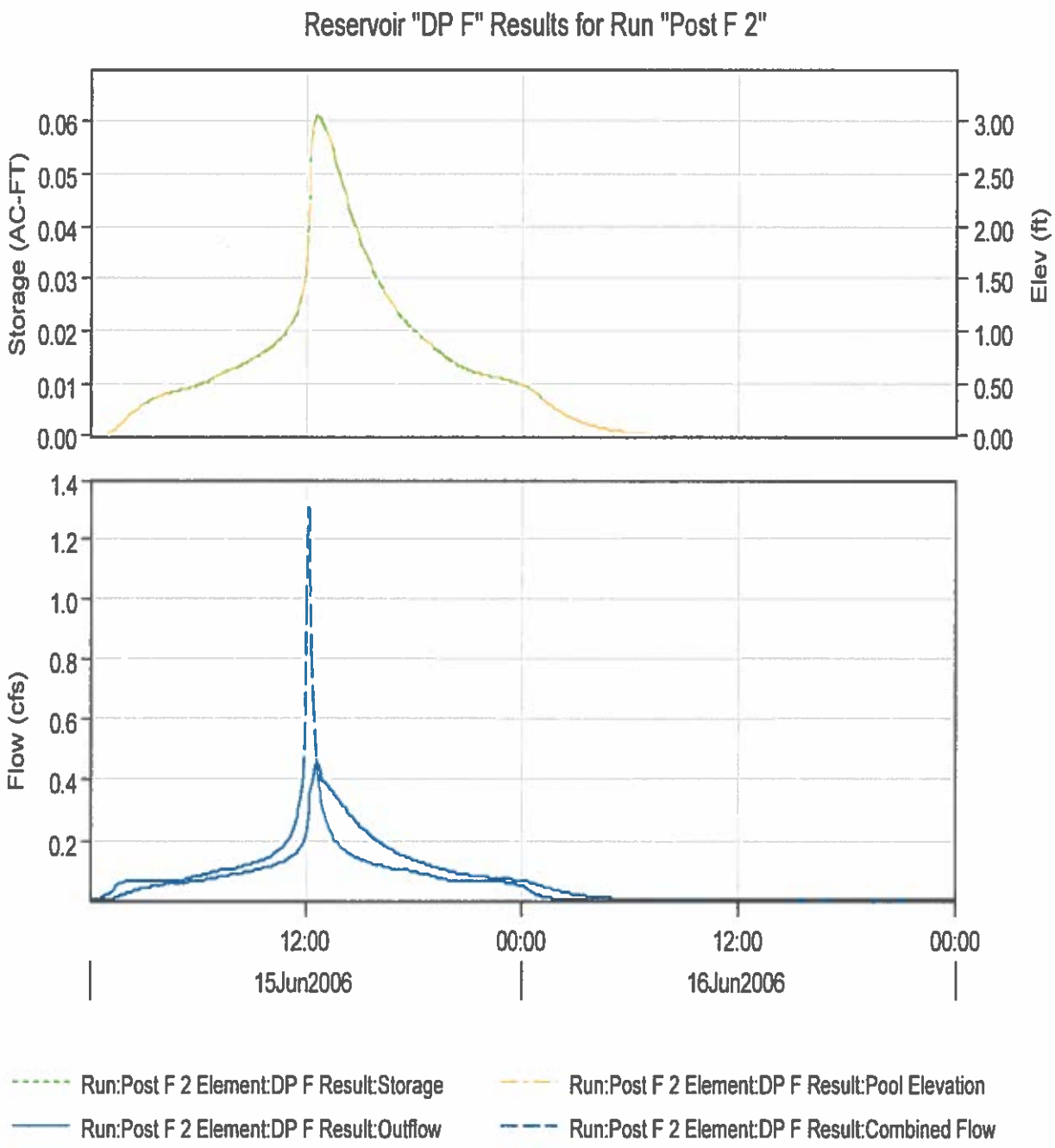
Start of Run:	15Jun2006, 00:05	Basin Model:	Post F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	29Sep2014, 22:50:25	Control Specifications:	24hr5mir

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
SF1	0.0028	2.9	15Jun2006, 12:05	0.42
DP F	0.0028	1.5	15Jun2006, 12:15	0.42
OF1	0.0016	1.5	15Jun2006, 12:10	0.24
OUTFALL F	0.0044	2.8	15Jun2006, 12:10	0.66

Project: LOOMIS PRELIM Simulation Run: Post F 100

Start of Run:	15Jun2006, 00:05	Basin Model:	Post F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24h
Compute Time:	29Sep2014, 22:50:28	Control Specifications:	24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
SF1	0.0028	5.6	15Jun2006, 12:05	0.62
DP F	0.0028	3.4	15Jun2006, 12:10	0.62
OF1	0.0016	2.7	15Jun2006, 12:05	0.36
OUTFALL F	0.0044	6.1	15Jun2006, 12:10	0.98


Reservoir "DP F" Results for Run "Post F 2"
Storage (AC-FT)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Elev (ft)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Flow (cfs)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post F 2 Element:DP F Result:Storage
Run:Post F 2 Element:DP F Result:Pool Elevation
Run:Post F 2 Element:DP F Result:Outflow
Run:Post F 2 Element:DP F Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post F 2

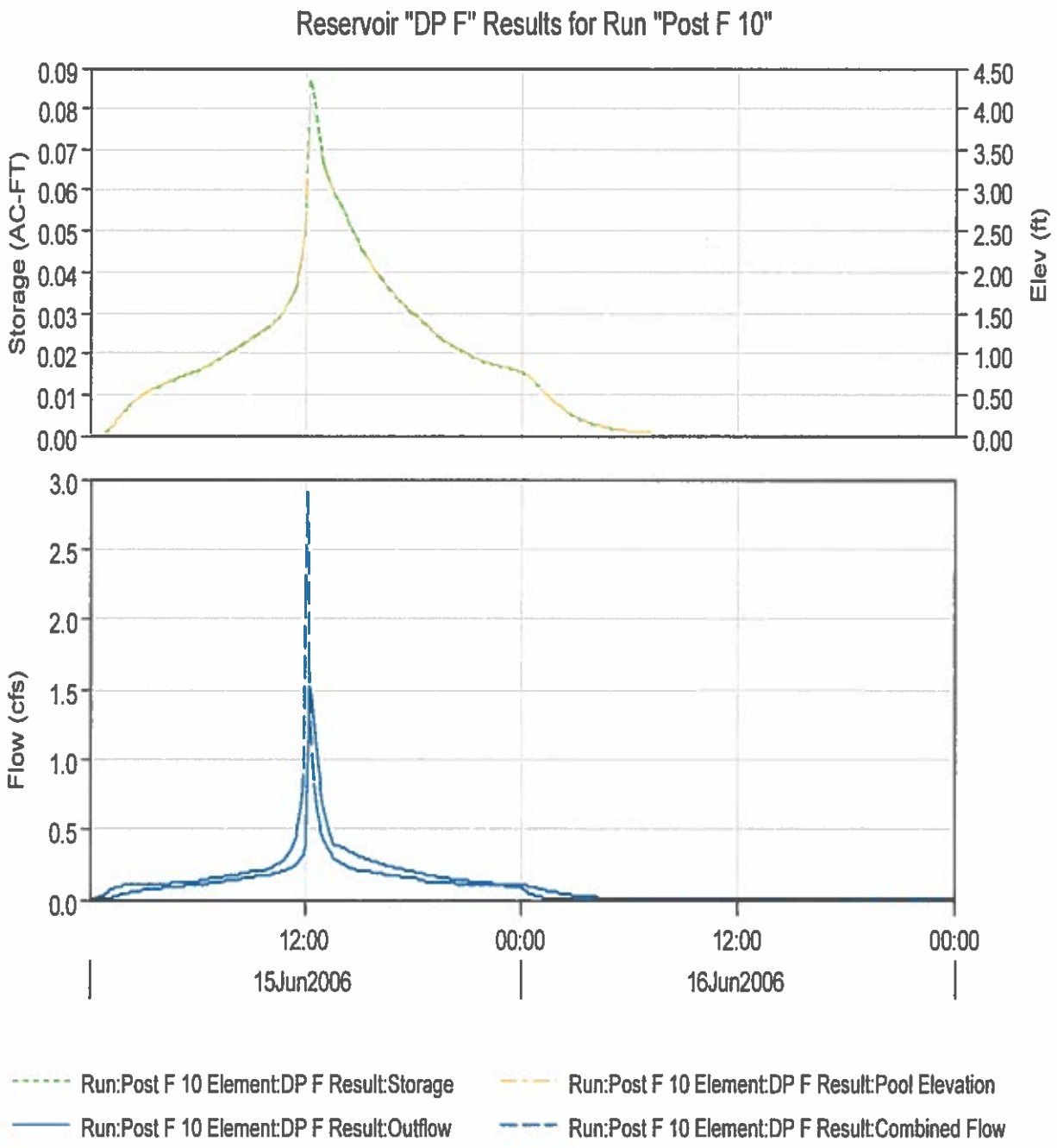
Reservoir: DP F

Start of Run:	15Jun2006, 00:05	Basin Model:	Post F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	2yr24hr
Compute Time:	29Sep2014, 22:50:31	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	1.3 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:05
Peak Discharge:	0.5 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:35
Inflow Volume:	0.26 (AC-FT)	Peak Storage:	0.06 (AC-FT)
Discharge Volume:	0.26 (AC-FT)	Peak Elevation:	3.1 (FT)


Reservoir "DP F" Results for Run "Post F 10"
Storage (AC-FT)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Elev (ft)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Flow (cfs)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post F 10 Element:DP F Result:Storage
Run:Post F 10 Element:DP F Result:Pool Elevation
Run:Post F 10 Element:DP F Result:Outflow
Run:Post F 10 Element:DP F Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post F 10

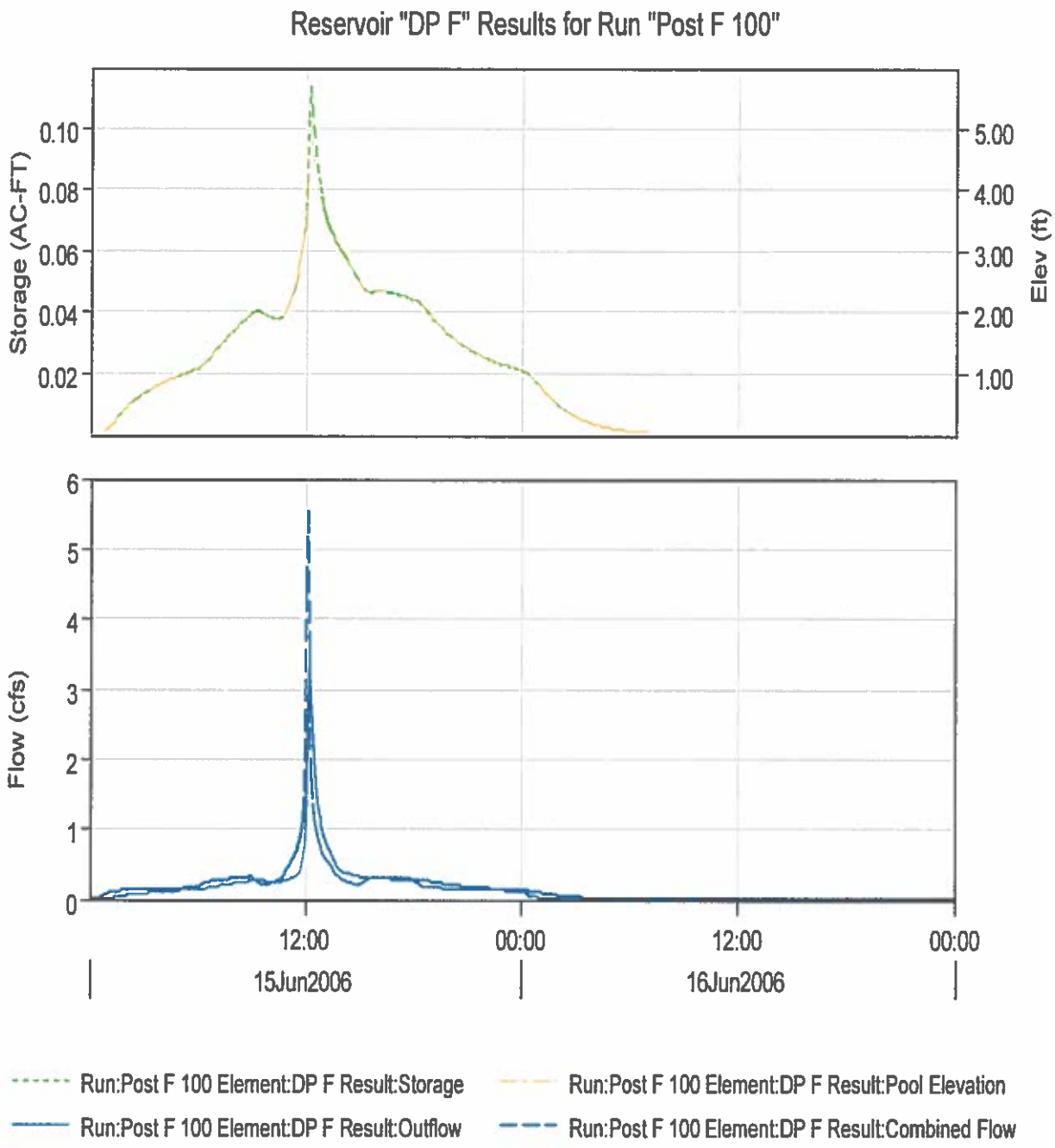
Reservoir: DP F

Start of Run:	15Jun2006, 00:05	Basin Model:	Post F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	10yr24hr
Compute Time:	29Sep2014, 22:50:25	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	2.9 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:05
Peak Discharge:	1.5 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:15
Inflow Volume:	0.42 (AC-FT)	Peak Storage:	0.09 (AC-FT)
Discharge Volume:	0.42 (AC-FT)	Peak Elevation:	4.1 (FT)


Reservoir "DP F" Results for Run "Post F 100"
Storage (AC-FT)
0.10
0.08
0.06
0.04
0.02
Elev (ft)
5.00
4.00
3.00
2.00
1.00
Flow (cfs)
6
5
4
3
2
1
0
12:00
00:00
12:00
00:00
15Jun2006
16Jun2006
Run:Post F 100 Element:DP F Result:Storage
Run:Post F 100 Element:DP F Result:Pool Elevation
Run:Post F 100 Element:DP F Result:Outflow
Run:Post F 100 Element:DP F Result:Combined Flow

Project: LOOMIS PRELIM Simulation Run: Post F 100

Reservoir: DP F

Start of Run:	15Jun2006, 00:05	Basin Model:	Post F
End of Run:	17Jun2006, 00:00	Meteorologic Model:	100yr24hr
Compute Time:	29Sep2014, 22:50:28	Control Specifications:	24hr5min

Volume Units: AC-FT

Computed Results

Peak Inflow:	5.6 (CFS)	Date/Time of Peak Inflow:	15Jun2006, 12:05
Peak Discharge:	3.4 (CFS)	Date/Time of Peak Discharge:	15Jun2006, 12:10
Inflow Volume:	0.62 (AC-FT)	Peak Storage:	0.11 (AC-FT)
Discharge Volume:	0.62 (AC-FT)	Peak Elevation:	5.1 (FT)

RATING TABLE
ELEV-AREA
DP F

Ordinate	ELEVATION	DP F AREA TABLE
Labels		
Units	FT	ACRE
Type	UNT	
1	0.0	0.016
2	6.0	0.032

RATING TABLE
STAGE-DISCHARGE
DP F GENERIC OUTFALL

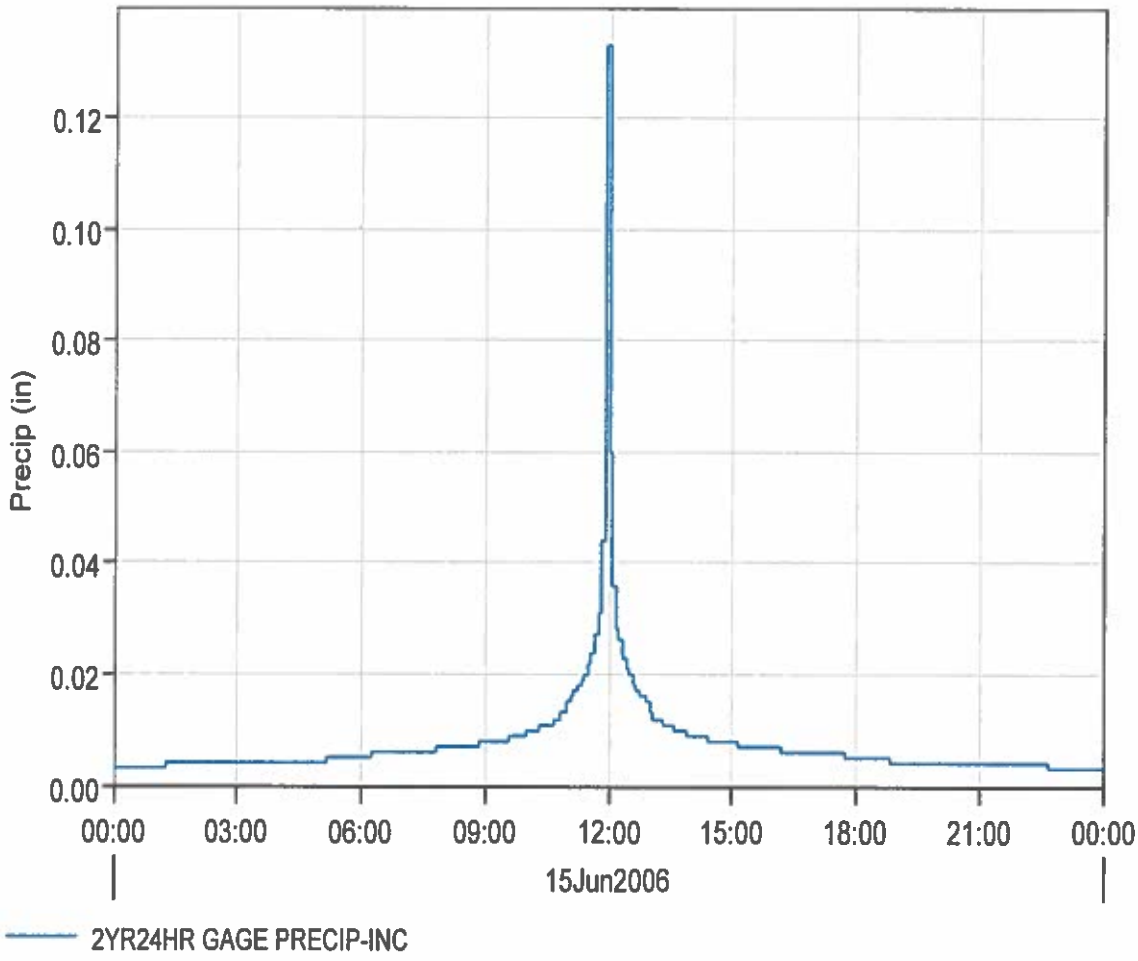
Ordinate	STAGE	F GENERIC O... FLOW TABLE
Labels		
Units	FT	CFS
Type	UNT	UNT
1	0.0	0.0
2	3.0	0.4
3	4.0	1.4
4	5.0	3.3
5	6.0	6.0

APPENDIX A.3

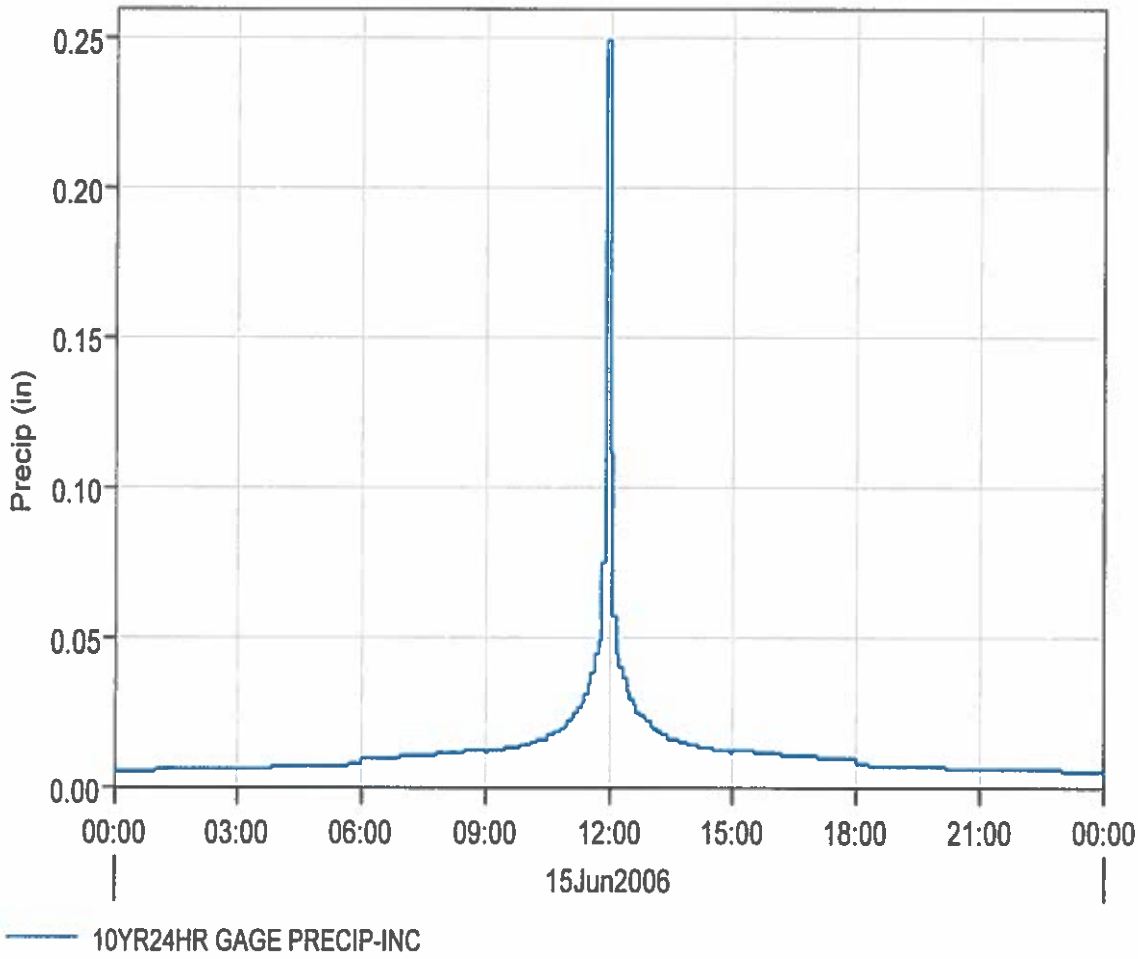
- Rainfall Hyetographs 2, 10 and 100-year Design Storms
- Post Development On-Site Watershed Sub-basin Parameters
- Pre Development On-Site Watershed Sub-basin Parameters
- Pre Development Off-Site Watershed Sub-basin Parameters
- USDA/SCS Soil Map
- Chart F.1 Overland Slope and Length

Figure A1, Pre-Development Watershed Map
Figure A2, Post-Development Watershed Map
Figure A3, Off-Site Watershed Map Land Cover Areas
Figure A4, Off-Site Watershed Map Basin Drainage and Connectivity

Placer County PDP
2-year, 24-hour design storm
Elevation = 385'



Placer County PDP
10-year, 24-hour design storm
Elevation = 385'



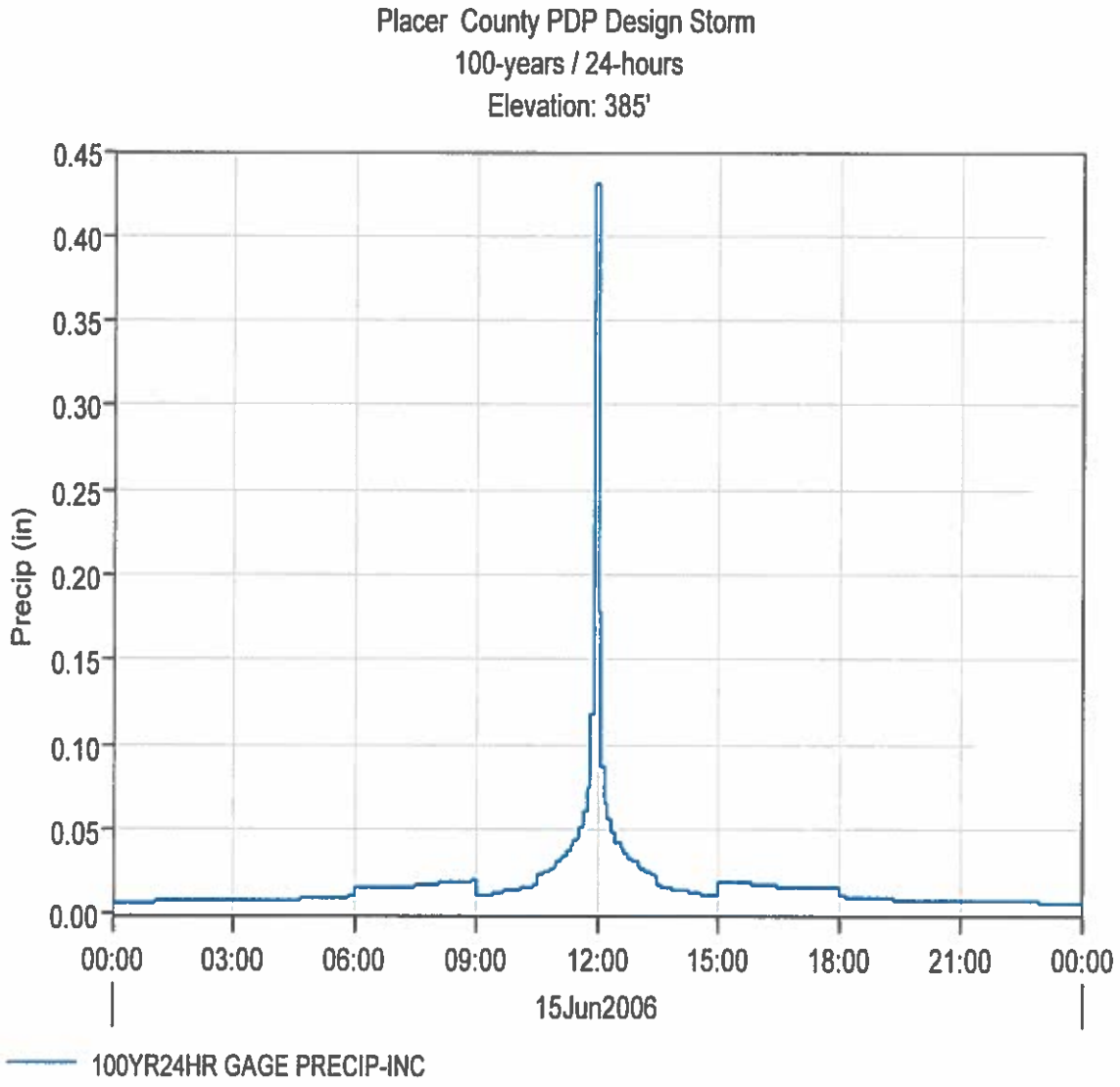

Placer County PDP Design Storm
100-years / 24-hours
Elevation: 385'
Precip (in)
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
15Jun2006
100YR24HR GAGE PRECIP-INC

Table A1.1

POST-DEVELOPMENT ONSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				Ī (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
SA1a										
PLANE 1	1.35	0.0021	G/O	OE1	85	0.00	1.35	0.00	0.00	0.25
	4.30	0.0067	RD	ROADWAY	90	0.00	4.30	0.00	0.00	0.25
	5.65	**0.0088**	**23**	**Average:**	**89**				**Average:**	**0.25**
PLANE 2	16.00	0.0250	G/O	Grassland/Woodland	5	0.00	9.04	0.00	6.96	0.19
	3.40	0.0053	GRASS	Grassland	5	0.00	3.40	0.00	0.00	0.25
	19.40	**0.0303**	**77**	**Average:**	**5**				**Average:**	**0.20**
Total:	**25.1**	**0.0391**								
DEVELOPED BASIN "5A1" ZONES (AS INDIVIDUAL SINGLE-PLANE SUB-BASINS)										
SA1b	7.70	0.0120	MDR	Medium Density Residential	65	0.00	7.70	0.00	0.00	0.25
SA1c	7.00	0.0109	MDR	Medium Density Residential	68	0.00	7.00	0.00	0.00	0.25
SA1d	2.20	0.0034	MDR	Medium Density Residential	68	0.00	2.20	0.00	0.00	0.25
SA1e	9.70	0.0152	MDR	Medium Density Residential	68	0.00	9.70	0.00	0.00	0.25
SA1f	0.70	0.0011	MDR	Medium Density Residential	68	0.00	0.70	0.00	0.00	0.25
	27.30	**0.0427**	**52**	**Average:**	**67**				**Average:**	**0.25**
Total:	**52.4**	**0.0818**								
SB1										
PLANE 1	5.45	0.0085	MDR	Medium Density Residential	65	0.00	5.43	0.00	0.02	0.25
Total:	**5.45**	**0.0085**		**Average:**	**65**				**Average:**	**0.25**

Table A1.1

POST-DEVELOPMENT ONSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				Ī (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
SC1a										
PLANE 1	1.72	0.0027	MDR	Medium Density Residential	65	0.00	0.22	0.00	1.50	0.14
Total:	**1.72**	**0.0027**		**Average:**	**65**				**Average:**	**0.14**
SC1b										
PLANE 1	4.46	0.0070	MDR	Medium Density Residential	65	0.00	4.18	0.00	0.28	0.24
Total:	**4.46**	**0.0070**		**Average:**	**65**				**Average:**	**0.24**
SF1										
PLANE 1	1.80	0.0028	MDR	Medium Density Residential	78	0.00	1.80	0.00	0.00	0.25
Total:	**1.80**	**0.0028**		**Average:**	**78**				**Average:**	**0.25**

Table A2.1

PRE-DEVELOPMENT ONSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				Ī (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
SA1										
PLANE 1	0.25	0.0004	LDR	Low Density Residential	50	0.00	0.25	0.00	0.00	0.25
	23.58	0.0368	GRASS	Grassland	5	0.00	23.58	0.00	0.00	0.25
	16.91	0.0264	WOOD	Woodland	5	0.00	8.91	0.00	8.00	0.19
	40.49	**0.0633**		**Average:**	**5**				**Average:**	**0.22**
SB1										
PLANE 1	0.89	0.0014	GRASS	Grassland	5	0.00	0.89	0.00	0.00	0.25
	0.79	0.0012	WOOD	Woodland	5	0.00	0.79	0.00	0.00	0.25
Total:	**1.68**	**0.0026**		**Average:**	**5**				**Average:**	**0.25**
SC1										
	7.22	0.0113	GRASS	Grassland	5	0.00	5.64	0.00	1.58	0.22
PLANE 1	3.12	0.0049	WOOD	Woodland	5	0.00	2.15	0.00	0.97	0.21
Total:	**10.34**	**0.0162**		**Average:**	**5**				**Average:**	**0.22**
SD1										
PLANE 1	3.16	0.0049	GRASS	Grassland	5	0.00	3.17	0.00	0.00	0.25
	0.93	0.0015	WOOD	Woodland	5	0.00	0.93	0.00	0.00	0.25
Total:	**4.09**	**0.0064**		**Average:**	**5**				**Average:**	**0.25**

Table A2.1

PRE-DEVELOPMENT ONSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				$\bar{I}$ (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
SE1										
PLANE 1	0.27	0.0004	LDR	Low Density Residential	50	0.00	0.27	0.00	0.00	0.25
	2.49	0.0039	GRASS	Grassland	5	0.00	2.49	0.00	0.00	0.25
	1.09	0.0017	WOOD	Woodland	5	0.00	1.09	0.00	0.00	0.25
	3.85	**0.0060**		**Average:**	8				**Average:**	**0.25**
SF1										
PLANE 1	0.27	0.0004	LDR	Low Density Residential	50	0.00	0.27	0.00	0.00	0.25
	2.52	0.0039	GRASS	Grassland	5	0.00	2.52	0.00	0.00	0.25
Total:	**2.79**	**0.0044**		**Average:**	9				**Average:**	**0.25**

Table A2.2

OFFSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				$\bar{I}$ (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
OA1										
PLANE 1,2	3.67	0.0057	HWY	Highway/Roadway	90	0.00	0.00	0.00	3.67	0.12
	2.06	0.0032	C/I	Commercial/Industrial	85	0.00	2.06	0.00	0.00	0.25
Total:	**5.73**	**0.0089**		**Average:**	**88**				**Average:**	**0.17**
OA2										
	28.15	0.0440	MDR	Medium Density Residential	65	0.00	23.40	0.00	4.75	0.23
	14.05	0.0220	MDR	Medium Density Residential	50	0.00	12.30	0.00	1.71	0.23
	3.40	0.0053	LDR	Low Density Residential	50	0.00	0.10	0.00	3.30	0.12
	6.60	0.0103	SC	School	50	0.00	6.60	0.00	0.00	0.25
PLANE 1	**52.20**		**89**		**58**				**Average:**	**0.20**
PLANE 2	6.20	0.0097	PK	Park	5	0.00	6.00	0.00	0.20	0.25
	6.20		**11**	**Average:**	**5**				**Average:**	**0.25**
Total:	**58.4**	**0.0913**								
OA3										
	7.60	0.0119	C/I	Commercial/Industrial	85	0.00	7.60	0.00	0.00	0.25
	29.90	0.0467	MDR	Medium Density Residential	65	0.00	28.40	0.00	1.50	0.24
PLANE 1,2	12.10	0.0189	MDR	Medium Density Residential	50	0.00	0.00	0.00	12.10	0.12
Total:	**49.60**	**0.0775**		**Average:**	**64**				**Average:**	**0.21**

Table A2.2

OFFSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				Ī (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
OA4a										
	13.90	0.0217	LDR	Low Density Residential	50	0.00	0.50	0.00	13.40	0.12
	11.20	0.0175	MDR	Medium Density Residential	50	0.00	7.60	0.00	3.60	0.21
	20.30	0.0175	SC	School	50	0.00	10.30	0.00	10.00	0.19
PLANE 1	0.07	0.0001	C/I	Commercial/Industrial	85	0.00	0.07	0.00	0.00	0.25
	45.47		**76**	**Average:**	**50**				**Average:**	**0.17**
	12.10	0.0189	PK	Park	5	0.00	0.60	0.00	11.50	0.13
PLANE 2	2.60	0.0189	OS	Open Space	5	0.00	0.10	0.00	2.50	0.13
	14.70		**24**	**Average:**	**5**				**Average:**	**0.13**
Total:	**60.2**	**0.0940**								
OA4b										
	6.10	0.0095	MDR	Medium Density Residential	50	0.00	6.10	0.00	0.00	0.25
	14.90	0.0233	C/I	Commercial/Industrial	85	0.00	14.90	0.00	0.00	0.25
PLANE 1,2	0.20	0.0003	OS	Open Space	5	0.00	0.20	0.00	0.00	0.25
Total:	**21.20**	**0.0331**		**Average:**	**74**				**Average:**	**0.25**

Table A2.2

OFFSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				Ī (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
OA5										
PLANE 1	37.90	0.0592	C/I	Commercial/Industrial	85	0.00	37.90	0.00	0.00	0.25
	37.90		**82**	**Average:**	**85**				**Average:**	**0.25**
PLANE 2	8.60	0.0134	OS	Open Space	5	0.00	8.60	0.00	0.00	0.25
	8.60		**18**	**Average:**	75				**Average:**	**0.25**
Total:	**46.5**	**0.0727**								
OB1										
PLANE 1	2.38	0.0037	HWY	Highway/Roadway	90	0.00	2.25	0.00	0.13	0.24
Total:	**2.38**	**0.0037**		**Average:**	90				**Average:**	**0.24**
OB2										
PLANE 1	34.60	0.0541	LDR	Low Density Residential	50	0.00	34.60	0.00	0.00	0.25
	34.60		**55**	**Average:**	**50**				**Average:**	**0.25**
	8.20	0.0128	PK	Park	5	0.00	7.30	0.00	0.90	0.24
PLANE 2	20.60	0.0322	OS	Open Space	5	0.00	14.40	0.00	6.20	0.21
	28.80		**45**	**Average:**	**5**				**Average:**	**0.22**
Total:	**63.4**	**0.0991**								

Table A2.2

OFFSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				Ī (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
OB3a										
	5.40	0.0084	C/I	Commercial/Industrial	85	0.00	5.40	0.00	0.00	0.25
	6.00	0.0094	LDR	Low Density Residential	50	0.00	6.00	0.00	0.00	0.25
	0.60	0.0009	MDR	Medium Density Residential	50	0.00	0.60	0.00	0.00	0.25
PLANE 1	0.07	0.0001	SC	School	50	0.00	0.07	0.00	0.00	0.25
	12.07		**92**	**Average:**	**66**				**Average:**	**0.25**
	13.00	0.0203	OS	Open Space	5	0.00	13.00	0.00	0.00	0.25
PLANE 2	1.10	0.0017	PK	Park	5	0.00	0.40	0.00	0.70	0.17
	1.10		**8**	**Average:**	**5**				**Average:**	**0.24**
Total:	**13.2**	**0.0206**								
OB3b										
	1.40	0.0022	LDR	Low Density Residential	50	0.00	1.40	0.00	0.00	0.25
PLANE 1	18.10	0.0066	MDR	Medium Density Residential	50	0.00	18.10	0.00	0.00	0.25
	18.10		**72**	**Average:**	**50**				**Average:**	**0.25**
PLANE 2	7.10	0.0111	OS	Open Space	5	0.00	7.10	0.00	0.00	0.25
	7.10		**28**	**Average:**	**5**				**Average:**	**0.25**
Total:	**25.2**	**0.0394**								

Table A2.2

OFFSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SUB-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				$\bar{I}$ (in/hr)
Basin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
OB4										
	9.10	0.0142	LDR	Low Density Residential	50	0.00	9.10	0.00	0.00	0.25
PLANE 1	3.30	0.0052	C/I	Commercial/Industrial	85	0.00	3.30	0.00	0.00	0.25
	12.40		**29**	**Average:**	**59**				**Average:**	**0.25**
PLANE 2	30.60		OS	Open Space	5	0.00	30.60	0.00	0.00	0.25
	30.60		**71**	**Average:**	5				**Average:**	**0.25**
Total:	**43.0**	**0.0672**								
OC1										
PLANE 1,2	3.61	0.0056	HWY	Highway/Roadway	90	0.00	0.00	0.00	3.61	0.12
Total:	**3.61**	0.0056		**Average:**	90					**0.12**
OC2										
	4.20	0.0066	LDR	Low Density Residential	50	0.00	0.00	0.00	4.20	0.12
PLANE 1,2	7.60	0.0119	MDR	Medium Density Residential	65	0.00	1.40	0.00	6.20	0.14
Total:	**11.80**	**0.0185**		**Average:**	60				**Average:**	**0.14**
OE1										
PLANE 1,2	1.49	0.0023	C/I	Commercial/Industrial	85	0.00	1.49	0.00	0.00	0.25
Total:	**1.49**	**0.0023**		**Average:**	**85**					**0.25**

Table A2.2

OFFSITE LAND USE IMPERVIOUSNESS AND INFILTRATION FACTORS

SU8-BASIN			LAND USE/ COVER	DESCRIPTION	IMPERVIOUSNESS (%)	INFILTRATION FACTOR (in./hr.)				Ī (in/hr)
8asin No.	Ac.	mi^2				A	B	C	D	
						0.48	0.25	0.16	0.12	
OF1										
	0.67	0.0010	HWY	Highway/Roadway	90	0.00	0.67	0.00	0.00	0.25
PLANE 1,2	0.37	0.0006	LDR	Low Density Residential	50	0.00	0.37	0.00	0.00	0.25
Total:	**1.04**	**0.0016**		**Average:**	**78**				**Average:**	**0.25**

USDA/SCS SOIL MAP 1/3

Hydrologic Soil Group—Placer County, California, Western Part

2/3

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Survey Areas

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Placer County, California, Western Part
Survey Area Data: Version 6, Dec 13, 2013

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

Date(s) aerial images were photographed: Nov 3, 2010—Apr 29, 2012

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Placer County, California, Western Part (CA620)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
106	Andregg coarse sandy loam, 2 to 9 percent slopes	B	1,031.1	69.2%
107	Andregg coarse sandy loam, 9 to 15 percent slopes	B	12.0	0.8%
108	Andregg coarse sandy loam, 15 to 30 percent slopes	B	2.0	0.1%
109	Andregg coarse sandy loam, rocky, 2 to 15 percent slopes	B	70.8	4.8%
130	Caperton-Andregg coarse sandy loams, 2 to 15 percent slopes	D	108.1	7.3%
194	Xerofluvents, frequently flooded	B	71.2	4.8%
196	Xerorthents, cut and fill areas	D	46.0	3.1%
197	Xerorthents, placer areas	D	148.9	10.0%
Totals for Area of Interest			1,490.2	100.0%

Chart F.1 Overland Slope and Length Based on Imperviousness for Calibrated Response Times

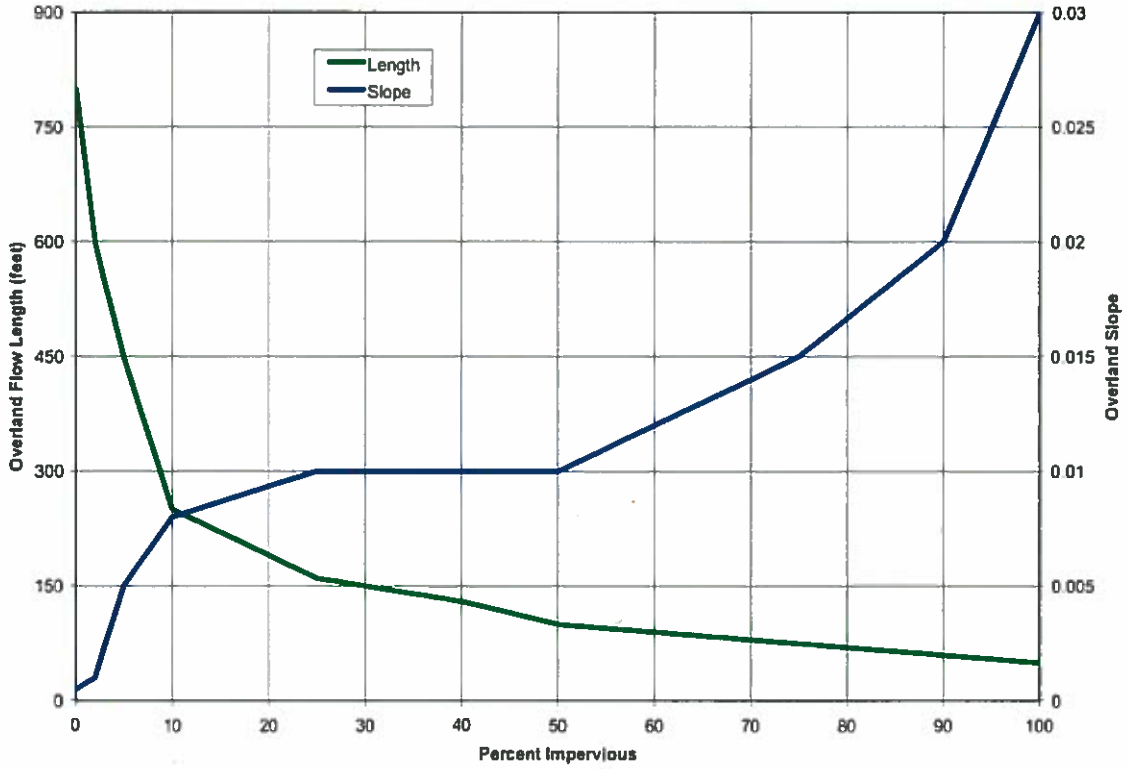


Table F.1 Overland Slope and Length Based on Imperviousness for Calibrated Response Times

Imperviousness (percent)	Length (feet)	Slope (feet/foot)
0	799	0.0005
2	600	0.001
5	450	0.005
10	250	0.008
25	160	0.01
40	130	0.01
50	100	0.01
75	75	0.015
90	60	0.02
100	50	0.03

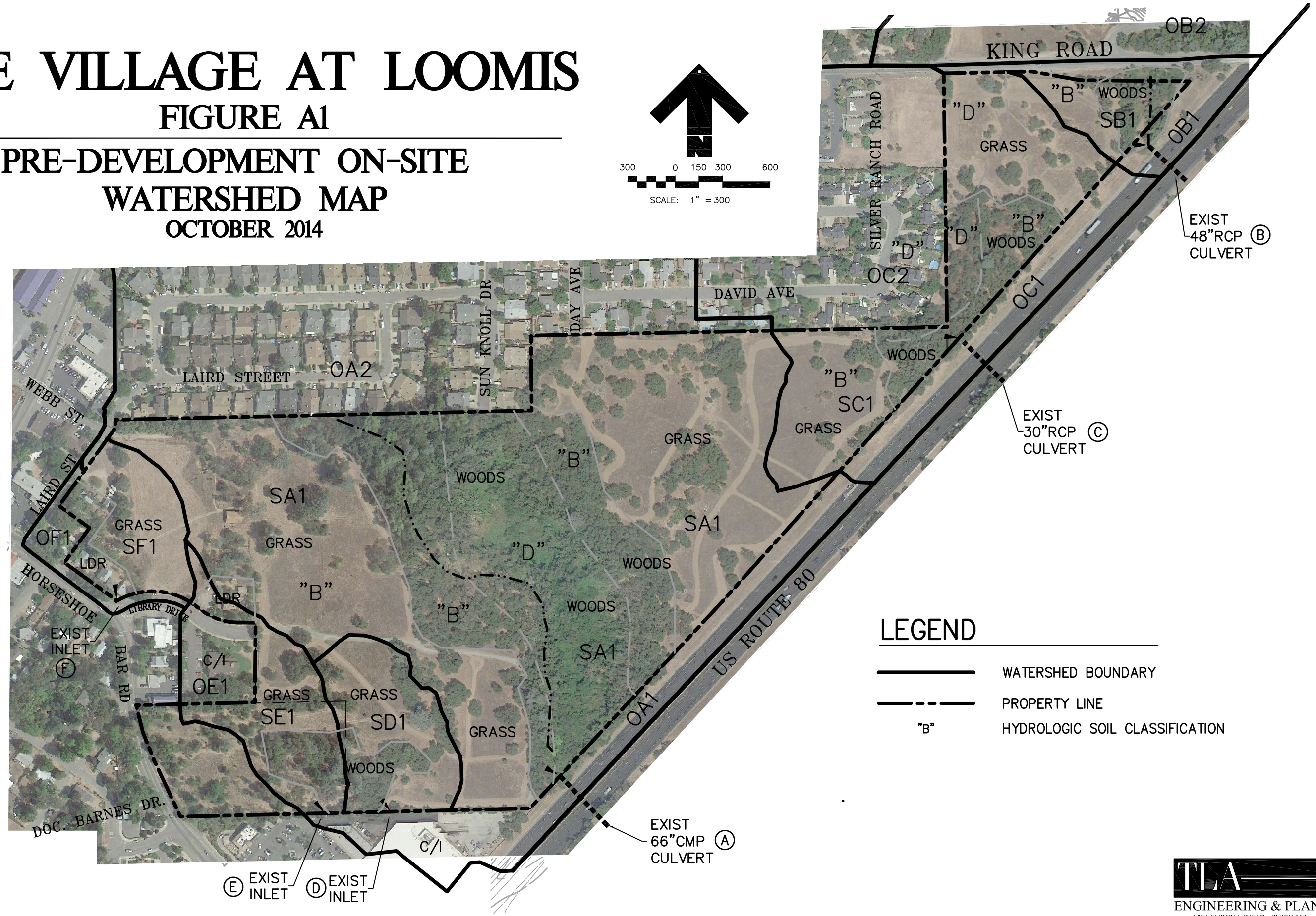
*TAKEN FROM "UPDATE TO DRYCREEK WATERSHED FLOOD CONTROL PLAN" NOV 2011

THE VILLAGE AT LOOMIS

FIGURE A1

PRE-DEVELOPMENT ON-SITE WATERSHED MAP

OCTOBER 2014



LEGEND

———	WATERSHED BOUNDARY
—— - - ——	PROPERTY LINE
"B"	HYDROLOGIC SOIL CLASSIFICATION

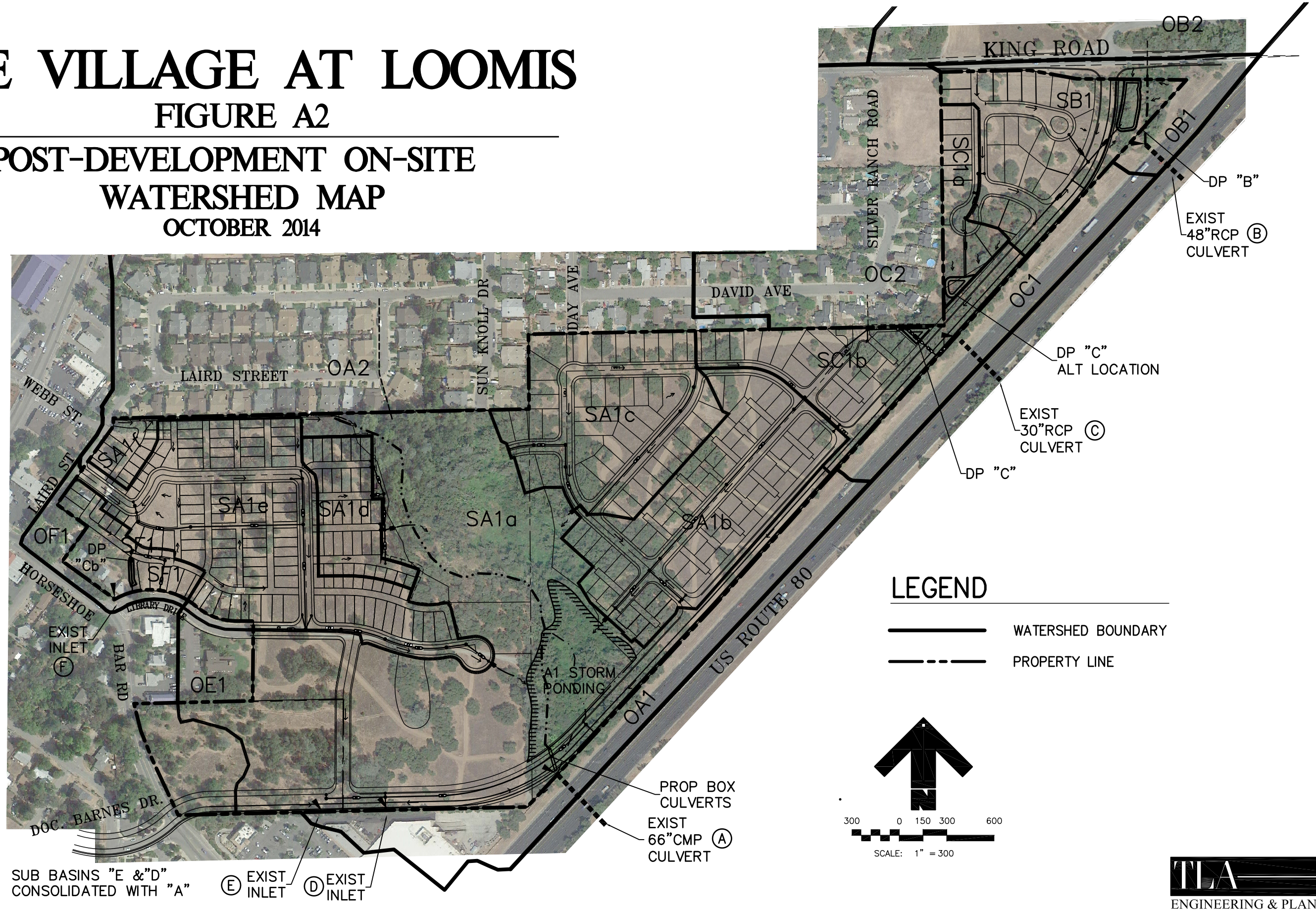
TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

THE VILLAGE AT LOOMIS

FIGURE A2

POST-DEVELOPMENT ON-SITE WATERSHED MAP

OCTOBER 2014



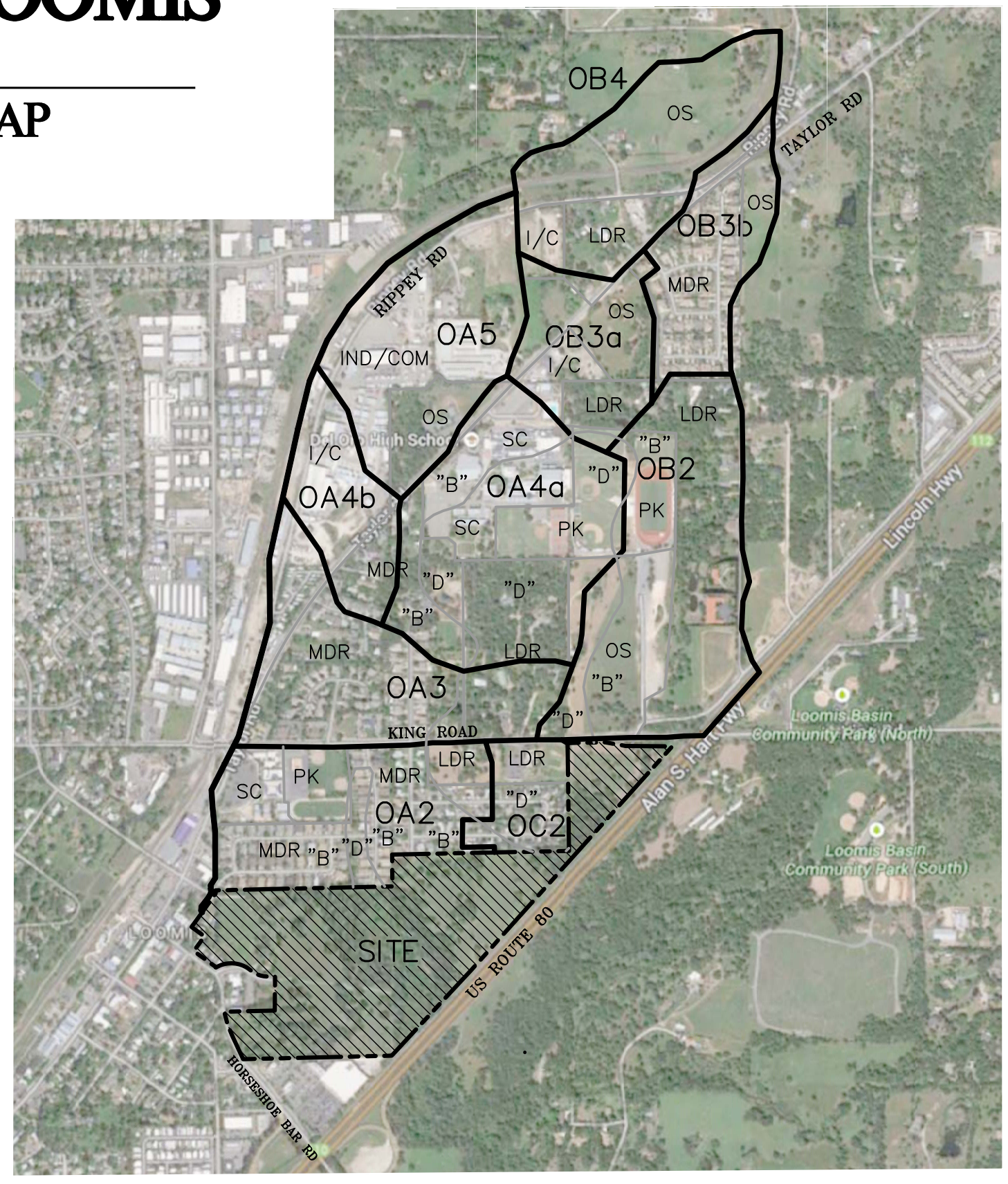
TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

THE VILLAGE AT LOOMIS

FIGURE A3

OFF-SITE WATERSHED MAP
LAND COVER AREAS

OCTOBER 2014



LEGEND

———	WATERSHED BOUNDARY
— - —	PROPERTY LINE
▨	PROJECT SITE
Ⓐ	ANALYSIS POINT OF DISCHARGE (POD)
"B"	HYDROLOGIC SOIL CLASSIFICATION

LAND USE INDEX

DESCRIPTION	ABBRV.
MEDIUM DENSITY RESIDENTIAL (MDR)	MDR
LOW DENSITY RESIDENTIAL (LDR)	LDR
OPEN SPACE/UNDEVELOPED (OS)	OS
SCHOOL (SC)	SC
PARK (PK)	PK
INDUSTRIAL/COMMERCIAL (IND/COM)	IND/COM

N

500 0 250 500 1000

SCALE: 1" = 500

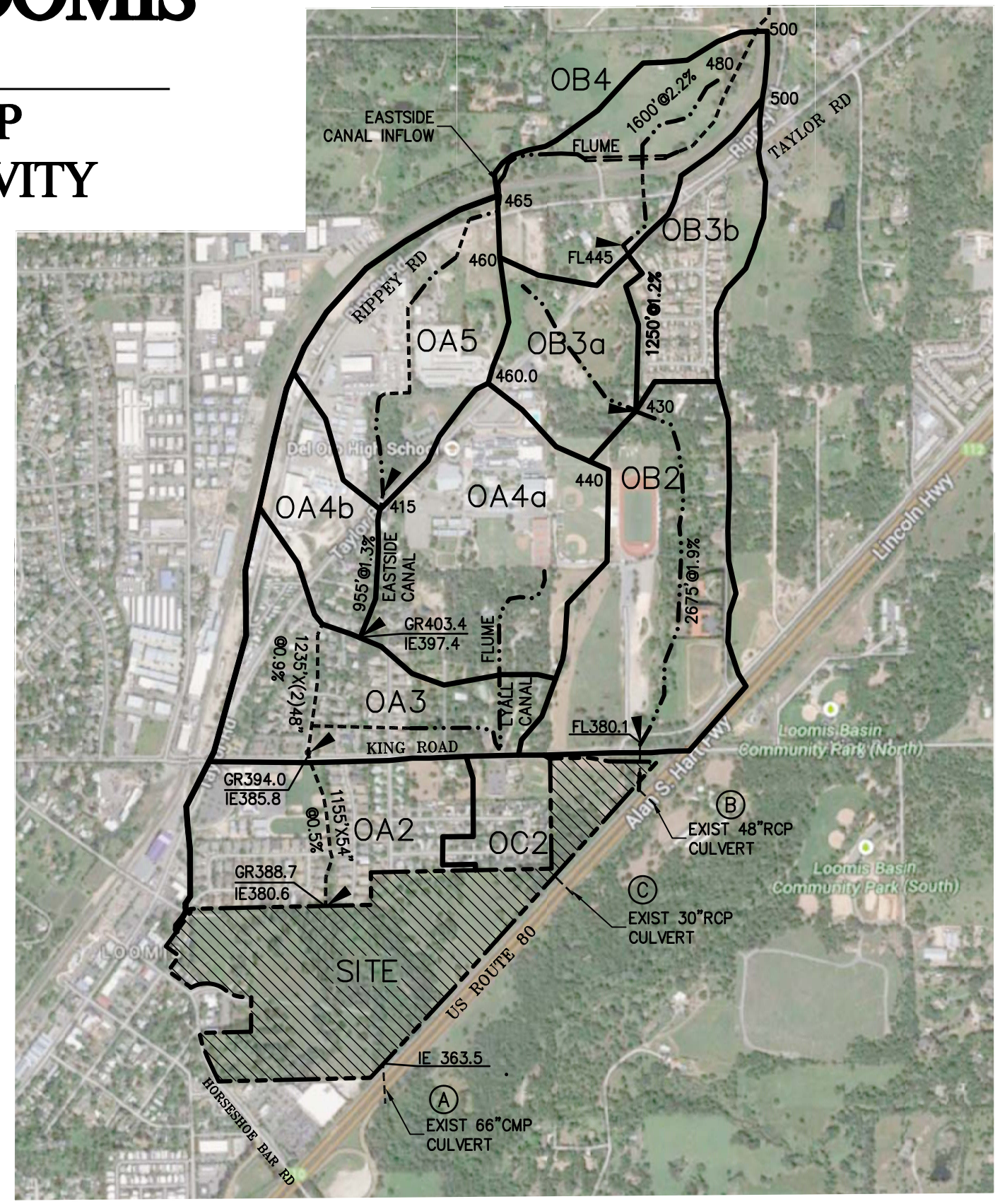
TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

THE VILLAGE AT LOOMIS

FIGURE A4

OFF-SITE WATERSHED MAP
BASIN DRAINAGE/CONNECTIVITY

OCTOBER 2014



PRIMARY DRAINAGE STRUCTURES

A2	STORM DRAIN	1155'@ 0.5%	54"RCP
A3	STORM DRAIN	1235'@ 0.9%	(2)48"RCP
A4	GUNITE CHL	955'@ 1.3%	B=4',Z=1:1,N= .020 EASTSIDE CANAL
B2	EARTH DITCH	2675@1.9%	B=2',Z=4:1,N=.060 DENSE BRUSH
B3	EARTH SWALE	1250@1.2%	B=2',Z=6:1,N=.080 SWAMPY, DENSE BRUSH

LEGEND

- WATERSHED BOUNDARY
- FLOW PATH/CHANNEL
- STORM DRAIN/CULVERT/IRRIG
- PROPERTY LINE
- PROJECT SITE
- (A) ANALYSIS POINT OF DISCHARGE (POD)

N

500 0 250 500 1000

SCALE: 1" = 500

TLA ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

APPENDIX "B" FLOODPLAIN ANALYSIS

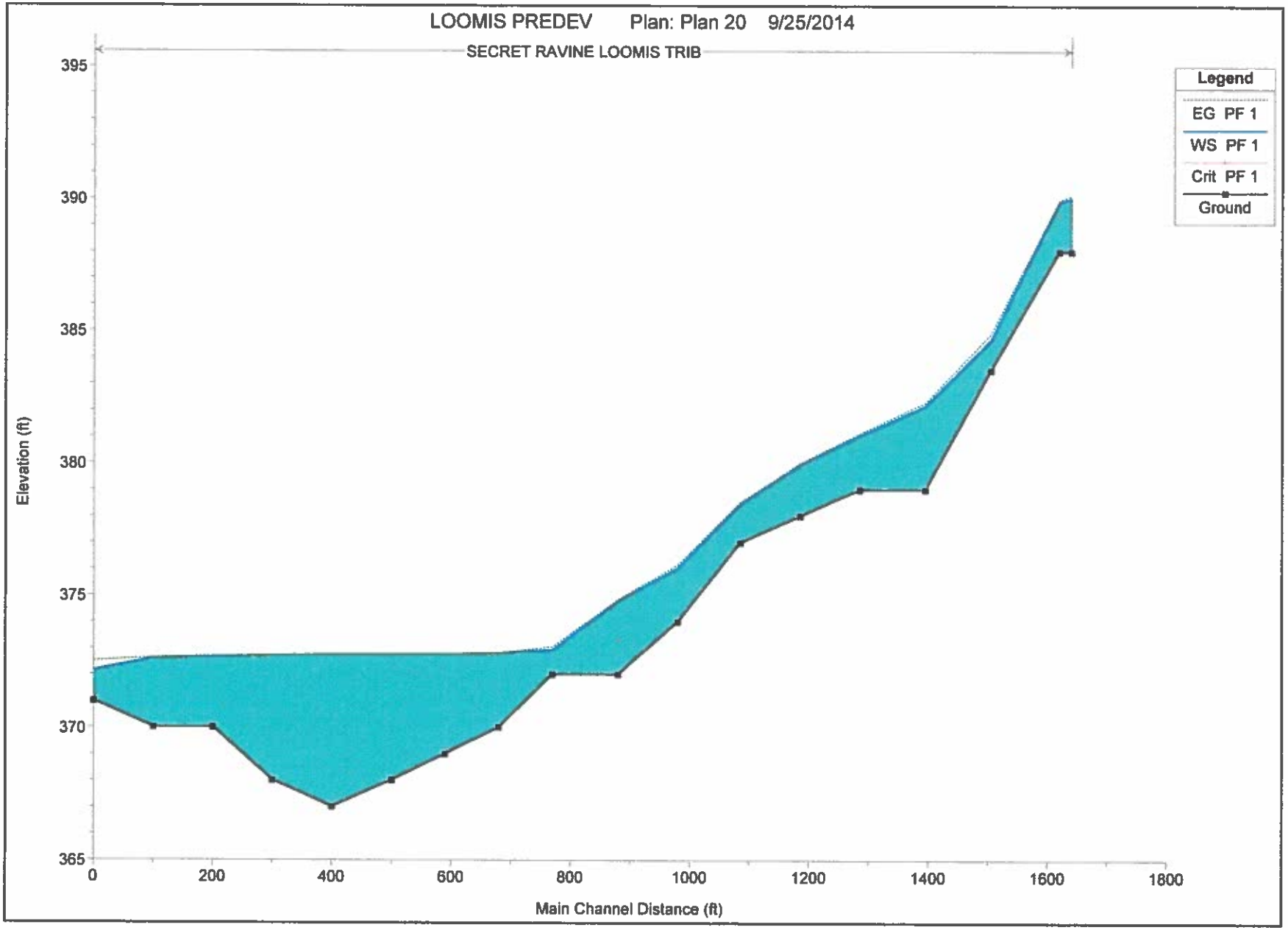
APPENDIX B.1

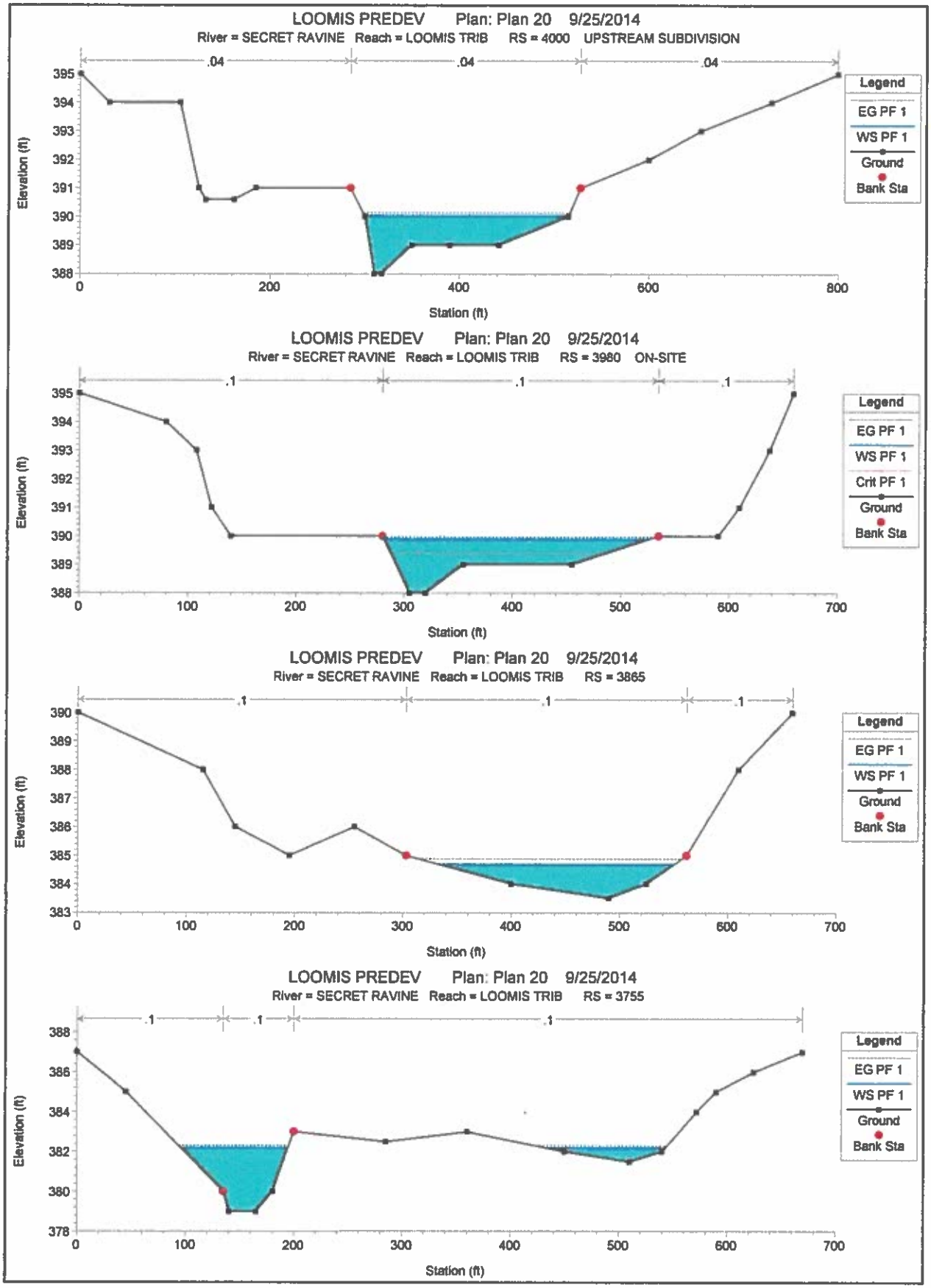
- Pre Development HEC-RAS Result Table, Profile and Section Plots, 100-yr event

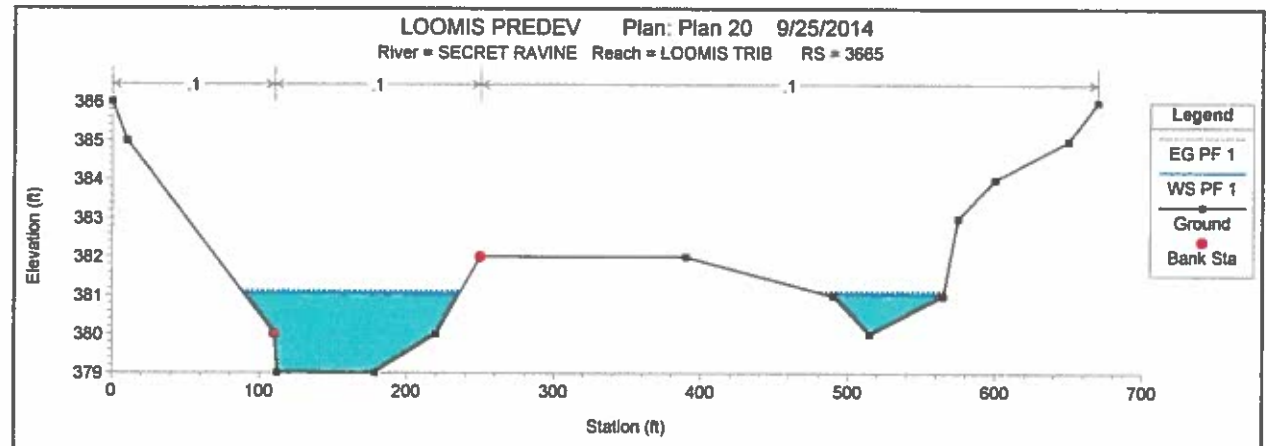
- Pre Development Drainage Tabulation

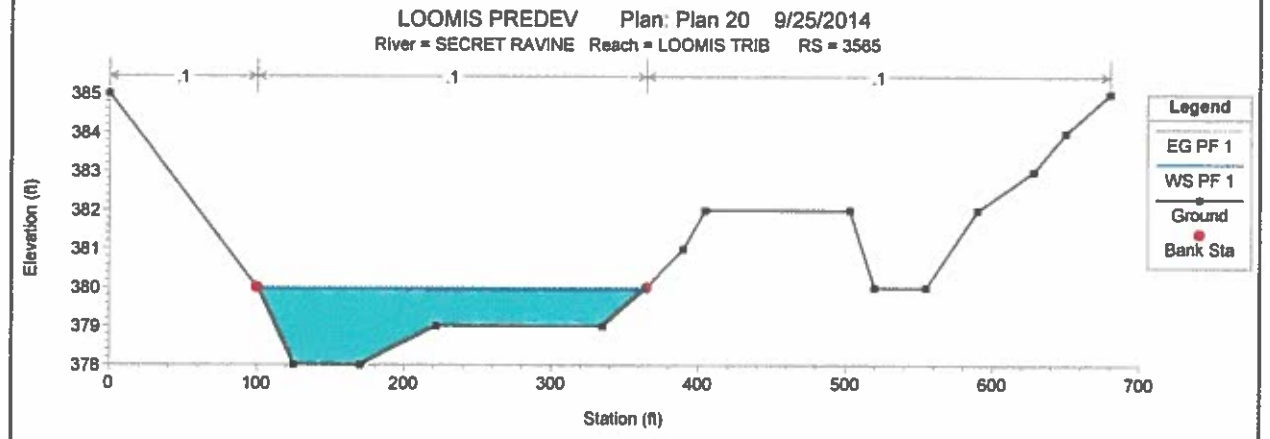
HEC-RAS Plan: Predev 100 River: SECRET RAVINE Reach: LOOMIS TRIB Profile: PF 1

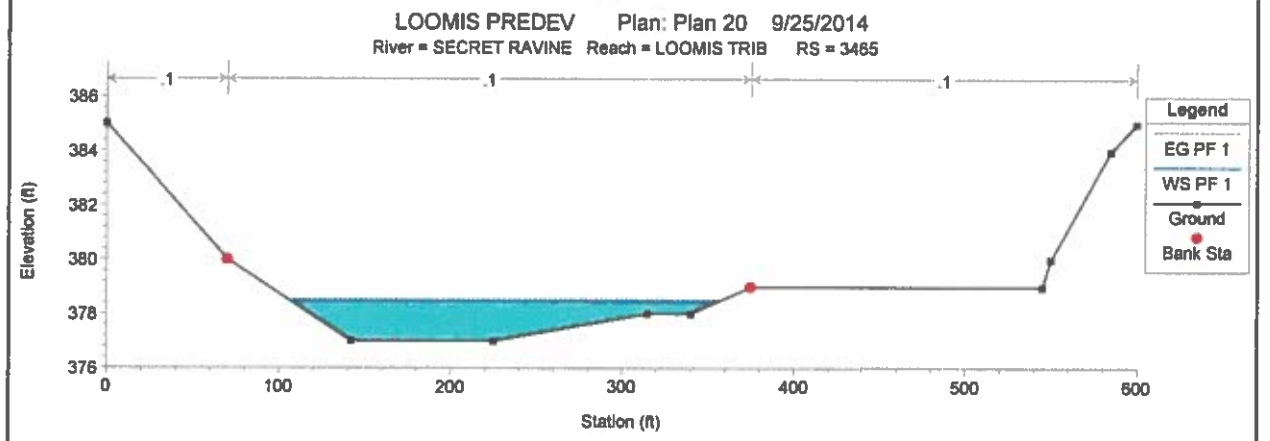
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOOMIS TRIB	4000	PF 1	475.00	388.00	390.04		390.12	0.003770	2.25	211.46	216.16	0.40
LOOMIS TRIB	3980	PF 1	475.00	388.00	389.89	389.39	389.96	0.024187	2.15	220.54	245.03	0.40
LOOMIS TRIB	3865	PF 1	529.00	383.50	384.69		384.89	0.093335	3.54	149.60	217.58	0.75
LOOMIS TRIB	3755	PF 1	529.00	379.00	382.20		382.30	0.010681	2.83	235.48	209.95	0.31
LOOMIS TRIB	3665	PF 1	529.00	379.00	381.05		381.13	0.011340	2.24	264.97	227.49	0.30
LOOMIS TRIB	3565	PF 1	529.00	378.00	379.95		380.00	0.010841	1.72	307.84	262.88	0.28
LOOMIS TRIB	3465	PF 1	529.00	377.00	378.46		378.53	0.020888	2.14	247.37	248.91	0.38
LOOMIS TRIB	3360	PF 1	529.00	374.00	376.05		376.16	0.024431	2.67	198.10	162.01	0.42
LOOMIS TRIB	3260	PF 1	529.00	372.00	374.79	373.31	374.85	0.008106	1.97	267.99	149.21	0.26
LOOMIS TRIB	3150	PF 1	529.00	372.00	372.95		373.05	0.047950	2.64	200.18	273.40	0.54
LOOMIS TRIB	3060	PF 1	529.00	370.00	372.81		372.82	0.000726	0.65	817.21	397.24	0.08
LOOMIS TRIB	2970	PF 1	529.00	369.00	372.78		372.79	0.000154	0.39	1155.85	446.54	0.04
LOOMIS TRIB	2880	PF 1	529.00	368.00	372.77		372.77	0.000160	0.48	1063.37	290.22	0.04
LOOMIS TRIB	2780	PF 1	529.00	367.00	372.75		372.75	0.000217	0.61	885.97	234.47	0.05
LOOMIS TRIB	2680	PF 1	313.00	368.00	372.72		372.73	0.000349	0.60	521.45	197.07	0.06
LOOMIS TRIB	2570	PF 1	313.00	370.00	372.66		372.69	0.000511	1.20	269.30	201.59	0.16
LOOMIS TRIB	2470	PF 1	313.00	370.00	372.60		372.64	0.000429	1.37	229.39	148.09	0.16
LOOMIS TRIB	2370	PF 1	313.00	371.00	372.15	372.02	372.50	0.006002	2.95	78.12	84.66	0.51

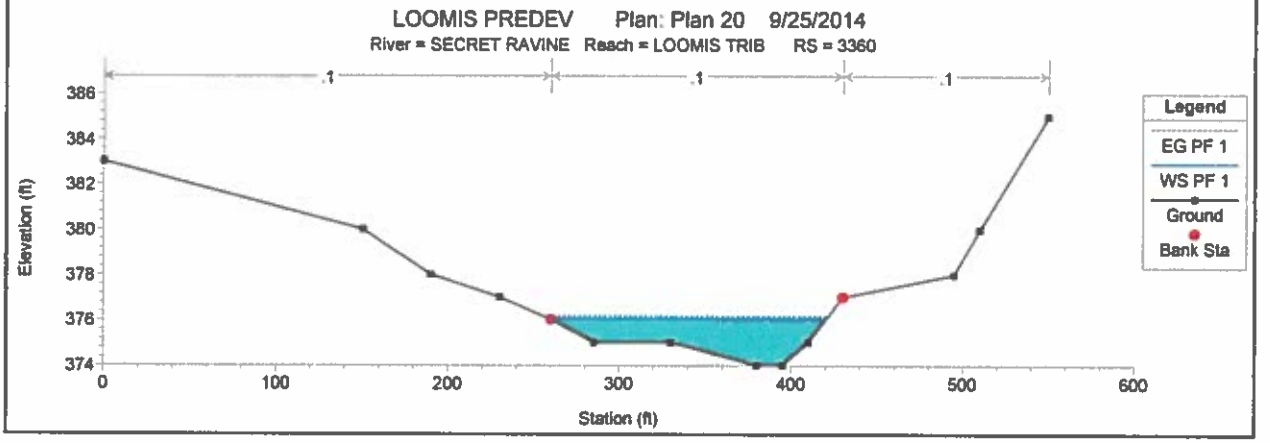

LOOMIS PREDEV Plan: Plan 20 9/25/2014
SECRET RAVINE LOOMIS TRIB
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
395
390
385
380
375
370
365
0
200
400
600
800
1000
1200
1400
1600
1800
Main Channel Distance (ft)

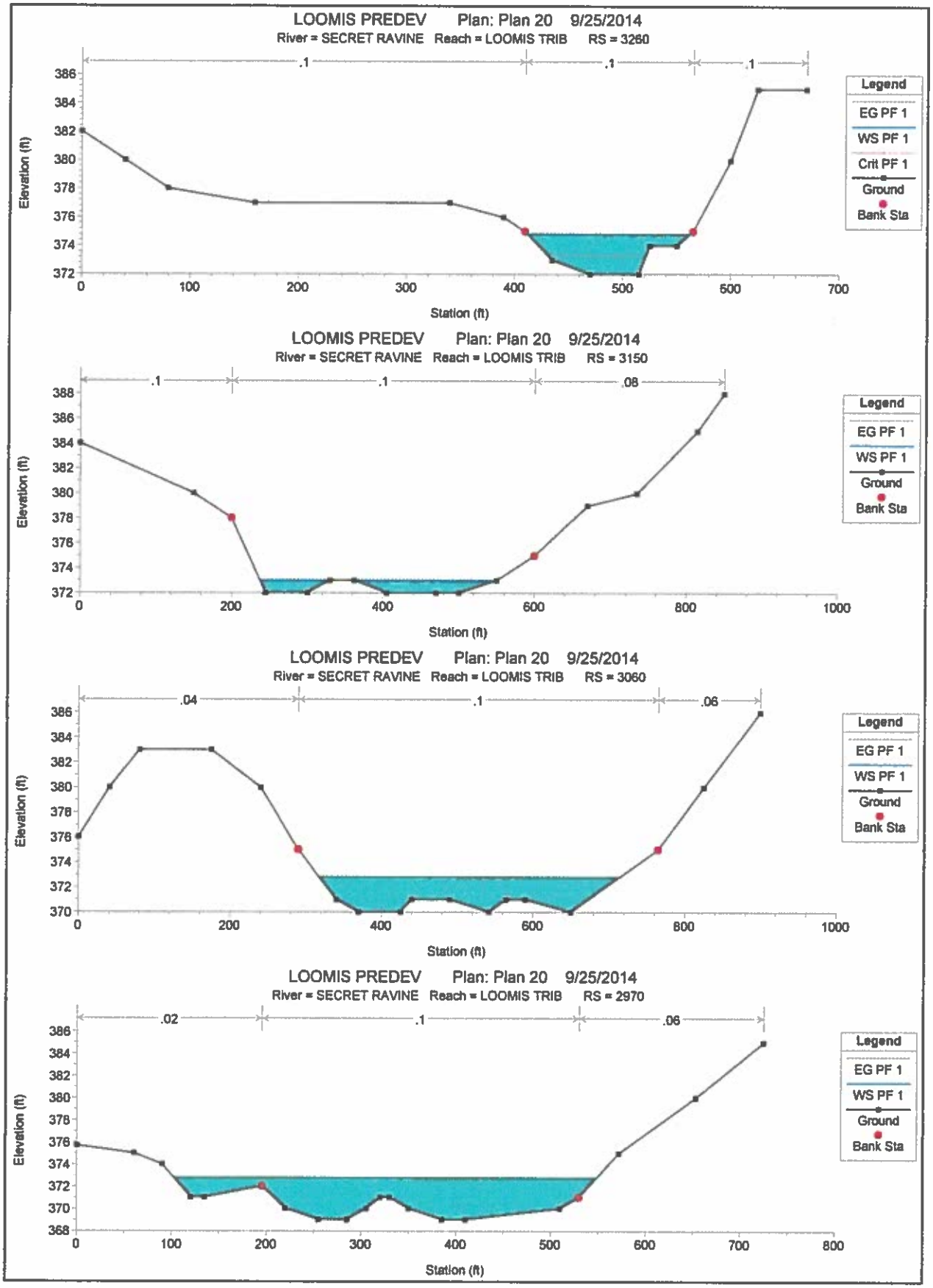

LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 4000 UPSTREAM SUBDIVISION
.04
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3980 ON-SITE
.1
.1
.1
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3865
.1
.1
.1
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3755
.1
.1
.1
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3685
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3585
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

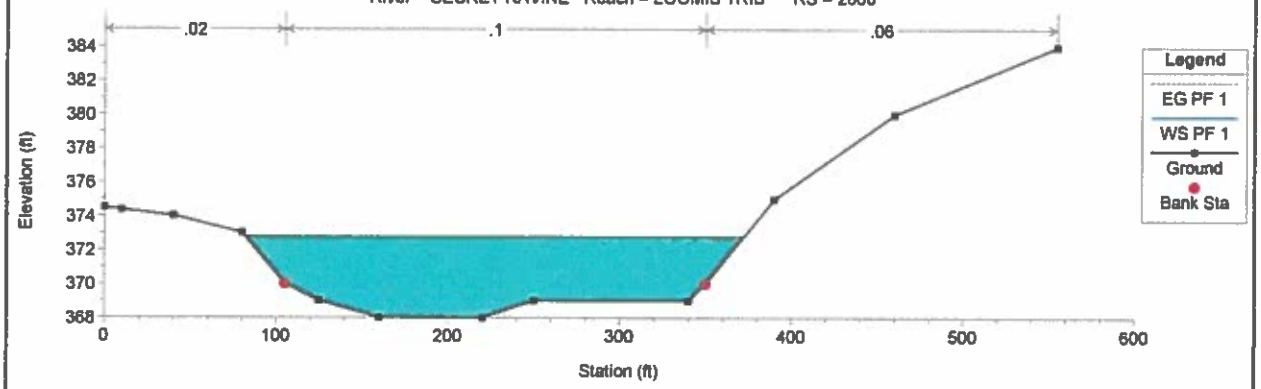

LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3465
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3360
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3260
.1
.1
.1
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3150
.1
.1
.08
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3060
.04
.1
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2970
.02
.1
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

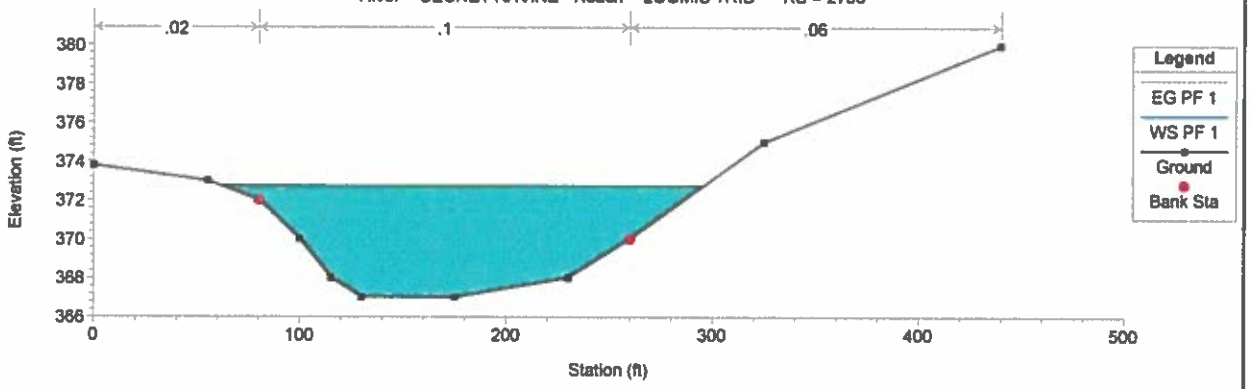
LOOMIS PREDEV Plan: Plan 20 9/25/2014

River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2680



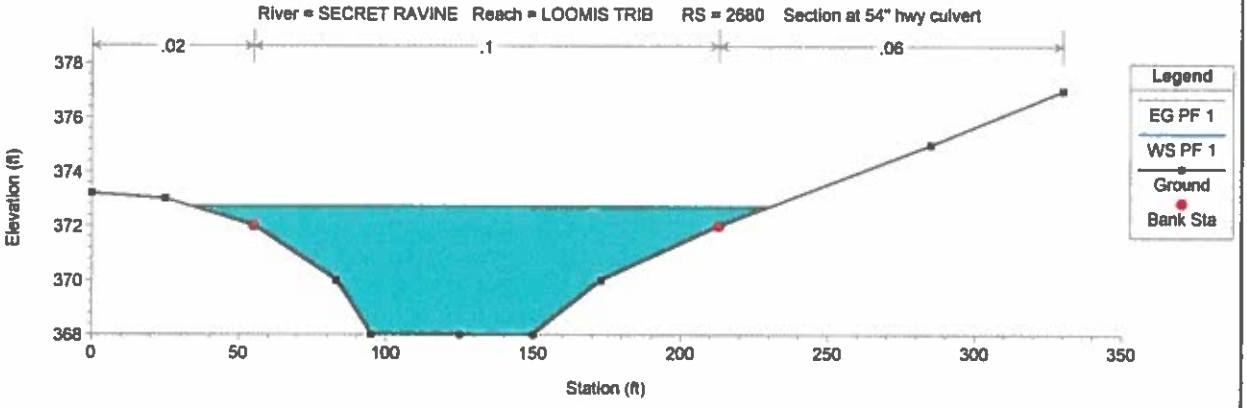
LOOMIS PREDEV Plan: Plan 20 9/25/2014

River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2780



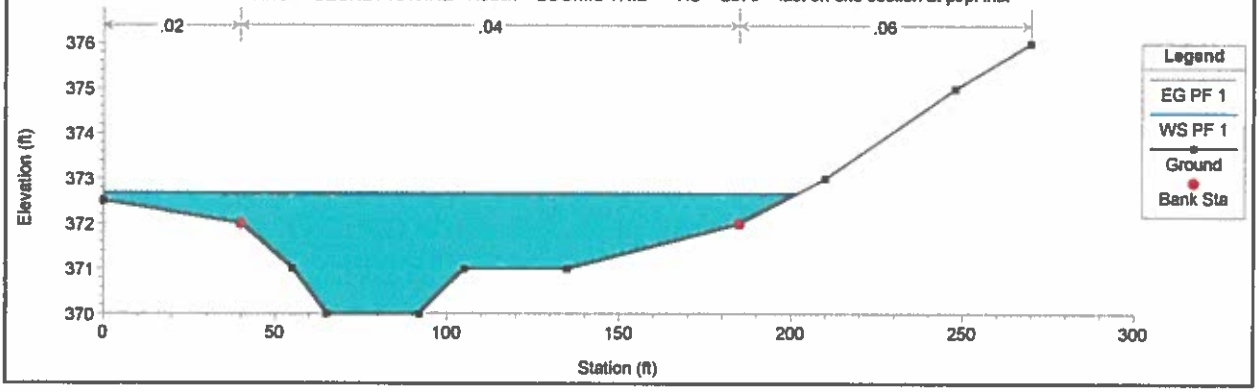
LOOMIS PREDEV Plan: Plan 20 9/25/2014

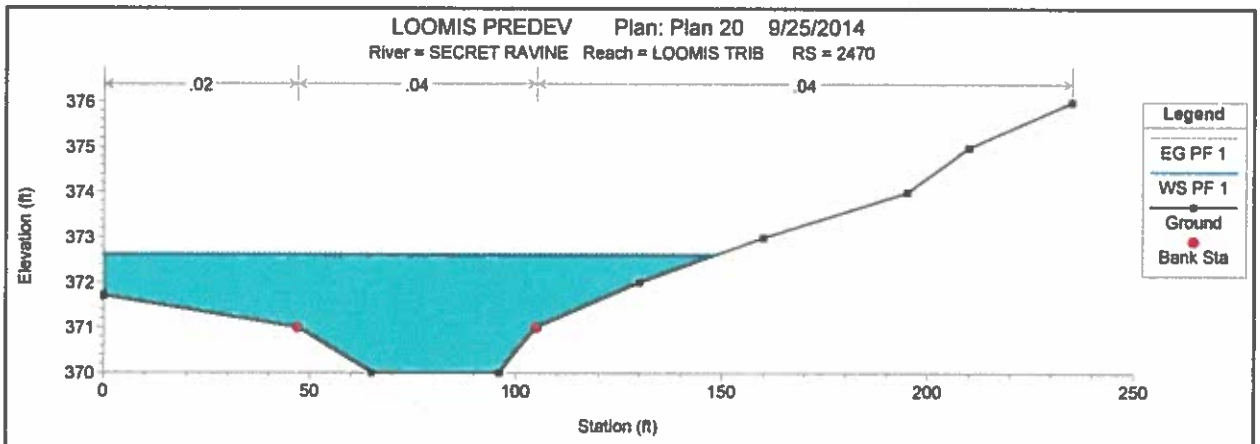
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2680 Section at 54" hwy culvert

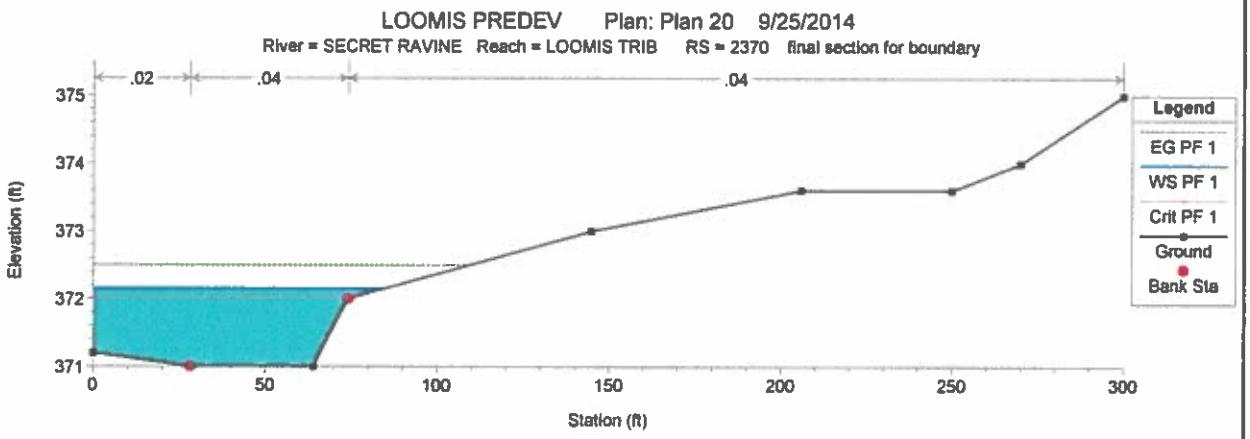


LOOMIS PREDEV Plan: Plan 20 9/25/2014

River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2570 last on-site section at pl/pl intx




LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2470
.02
.04
.04
Elevation (ft)
376
375
374
373
372
371
370
0
50
100
150
200
250
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PREDEV Plan: Plan 20 9/25/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2370 final section for boundary
.02
.04
.04
Elevation (ft)
375
374
373
372
371
0
50
100
150
200
250
300
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

Project: LOOMIS Simulation Run: Pre A no DP

Start of Run: 15Jun2006, 00:05 Basin Model: Pre A no
End of Run: 17Jun2006, 00:00 Meteorologic Model: 100yr24h
Compute Time: 25Sep2014, 14:30:28 Control Specifications: 24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)	STA
OA5	0.0727	120.3	15Jun2006, 12:05	3.78	4000
OA4b	0.0331	69.3	15Jun2006, 12:05	4.03	↓
OA4a	0.1998	278.4	15Jun2006, 12:05	3.52	
OA3	0.2773	382.6	15Jun2006, 12:05	3.57	
OA2	0.3686	474.7	15Jun2006, 12:10	3.46	4000
SA1	0.4319	528.7	15Jun2006, 12:15	3.18	3865
OA1	0.0089	20.1	15Jun2006, 12:05	4.62	↓
OE1	0.0023	4.5	15Jun2006, 12:05	4.44	
SE1	0.0079	7.0	15Jun2006, 12:10	2.44	
SD1	0.0064	6.5	15Jun2006, 12:15	1.44	
2 OUTFALL A	0.4551	549.1	15Jun2006, 12:15	3.17	2680

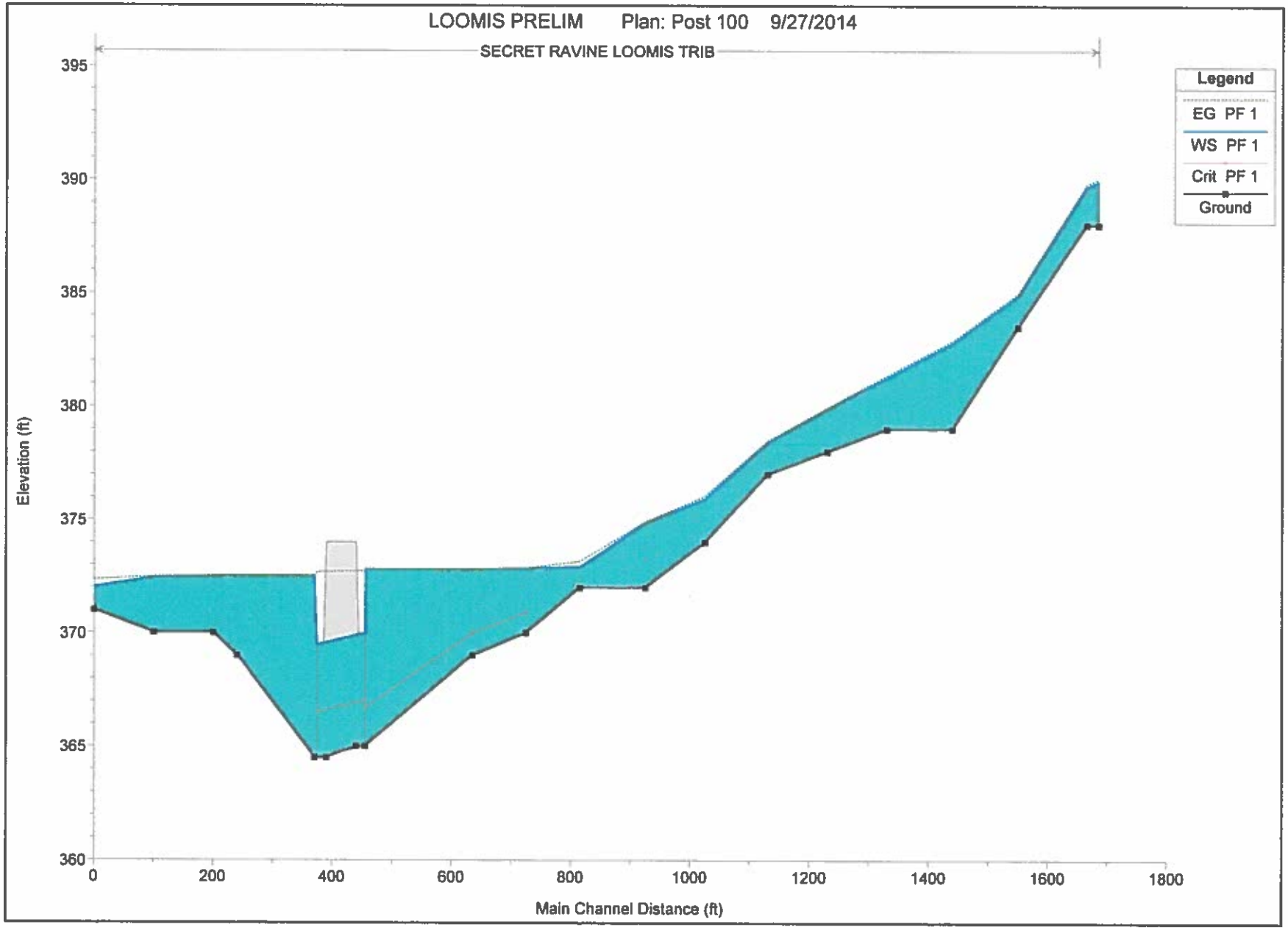
549
− 236. CULVERT @ I-80 (SEE ATT)
USE 313

APPENDIX B.2

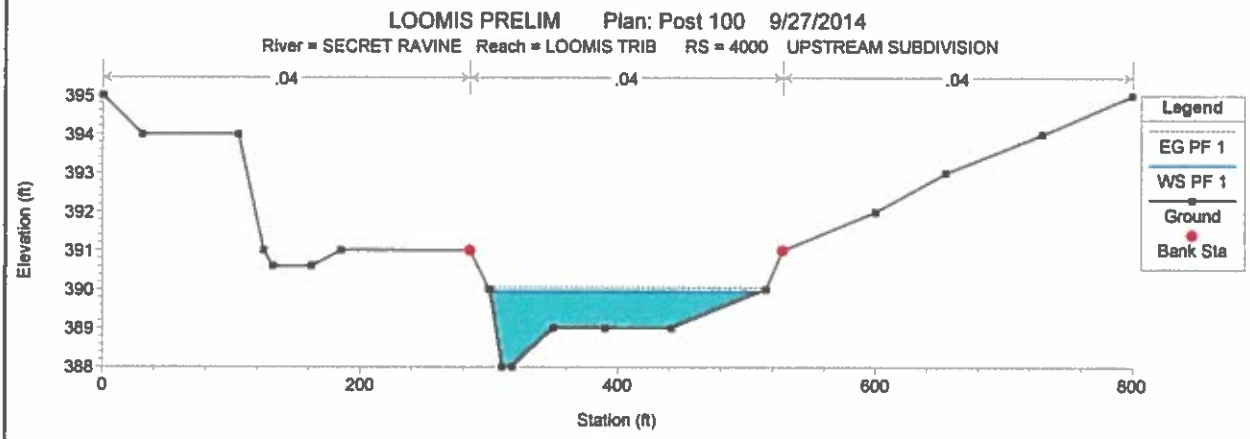
- Post Development HEC-RAS Result Table, Profile and Section Plots, 100-yr event
- Post Development Drainage Tabulation

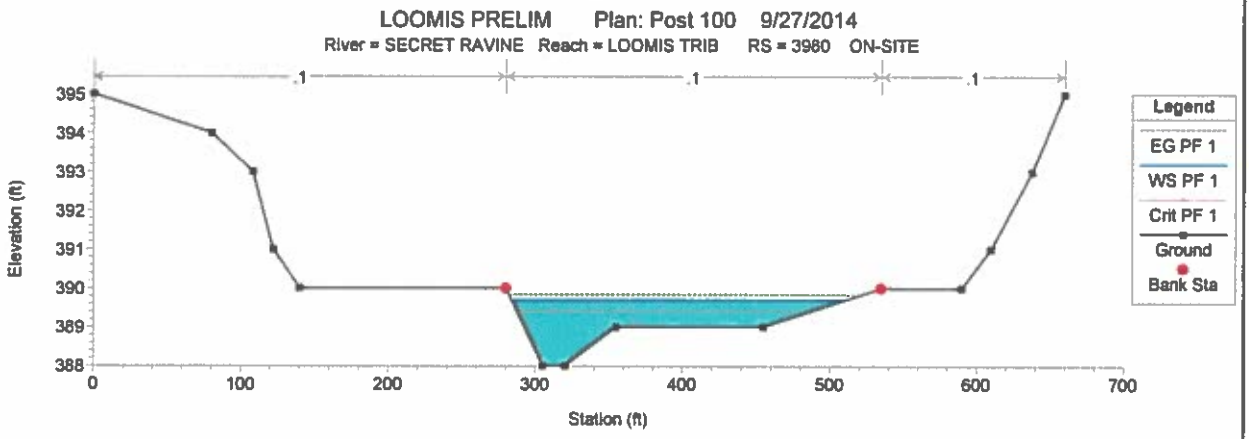
HEC-RAS Plan: Post 100 River: SECRET RAVINE Reach: LOOMIS TRIB Profile: PF 1

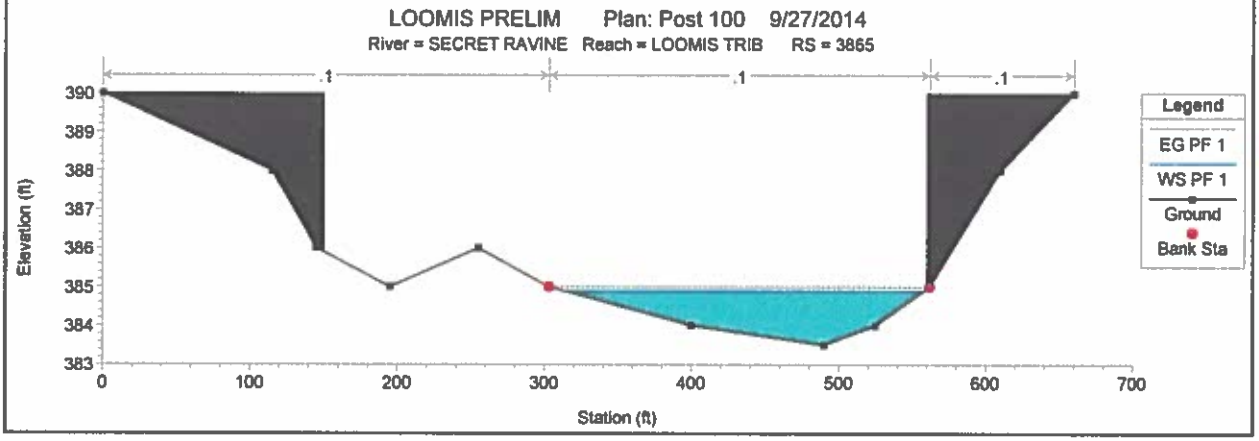
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOOMIS TRIB	4000	PF 1	475.00	388.00	389.95		390.04	0.005074	2.48	191.58	211.00	0.46
LOOMIS TRIB	3980	PF 1	475.00	388.00	389.70	389.40	389.81	0.047383	2.72	174.87	227.13	0.55
LOOMIS TRIB	3865	PF 1	487.00	383.50	384.89		384.99	0.037399	2.48	196.29	244.65	0.49
LOOMIS TRIB	3755	PF 1	487.00	379.00	382.80		382.89	0.011039	2.79	257.06	315.31	0.30
LOOMIS TRIB	3665	PF 1	487.00	379.00	381.27		381.37	0.016866	2.69	211.61	192.42	0.36
LOOMIS TRIB	3565	PF 1	487.00	378.00	379.90		379.95	0.011139	1.73	281.84	242.15	0.28
LOOMIS TRIB	3465	PF 1	487.00	377.00	378.42		378.48	0.020036	2.05	237.45	246.54	0.37
LOOMIS TRIB	3360	PF 1	487.00	374.00	375.94		376.05	0.027007	2.70	180.14	154.39	0.44
LOOMIS TRIB	3260	PF 1	487.00	372.00	374.86	373.25	374.91	0.006114	1.75	279.02	151.23	0.23
LOOMIS TRIB	3150	PF 1	487.00	372.00	372.93		373.15	0.102745	3.79	128.64	181.53	0.79
LOOMIS TRIB	3060	PF 1	487.00	370.00	372.85	370.90	372.86	0.000747	0.67	727.40	340.57	0.08
LOOMIS TRIB	2970	PF 1	487.00	369.00	372.81	369.99	372.81	0.000359	0.59	827.63	341.83	0.06
LOOMIS TRIB	2800	PF 1	487.00	365.00	372.81	366.68	372.81	0.000005	0.23	1837.40	463.89	0.02
LOOMIS TRIB	2760		Culvert									
LOOMIS TRIB	2720	PF 1	487.00	364.50	372.52		372.52	0.000008	0.29	1563.18	459.75	0.02
LOOMIS TRIB	2600	PF 1	257.00	369.00	372.51		372.52	0.000055	0.60	475.58	214.56	0.06
LOOMIS TRIB	2570	PF 1	257.00	370.00	372.49		372.51	0.000553	1.22	215.35	163.96	0.17
LOOMIS TRIB	2470	PF 1	257.00	370.00	372.43		372.46	0.000407	1.27	204.92	143.05	0.15
LOOMIS TRIB	2370	PF 1	257.00	371.00	372.03	371.88	372.33	0.006003	2.73	68.71	76.37	0.50

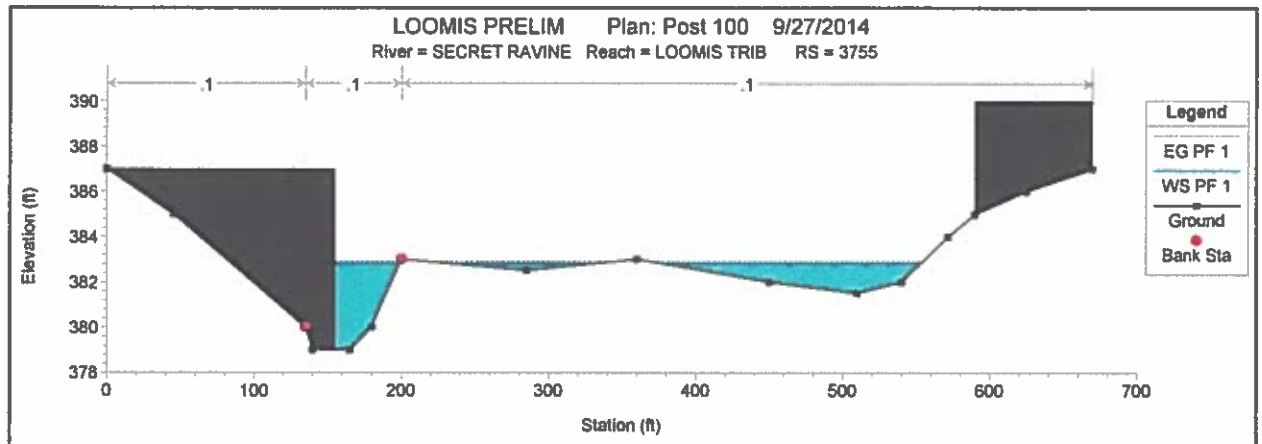

LOOMIS PRELIM Plan: Post 100 9/27/2014
SECRET RAVINE LOOMIS TRIB
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
395
390
385
380
375
370
365
360
0
200
400
600
800
1000
1200
1400
1600
1800
Main Channel Distance (ft)

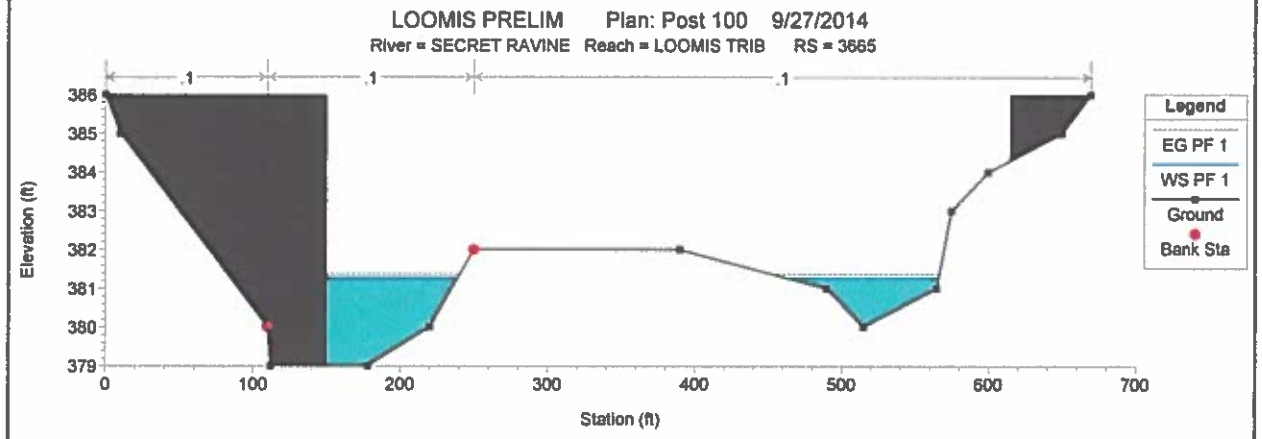
No Data for Plot

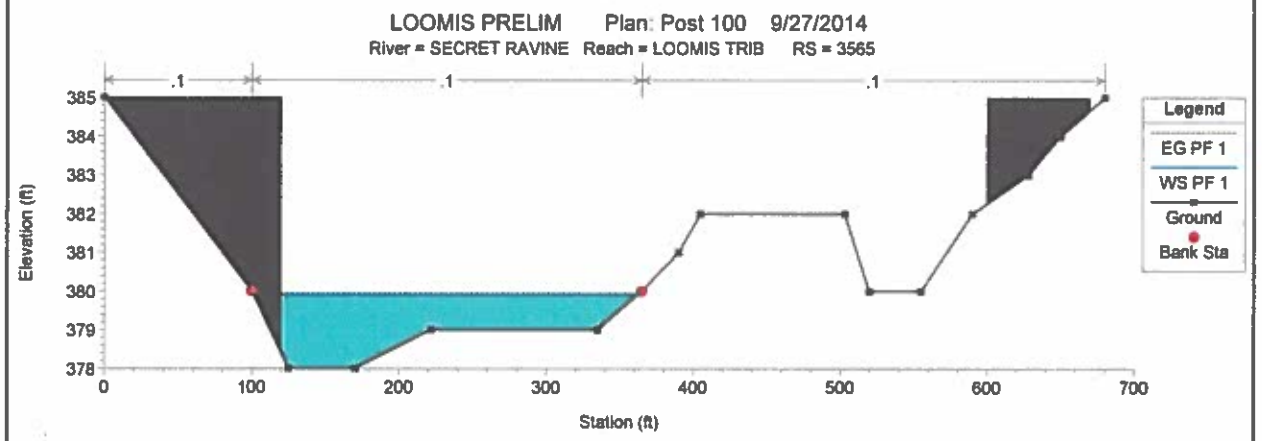


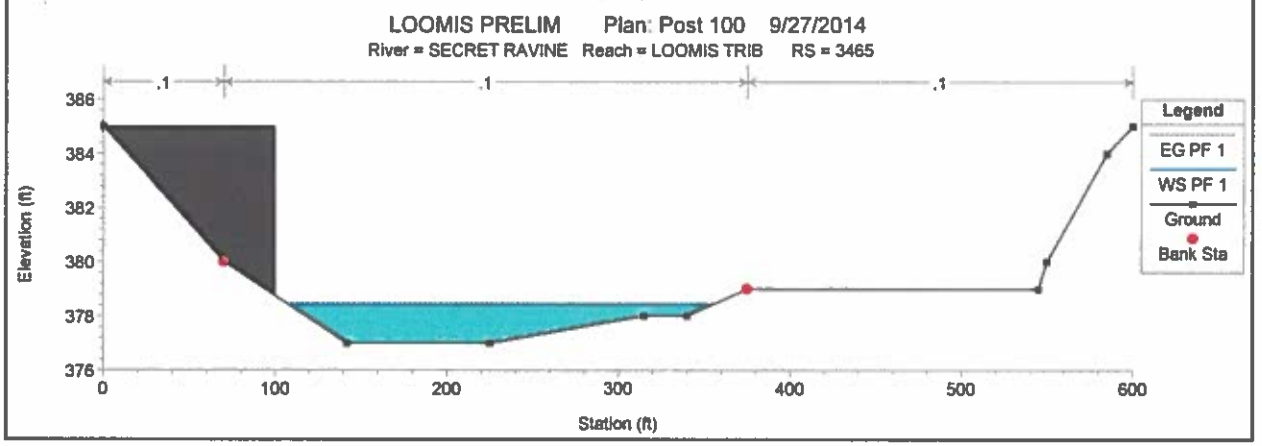


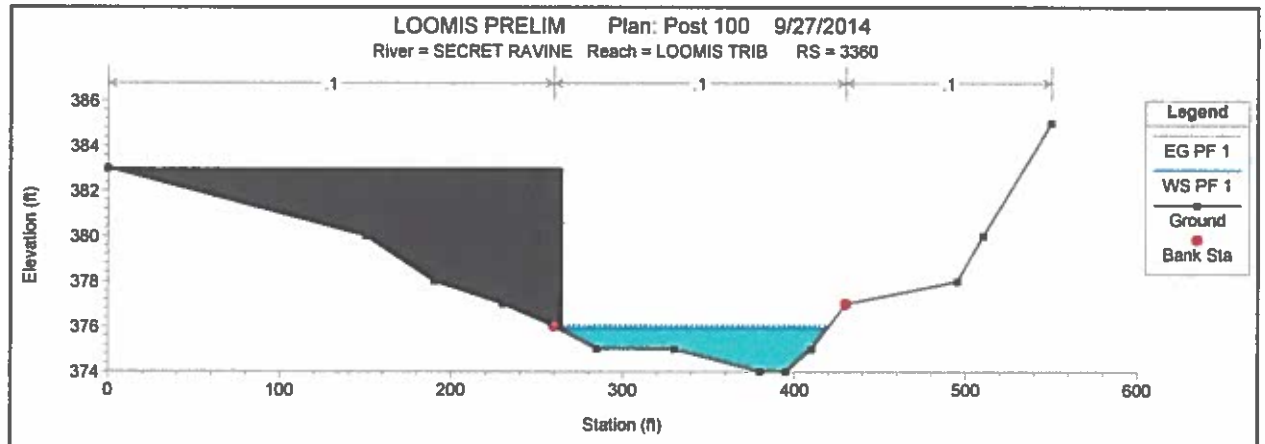


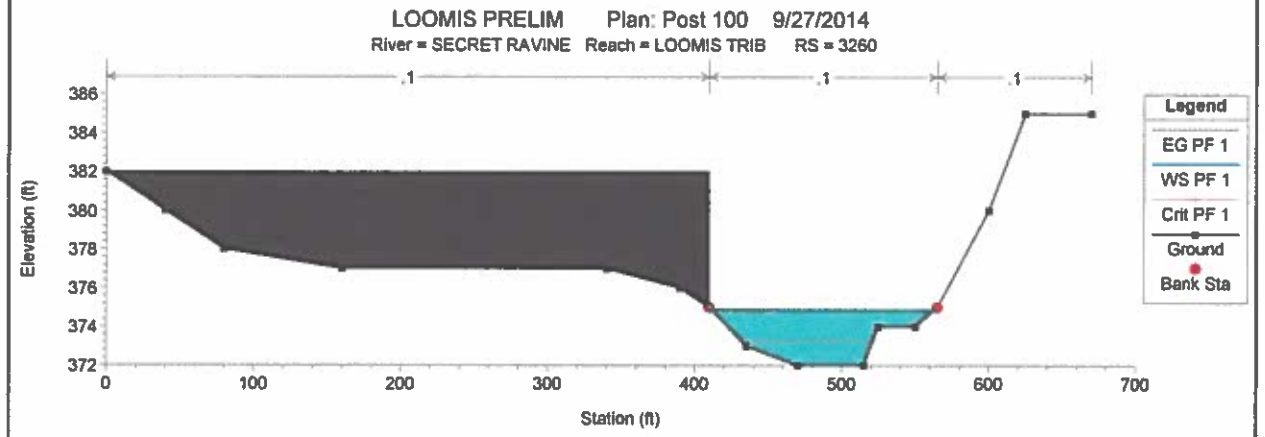

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3755
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

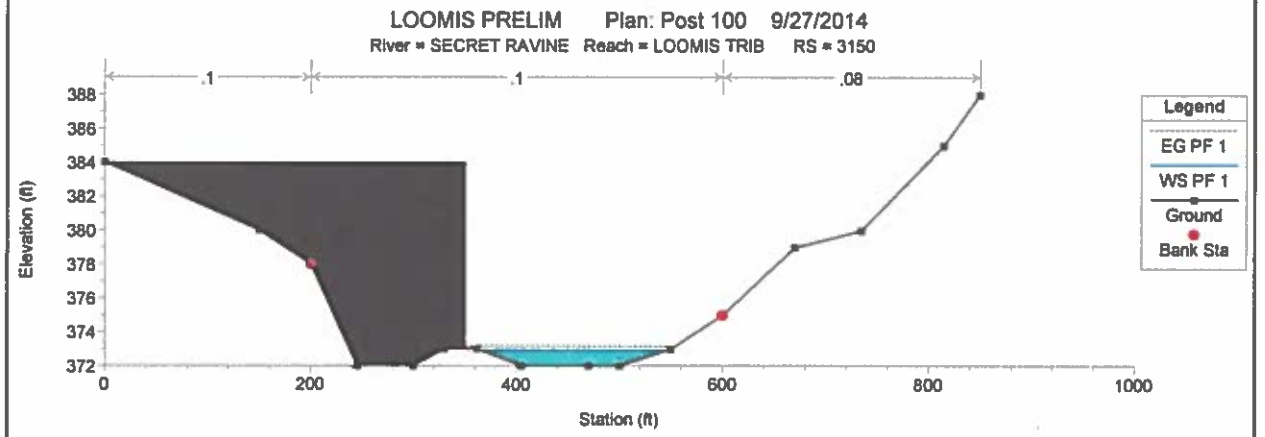

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3665
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

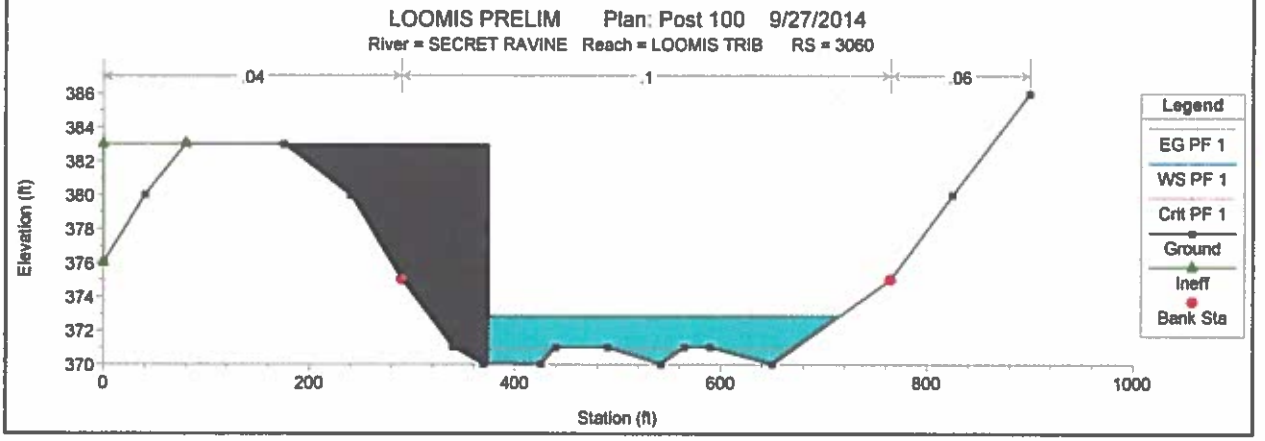

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3565
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

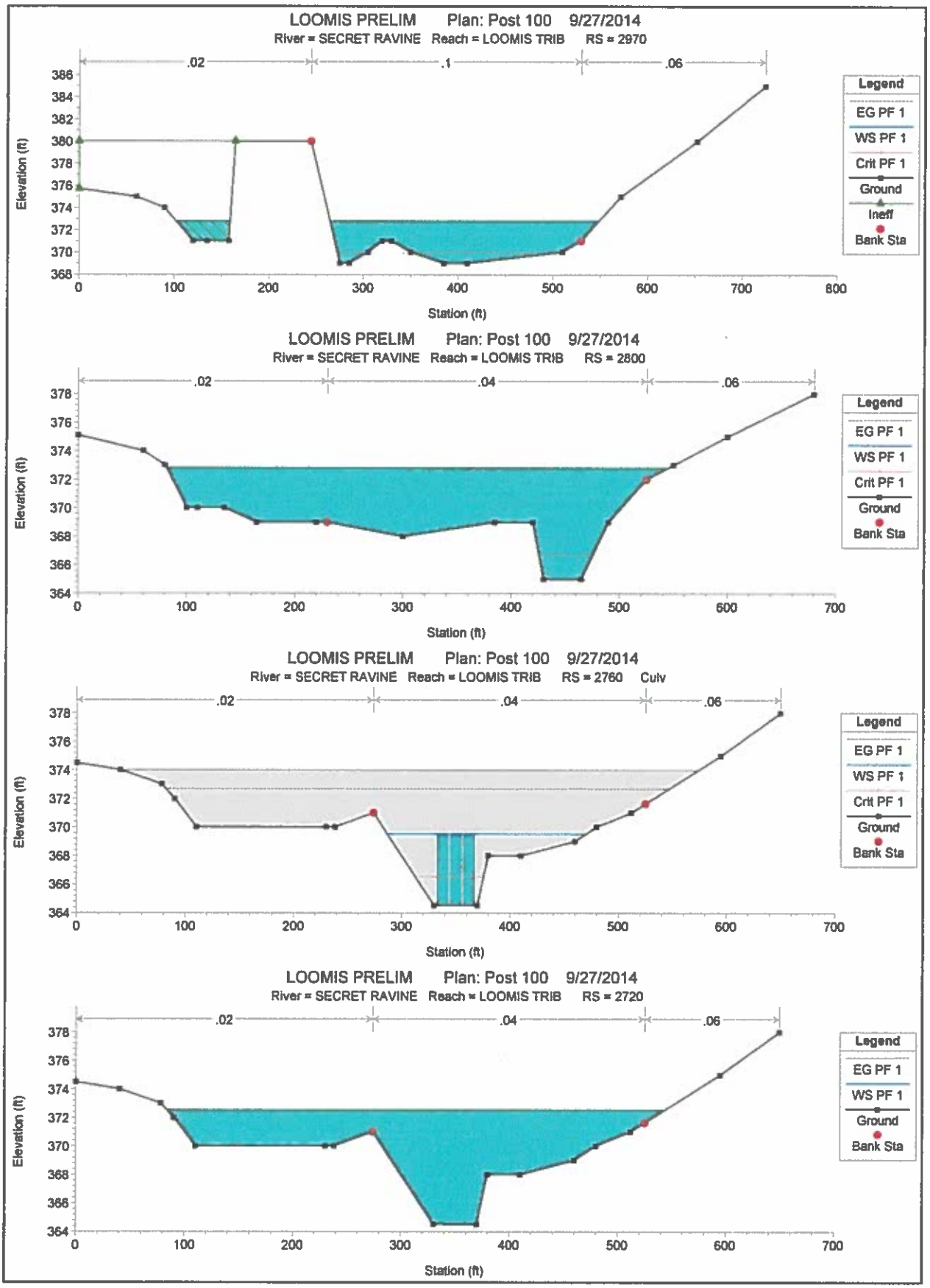

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3465
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

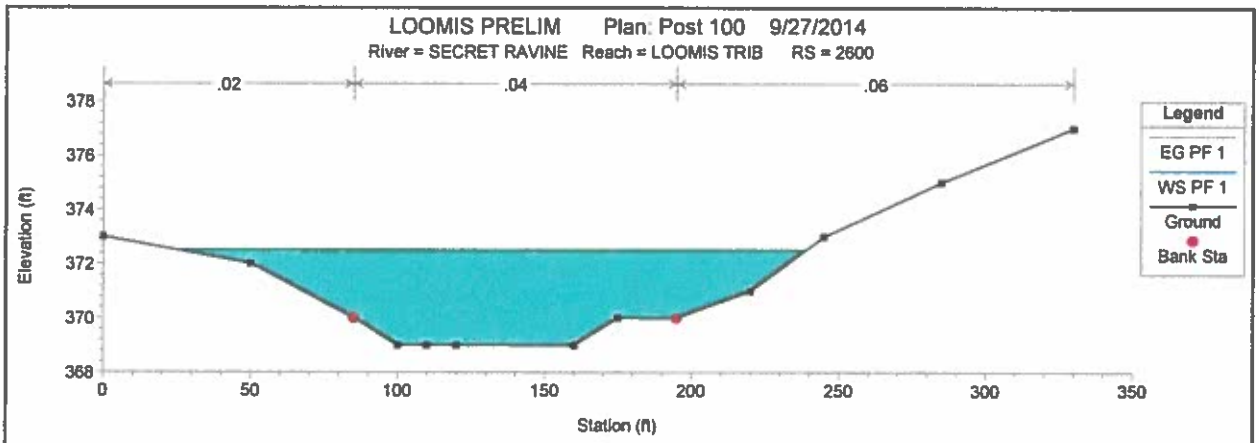

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3360
.1
.1
.1
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

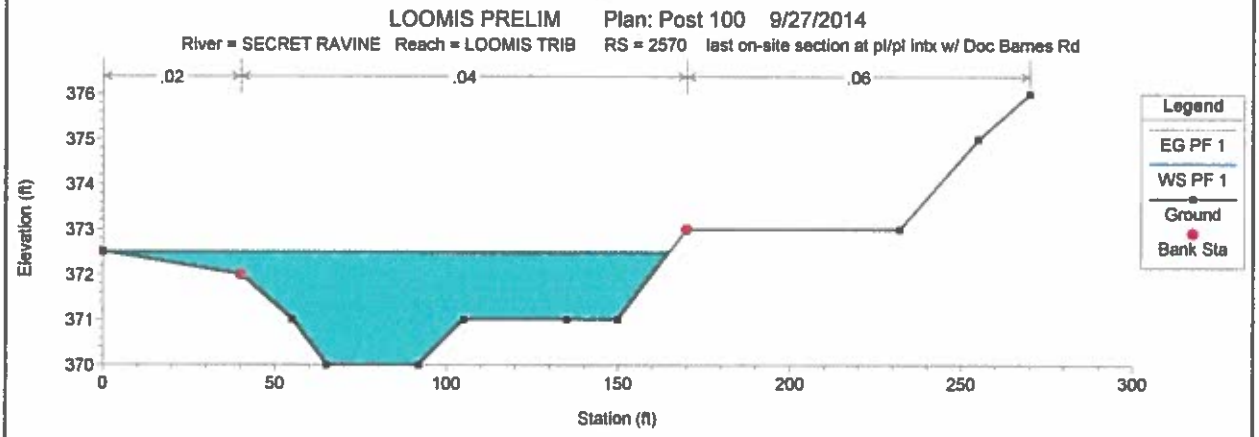

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3260
.1
.1
.1
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

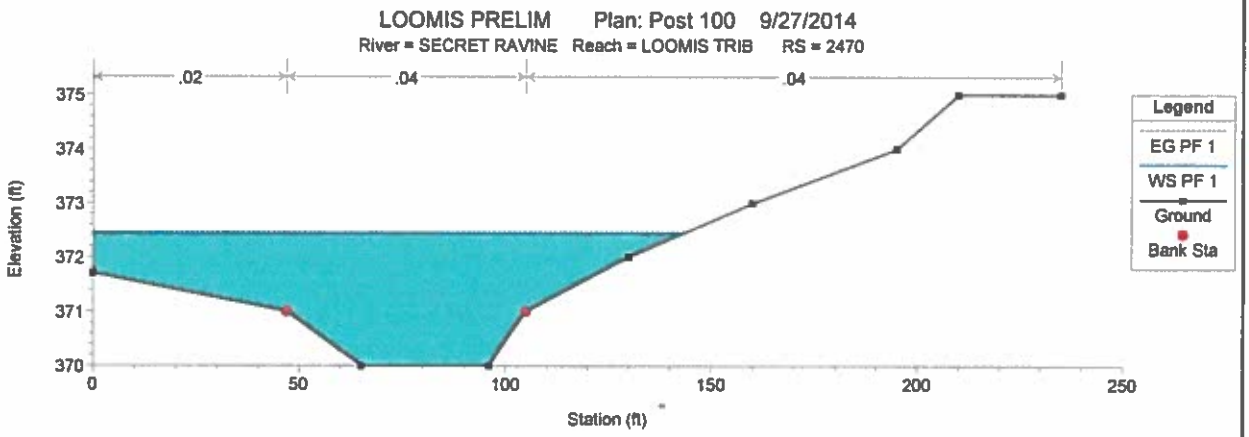

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3150
.1
.1
.08
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta

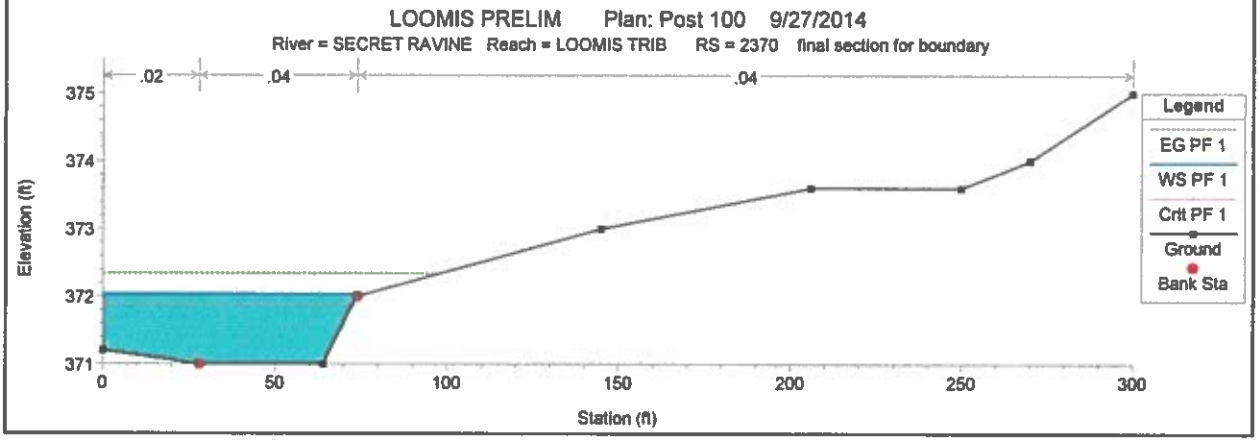

LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 3060
.04
.1
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta


LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2970
.02
.1
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2800
.02
.04
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2760 Culv
.02
.04
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2720
.02
.04
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2600
.02
.04
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2570 last on-site section at pl/pl intx w/ Doc Barnes Rd
.02
.04
.06
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2470
.02
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta


LOOMIS PRELIM Plan: Post 100 9/27/2014
River = SECRET RAVINE Reach = LOOMIS TRIB RS = 2370 final section for boundary
.02
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

Project: LOOMIS PRELIM Simulation Run: Post A 100

Start of Run: 15Jun2006, 00:05 Basin Model: Post A
End of Run: 17Jun2006, 00:00 Meteorologic Model: 100yr24h
Compute Time: 27Sep2014, 19:58:29 Control Specifications: 24hr5min

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)	STA
OA5	0.0727	120.3	15Jun2006, 12:05	14.67	4000
OA4b	0.0331	69.3	15Jun2006, 12:05	7.11	
OA4a	0.1998	278.4	15Jun2006, 12:05	37.46	
OA3	0.2773	382.6	15Jun2006, 12:05	52.80	
OA2	0.3686	474.7	15Jun2006, 12:10	67.94	
SA1e	0.0152	27.9	15Jun2006, 12:05	3.08	
SA1b	0.0120	21.9	15Jun2006, 12:05	2.36	
SA1c	0.0109	20.0	15Jun2006, 12:05	2.21	
SA1d	0.0034	6.2	15Jun2006, 12:05	0.69	
SA1f	0.0011	2.0	15Jun2006, 12:05	0.22	
SA1a	0.4503	586.3	15Jun2006, 12:10	81.41	
DP A	0.4503	487.3	15Jun2006, 12:20	81.41	3865
OA1	0.0089	20.1	15Jun2006, 12:05	2.19	
OUTFALL A	0.4592	492.7	15Jun2006, 12:20	83.60	2600

493
- 236
257 cfs

APPENDIX B.3

- Rating Table for Existing I-80 culvert

Figure B1, Pre-Development 100-year Floodplain
Figure B2, Post-Development 100-year Floodplain
FEMA FIRMette Map FM06061C0418F

1221 - Loomis Town Center

Table H2. Pre-Project Drainage Corridor D Hydraulic Calculations for Existing 66" Pipe

UNDER I-80 FLOW AT EXISTING 66" CMP W/ HEADWALL

Given: 66" Inlet Pipe

Area	23.76	ft^2
Dia.	5.50	ft
Length	164	ft
Slope	0.005	ft/ft
n-value	0.015	
$K_{entrance}$	0.5	
Up Flowline	364.50	ft
Down Flowline	363.73	ft

Flow (cfs)	66" Inlet Pipe Critical Depth (ft)	Critical Vel. (ft/s)	Normal Depth (ft)	Normal Vel. (ft/s)	Friction Slope S_e	Basin Elevation (ft)
0	0.00	0.00	0.00	0.00		364.50
5	0.59	N/A	0.55	4.02		365.43
10	0.84	N/A	0.77	4.95		365.84
50	1.93	N/A	1.71	7.92		367.67
100	2.76	N/A	2.49	9.57		369.12
150	3.42	N/A	3.17	10.57		370.27
200	3.96	N/A	3.87	11.20		371.29
226	4.21	N/A	4.29	11.37		371.80
250	4.41	N/A	4.83	11.31		372.31
255.4	4.45	N/A	5.15	11.04		372.49
275					0.0089	373.81
300					0.0106	374.69

Simplified Stage-Discharge Curve for HEC-HMS Calculations

Flow (cfs)	Elevation (ft)
0	364.50
3	365.00
10	366.00
36	367.00
61	368.00
96	369.00
146	370.00
185	371.00
236	372.00
236	373.00
236	374.00
236	375.00

Calculations:

Friction slope (S_e) = $((Flow*n)/(1.486*Area*R^{2/3}))^2$

Hydraulic radius (R) = Area / Wetted perimeter = Diameter / 4 {for full flow}

Basin Elevation (partial flow) = (Up Flowline)+ 66" Normal Depth + [(1+K_e)(66" Normal Velocity)^2] / 2g

Basin Elevation (full flow/with no tailwater effect) = (Down Flowline + 66" Diameter)+ S_eL + [(1+K_e)(66" Normal Velocity)^2] / 2g

ASSUMPTIONS:

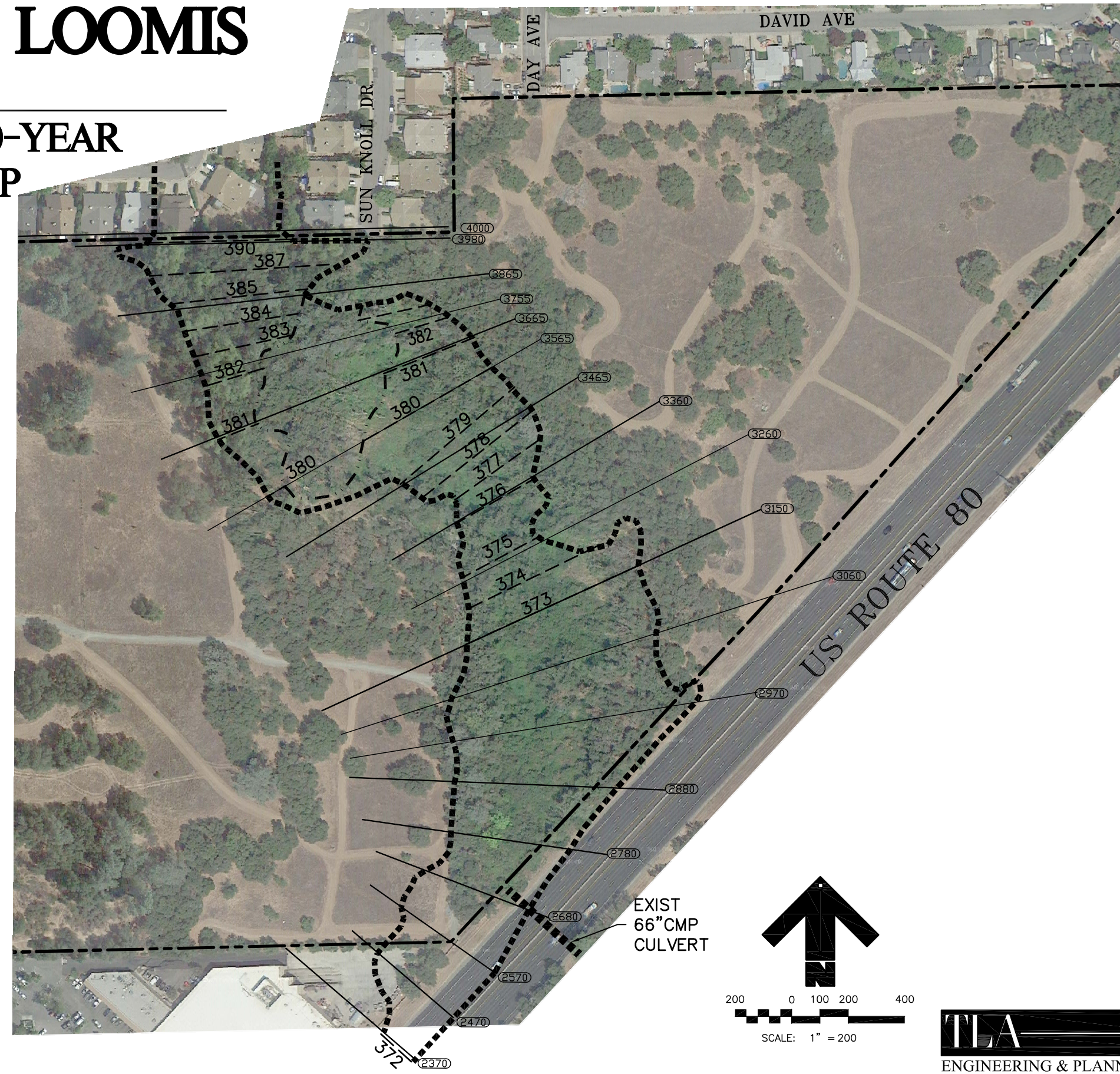
Based on preliminary RAS modeling, maximum WSE at culvert is approximately 272.0, excess becomes overland sheet flow to the north west. Culvert acts as diversion.

THE VILLAGE AT LOOMIS

FIGURE B1

PRE-DEVELOPMENT 100-YEAR FLOOD LIMIT MAP

OCTOBER 2014



LEGEND

- FLOOD PLAIN LIMITS, PRE DEVELOPMENT, 100-YEAR
- 375 — WATER SURFACE ELEVATION, 100-YEAR
- 3150 — CROSS SECTION STATION
- AREA OF INDETERMINATE SHALLOW FLOODING
- PROJECT PROPERTY BOUNDARY

BENCHMARK

HORIZONTAL DATUM: LOCAL GROUND COORDINATES WITH TIES TO NAD83 (1991.35) CA HPGN
VERTICAL DATUM: NGVD29 BASED ON BENCH MARK USGS BM W45 (PID JS0766)
ELEV: 398.65
DESCRIPTION: TOP OF PILLAR FOUNDATION AT NORTHWEST ENTRANCE TO ROCKLIN LOOMIS MUNICIPAL UTILITIES DISTRICT BUILDING.

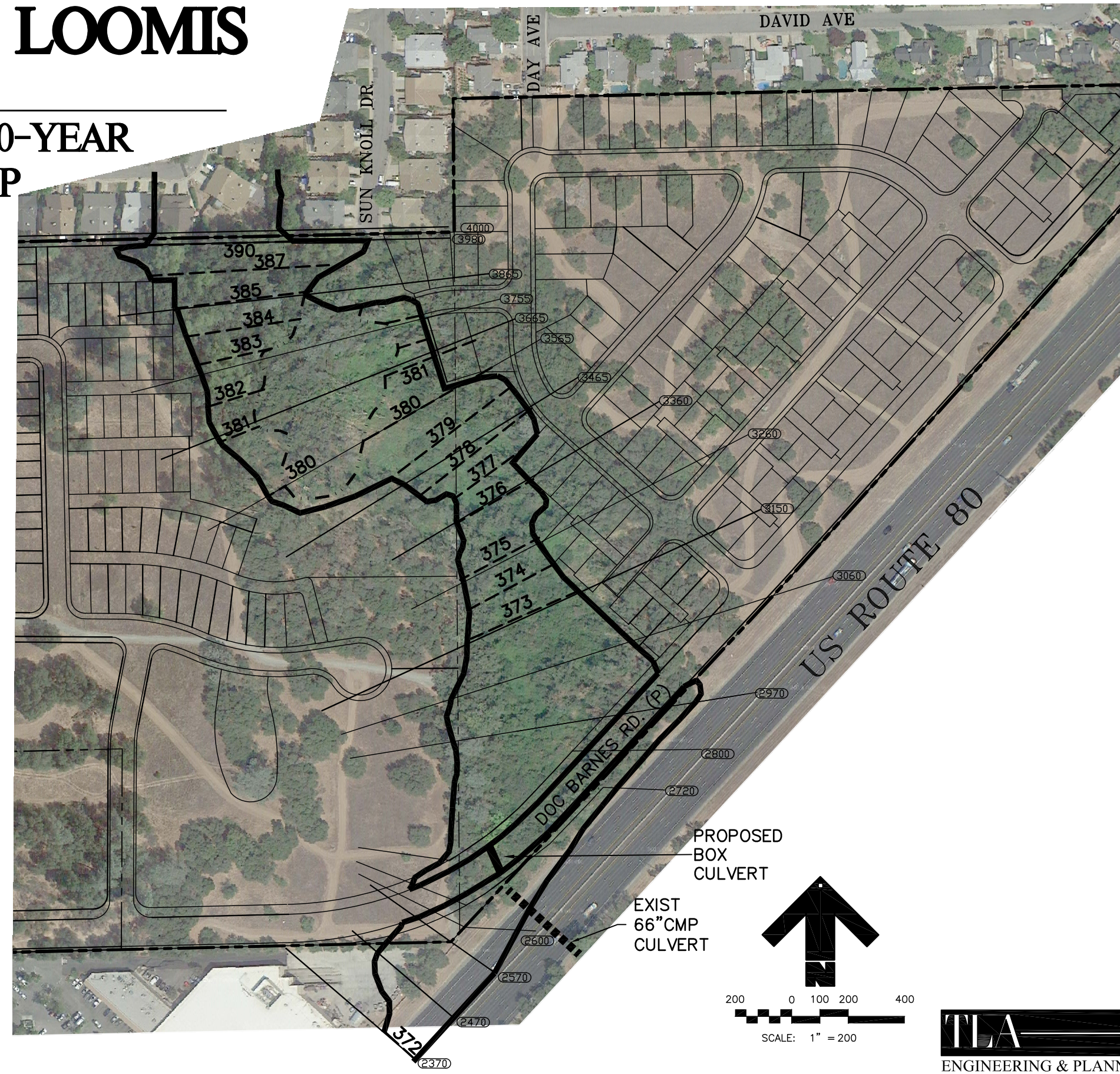
TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

THE VILLAGE AT LOOMIS

FIGURE B2

POST-DEVELOPMENT 100-YEAR FLOOD LIMIT MAP

OCTOBER 2014



LEGEND

- FLOOD PLAIN LIMITS, POST DEVELOPMENT, 100-YEAR
- 375 — WATER SURFACE ELEVATION, 100-YEAR
- (3150) — CROSS SECTION STATION
- AREA OF INDETERMINATE SHALLOW FLOODING
- PROJECT PROPERTY BOUNDARY

BENCHMARK

HORIZONTAL DATUM: LOCAL GROUND COORDINATES WITH TIES TO NAD83 (1991.35) CA HPGN
VERTICAL DATUM: NGVD29 BASED ON BENCH MARK USGS BM W45 (PID JS0766)
ELEV: 398.65
DESCRIPTION: TOP OF PILLAR FOUNDATION AT NORTHWEST ENTRANCE TO ROCKLIN LOOMIS MUNICIPAL UTILITIES DISTRICT BUILDING.

TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

APPENDIX "C" STORM WATER QUALITY

APPENDIX C.1

- Preliminary Water Quality Treatment Areas
- Sizing Criteria, MS4/General Permit, Excerpt
- Typical Details, Storm water BMP's
- Typical Detail, "Contech" CDS Separator

Figure C1, Storm Water treatment Areas, Phase 1
Figure C2, Storm Water treatment Areas, Phase 2
Figure C3, Storm Water treatment Areas, Phase 3

Oct-14

THE VILLAGER AT LOOMIS -DRAINAGE STUDY

PRELIMINARY WATER QUALITY TREATMENT AREAS

shed	area	sf	% Impervious	Impervious Area	% for treatment	Treament Area (sf)	Pre Volume	Post Volume	Change	cft
SA1a	25.05	1,091,178	21%	229,147	4%	9,166				
SA1b	7.7	335,412	65%	218,018	4%	8,721	0.22	0.95	0.73	31,799
SA1c	7	304,920	68%	207,346	4%	8,294	0.2	0.9	0.7	30,492
SA1d	2.2	95,832	68%	65,166	4%	2,607	0.06	0.28	0.22	9,583
SA1e	9.7	422,532	68%	287,322	4%	11,493	0.28	1.25	0.97	42,253
SA1f	0.7	30,492	68%	20,735	4%	829	0.02	0.09	0.07	3,049
SB1	5.45	237,402	65%	154,311	4%	6,172	0.04	0.67	0.63	27,443
SC1	6.18	269,201	65%	174,981	4%	6,999	0.04	0.78	0.74	32,234

SIZING CRITERIA
MS4 / GENERAL PERMIT

2) Concentrate development on portions of the site with less permeable soils and preserve areas that can promote infiltration.
3) Limit overall impervious coverage of the site with paving and roofs.
4) Set back development from creeks, wetlands, and riparian habitats.
5) Preserve significant trees.
6) Conform the site layout along natural landforms.
7) Avoid excessive grading and disturbance of vegetation and soils.
8) Replicate the site's natural drainage patterns.
9) Detain and retain runoff throughout the site.

(b) **Drainage Management Areas**

The Permittee shall require each Regulated Project to provide a map or diagram dividing the developed portions of the project site into discrete Drainage Management Areas (DMAs), and to manage runoff from each DMA using Site Design Measures, Source Controls and/or Storm Water Treatment and Baseline Hydromodification Measures.

(c) **Numeric Sizing Criteria for Storm Water Retention and Treatment**

The Permittees shall require facilities designed to evapotranspire, infiltrate, harvest/use, and biotreat storm water to meet at least one of the following hydraulic sizing design criteria:

1) Volumetric Criteria:

a) The maximized capture storm water volume for the tributary area, on the basis of historical rainfall records, determined using the formula and volume capture coefficients in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87 (1998) pages 175-178 (that is, approximately the 85th percentile 24-hour storm runoff event); or

b) The volume of annual runoff required to achieve 80 percent or more capture, determined in accordance with the methodology in Section 5 of the CASQA's Stormwater Best Management Practice Handbook, New Development and Redevelopment (2003), using local rainfall data.

2) Flow-based Criteria:

a) The flow of runoff produced from a rain event equal to at least 0.2 inches per hour intensity; or

b) The flow of runoff produced from a rain event equal to at least 2 times the 85th percentile hourly rainfall intensity as determined from local rainfall records.

(d) **Site Design Measures**

The Permittee shall implement Site Design Measures (as defined in Section E.12.b. Site Design Measures and Section E.12.e(ii)(a) Site Assessment), site layout and design measures, based on the objective of achieving infiltration, evapotranspiration and/or harvesting/reuse of the 85th percentile 24-hour storm runoff event. Site design measures shall be used to reduce the amount of runoff, to the extent technically feasible, for which retention and runoff is required . Any remaining runoff from impervious DMAs may then be directed to one or more bioretention facilities as specified in Section E.12.e.(ii)(f), below.

(e) **Source Controls**

The Permittee shall implement Source Controls as defined in Section E.12.d. Source Control Measures.

(f) **Storm Water Treatment Measures and Baseline Hydromodification Management Measures**

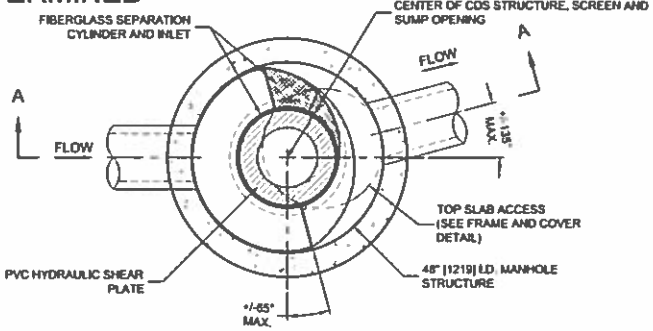
After implementation of Site Design Measures, remaining runoff from impervious DMAs must be directed to one or more facilities designed to infiltrate, evapotranspire, and/or bioretain the amount of runoff specified in Section E.12.e(ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment. The facilities must be demonstrated to be at least as effective as a bioretention system with the following design parameters:

1) Maximum surface loading rate of 5 inches per hour, based on the flow rates calculated. A sizing factor of 4% of tributary impervious area may be used.
2) Minimum surface reservoir volume equal to surface area times a depth of 6 inches.
3) Minimum planting medium depth of 18 inches. The planting medium must sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project and must maximize runoff retention and pollutant removal. A mixture of sand (60%-70%) meeting the specifications of American Society for Testing and Materials (ASTM) C33 and compost (30%-40%) may be used.
4) Subsurface drainage/storage (gravel) layer with an area equal to the surface area and having a minimum depth of 12 inches.
5) Underdrain with discharge elevation at top of gravel layer.
6) No compaction of soils beneath the facility, or ripping/loosening of soils if compacted.
7) No liners or other barriers interfering with infiltration.
8) Appropriate plant palette for the specified soil mix and maximum available water use.

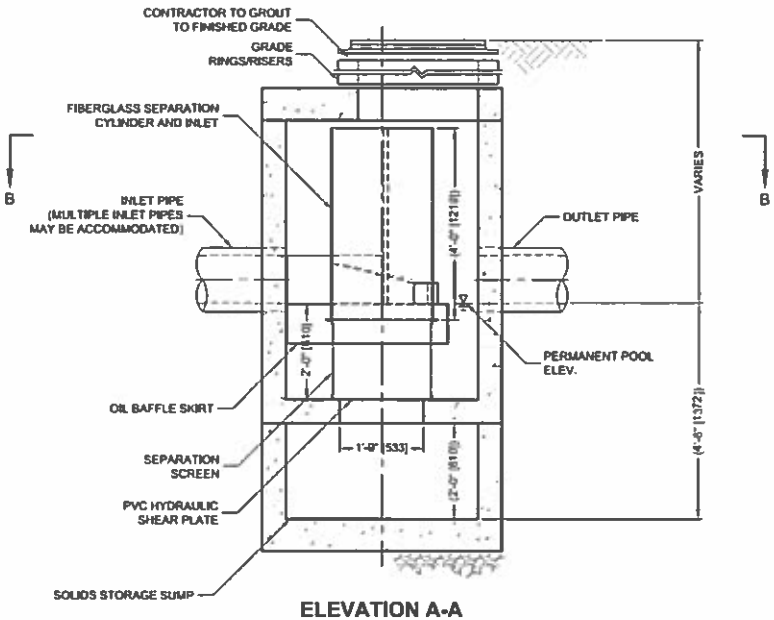
(g) **Alternative Designs** — Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following

TYPICAL DETAIL
CONTECH CDS UNIT

TYPICAL HYDRODYNAMIC SEPARATOR
SIZE TO BE DETERMINED



PLAN VIEW B-B
N.T.S.



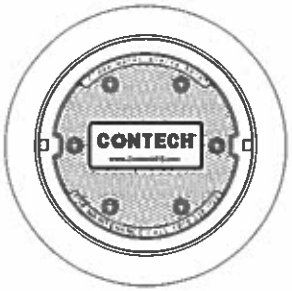
ELEVATION A-A
N.T.S.

CDS2015-4-C DESIGN NOTES

CDS2015-4-C RATED TREATMENT CAPACITY IS 0.7 CFS [19.8 L/s], OR PER LOCAL REGULATIONS. MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 10.0 CFS [283 L/s]. IF THE SITE CONDITIONS EXCEED 10.0 [283 L/s] CFS, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT. HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-4-C
INLINE CDS
STANDARD DETAIL

H:\STORMWATER\COMMON\P522 CDS\40 STANDARD DRAWINGS\INLINE (CDS-C)\DWG\CDS2015-4-C-DTL.DWG 5/13/2014 9:53 PM

TYPICAL DETAIL
STORM WATER BMP'S

6.1 Bioretention Area

Figure 6-1: Bioretention area, Fremont

Best uses

- Any type of development
- Drainage area up to 2 acres
- Landscape design element

Advantages

- Detains low flows
- Landscape feature
- Low maintenance
- Reliable once established

Limitations

- Not appropriate where soil is unstable
- Requires irrigation
- Susceptible to clogging – especially if installed prior to construction site soil stabilization.

Bioretention[1] areas, or "rain gardens," function as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a ponding area, organic layer or mulch layer, planting soil, and plants. Bioretention areas are designed to distribute stormwater runoff evenly along a ponding area. Percolation of stored water in the bioretention area's engineered planting soil with a high rate of infiltration will enter an underlying rock layer, from which water will either percolate into the underlying soil or enter the underdrain, so that the bioretention area empties over two days. Unless the geotechnical engineer identifies conditions, such as steep slope or a high groundwater table, that would make infiltration unsafe, bioretention areas should be designed to maximize infiltration by raising the underdrain toward the top of the rock layer. Bioretention areas can be any shape, including a linear treatment measure. The guidelines listed below apply to bioretention areas.

Design and Sizing Guidelines

DRAINAGE AREA AND SETBACK REQUIREMENTS

- Set back from structures 10' or as required by structural or geotechnical engineer, or local jurisdiction.
- Area draining to the bioretention area does not exceed 2 acres.
- Area draining to the bioretention area shall not contain a significant source of soil erosion, such as high velocity flows along slopes not stabilized with vegetation or hardscape.

[1] A bioretention area that is unlined and has a raised underdrain in the underlying rock layer to promote infiltration may also be called a "bioinfiltration area".

- Areas immediately adjacent to bioretention area shall have slopes more than 0.5% for pavement and more than 1% for vegetated areas.
- Bioretention areas, including linear treatment measures, shall not be constructed in slopes greater than 4%, unless constructed as a series of bioretention cells. Separate bioretention cells by check dams up to 24 inches high and at least 25 feet apart. The slope within cells shall not exceed 4%. Bioretention cells are not recommended if overall slope exceeds 8%.
- If treatment measure is designed to infiltrate stormwater to underlying soils, a 50-foot setback is needed from septic system leach field.

TREATMENT DIMENSIONS AND SIZING

- Bioretention area may be sized to 4% of the impervious surface area on the project site. The area of impervious surface multiplied by 0.04 sizing factor will equal the footprint of the bioretention area. Alternatively, bioretention sizing may be calculated using the flow-based treatment standard, or the combination flow- and volume-based treatment standard described in Section 5.1 based on the flow entering the basin at the treatment flow rate over the initial hours of the storm until the treatment volume is attained.
- The bioretention area shall be sized to either:
  - Percolate the design treatment flow using a rate of 5 inches per hour. No additional allowance is provided for storage or for infiltration rates exceeding 5 inches/ hour; or,
  - Store the 24-hour treatment volume based on inflow at the water treatment rate for the initial hours of the storm and outflow by infiltration.
- Where there is a positive surface overflow, bioretention areas shall have freeboard of at least 0.2 feet to the lowest structural member versus the 100-year storm water level in the bioretention area, unless local jurisdiction has other requirements.
- Where the bioretention area is in a sump that depends on outflow through a catch basin, the bioretention area shall have a freeboard of at least 0.5 feet to the lowest building finished floor elevation (including garage and excluding crawl space) for conditions with the outlet 50 percent clogged, unless local jurisdiction has other requirements. Where the freeboard cannot be provided, emergency pump may be allowed on a case-by-case basis.
- Minimum 2 inches between the crest of the emergency outfall riser and higher elevation (top of planting mounds) of the treatment surface area.
- The elevation of the surface area may vary as needed to distribute stormwater flows throughout the surface area.
- Side slopes do not exceed 3:1; downstream slope for overflow shall not exceed 3:1.
- Surface ponding depths should vary, with a maximum 12-inch depth. If ponding depths exceed 6 inches, landscape architect shall approve planting palette for desired depth.
- The inlet to the overflow catch basin shall be at least 6 inches above the low point of the bioretention planting area.

INLETS TO TREATMENT MEASURE

Flow may enter the treatment measure (see example drawings in Section 5.10):

- As overland flow from landscaping (no special requirements)
- As overland flow from pavement (cutoff wall required)
- Through a curb opening (minimum 18 inches)
- Through a curb drain
- With drop structure through a stepped manhole (refer to Figure 5-3 in Chapter 5)
- Through a bubble-up manhole or storm drain emitter
- Through roof leader or other conveyance from building roof

- Where flows enter the biotreatment measure, allow a change in elevation of 4 to 6 inches between the paved surface and biotreatment soil elevation, so that vegetation or mulch build-up does not obstruct flow.
- Cobbles or rocks shall be installed to dissipate flow energy where runoff enters the treatment measure.

VEGETATION

- Plant species should be suitable to well-drained soil and occasional inundation. See planting guidance in Appendix B.
- Shrubs and small trees shall be placed to anchor the bioretention area cover.
- Tree planting shall be as required by the municipality. If larger trees are selected, plant them at the periphery of bioretention area.
- Underdrain trench shall be offset at edge of tree planting zone, as needed, to maximize distance between tree roots and underdrain. No trees shall be planted within 20 feet of overflow inlet. Underdrain shall be solid pipe 10 feet upstream and downstream of any tree.
- Use integrated pest management (IPM) principles in the landscape design to help avoid or minimize any use of synthetic pesticides and quick-release fertilizer. Check with the local jurisdiction for any local policies regarding the use of pesticides and fertilizers.
- Drought tolerant plants are preferred. Provide sufficient irrigation to maintain plant life.
- Trees and vegetation do not block inflow, create traffic or safety issues, or obstruct utilities.

SOIL CONSIDERATIONS SPECIFIC TO BIORETENTION AREAS

- Planting soil shall have a minimum percolation rate of 5 inches per hour and a maximum percolation rate of 10 inches/hour. Soil specifications are provided in Appendix L. Check with municipality for any additional requirements.
- Bioretention areas shall have a minimum planting soil depth of 18 inches.
- Provide 3-inch layer of mulch in areas between plantings.
- An underdrain system is generally required. Depending on the infiltration rate of in situ soils, the local jurisdiction may allow installation without an underdrain on a case-by-case basis.
- Underdrain trench shall include a 12-inch thick layer of Caltrans Standard Section 68-1.025 permeable material Class 2. A minimum 4-inch diameter perforated pipe shall be placed within the backfill layer. To help prevent clogging, two rows of perforation may be used.
- If there is at least a 10-foot separation between the base of the underdrain and the groundwater table, and geotechnical conditions allow, there shall be at least 6-inch separation between the perforated pipe and the base of the trench to allow percolation.

SOIL CONSIDERATIONS FOR ALL BIOTREATMENT SYSTEMS

- Filter fabric shall not be used in or around underdrain trench.
- If there is less than 10 feet separation to the groundwater table, an impermeable fabric shall be placed at the base of the underdrain and the perforated pipe shall be placed on the impermeable fabric.
- The underdrain shall include a perforated pipe with cleanouts and connection to a storm drain or discharge point. Clean-out shall consist of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 4 inches and a watertight cap fit flush with the ground, or as required by municipality.
- There shall be adequate fall from the underdrain to the storm drain or discharge point.

- Beginning December 1, 2011, soils in the area of inundation within the facility shall meet biotreatment soil specifications approved by the Regional Water Board (Appendix L). A minimum percolation rate of 5 inches per hour and a maximum percolation rate of 10 inches/hour are required (initial infiltration rate may exceed this to allow for tendency of infiltration rate to reduce over time).

CONSTRUCTION REQUIREMENTS FOR ALL BIOTREATMENT SYSTEMS

- When excavating, avoid spreading fines of the soils on bottom and side slopes. Remove any smeared soiled surfaces and provide a natural soil interface into which water may percolate.
- Minimize compaction of existing soils. Protect from construction traffic.
- Protect the area from construction site runoff. Runoff from unstabilized areas shall be diverted away from biotreatment facility.

MAINTENANCE CONSIDERATIONS FOR ALL TREATMENT MEASURES

- A Maintenance Agreement shall be provided.
- Maintenance Agreement shall state the parties' responsibility for maintenance and upkeep.
- Prepare a maintenance plan and submit with Maintenance Agreement. Maintenance plan templates are in Appendix H.

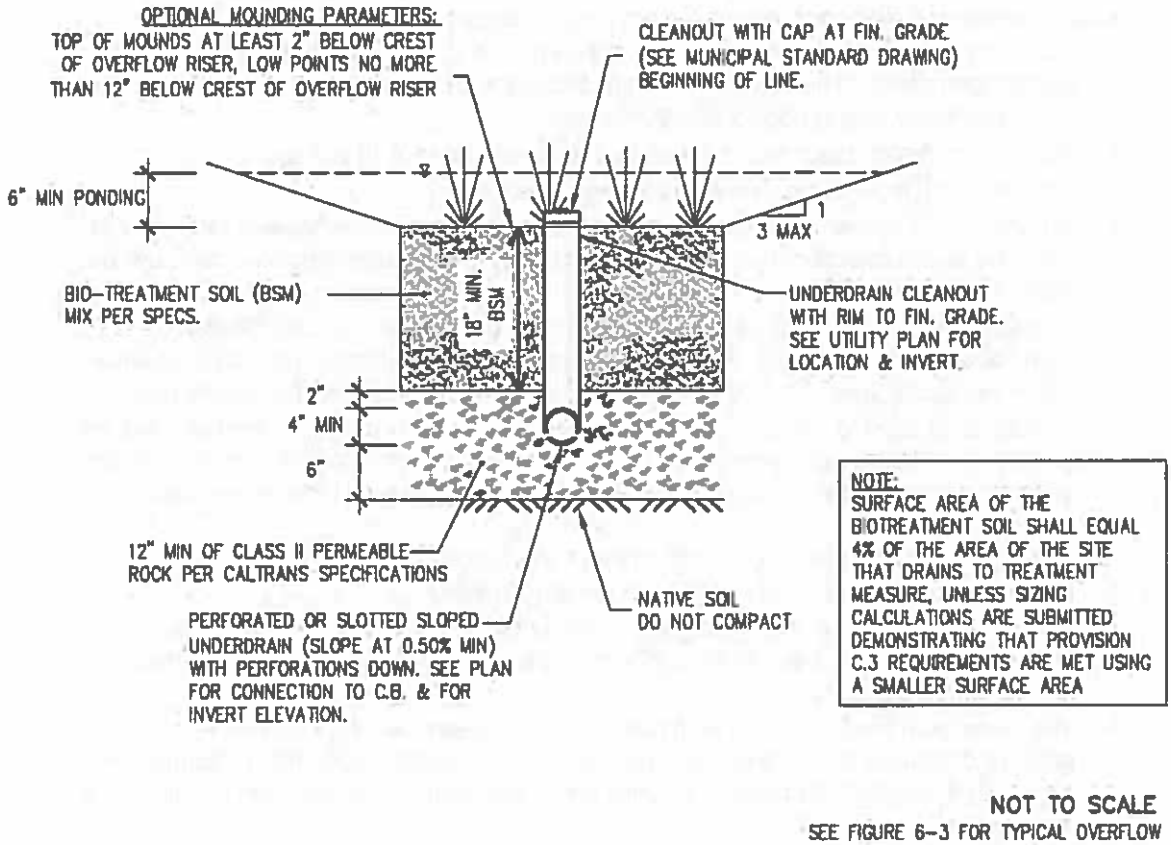


Figure 6-2: Cross Section, Bioretention Area

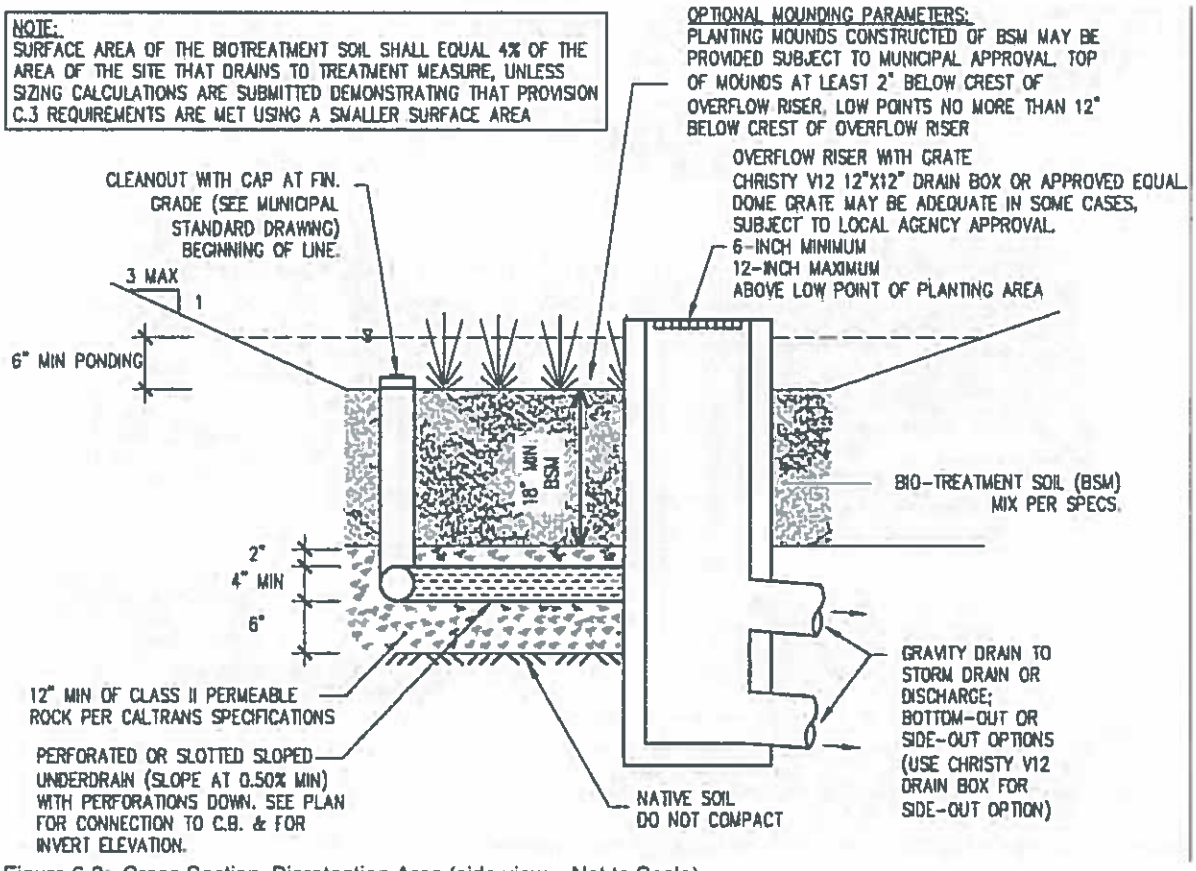


Figure 6-3: Cross Section, Bioretention Area (side view – Not to Scale)

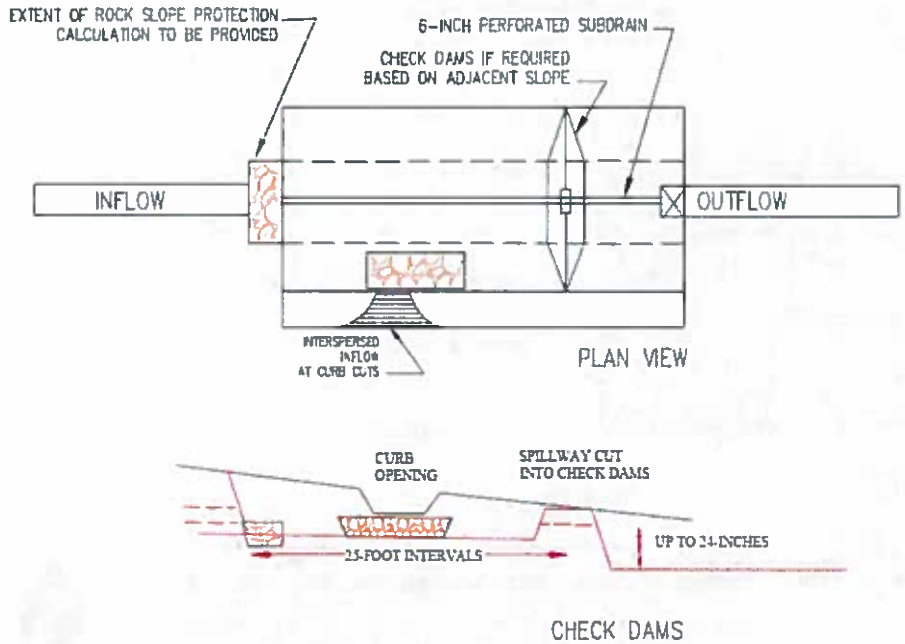


Figure 6-4: Check dam (plan view and profile) for installing a series of linear bioretention cells in sloped area

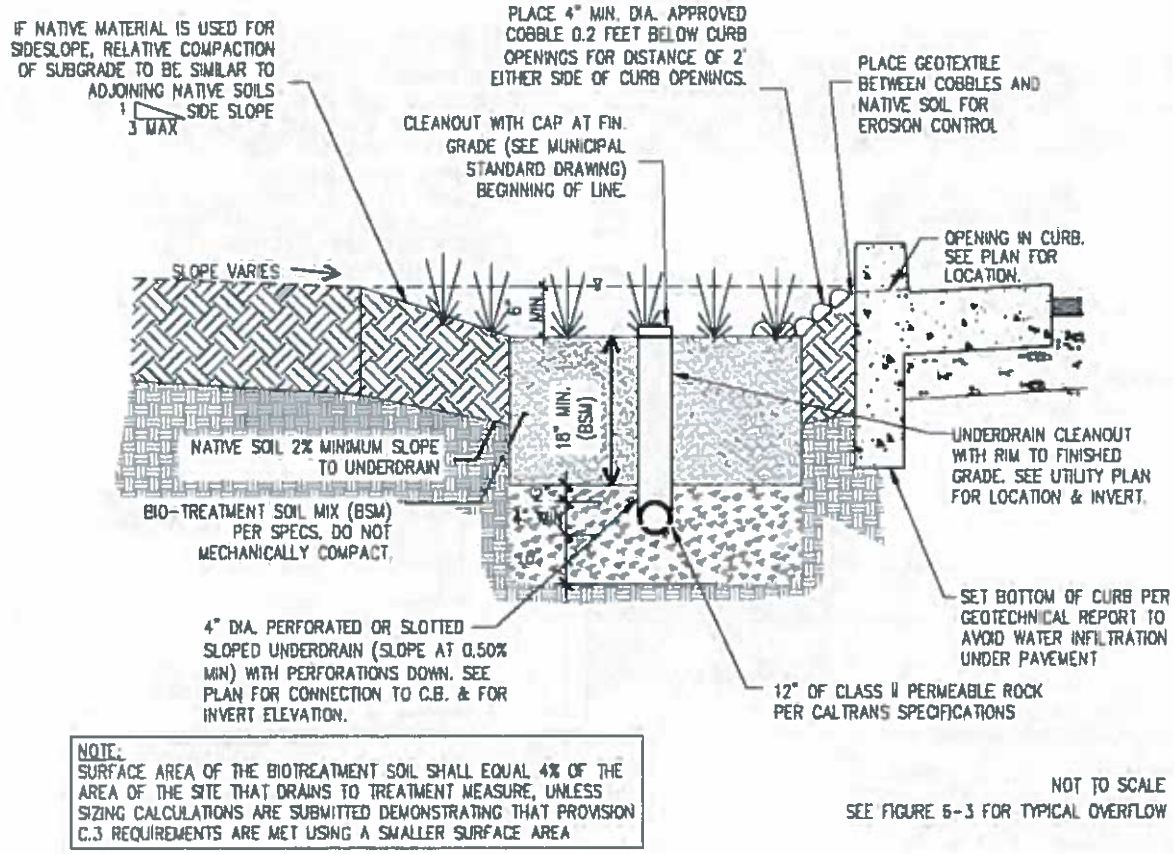


Figure 6-5: Cross-section of bioretention area showing inlet from pavement.

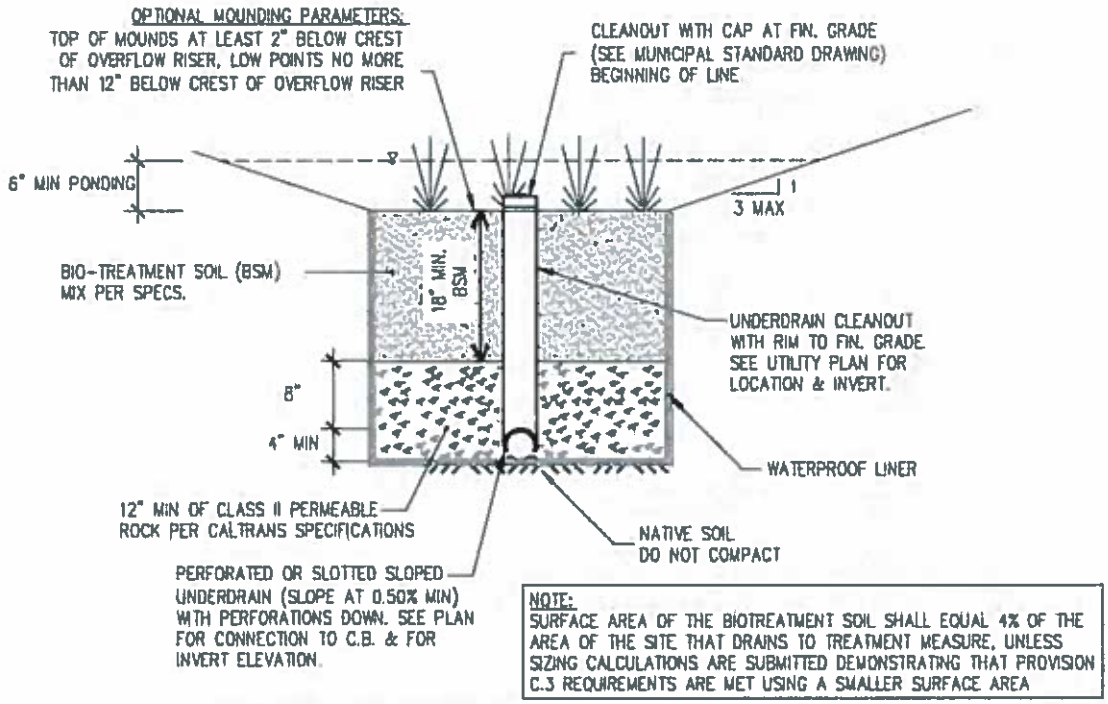


Figure 6-6: Cross section of lined bioretention area (Not to Scale)

6.2 Flow-Through Planter

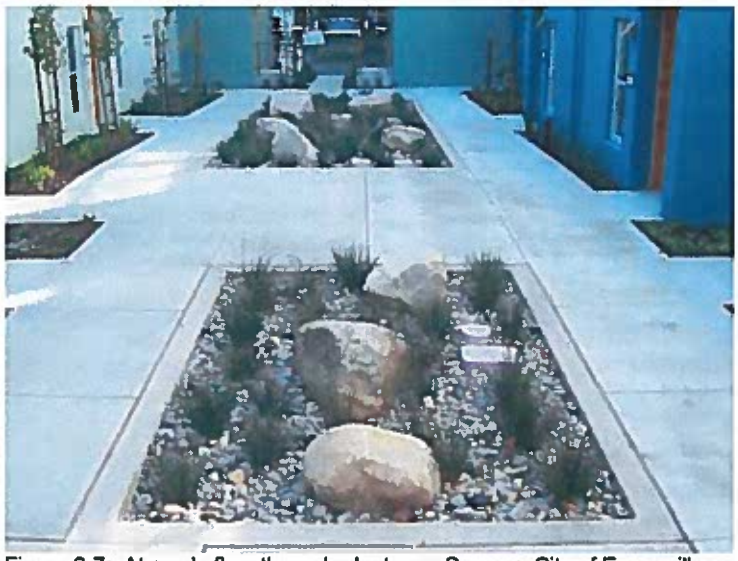


Figure 6-7: At-grade flow-through planters. Source: City of Emeryville

Best uses

- Treating roof runoff
- Next to buildings
- Dense urban areas
- Locations where infiltration is not desired

Advantages

- Can be adjacent to structures
- Multi-use
- Versatile
- May be any shape
- Low maintenance

Limitations

- Requires sufficient head
- Careful selection of plants
- Requires level installation
- Susceptible to clogging

Flow-through planters are designed to treat and detain runoff without allowing seepage into the underlying soil. They can be used next to buildings and other locations where soil moisture is a potential concern. Flow-through planters typically receive runoff via downspouts leading from the roofs of adjacent buildings. However, flow-through planters can also be set level with the ground and receive sheet flow. Pollutants are removed as the runoff passes through the soil layer and is collected in an underlying layer of gravel or drain rock. A perforated pipe underdrain must be directed to a storm drain or other discharge point. An overflow inlet conveys flows that exceed the capacity of the planter.

Design and Sizing Guidelines

TREATMENT DIMENSIONS AND SIZING

- Flow-through planters may be designed with a 4% sizing factor (percentage of the surface area of planter compared to the surface area of the tributary impervious area). The area of impervious surface multiplied by 0.04 sizing factor will equal the footprint of the flow-through planter. Alternatively, calculations may be performed using either the hydraulic sizing criteria for flow-based treatment measures or the hydraulic sizing criteria for combination flow- and volume-based treatment measures, included in Section 5.1.
- Install an overflow weir adequate to meet municipal drainage requirements.
- Flow-through planters can be used adjacent to building and within set back area.
- Flow-through planters can be used above or below grade.
- Size overflow trap for building code design storm, set trap below top of planter box walls.
- Planter wall set against building should be higher to avoid overflow against building.
- Elevation of the surface area may vary as needed to distribute stormwater flows throughout the surface area.

- Minimum 2 and up to12 inches of water surface storage between the planting surface and crest of overflow weir.

VEGETATION

- Plantings should be selected for viability in a well-drained soil. See planting guidance in Appendix B.
- Use integrated pest management (IPM) principles in the landscape design to help avoid or minimize any use of synthetic pesticides and quick-release fertilizer. Check with the local jurisdiction for any local policies regarding the use of pesticides and fertilizers.
- Irrigation shall be provided, as needed, to maintain plant life.
- Trees and vegetation do not block inflow, create traffic or safety issues, or obstruct utilities.

INLETS TO TREATMENT MEASURE

Flow may enter the treatment measure (see example drawings in Section 5.10):

  - As overland flow from landscaping (no special requirements)
  - As overland flow from pavement (cutoff wall required)
  - Through a curb opening (minimum 18 inches)
  - Through a curb drain
  - With drop structure through a stepped manhole (refer to Figure 5-4 in Chapter 5)
  - Through a bubble-up manhole or storm drain emitter
  - Through roof leader or other conveyance from building roof

- Where flows enter the biotreatment measure, allow a change in elevation of 4 to 6 inches between the paved surface and biotreatment soil elevation, so that vegetation or mulch build-up does not obstruct flow.
- Splash blocks, cobbles or rocks shall be installed to dissipate flow energy where runoff enters the treatment measure.
- For long linear planters, space inlets to planter at 10-foot intervals or install flow spreader.

SOIL CONSIDERATIONS SPECIFIC TO FLOW THROUGH PLANTERS

- Waterproofing shall be installed as required to protect adjacent building foundations.
- If site conditions permit infiltration to underlying soils, waterproofing is not required.
- An underdrain system is generally required for flow through planters. Depending on the infiltration rate of in situ soils, the local jurisdiction may allow installation without an underdrain on a case-by-case basis.
- Underdrain trench shall include a 12-inch thick layer of Caltrans Standard Section 68-1.025 permeable material Class 2. Minimum 4-inch diameter perforated pipe shall be placed within backfill layer. To help prevent clogging, two rows of perforation may be used.
- Planting soil shall have a minimum percolation rate of 5 inches per hour and a maximum percolation rate of 10 inches/hour. Soil specifications are provided in Appendix L. Check with municipality for any additional requirements.
- The planting soil shall be at least 18 inches thick.
- Provide 3-inch layer of mulch in areas between plantings.

SOIL CONSIDERATIONS FOR ALL BIOTREATMENT SYSTEMS

- Beginning December 1, 2011, soils in the area of inundation within the facility shall meet biotreatment soil specifications approved by the Regional Water Board (Appendix L). A minimum percolation rate of 5 inches per hour and a maximum percolation rate of 10 inches/hour are required (initial infiltration rate may exceed this to allow for tendency of infiltration rate to reduce over time).

- Filter fabric shall not be used in or around underdrain trench.
- The underdrain shall include a perforated pipe with cleanouts and connection to a storm drain or discharge point. Clean-out shall consist of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 4 inches and a watertight cap fit flush with the ground.
- There shall be adequate fall from the underdrain to the storm drain or discharge point.

CONSTRUCTION REQUIREMENTS FOR ALL BIOTREATMENT SYSTEMS

- When excavating, avoid spreading fines of the soils on bottom and side slopes. Remove any smeared soiled surfaces and provide a natural soil interface into which water may percolate.
- Minimize compaction of existing soils. Protect from construction traffic.
- Protect the area from construction site runoff. Runoff from unstabilized areas shall be diverted away from biotreatment facility.

MAINTENANCE CONSIDERATIONS FOR ALL TREATMENT MEASURES

- A Maintenance Agreement shall be provided.
- Maintenance Agreement shall state the parties' responsibility for maintenance and upkeep.
- Prepare a maintenance plan and submit with Maintenance Agreement. Maintenance plan templates are in Appendix H.

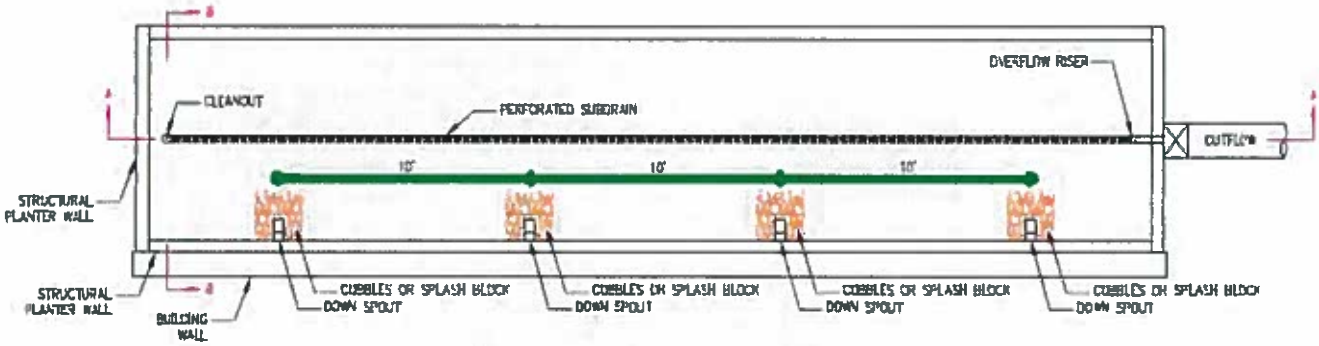


Figure 6-8: Plan view of long, linear planter, with inlets to the planter distributed along its length at 10' intervals.

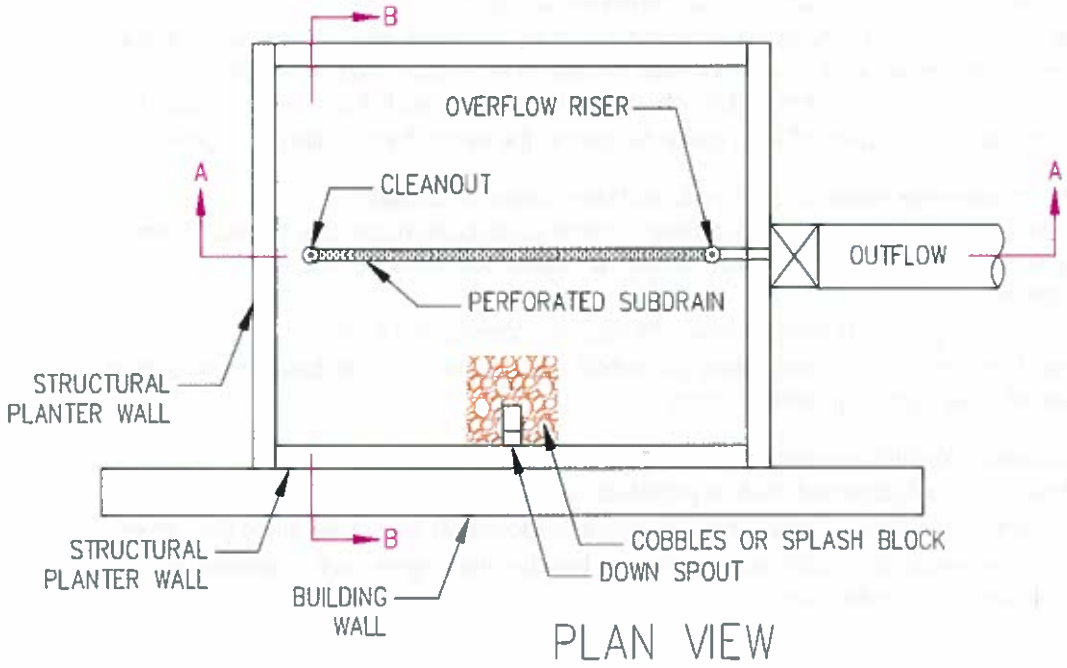


Figure 6-9: Plan view of planter designed to disperse flows adequately with only one inlet to planter

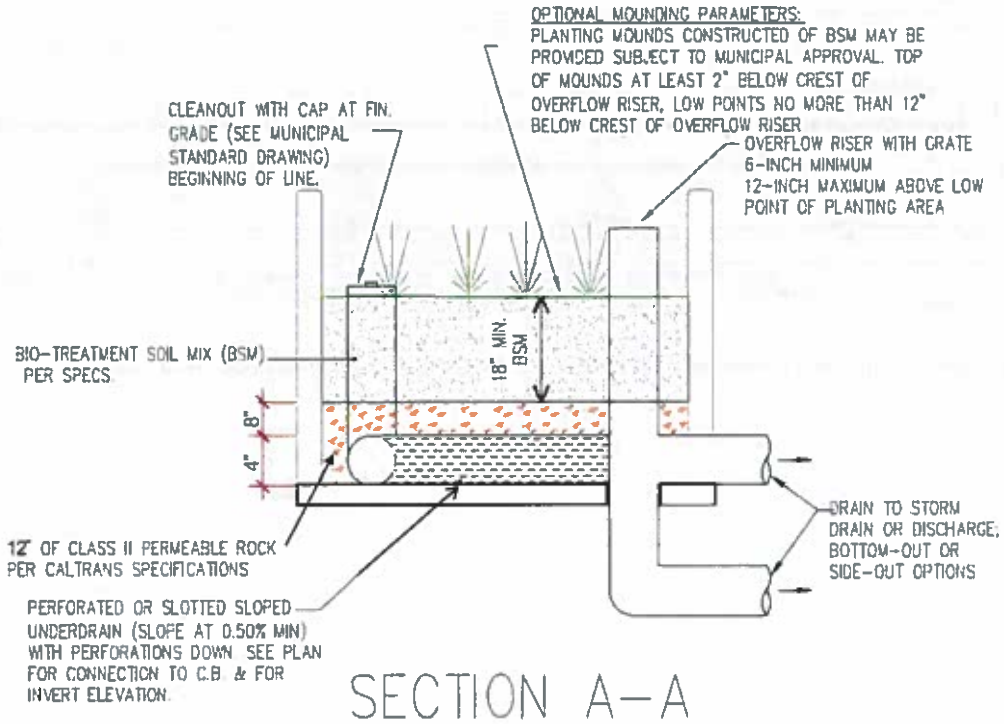


Figure 6-10: Cross section A-A of flow-through planter, shows side view of underdrain

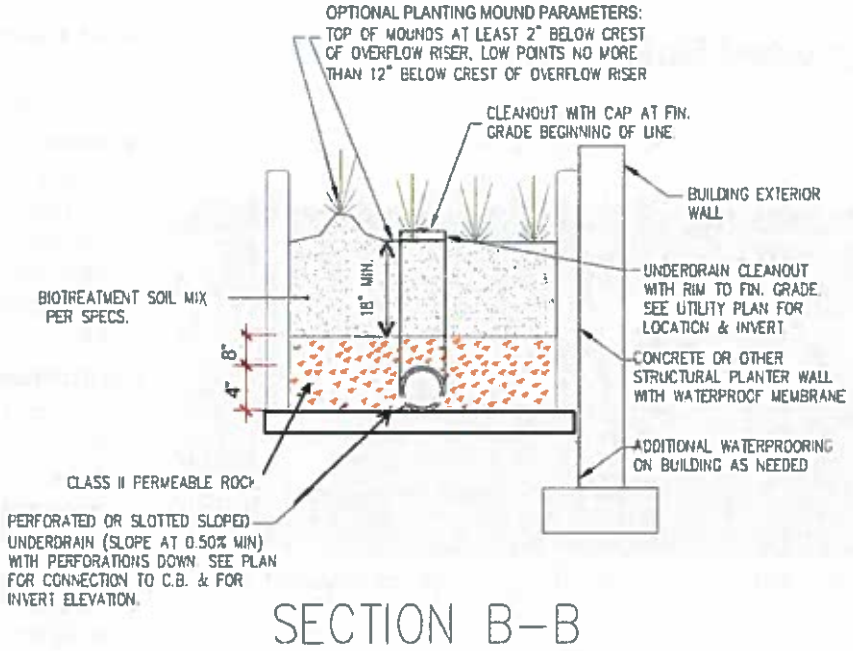


Figure 6-11: Cross section B-B of flow-through planter, shows cross section of underdrain

Figure 6-12: Half-buried, perforated flexible pipe serves as a flow spreader to distribute stormwater evenly throughout long, linear flow-through planter in Emeryville (Source: GreenGrid/ Weston Solutions).

Figure 6-13: The same planter as shown in Figure 6-12, after vegetation has matured and partially conceals the half-buried pipe from view (Source: San Francisco Estuary Partnership).

6.4 Vegetated Buffer Strip

Figure 6-17: Vegetated buffer strip. Source: www.cabmphandbooks.com

Best Uses
- Roadside shoulders
- Landscape buffer

Advantages
- Minimal maintenance
- Reliable
- Aesthetic appeal
- Adjustable to suit site

Limitations
- No large drainage areas
- Thick cover necessary
- Large size requirements
- Minimal detention provided

Vegetated buffer strips (grassed buffer strips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Vegetated buffer strips function by slowing runoff velocities and allowing sediment and other pollutants to settle and by providing some infiltration into underlying soils. Vegetated buffer strips were originally used as an agricultural treatment practice and have more recently evolved into an urban practice. With proper design and maintenance, vegetated buffer strips can provide relatively high pollutant removal. In addition, the public views them as landscaped amenities and not as stormwater infrastructure.

Design and Sizing Guidelines

TREATMENT DIMENSIONS AND SIZING

- Strip shall be sized as long as the site will reasonably allow. The width in the direction of flow shall be at least:
  - 5 feet where the length of flow across an impervious surface is less than 10-feet in the direction of flow.
  - At least 50 percent of the length of flow across an impervious surface where the length of flow across an impervious surface is between 10 and 30 feet in the direction of flow.
  - At least 15 feet where the length of flow across an impervious surface is between 30 feet and 60 feet in the direction of flow.
- Level spreaders shall be used if the length of flow across an impervious surface is greater than 60 feet in the direction of flow. The level spreader shall distribute flows over a length that will provide equivalent discharge per linear foot of level spreader as if the flow to the vegetated buffer strip was from a surface with 60-feet length in the direction of flow.
- Slopes should not exceed 1-foot Vertical to 4-foot Horizontal (1:4).
- Strip shall be free of gullies or rills.

VEGETATION

- Either grass or a diverse selection of other low growing, drought tolerant, native vegetation should be specified. Vegetation whose growing season corresponds to the wet season is preferred. See planting guidance in Appendix B.
- Use integrated pest management (IPM) principles in the landscape design to help avoid or minimize any use of synthetic pesticides and quick-release fertilizer. Check with the local jurisdiction for any local policies regarding the use of pesticides and fertilizers.
- Irrigation shall be provided, as needed, to maintain plant life.
- Trees and vegetation do not block inflow, create traffic or safety issues, or obstruct utilities.

INLETS

- Flow may enter the treatment measure (see example drawings in Section 5.10):
  - As overland flow from landscaping (no special requirements)
  - As overland flow from pavement (cutoff wall required)
  - Through a curb opening (minimum 18 inches)
  - Through a curb drain
  - With drop structure through a stepped manhole (refer to Figure 5-4 in Chapter 5)
  - Through a bubble-up manhole or storm drain emitter
  - Through roof leader or other conveyance from building roof
- Where flows enter the biotreatment measure, allow a change in elevation of 4 to 6 inches between the paved surface and biotreatment soil elevation, so that vegetation or mulch build-up does not obstruct flow.
- If runoff is piped or channeled to the strip, a level spreader must be installed to create sheet flow.
- Flows from the buffer strip must concentrate sheet flows for discharge to storm drain system. This may be accomplished with a trench drain, vegetated conveyance swale, or other method approved by the municipality.

SOIL CONSIDERATIONS SPECIFIC TO VEGETATED BUFFER STRIPS

- Check with municipality for planting soil requirements. Until December 1, 2011, and except where other municipal requirements apply, planting soil shall have a minimum percolation rate of 2 inches per hour and a maximum percolation rate of 10 inches/hour. If native soils do not meet this percolation requirement, import soil meeting the Clean Water Program's dewatering soil specifications shall be used in the area of inundation.
- Planting soil will be to a minimum depth of at least 6 inches.
- No underdrain trench is needed where native soils are Hydrologic Soil Group A or B.
- When placed on native hydrologic soil group C and D soils, drainage must be provided to allow gravity drainage of the treatment soils. This may consist of underdrain trenches or other means to assure that the biotreatment soil is able to fully dewater after storm event.
- Underdrain trench shall include a 12-inch thick layer of Caltrans Standard Section 68-1.025 permeable material Class 2. A minimum 4-inch diameter perforated pipe shall be placed within the backfill layer. To help prevent clogging, two rows of perforation may be used.
- If there is at least a 10-foot separation between the base of the underdrain and the groundwater table, there shall be at least 6-inch separation between the perforated pipe and the base of the trench to allow percolation.
- Provide 3-inch layer of mulch in areas between plantings.

SOIL CONSIDERATIONS FOR ALL BIOTREATMENT SYSTEMS

- If there is less than 10 feet separation to the groundwater table, an impermeable fabric shall be placed at the base of the underdrain and the perforated pipe shall be placed on the impermeable fabric.
- No filter fabric shall be used in or around underdrain trench.
- The underdrain shall include a perforated pipe with cleanouts and connection to a storm drain or discharge point. Clean-out shall consist of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 4 inches and a watertight cap fit flush with the ground.
- There shall be adequate fall from the underdrain to the storm drain or discharge point.
- Beginning December 1, 2011, soils in the area of inundation within the facility shall meet biotreatment soil specifications approved by the Regional Water Board (Appendix L). The minimum percolation rate for the biotreatment soil is 5 inches per hour. The long-term desired maximum infiltration rate is 10 inches per hour, although initial infiltration rate may exceed this to allow for tendency of infiltration rate to reduce over time.

CONSTRUCTION REQUIREMENTS FOR ALL BIOTREATMENT SYSTEMS

- When excavating, avoid spreading fines of the soils on bottom and side slopes. Remove any smeared soiled surfaces and provide a natural soil interface into which water may percolate.
- Minimize compaction of existing soils. Protect from construction traffic.
- Protect the area from construction site runoff. Runoff from unstabilized areas shall be diverted away from biotreatment facility.

MAINTENANCE CONSIDERATIONS FOR ALL TREATMENT MEASURES

- A Maintenance Agreement shall be provided.
- Maintenance Agreement shall state the parties' responsibility for maintenance and upkeep.
- Prepare a maintenance plan and submit with Maintenance Agreement. Maintenance plan templates are in Appendix H.

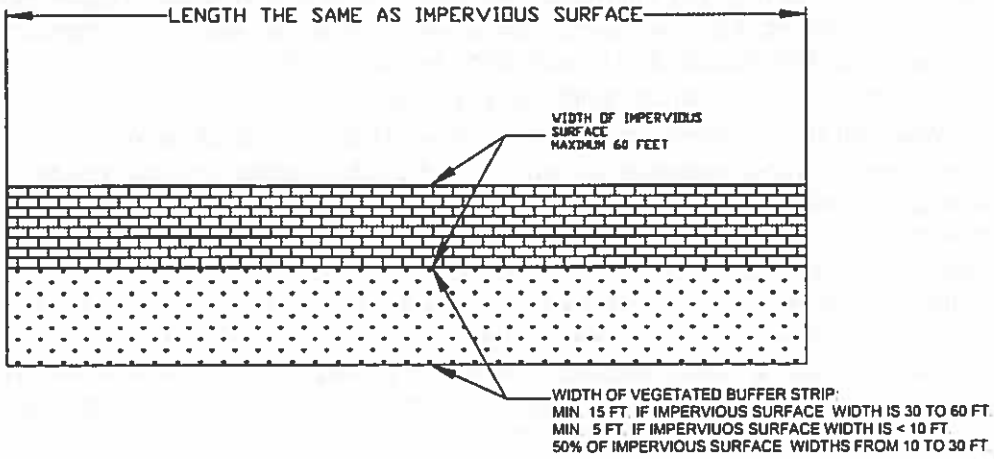
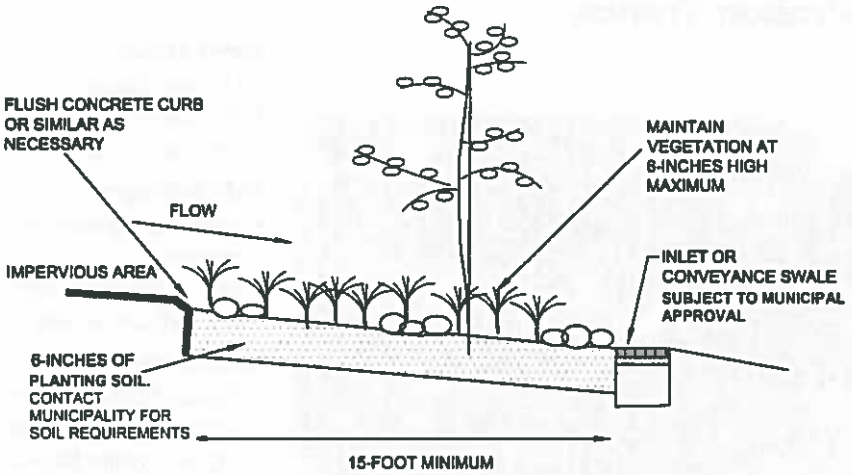


Figure 6-18: Plan View, Vegetated Buffer Strip



PLANTING SOIL WILL BE OF A MINIMUM DEPTH OF AT LEAST 6 INCHES.

15% MAXIMUM SLOPE, 2% MINIMUM SLOPE, 0.5% MINIMUM SLOPE WITH UNDERDRAIN.

LONGITUDINAL LENGTH = LONGITUDINAL LENGTH OF CONTRIBUTING AREA

STRIP SHALL BE FREE OF GULLIES OR RILLS.

Figure 6-19: Profile View, Vegetated Buffer Strip

6.5 Infiltration Trench

Figure 6-20: Infiltration trench. Source: CASQA, 2003

Best Uses
- Limited space
- Adjacent to roadways
- Landscape buffers

Advantages
- Increases groundwater recharge
- Removes suspended solids
- No surface outfalls

Limitations
- Susceptible to clogging; fails with no maintenance
- No high water tables
- Infiltration rate of existing soils must exceed 0.5 in/hr
- No steep slopes
- Drainage area less than 5 acres

An infiltration trench is a long, narrow, excavated trench backfilled with a stone aggregate, and lined with a filter fabric. Runoff is stored in the void space between the stones and infiltrates through the bottom and into the soil matrix. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of coarse sediment, which can clog and render the trench ineffective. Infiltration practices, such as infiltration trenches, remove suspended solids, particulate pollutants, coliform bacteria, organics, and some soluble forms of metals and nutrients from stormwater runoff. The infiltration trench treats the design volume of runoff either underground or at grade. Pollutants are filtered out of the runoff as it infiltrates the surrounding soils. Infiltration trenches also provide groundwater recharge and preserve base flow in nearby streams. Infiltration trenches have a high rate of failure where soil conditions are not suitable.

Design and Sizing Guidelines

DRAINAGE AREA AND SETBACK CONSIDERATIONS

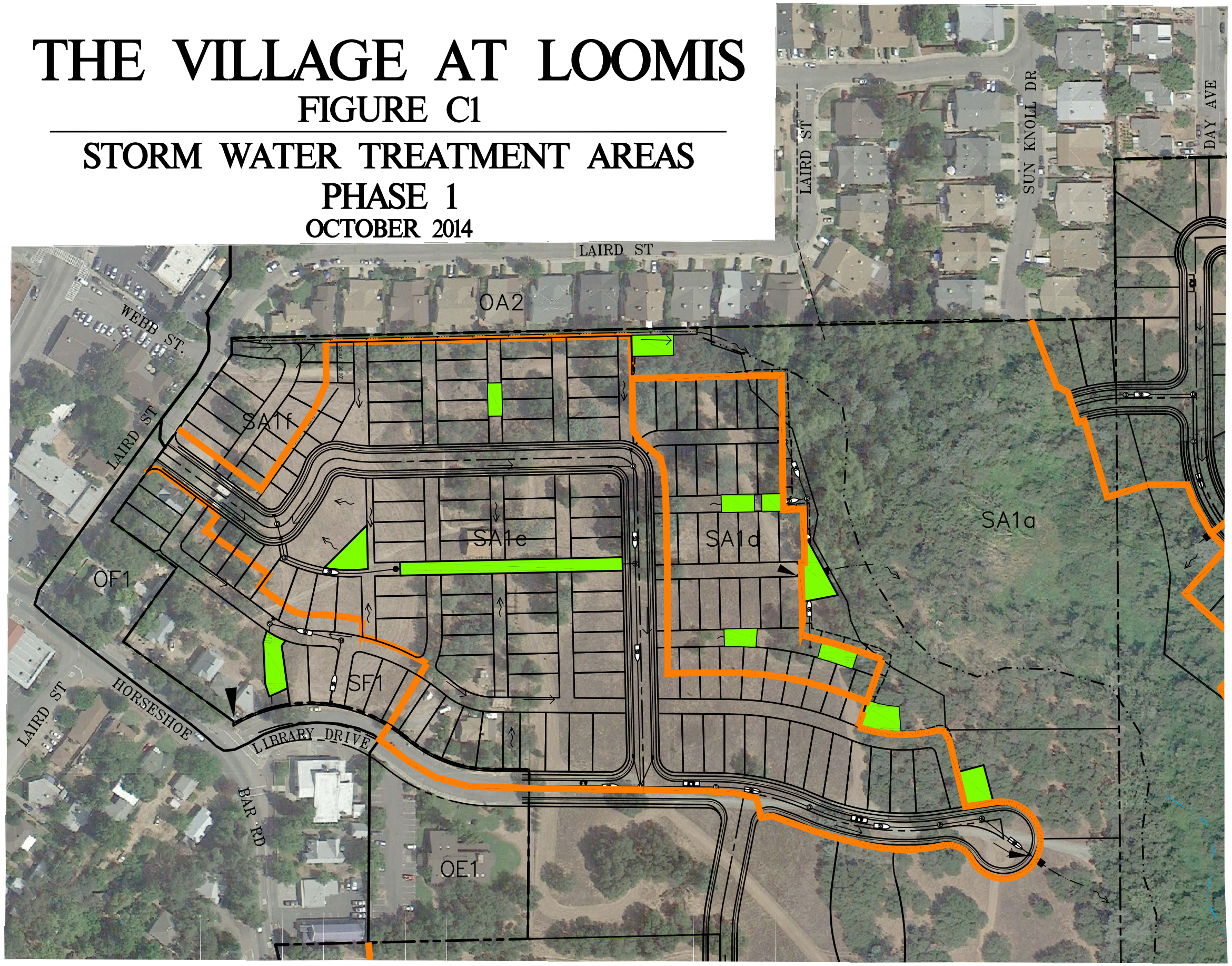
- When the drainage area exceeds 5 acres, other treatment measures shall be considered.
- Infiltration trenches work best when the upgradient drainage area slope is less than 5 percent. The downgradient slope shall be no greater than 20 percent to minimize slope failure and seepage.
- In-situ/undisturbed soils shall have a low silt and clay content and have percolation rates greater than 0.5 inches per hour. In-situ testing is required to confirm percolation rate of trench site. CASQA's BMP Handbook recommends against using infiltration trenches in Type C or D soils.
- There shall be at least 10 feet between the bottom of the trench and the groundwater table to prevent potential groundwater problems.
- Trenches shall also be located at least 100 feet upgradient from water supply wells.

THE VILLAGE AT LOOMIS

FIGURE C1

STORM WATER TREATMENT AREAS
PHASE 1

OCTOBER 2014



LEGEND

WATERSHED BOUNDARY

PROPERTY LINE

AREA RESERVED FOR STORMWATER TREATMENT

N

150 0 75 75 300

SCALE: 1" = 150

TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 110
ROSEVILLE, CA 95661 916.786.0685

L:\1proj\12xx\1221\dwg\Drainage\2014 REPORT\D1221WQ-ONSITE.dwg Oct 17, 2014 - 3:21pm - sfritz

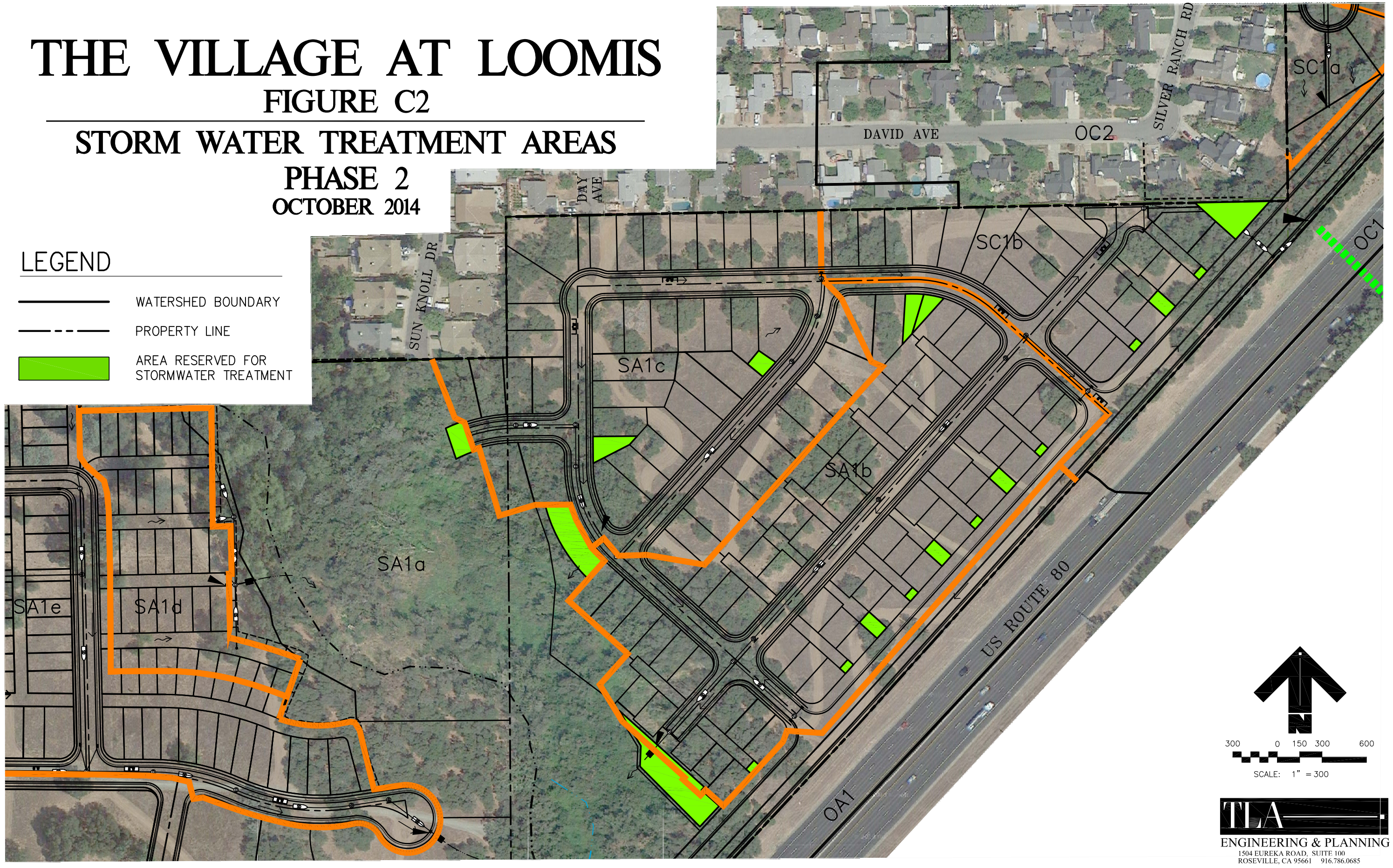
THE VILLAGE AT LOOMIS

FIGURE C2

STORM WATER TREATMENT AREAS

PHASE 2

OCTOBER 2014



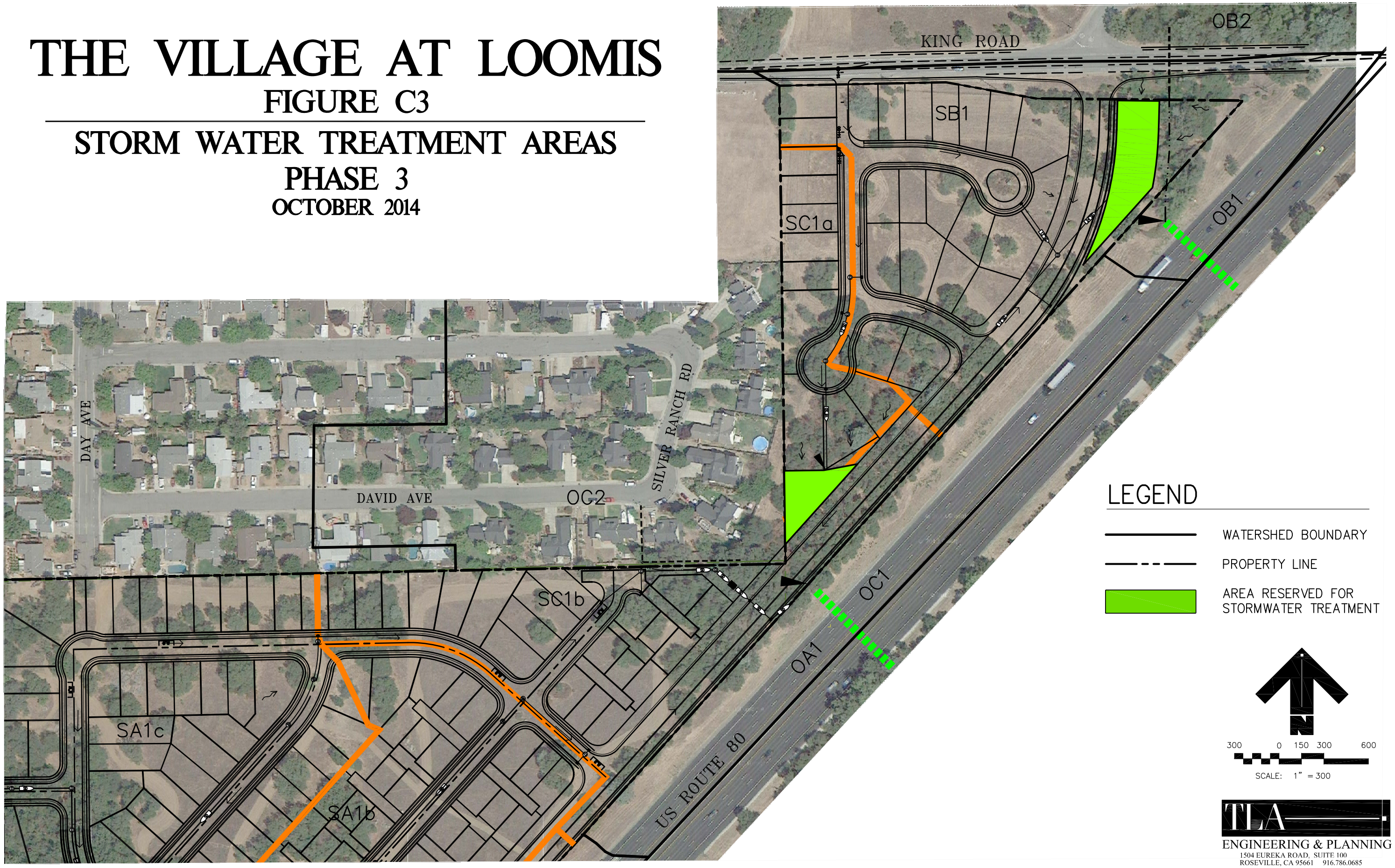
TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 100
ROSEVILLE, CA 95661 916.786.0685

L:\1proj\12xx\1221\dwg\Drainage\2014 REPORT\D1221WQ-ONSITE.dwg Oct 17, 2014 - 3:22pm - sfritz

THE VILLAGE AT LOOMIS

FIGURE C3

STORM WATER TREATMENT AREAS
PHASE 3
OCTOBER 2014



TLA
ENGINEERING & PLANNING
1504 EUREKA ROAD, SUITE 100
ROSEVILLE, CA 95661 916.786.0685

L:\1proj\12xx\1221\dwg\Drainage\2014 REPORT\D1221WQ-ONSITE.dwg Oct 17, 2014 - 3:23pm - sfritz

Tully & Young
Comprehensive Water Planning

Tully & Young, Inc.
3600 American River Drive, Suite 260
Sacramento, CA 95864

MEMORANDUM

To: Todd Lowell
Village at Loomis, LLC

Date: September 9, 2015

From: Greg Young
Kris Olof

Subject: Water Supply Analysis for The Village at Loomis

1.0 Introduction

The purpose of this memorandum is to detail the assessment of availability and sufficiency of potable water to serve the water demands of proposed The Village at Loomis development ("Proposed Project") in the Town of Loomis ("Town"), California. Potable water will be provided by the Placer County Water Agency ("PCWA") as part of PCWA's historic and continued retail water service to the Town. This analysis, therefore, relies upon information available from PCWA, including but not limited to PCWA's 2010 Urban Water Management Plan ("UWMP"), as adopted on June 16, 2011, as well as updated PCWA analysis of "equivalent dwelling units" (EDUs) as used for determining connection fees.

As the lead agency under the California Environmental Quality Act ("CEQA"), the Town is assessing the potential environmental impacts associated with the Proposed Project in the southwestern portion of Placer County. This memorandum has been prepared to support the CEQA analysis for the Proposed Project.

1.1 Applicability of Water Code 10910

Section 10912 of the California Water Code ("Water Code") requires the preparation and approval of a Water Supply Assessment ("WSA") for certain development projects. Triggers requiring the preparation of a WSA include, residential developments of more than 500 dwelling units, shopping centers or business establishments employing more than 1,000 persons or having more than 500,000 square feet of floor space, commercial office buildings employing more than 1,000 persons or having more than 250,000 square feet of floor space and projects that would

demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project.[1]

Two possible thresholds related to the Proposed Project are evaluated to determine if a WSA is triggered:

- a proposed residential development of more than 500 dwelling units; and
- a project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project.

While the Project is a residential development, its direct dwelling unit counts falls short of 500 units. The Proposed Project includes 436 residential dwelling units, ranging from medium density single-family lots to high-density multi-family lots (detailed later in this section). Thus the Project is more than 60 dwelling units shy of the trigger.

To test the second trigger, the overall water demand is analyzed to establish its equivalency to a 500 dwelling unit project. This analysis considers all project land uses shown in Table 1-1, i.e., residential, commercial, parks and streetscape. As detailed in this memorandum the Proposed Project has an estimated water demand of about 141 acre-feet annually. This demand can be translated to a dwelling unit equivalency using PCWA's represented value for "equivalent dwelling units" (EDUs) as used to assess infrastructure capacity and set Water Connection Charges that are levied on new developments.[2] According to PCWA, one equivalent dwelling unit – or EDU – uses 0.644 acre-feet per year, inclusive of the system losses that occur between the treatment plant and the customer's meter.[3] This represents PCWA's current average residential lot demand, determined to be between 7,001 and 10,000 square feet. For comparison, a lot ranging from 2,901 to 4,400 square feet is 60% of one EDU.

By dividing 0.644 af/du into the Proposed Project's estimated demand (see Section 2 for demand estimate details), the Proposed Project is equivalent to approximately 230 standard PCWA dwelling units. This equivalent value is much lower than the actual dwelling-unit count of 436 primarily because of the Proposed Project's smaller single-family lot size and significant number of multi-family units, which translate to dwelling units that are equivalent to less than one.

Thus, as represented above, the Proposed Project does not meet the threshold for requiring a formal WSA. However, the CEQA analysis will still need to evaluate the adequacy and potential impacts of water resources used to meet the Proposed Project's water needs. This memorandum provides a basis for the CEQA analysis to rely upon, assessing availability of PCWA water supplies in a manner similar to that required for a formal WSA.

This memorandum relies upon publicly available information published and adopted by PCWA.

---

[1] Water Code § 10912, subdivision (a).
[2] PCWA: Personnel and Administrative Manual, Chapter 4, Article 9, Section 40900 et seq.
[3] This value is calculated by PCWA using a maximum day demand of 1150 gallons per dwelling unit, divided by 2.0 (the max day to average day peaking factor), multiplied by 365 days and converted to acre-feet.

1.2 Water Supply Identified in Existing PCWA Documents

Although the Proposed Project does not require a WSA, this memorandum documents an evaluation of the PCWA UWMP and other adopted PCWA information in a fashion similar to that allowed for a formal WSA, which can be used to support the Town's CEQA process.

As a point of reference, the WSA statutes require that the lead agency (e.g. the Town) identify any water system that is or may become, as a result of serving the Proposed Project, a "public water system"[4] that may serve the project. In this instance, PCWA is the public water system serving the Proposed Project within the meaning of the law, as its retail water service area includes the Town. Though not required, this WSA directive can be used to guide the development of information for the CEQA process.

As allowed under Water Code Section 10910 (the statutes detailing requirements of a WSA):

> *"(c) (1) The city or county, at the time it makes the determination required under Section 21080.1 of the Public Resources Code, shall request each public water system identified pursuant to subdivision (b) to determine whether the projected water demand associated with a proposed project was included as part of the most recently adopted urban water management plan adopted pursuant to Part 2.6 (commencing with Section 10610).*
>
> *(2) If the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan, the public water system may incorporate the requested information from the urban water management plan in preparing the elements of the assessment required to comply with subdivisions (d), (e), (f), and (g)."*

As documented herein, the Proposed Project was found to be detailed within the UWMP, allowing PCWA's evaluation and conclusions of water supply availability and sufficiency in that adopted document to be used to evaluate the availability and sufficiency of water supplies to meet demands of the Proposed Project.

1.3 Proposed Project Description

The Proposed Project is a new development on about 66 acres located north of Interstate 80, south of King Road, and east of Horseshoe Bar Road (see **Figure 1-1**).

The Proposed Project will subdivide the 66 acres into four distinct residential areas/phases along with commercial space, parks, and open space. Phase A includes 143 alley-loaded residential units, commercial development, 125 multi-family housing units, two parks, and open space. Phase B consists of 60 traditional single-family housing units and open space (though on smaller

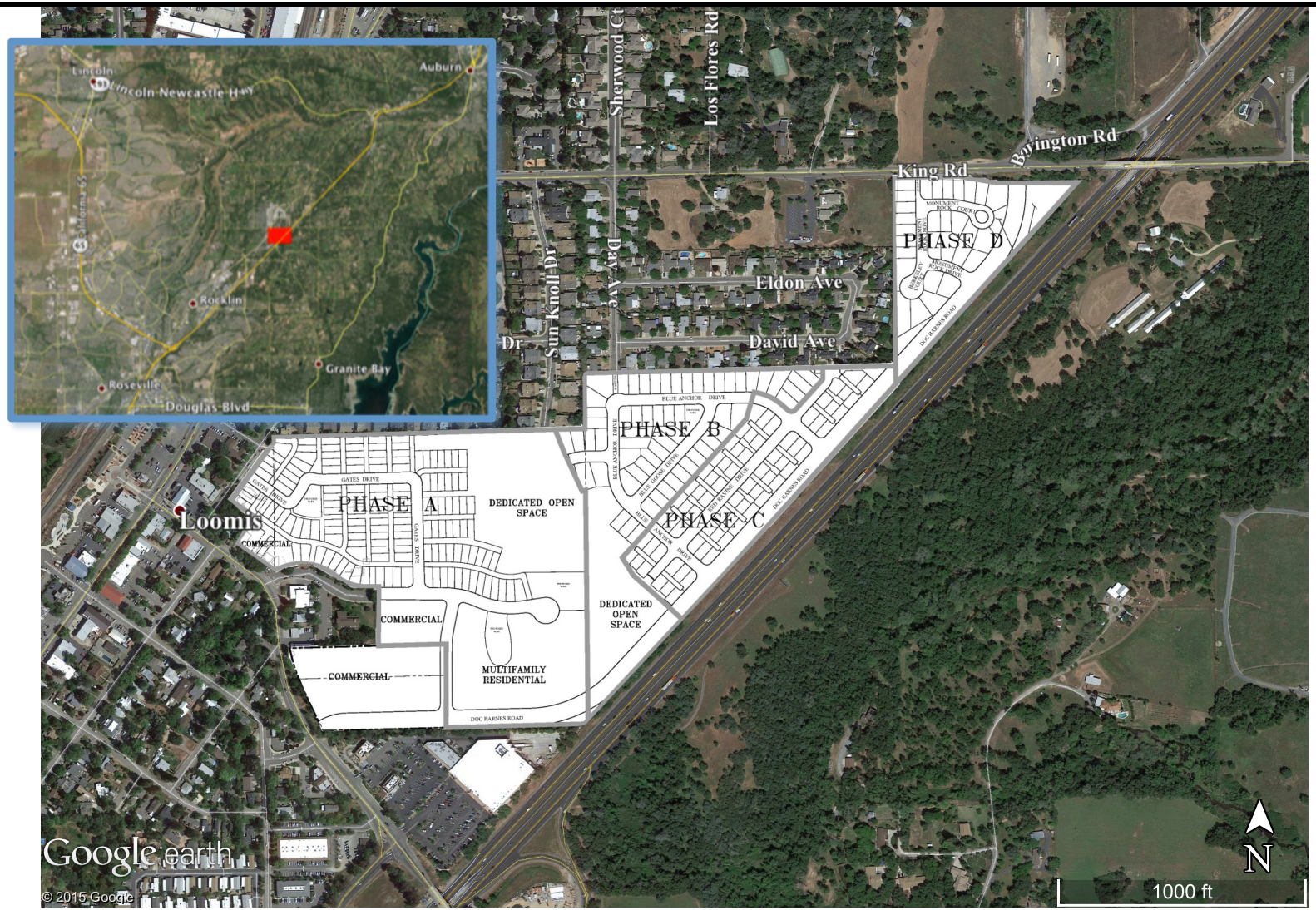
[4] A "public water system" is a system that provides water for human consumption that has 3,000 service connections.

lots than considered "traditional" by PCWA's standards). Phase C consists of 71 units of attached single-family housing on courts. Phase D includes the final 29 traditional single-family housing units and open space. **Table 1-1** summarizes the Proposed Project's land use acreages, dwelling unit counts, and lot sizes.

Table 1-1 – Summary of Project Land Uses and Acreages

Type of Use	Approximate Residential Lot Size (sf)	Planned Unit Count
Village Residential District – Alley Load Product	2600	143 Units
Village Single Family District – Traditional Product	5250	89 Units
Village Single Family District – Green Court	3550	71 Units
Village High Density – Multi-family Residential	n/a	125 Units
Village Mixed Use – Multi-family Residential	n/a	8 Units
Village Mixed Use – Office and Commercial / Retail	n/a	6.2 Acres
Parks	n/a	1.7 Acres
Streetscape	n/a	1.2 Acres

Figure 1-1 – Proposed Project Location and Land Uses
(source: Village at Loomis, LLC)



Tully & Young
Comprehensive Water Planning

Image Sources:
The Village at Loomis Site Plan - July 2014
Google Earth Pro - Licensed to Tully & Young, Inc.

2.0 Project Water Demand

This section describes the methodology, provides the supporting evidence, and presents the estimated annual water demands for the Proposed Project.

2.1 Determining Unit Water Demand Factors

As detailed in Section 1, the Proposed Project has specific residential and non-residential land-uses with defined residential lot-sizes and other characteristics. As these attributes vary among the types of proposed land-uses, so too will the water needs. To understand the water needs of the entire Proposed Project, unique demand factors that correspond with each unique land use are necessary. This subsection presents the methodology for determining the unit water demand factors that become the basis of the Proposed Project water demand estimates. Two distinct groups of demand factors are presented: (1) residential, and (2) non-residential.

Unique water demand factors used by PCWA for determining demands for its UMWP were used as a baseline for the Proposed Project's land-uses as described below, modified for a few land-uses to reflect the recent adoption by the State of a new Model Water Efficient Landscape Ordinance (MWELO) that becomes effective December 1, 2015.

2.2 PCWA Residential and Non-Residential Water Use Demand Factors

The PCWA 2010 UWMP uses demand factors for both residential and non-residential demand types developed by PCWA based on meter data of what is actually seen in their service area. Additionally, PCWA differentiates residential demands by more than a half dozen housing unit types providing for an accurate representation of most modern residential development types. PCWA then adjusts the measured demand factors to account for several factors. As stated in the UWMP:

> "*The future unit water demand factors are separated into two categories: (1) those for new construction, and (2) those for existing customers. The unit water demand factors for new construction were developed using the methods detailed in Appendix C-3. These factors reflect the impact from several recent changes, including, but not limited to, (1) a focus on new housing products with a greater house-to-landscape area ratio (e.g. large houses built on smaller lots, resulting in less landscaped area), (2) the State's Model Efficient Model Landscape Ordinance, and (3) the State's mandatory Green Building Standards Code (CAL Green Code), which will requires the installation of water-efficient indoor infrastructure for all new projects after January 1, 2011. The reflection of each of these on unit demand factors is detailed in Appendix C-3.*
>
> *The future demand factors for existing customers, however, represents anticipated reductions resulting from PCWA's conservation efforts and other externalities that will help reduce the unit demands (e.g. some conservation occurs without*

agency input such as the purchase of replacement water-using fixtures and appliances absent any PCWA rebate). The demand factors are provided for each land classification and by upper and lower areas of Zone 1 to account for the climate differences between Auburn and Roseville. Table 4-5 summarizes the future demand factors for Zone 1 for existing customers and new construction." (PCWA 2010 UWMP, Chapter 4, p. 4-8).

Table 2-1 provides the PCWA baseline demand factor for each residential and non-residential land-use category used to estimate the Proposed Project's water use. The PCWA demand factors are detailed in Table 4-5 of Chapter 4 of the UWMP.[5] This table also reflects a further adjustment from the PCWA baseline demand factors for non-residential uses to reflect the adoption of the State's new MWELO. Residential demand factors were not adjusted as they conservatively already represent the anticipated use even with the new MWELO requirements.[6]

Table 2-1 – PCWA Unit Water Demand Factors Applied to Proposed Project

Type of Use	Baseline Unit Water Demand (AF per Unit or Acre)	Adjustment To Baseline Factor	Annual Unit Water Demand (AF per Unit or Acre)
Village Residential District – Alley Load Product	0.20 AF/Unit	None	0.20 AF/Unit
Village Single Family District – Traditional Product	0.39 AF/Unit	None	0.39 AF/Unit
Village Single Family District – Green Court	0.32 AF/Unit	None	0.32 AF/Unit
Village High Density – Multi-family	0.18 AF/Unit	None	0.18 AF/Unit
Village Mixed Use – Multi-family	0.18 AF/Unit	None	0.18 AF/Unit
Village Mixed Use – Office and Commercial / Retail	2.17 AF/Acre	20% less	1.74 AF/Acre
Parks	3.76 AF/Acre	20% less	3.01 AF/Acre
Streetscape	3.76 AF/Acre	50% less	1.88 AF/Acre

2.3 Proposed Project Water Demand Projection

Combining the Proposed Project's land-use details as summarized in **Table 1-1** with the demand factors presented in **Table 2-1**, the water demands for the Proposed Project from initiation to build-out can be estimated. At completion, the Proposed Project is estimated to need approximately 128 acre-feet of water annually (prior to considerations of non-revenue water, described in the next subsection) and approximately 141 acre-feet when considering non-revenue water, as shown in **Table 2-2**.

[5] The 2010 PCWA UWMP can be accessed at: http://www.pcwa.net/files/docs/eng/PCWA_UWMP.pdf.

[6] The State's new MWELO (accessed at: http://www.water.ca.gov/wateruseefficiency/landscapeordinance/) focuses on further reducing the planting of turf for residential and non-residential developments. While a key factor in the residential "allowable water" calculation is reduced, which will affect the likely area planted to turf, the non-residential sector now has factors that essentially eliminate any use of turf (outside of playfields).

2.3.1 Non-Revenue Water Demands

The demand factors presented above represent the demand for water at the residential or non-residential customer meter for each category. To fully represent the demand on water resources, non-revenue water also needs to be included. Non-revenue water represents all of the water necessary to deliver to the customer accounts and reflects distribution system leaks, water demands from potentially un-metered uses such as fire protection, hydrant flushing, and unauthorized connections, and inescapable inaccuracies in meter readings.[7] In most instances, the predominant source of non-revenue water is from system leaks – the loss from fittings and connections from water sources through treatment plants, tanks, pumping plants, major delivery system back-bone pipelines, and community distribution systems. Because a significant portion of the delivery system used to bring water to the Proposed Project will be new, the percentage of non-revenue water is estimated to meet the 10 percent goal set forth by the American Water Works Association. The Proposed Project's water delivery system is expected to require an additional 13 acre-feet at build-out due to non-revenue water demands. Values in **Table 2-2** include the 10 percent loss factor.

Table 2-2 – Summary of Project Water Demands

Type of Use	Number of Units/Acres	Annual Unit Water Demand (AF per Unit or Acre)	Total Annual Water Demand (AF/Year) (Includes 10% loss factor)
Village Residential District – Alley Load Product	143 Units	0.20 AF/Unit	31.5
Village Single Family District – Traditional Product	89 Units	0.39 AF/Unit	38.2
Village Single Family District – Green Court	71 Units	0.32 AF/Unit	25.0
Village High Density – Multi-family	125 Units	0.18 AF/Unit	24.8
Village Mixed Use – Multi-family	8 Units	0.18 AF/Unit	1.6
Village Mixed Use – Office and Commercial / Retail	6.2 Acres	1.74 AF/Acre	11.9
Parks	1.7 Acres	3.01 AF/Acre	5.6
Streetscape	1.2 Acres	1.88 AF/Acre	2.5
	Total Estimated Water Use		**141 AF/Year**

[7] The American Water Works Association and the California Urban Water Conservation Council recognize the inherent non-revenue water that is either lost or not accounted for in urban treated water distribution systems and suggest purveyors strive for a value of 10% of all delivered water. Obtaining this value is dependent on numerous factors including the age and extent of distribution system infrastructure, meter rehabilitation programs, and how a purveyor accounts for actions such as fire flows and hydrant flushing.

3.0 Water Supply Availability

This section evaluates existing representations of water supply availability as detailed in the PCWA 2010 UWMP. As detailed in the UWMP, PCWA demonstrates sufficient water supplies are available during normal, single-dry, and multiple dry years.[8] This determination is based upon estimates of future water demand for PCWA's retail and wholesale customers. The Town is one of PCWA's retail customers, with PCWA serving all existing and planned potable water demands within the Town's boundaries. As such, PCWA estimated the Town's existing and future water demands as part of its considerations of water supply availability and reliability in its recent UMWP.

3.1 PCWA's Demand Estimate

Using existing customer data combined with available general plan and other land use documents, PCWA estimated the "existing" and "build-out" conditions for each of the various retail service areas it serves. For the Town, build-out conditions PCWA derived information from the Town's General Plan. **Table 3-1** presents the land-use conditions assumed by PCWA for purposes of its UWMP water supply availability analysis. Build-out values are inclusive of the existing values. This land use information was aggregated with other retail data and assumptions for PCWA's western service area and presented in Chapter 4 of the UWMP.

Table 3-1 – Town of Loomis Land Use Assumed by PCWA for 2010 UWMP

Type of Use	Existing (DU or Acres)	Build-out (DU or Acres)
Residential (# of DUs)		
High density 10.1-15 DU/Ac.	0	14
Medium density 7.1-10 DU/Ac.	25	41
Medium density 5.1-7 DU/Ac.	687	687
Low density 3.1-5 DU/Ac.	729	729
Low density 1.1-3 DU/Ac.	26	59
Low density 0.1-1 DU/Ac.	35	101
Rural Residential 1.1-2.3 Ac./DU	93	265
Rural Residential 2.31-4.6 Ac./DU	258	738
Rural Residential 4.61-10 Ac./DU	0	1
Total	**1,853**	**2,635**
Non-Residential (# of acres)		
Commercial	185	246
Industrial	6	114
Public	14	55
Total	**204**	**415**

The Proposed Project represents a subset of the Town's planned growth (see **Figure 3-1**).[9] To determine whether PCWA's UWMP water supply availability assessment is applicable, the

[8] See PCWA's 2010 UWMP, specifically Chapter 8, as available at: http://www.pcwa.net/files/docs/eng/PCWA_UWMP.pdf

[9] Note that the RS-7 and RS-10 land-use shown inside the "Proposed Project Location" circle already exist and are not part of the Proposed Project. See Figure 1-1 for the Proposed Project land use details.

planned land uses of the Proposed Project need to be compared with the land uses of the Town's General Plan for the same subarea. Based on a review of the Town's General Plan land use information, the Proposed Project subarea was planned to be a combination of:[10]

- **RS-5** – single family residential lots
- **CO** – Office Commercial
- **CG –** General Commercial

Because specific lot size information is not available from the Town's Land Use Map to be able to directly compare the Proposed Project's planned lots to the assumptions in the UWMP, this memorandum applies an average lot size to the subarea's RS-5 acreage. Using PCWA's unit water demand factors, an estimate of the build-out water demand for this subarea of the Land Use Map can be made (see **Table 3-2**). The estimated water demand for the Proposed Project's subarea of the Town's Land Use Map, as represented by PCWA, is compared with the Proposed Project's planned residential and non-residential details to evaluate if the Proposed Project's water demand exceeds that of the UMWP.

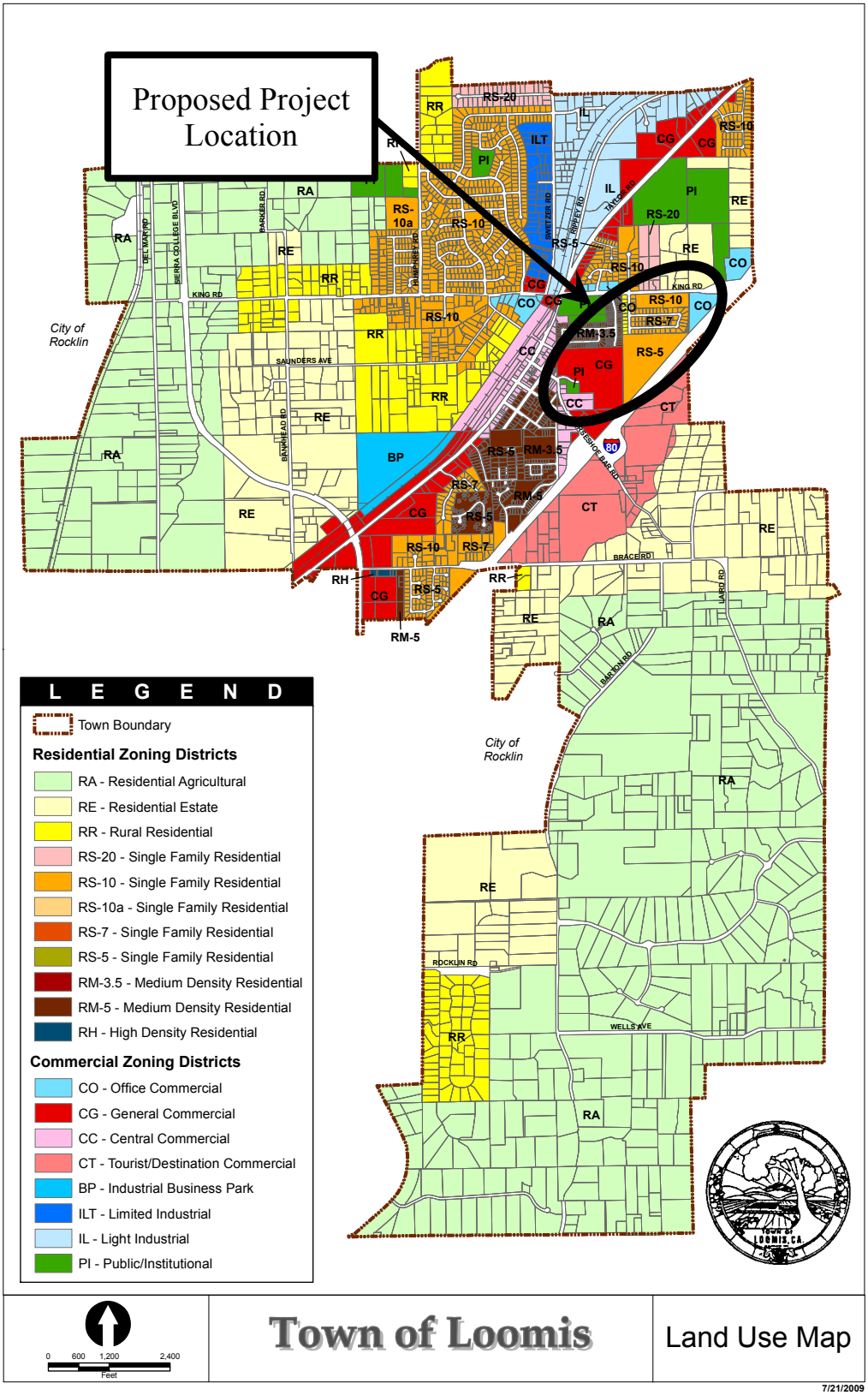
As detailed in **Table 2-2**, the Proposed Project estimates a demand for approximately 141 acre-feet annually. As shown in **Table 3-2**, PCWA estimated water demand for this subarea to be 165 acre-feet annually. Accordingly, the Proposed Project's water demand is approximately 24 acre-feet less than used in PCWA's UWMP sufficiency analysis.

Table 3-2 – PCWA's UWMP Representative Water Demand for Proposed Project Subarea

Type of Use	Number of Units/Acres	Annual Unit Water Demand (AF per Unit or Acre)	Total Annual Water Demand (AF/Year) (Includes 10% loss factor)
RS-5 – Single Family Residential	187 Units	0.39 AF/Unit	80.2
CO – Office Commercial	7.2 Acres	2.17 AF/Acre	17.2
CG – General Commercial	28.4 Acres	2.17 AF/Acre	67.8
	Total Estimated Water Use		**165 AF/Year**

[10] Town of Loomis Zoning Map dated 7/21/2009

Figure 3-1 – Town of Loomis General Plan Zoning Map
(source: Town of Loomis 2009 Zoning Map)



4.0 Conclusion of Sufficiency

Comparing the demand calculations for the PCWA 2010 UWMP with the new Proposed Project land use, there is sufficient supply accounted for in PCWA's 2010 UWMP to serve the Proposed Project. As detailed in UWMP, PCWA has sufficient water supplies to meet future demands in all conditions. Specifically, the UWMP concludes:

> "*For the planning horizon required for the Urban Water Management Planning Act (2030 for the 2010 Update), and even through 2035, PCWA will be able to fully meet the driest-year demands of all service areas*." (PCWA 2010 UWMP, Chapter 8, p. 8-5)

Therefore, PCWA will have sufficient supply to meet the Proposed Project's estimated 141 acre-feet per year water demand. The Proposed Project is predicted to consume about 24 acre-feet less per year than PCWA has allocated for the area. This represents a 15 percent reduction from the PCWA UWMP assumptions.