Appendix C

Preliminary Stormwater Control Plan

Preliminary Storm ater Control Plan
for the Del Webb at San uan Oa s Pro ect,

San Benito County, California

Prepared for:

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Preliminary Storm ater Control Plan for the Del Webb at San uan Oa s Pro ect, San Benito County, California

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1 INTRODUCTION

This report presents the preliminary Stormwater Control Plan (SWCP) for the Del Webb at San Juan Oaks project located in northwest San Benito County, California. The project proposes to construct a new community including approximately 1,099 single family residential units, an amenity center, neighborhood commercial area, resort hotel, and parks covering approximately 330 acres of a nearly 2,000 acre site.

Whitson Engineers requested that Balance Hydrologics, Inc. prepare a preliminary SWCP at an early stage of the project planning process to help guide the design in a manner that directly addresses potential impacts related to hydrology, water quality, and sediment. The plan will be refined during subsequent design stages to provide a more detailed accounting of how the San Juan Oaks project will provide a high level of protection to the watershed where the project is located.

The SWCP is intended to accomplish a number of goals, including the following:

- Summarize reference meteorological, geological, and soils information needed to describe the hydrologic setting of the site.
- Identify key opportunities and constraints that impact the stormwater management strategy for the site.
- Set forth clear objectives for the control of peak stormwater flows by evaluating on-site and off-site hydrologic conditions.
- Present the basis for, and calculations in support of, the initial sizing of critical elements in the storm drainage infrastructure.
- Identify opportunities for incorporating water-quality best management practices (BMPs) for treatment of the runoff from the site.
- Identify opportunities for managing sediment and debris flows to the project.

2 HYDROLOGIC SETTING

2 1 Geographic Description

The San Juan Oaks project site is located in northwest San Benito County, approximately 3 miles southwest of the City of Hollister as shown in Figure 1. The proposed project includes a series of parcels that total an area of 1,994 acres, of which less than 17 percent would be developed into new residential, commercial, and recreational uses. An illustration of the project site boundary with approximate extents of the proposed development is included as Figure 2 with a conceptual site plan prepared by Whitson Engineers as Figure 3.

The overall site topography is characterized by steep terrain descending from the eastern slopes of the Gabilan Range and transitioning along a series of alluvial fans extending northwest towards the San Juan Valley. The topography along the southern portion of the site is significantly influenced by the San Andreas Rift Zone that intersects the southern property boundary. The maximum elevation lies along the ridge northeast of the Rift Zone at an elevation of approximately 1,120 feet (NAVD-88), while the minimum elevation of 215 feet is found at the northwest corner of the site.

Land cover at the site is predominately grasses and scrub vegetation with spotted stands of trees that become more prevalent in the valleys within the southern portions of the site. The site is used primarily for cattle grazing with a corral located along the northwest boundary of the site. The northeast portion of the site includes an existing 18-hole golf course, driving range, clubhouse, and associated improvements.

2 2 Climate Characteristics

The climate characteristics of the site reflect the general Mediterranean climate zone typical of interior, central California. This climate zone is characterized by cool, relatively wet winters and hot, dry summers. Average rainfall conditions in this area are the statistical mean of rainfall totals that show a wide range of values strongly influenced by global weather patterns such as the El Niño Southern Oscillation and prolonged periods of drought. The mean annual rainfall at San Juan Oaks and the surrounding watersheds is estimated to be 15 inches based on rainfall mapping adopted by San Benito County as Figure 23.31.041(1) in their Code of Ordinances.

2 3 Soil Characteristics

The characteristics of the surficial soils underlying the project site are fundamental in understanding the hydrology of the site and the surrounding watersheds. Appendix A includes an illustration and brief description of the soil types found in the vicinity of the project as presented in the soil survey prepared by the National Resource Conservation Service. A more detailed description of the soils and geology of the site can be found in the geotechnical exploration report (ENGEO, 2013).

The soil survey indicates that the project site and surrounding watersheds generally consist of clays to the north, transitioning to clay loams and then sandy loams along the higher elevations to the south. Hydrologic soil groups range from A to D, with D having the highest runoff potential. The clay soils along the flatter, northern portions of the site where development is proposed are categorized as Hydrologic Soil Group D. Further up the slope to the south the soils are classified as Hydrologic Soil Group C with Hydrologic Soil Group B soils prevalent to the south of the San Andreas Rift Zone.

2 4 Regional Watershed Conte t

The regional hydrologic setting presents perhaps the most significant challenge to designing the drainage system for the project. Upstream from the project site are a number of hillside drainages that flow through the project area and ultimately discharge downstream from the northwest corner of the site. With the exception of the golf course and associated facilities, the upstream watersheds are largely undeveloped with a total area of 6.5 square miles (4,200 acres).

Runoff from the project site and upstream watersheds are conveyed through a series of downstream agricultural ditches that generally flow north and west past San Juan Bautista, ultimately discharging approximately 7 miles downstream to the San Benito River near the confluence with the Pajaro River. Figure 4 delineates the conveyance path from the project site to the San Benito River. The conveyance capacity of the drainage network downstream from the project site is generally limited in relation to the flow rates anticipated to be produced by the existing upstream watershed.

2 5 E isting Site Drainage Patterns

As mentioned previously, all surface runoff from the site during flood events, including a number of adjacent, off-site watersheds, currently discharges to a drainage ditch at the northwest corner of the subject property. A map of these drainages and associated watershed boundary is included as Figure 5. Along the eastern portion of the site, the upland watersheds are characterized by clearly defined flow paths that generally run from south to north and discharge towards the golf course. Prior to discharging to the golf course, most of these drainages flow through stormwater basins that were constructed to reduce flood flows and minimize sediment and debris delivered to the golf course.

Runoff is conveyed across the golf course through a series of open channels, underground storm drains, and golf course ponds. Most of the golf course ponds hold water year round and are used for irrigation purposes and to provide an aesthetic benefit to the golf course. Given the minimal storage capacity above the normal operating water level, these ponds are not anticipated to provide any significant level of flow control during flood events. Two possible exceptions to this assumption include the large stormwater basin (Basin E1) that was constructed to the northwest of the clubhouse and designed specifically to detain peak flood flows from the parking lot, and a relatively deep depression (Basin E2) located southeast of the golf course maintenance building that is anticipated to retain runoff during moderately sized flood events.

Most of the channels that flow onto and through the golf course discharge to a drainage ditch that flows along the northwest boundary of the project site. The southwest portion of the golf course and upslope drainages discharge into a well-defined channel that flows onto the series of shallow alluvial fans that cover the northwest portion of the site. As this channel flows west across the alluvial fans, it loses form and disperses flow across the shallow grass plain. During large storm events, these flows collect in an area of shallow ponding at the northwest corner of the site (Basin E0) that overtops into the same drainage ditch that conveys flows from the majority of the golf course.

3 STOR WATER ANAGE ENT OB ECTI ES

An overview of the management objectives of the proposed stormwater system at San Juan Oaks is useful in understanding the modeling and analyses associated with its design. These objectives were developed with careful attention to the policies outlined in the San Benito County Code of Ordinances and regulatory guidance put forth by the State and Regional Water Quality Control Boards. In addition to meeting these stipulated criteria, the project is committed to applying a more stringent stormwater management standard to provide further protections to on-site and downstream water bodies in respect to peak flow control, water quality treatment, and sediment control.

3 1 Control of Pea Storm ater Flo s

Increases in peak stormwater flows are often a concern related to development. These concerns are warranted if the development alters site hydrology to such an extent that peak flow rates are increased significantly and if the receiving waters are susceptible to impacts related to the increased flow. San Benito County addresses these issues through their Code of Ordinances, Title 23, Chapter 23.31, Article III Storm Drainage Design Standards. These standards focus on the 100-year design storm standard for the sizing of detention basins used to provide peak flow attenuation.

The proposed development at San Juan Oaks will not only meet this 100-year design storm standard, but is also committed to matching developed condition peak flow rates to existing condition peak flow rates for the 2- and 10-year design storm events. This conservative standard adopted by the project is intended to address the limited conveyance capacity in the receiving waters immediately downstream from the project site and to further mitigate for potential project impacts related to increased peak flow rates.

3 2 Storm ater uality anagement

The Storm Drainage Standards contained within the County Code of Ordinances indicate that proposed stormwater infrastructure shall be designed to meet the requirements of the State's Water Quality Control Board. The regulatory guidance put forth by the Water Board that sets the water quality design criteria for the San Juan Oaks project is the Construction General

Permit Order 2009-0009-DWQ. Post-construction design criteria contained in the permit are focused on addressing not only water quality impacts, but also reducing runoff during smaller storm events. The Board Order provides a Post-Construction Water Balance Performance Standard Spreadsheet that allows for the detailed accounting of practices and design elements such as porous pavement, tree planting, downspout disconnection, vegetated swales, landscaping soil quality, etc. to satisfy the criteria. The project is committed to addressing this criteria and to providing the required spreadsheet and supporting documentation as part of the General Permit application to the Water Board.

In addition to meeting the criteria contained within the Construction General Permit, the project plans on meeting the more stringent standards related to water-quality treatment control measures outlined in the California Stormwater Quality Association Stormwater Best Management Practice Handbook. More specifically the project intends to use either the flow or volume based BMP (Best Management Practice) design criteria from this document to size treatment controls such as rain gardens, in-ground planters, vegetated swales, and wet ponds. The project may also incorporate drain inserts and media filters in a limited number of constrained locations to meet the stated water quality objectives. By electing to apply this more stringent standard, the project is committed to providing additional mitigation for water quality impacts that are comparable to other jurisdictions within the Bay Area and Central Coast California.

3 3 Sediment and Debris Control

Although no specific regulatory guidance has been identified that addresses sediment and debris control design criteria, the project intends to provide infrastructure to reduce the impacts of sediment and debris delivery from the upslope watersheds and minimize sediment deposition within the proposed stormwater infrastructure at the site and along the downstream receiving waters.

4 STOR WATER ANAGE ENT CONSTRAINTS AND OPPORTUNITIES

The background information presented in Section 2 alludes to several of the most significant constraints and opportunities in regards to developing stormwater controls at the site and meeting the stated stormwater management objectives. These include several important considerations listed below.

4 1 Storm ater anagement Constraints

Downstream conveyance limitations. The drainage network downstream from the project site has limited conveyance capacity that has prompted the project to adopt more stringent peak flow attenuation standard including 2-, 10-, and 100-year design storm events.

Off-site run-on. Portions of the project site that are proposed to be developed receive run-on from undeveloped portions of the site as well as from adjacent drainages. The total watershed area that will need to be routed through the northwest portion of the site is approximately 6.5 square miles (approximately 12 times larger than the 330 acres proposed for development).

Upslope sediment and debris delivery. The upslope drainages are anticipated to deliver sediment and debris to the proposed developed areas within the project site during moderate to large storm events. If unaddressed, sediment and debris could deposit within the proposed stormwater infrastructure and along the receiving waters downstream from the project.

Low permeability soils. The proposed developed portions of the site are characterized by soils that have relatively low permeability (Hydrologic Soil Group D) precluding the use of infiltration based stormwater management strategies.

4 2 Storm ater anagement Opportunities

Low rainfall totals and intensities. The mean annual precipitation at the site is roughly 15 inches, an indicator of a relatively dry climate consistent with the watershed location on the lee side of the Gabilan Range. The related volume of rainfall in individual storm events as well as the peak rainfall intensities will be similarly muted. The net result is that less volume and lower flow rates will need to be accommodated to meet runoff treatment goals.

Low permeability soils. Also listed as a constraint, the low permeability soils within the developed portions of the site will limit the impacts of newly added impervious area on peak runoff rates from the project site.

Higher permeability off-site soils. The watershed areas upslope from the portions of the site proposed for development are generally characterized by soils that have moderate to high permeability, reducing the magnitude and volume of the flows that need to be routed through the proposed project stormwater infrastructure.

Favorable topography. The site topography lends itself to a grading plan that takes advantage of a limited number of points of concentration where "end of pipe" treatment controls can be located.

Land use plan. The current land plan contains clustered development areas with ample adjacent acreage that is suitable for siting treatment measures.

Golf course basins. A number of existing stormwater and sediment control basins located upstream from the existing golf course have the potential to be expanded and modified as needed to meet the stormwater management objectives for the project.

5 CONTROL OF PEA STOR WATER FLOWS

5 1 Selection and Design of Flo Control Facilities

Peak flow attenuation objectives for the San Juan Oaks project are proposed to be met through a number of stormwater detention basins that are included as a part of the overall stormwater control plan. Within the current site plan 24 separate stormwater basins have been identified, although the exact number and configuration of these basins is subject to change as the overall project design is refined. A map identifying the initially proposed locations and general scale of the stormwater basins is included as Figure 6. These basins will be designed to match post-project peak flow rates to pre-project levels for the 2-, 10-, and 100-year storm events at a point of compliance set in the drainage ditch near the northwest corner of the project site.

5 2 Overvie of the Basin Si ing ethodology

Preliminary sizing estimates of the detention volume required within the stormwater basins was completed using a hydrologic model as allowed for in the Storm Drainage Standards contained within the County Code of Ordinances. Since detailed guidance related to hydrologic modeling methodology is not provided in the Storm Drainage Standards, guidance contained in the Santa Clara County Drainage Manual was adopted for this purpose. This document was selected due in large part to the standard methodologies employed by the manual and the similarities between the hydrologic characteristics of the San Juan Oaks project site to large portions of southern Santa Clara County.

Due to the conceptual nature of the site plan at this stage of project entitlements, a number of simplifying assumptions were made to complete the preliminary basin sizing analysis. Foremost among these assumptions is that the 21 basins proposed to be located within the residential development west of the golf course (3 additional basins are proposed within the golf course) were consolidated into 4 representative basins (approximately consistent with proposed project phasing) for purposes of the analysis. This assumption allows for a preliminary sizing estimate of the total detention volume required at the site to be provided, but does not require detailed designs for the individual basins to be developed at this early project planning phase.

5 3 odeling Structure and Assumptions

The Army Corps of Engineers' HEC-HMS software package was used to complete the hydrologic modeling for the San Juan Oaks project. Modeled scenarios were developed for pre- and post-project conditions and were run for the 2-, 10-, and 100-year design storms. As with all hydrologic modeling, a number of assumptions were needed to approximate the actual physical conditions that would prevail. These include the following:

Design Storm Depth and Distribution. Mean annual precipitation at the project site was determined to be 15 inches from San Benito County's Isohyetal Map contained in the Code of Ordinances. This value was used to select the 24-hour storm event rainfall distribution pattern from the Santa Clara County Drainage Manual and calculate depths of 1.8, 3.0, and 4.5 inches for the 2-, 10-, and 100-year design storms. Graphs of the modeled design storms are included as Figure 7.

Watershed Areas. Watershed boundaries were delineated from topographic information provided by Whitson Engineers. 15 sub-watersheds were modeled for the pre-project site conditions and are delineated on Figure 8. 21 sub-watersheds were modeled for the post-project site conditions and are delineated on Figure 9. Areas for modeled pre- and post-project sub-watersheds are summarized on Tables 1 and 2.

Curve Number. The hydrologic modeling uses the SCS unit hydrograph methodology, which accounts for rainfall losses through use of Curve Numbers. The Curve Numbers for the modeled sub-watersheds were selected from the Curve Number Table contained in the Drainage Manual assuming a land use type of grassland in good condition for undeveloped areas and high density residential for proposed developed areas. Curve Numbers were adjusted based on the area-weighted percentage of Hydrologic Soil Group type within each sub-watershed and again adjusted to reflect an Antecedent Moisture Condition of 2.5. Curve Numbers for pre- and post-project modeled sub-watersheds are summarized on Tables 1 and 2.

Impervious Area. Impervious areas for pre-project sub-watersheds were estimated from aerial photographs. Developed areas within the post-project sub-watersheds were assumed uniformly 65 percent impervious. Impervious area percentages for pre- and post-project modeled sub-watersheds are summarized on Tables 1 and 2.

Basin Lag. Basin lag was calculated using the SCS lag equation as recommended in the Drainage Manual. Longest flow paths and sub-watershed centroids used to parameterize the equation are illustrated on Figures 8 and 9 and summarized along with the calculated basin lag times on Tables 1 and 2.

Routing Lengths. Phasing between the sub-watersheds was accounted for in the model through routing elements defined using the Muskingum-Cunge routing method. Routing lengths for pre- and post-project conditions are illustrated on Figures 8 and 9 and summarized along with other routing parameters on Tables 3 and 4. Schematics of the pre- and post-project condition model builds including the routing lengths are included as Figure 10.

Basins. Six existing basins (Basins E0, E1, E2, E3, E4, and E5) located in the vicinity of the golf course and identified on Figures 8 and 9 were included in the analysis and parameterized in the model using stage-storage-discharge relationships. The stage-storage-discharge relationships and supporting calculations are included in Appendix B. Six additional basins (Basins A1, A2, A3, A4, G1, and D2) were added to the post-project conditions model with stage-storage-discharge relationships and supporting calculations included as Appendix C. Additionally, the existing conditions basin located to the northwest of the club house (Basin DE1) was assumed to be expanded as part of the post-project condition with stage-storage-discharge relationships and supporting calculations included with Appendix C.

5 4 odel Results

Modeled peak flow rates in the drainage ditch at the northwest corner of the project site for pre-project conditions are estimated as 79, 279, and 842 cubic feet per second (cfs) for the 2-, 10-, and 100-year design storm events respectively. These values can be compared to the post-project conditions at that same location with estimated peak flow rates of 79, 268, and 789 cfs for the 2-, 10-, and 100-year design storm events respectively. These peak flow rate values are summarized on Table 5 with the associated flow hydrographs plotted on Figure 11. Detailed modeling output from the HEC-HMS model is included as Appendix D.

In summary the preliminary sizing analysis indicates that a combined additional detention volume of 63 acre-feet would satisfy the objective to match post-project peak flow rates to pre-project levels across a range of design storms at the terminal discharge location from the project site. As the site plan for the San Juan Oaks project is refined and detailed basin designs developed, a more comprehensive analysis will be completed that accounts for the stormwater basins on an individual basis. In the event that additional detention volume is determined to be required, the project may elect to expand and modify additional basins located throughout the golf course.

6 STOR WATER UALITY TREAT ENT

In light of the opportunities and constraints that exist at the project site, developing an effective BMP framework requires implementing a number of practices specific to the site conditions. The BMP framework will be based on a hierarchical approach advocated by stormwater quality regulators. The hierarchical approach has the following levels:

- *Level I – Site Design*. One of the key elements of the SWCP for the project will be incorporating appropriate site design elements that enhance efforts to limit water quality impacts. Properly implemented features in essence "set the stage" for an effective plan by establishing a land use pattern that limits the amount of directly connected impervious areas to the greatest extent practicable.

- *Level II – Source Control*. Another of the primary focuses of this plan is a strong and broad-based source control program. This approach capitalizes on the fact that it is generally more effective, both in impacts and costs; to prevent or limit constituents of concern from being released than it is to remove them from the environment once they have been mobilized.

- *Level III – Treatment Controls*. The term "treatment controls" refers to those BMPs that are designed to reduce constituents of concern once they have been mobilized in stormwater runoff. They are generally seen as a "last line of defense" in the overall suite of BMPs that are employed. Treatment controls are generally considered necessary BMPs since even the most aggressive site design and source control programs cannot guarantee that constituents of concern will not be mobilized from the site.

6 1 Site Design Elements

The primary goal of water-quality sensitive site design is to limit the amount of directly connected impervious area within the development envelope. Limiting directly connected impervious area promotes infiltration (though modestly in areas with low permeability), increases times of concentration within sub-basins and reduces runoff volumes. Additionally, lower impervious area generally leads to increased amounts of space that can be dedicated to landscaping and open space uses that limit the introduction of pollutants to the environment and can filter out pollutants that already have been mobilized.

Specific site design features that will be included to the maximum extent practicable include the following:

Reduced street widths. The project proposes to use the minimum street widths compatible with safety of the residents and in conformance with the requirements of San Benito County.

Residential lot design. All residential lots will be graded to drain towards the street so that runoff from individual homes is routed through treatment controls. Additional lot design measures will include holding driveway widths to the minimum necessary for achieving vehicle access and parking goals.

Trash collection areas. The project is proposed to include a commercial component, community center, and resort hotel. All dumpsters serving these areas will be covered to prevent rainfall from mobilizing pollutants.

Dedicated open-space. Approximately 68 percent of the project site will remain as permanent wildlife habitat and open space common areas.

6 2 Source Control Elements

The source control program will incorporate the following strategies:

Education and outreach. One proven tactic in terms of educating the community is the marking of storm drain inlets and collection points to indicate that runoff can directly impact receiving waters. At these sites, such markings may be along the lines of "Drains to the San Benito River" or "Drains to Monterey Bay".

Regular street sweeping. Regular street sweeping can have a significant impact on the control of such constituents of concern as trash and debris, particulates, and heavy metals. The project is committed to implementing a regular street sweeping program.

6 3 Guidelines for Treatment Control Elements

Treatment control is generally considered necessary as a final element in water-quality protection even when the use of approved site planning and source control BMPs is maximized. Pollutants typically found in urban runoff include household and lawn-care chemicals (insecticides, herbicides, fungicides and rodenticides), heavy metals (i.e., copper, lead, zinc, cadmium, mercury), oils and greases, nutrients (nitrogen and phosphorus), and coliform bacteria.

As mentioned previously, the San Juan Oaks project is committed to meeting the more stringent standards related to water-quality treatment control measures outlined in the California Stormwater Quality Association Stormwater Best Management Practice Handbook. While the individual treatment control elements will be defined at a more detailed design phase of the project, the following elements are anticipated to be incorporated into the site plan.

Bioretention basins. The primary treatment control measure for the project will likely be provided in the form of bioretention basins located along the bottom of the stormwater basins planned throughout the site. Bioretention basins function as a soil and plant-based filtration device consisting of a shallow ponding layer, mulch and planting layer, permeable soil layer, and an underdrained gravel layer.

In-ground planters. In-ground planters are nearly identical to bioretention basins with the exception that the edge treatment typically consists of concrete curbs in place of earthen slopes. These features will be considered for placement along landscaped areas and within rights-of-way or parking lots, in locations where pedestrian safety will not be compromised.

Vegetated swales. Vegetated swales are channels of shallow depth and at a shallow slope that provide treatment by filtering runoff through grasses or other vegetation and by infiltrating runoff through a permeable soil layer. Vegetated swales may be utilized within the rights-of-way along stretches of roadways that are uninterrupted by driveways and where pedestrian safety will not be compromised.

Wet ponds. Wet ponds will be considered for use in areas that cannot meet the water quality treatment objectives adopted by the project using the previously described treatment controls. Wet ponds are constructed basins that have a permanent pool of water throughout the year and provide treatment by settling out pollutants through the water profile and uptake of pollutants through aquatic vegetation. Due to their typical depths, wet basins typically require a smaller footprint compared to other treatment controls.

7 SEDI ENT AND DEBRIS CONTROL

The San Juan Oaks project is committed to providing the necessary controls to minimize the delivery of sediment and debris from upslope areas to the stormwater infrastructure proposed with the project and the receiving waters downstream from the site. Similar to the existing sediment control approach utilized by the golf course, the proposed project will be designed to include a depressed sediment retention area within a number of the stormwater basins located at the base of the larger upslope drainages. Although the scale of these facilities has not been determined at this phase of the project, it is understood that smaller facilities will require more frequent maintenance and larger facilities will require less frequent maintenance. Ultimately, through a combination of infrastructure and regularly scheduled maintenance, the project is committed to minimizing the impacts of sediment and debris deposition on the continued functioning of the downstream stormwater infrastructure.

8 LI ITATIONS

This report was prepared in general accordance with the accepted standards of practice in surface-water hydrology and stormwater management existing in Northern California for projects of similar scale at the time the investigations were performed. No other warranties, expressed or implied, are made.

Concepts, findings and interpretations contained in this report are intended for the exclusive use of the project specified and for the purposes discussed therein, under the conditions presently prevailing except where noted otherwise. Their use beyond the boundaries of the site could lead to environmental or structural damage, and/or to noncompliance with policies, regulations or permits. They should not be used for other purposes without great care, updating, review of analytical methods used, and consultation with Balance staff familiar with the project site.

As is customary, we note that readers should recognize that the interpretation and evaluation of factors affecting the hydrologic context of any site is a difficult and inexact art. Judgments leading to conclusions and recommendations are generally made with an incomplete knowledge of the conditions present. More extensive or extended studies, including hydrologic baseline monitoring, can reduce the inherent uncertainties associated with such studies. We note, in particular, that many factors affect local and regional issues related to the management of stormwater from both a quantity and quality perspective. We have used standard environmental information -- such as rainfall, topographic mapping, and soil mapping -- in our analyses and approaches without verification or modification, in conformance with local custom. New information or changes in regulatory guidance could influence the plans or recommendations, perhaps fundamentally. As updated information becomes available, the interpretations and recommendations contained in this report may warrant change.

To aid in revisions, we ask that readers or reviewers who have additional pertinent information of new plans, data or other information, who have observed changed conditions, or who may note material errors should contact us with their findings at the earliest possible date, so that timely changes may be made.

REFERENCES

California Stormwater Quality Association, 2003, Stormwater best management practice handbook: new development and redevelopment.

ENGEO, 2013, Geotechnical Exploration, San Juan Oaks, Report prepared for San Juan Oaks, LLC.

National Resources Conservation Service, 2013, Web Soil Survey- San Benito County.

Santa Clara County, 2007, Drainage Manual.

Soil Conservation Service, 1972, National Engineering Handbook, Section 4, Hydrology.

State Water Resources Control Board, 2010, 2009-0009-DWQ as amended by 2010-0014-DWQ- Construction General Permit.

TABLES

Table 1. Pre-project sub-watershed modeling parameters

		Curve Number Calculations								Time Lag Calculations						
		Hydrologic Soil Group				Land Cover										
Watershed	Area	A	B	C	D	Grassland	High Den Res	Imperv Area	Curve Number	N	Length	Length-c	Delta Elev	Slope	D	Time lag
-	*sq mi*	*%*	*%*	*%*	*%*	*%*	*%*	*%*	-	-	*miles*	*miles*	*ft*	*ft/mile*	*hr*	*minutes*
A	0.6213	0	0	0	100	100	0	0	83	0.080	1.713	0.525	300	175	0.04	35
B1	0.6495	0	55	18	27	100	0	0	69	0.080	1.731	0.834	915	529	0.04	33
B2	0.0578	0	0	22	78	100	0	0	81	0.080	0.494	0.272	505	1022	0.04	11
B3	0.0462	0	0	0	100	100	0	0	83	0.080	0.356	0.137	305	858	0.04	8
C	0.1731	0	0	21	79	100	0	0	81	0.080	0.692	0.351	570	824	0.04	15
D	0.7275	0	4	51	45	100	0	0	79	0.080	1.687	0.863	860	510	0.04	34
E	0.1698	0	0	10	90	100	0	5	82	0.050	1.084	0.464	150	138	0.04	18
F	0.3042	0	22	27	51	100	0	1	76	0.080	1.320	0.740	345	261	0.04	33
G	0.1063	0	0	72	28	100	0	1	78	0.080	0.832	0.357	60	72	0.04	27
H	0.0799	0	0	84	16	100	0	0	78	0.080	0.844	0.439	95	113	0.04	27
I	0.7125	0	21	69	10	100	0	0	74	0.080	1.787	0.739	920	515	0.04	33
J	1.2671	6	94	0	0	100	0	0	59	0.080	2.063	0.827	1495	725	0.04	34
K	0.0905	0	0	78	22	100	0	0	78	0.080	0.600	0.303	510	850	0.04	13
L	0.7562	0	38	61	1	100	0	0	70	0.080	2.009	0.998	1225	610	0.04	37
M	0.7849	0	13	82	5	100	0	0	74	0.080	1.781	0.802	870	488	0.04	34

Notes
- Hydrologic soils group information provided through NRCS soils mapping
- Land cover definitions assigned and curve number calculations completed per the Santa Clara County Drainage Manual.
- Time lag calculations completed per the Santa Clara County Drainage Manual.
- Model parameters extracted from the workmap included as Figure 8.

Table 2. Post-project sub-watershed modeling parameters

		Curve Number Calculations								Time Lag Calculations						
		Hydrologic Soil Group				Land Cover										
Watershed	Area	A	B	C	D	Grassland	High Den Res	Imperv Area	Curve Number	N	Length	Length-c	Delta Elev	Slope	D	Time lag
-	*sq mi*	*%*	*%*	*%*	*%*	*%*	*%*	*%*	*-*	*-*	*miles*	*miles*	*ft*	*ft/mile*	*hr*	*minutes*
A1	0.1194	0	0	0	100	0	100	65	83	0.038	0.864	0.277	95	110	0.04	10
A2	0.1650	0	0	0	100	0	100	65	83	0.038	0.675	0.303	50	74	0.04	10
A3	0.0851	0	0	0	100	0	100	65	83	0.038	0.923	0.434	65	70	0.04	14
A4	0.1344	0	0	0	100	0	100	65	83	0.038	0.903	0.529	25	28	0.04	18
B1	0.6655	0	54	17	29	100	0	0	69	0.080	1.733	0.826	915	528	0.04	33
B2	0.0642	0	0	20	80	100	0	0	81	0.080	0.539	0.291	515	955	0.04	12
B3	0.0617	0	0	0	100	100	0	0	83	0.080	0.356	0.088	305	858	0.04	6
C1	0.2170	0	0	17	83	100	0	0	81	0.080	0.692	0.295	570	824	0.04	14
C2	0.0234	0	0	0	100	100	0	0	83	0.080	0.229	0.124	215	937	0.04	6
D1	0.7000	0	4	53	43	100	0	0	79	0.080	1.657	0.858	855	516	0.04	33
D2	0.0367	0	0	0	100	44	56	36	82	0.038	0.313	0.108	105	335	0.04	3
E	0.1647	0	0	10	90	85	11	12	79	0.038	0.977	0.427	150	153	0.04	12
F	0.3034	0	22	27	51	90	9	9	75	0.080	1.320	0.740	345	261	0.04	33
G1	0.0215	0	0	38	62	0	100	65	80	0.038	0.482	0.221	40	83	0.04	7
G2	0.0930	0	0	76	24	100	0	0	78	0.080	0.832	0.357	55	66	0.04	27
H	0.0808	0	0	83	17	97	6	4	79	0.080	0.844	0.439	95	113	0.04	27
I	0.7125	0	21	69	10	100	0	0	74	0.080	1.787	0.739	920	515	0.04	33
J	1.2671	6	94	0	0	100	0	0	59	0.080	2.063	0.827	1495	725	0.04	34
K	0.0905	0	0	78	22	100	0	0	78	0.080	0.600	0.303	510	850	0.04	13
L	0.7562	0	38	61	1	100	0	0	70	0.080	2.009	0.998	1225	610	0.04	37
M	0.7849	0	13	82	5	100	0	0	74	0.080	1.781	0.802	870	488	0.04	34

Notes
- Hydrologic soils group information provided through NRCS soils mapping
- Land cover definitions assigned and curve number calculations completed per the Santa Clara County Drainage Manual.
- Time lag calculations completed per the Santa Clara County Drainage Manual.
- Model parameters extracted from the workmap included as Figure 9.

Table 3. Pre-project channel rounting modeling parameters

Name	Length	Delta Elev	Slope	n	Width	Side Slope
-	*ft*	*ft*	*ft/ft*	-	*ft*	-
R-B1	2421	35	0.014	0.06	6	6
R-B2	3112	35	0.011	0.06	6	6
R-B3	2992	30	0.010	0.06	6	6
R-C	4106	45	0.011	0.06	6	6
R-D	6223	40	0.006	0.06	12	6
R-BE1	6545	30	0.005	0.06	4	4
R-F	6808	40	0.006	0.06	4	4
R-G	302	5	0.017	0.06	6	4
R-BE2	2228	40	0.018	0.06	4	4
R-BE3	3684	70	0.019	0.06	4	4
R-J	7913	700	0.088	0.06	4	4
R-BE4	3993	80	0.020	0.06	4	4
R-BE5	574	20	0.035	0.06	6	4
R-JM	6854	105	0.015	0.06	4	4

Notes
- Modeling parameters calculated per the Santa Clara County Drainage Manual for use with the Muskingum Cunge Routing Method
- Model parameters extracted from the workmap included as Figure 9.

Table 4. Post-project channel rounting modeling parameters

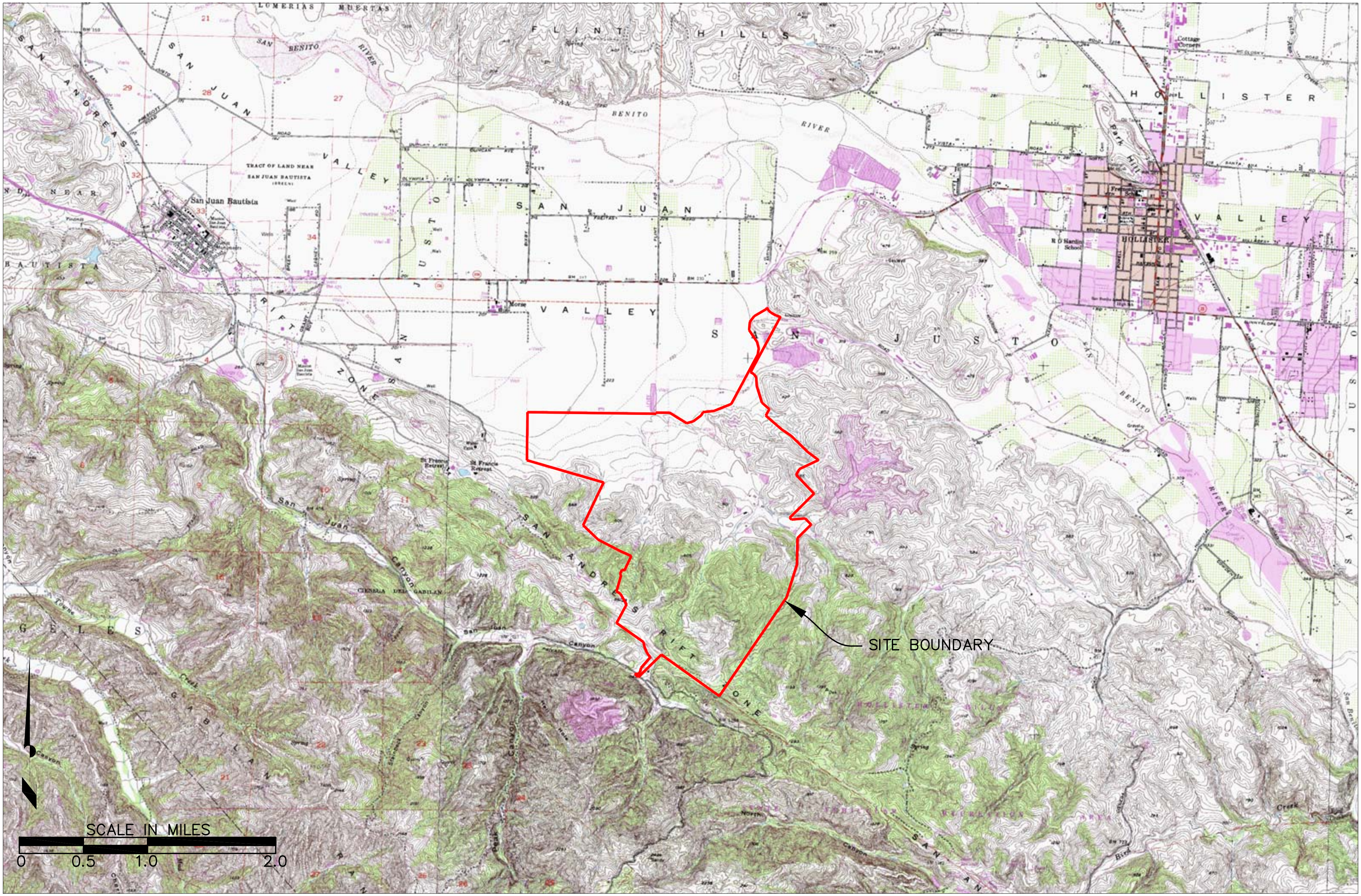
Name	Length	Delta Elev	Slope	n	Width	Side Slope
-	*ft*	*ft*	*ft/ft*	-	*ft*	-
R-JA1	1388	5	0.004	0.04	12	4
R-JA2	1697	5	0.003	0.04	12	4
R-JA3	1627	5	0.003	0.04	12	4
R-B1	2087	25	0.012	0.04	8	4
R-B2	3822	20	0.005	0.04	8	4
R-B3	4233	25	0.006	0.04	8	4
R-C1	3369	40	0.012	0.04	8	4
R-C2	3140	50	0.016	0.04	8	4
R-D	2764	35	0.013	0.04	8	4
R-D2	1652	35	0.021	0.06	8	4
R-BE1	6856	15	0.002	0.06	8	4
R-F	459	5	0.011	0.06	12	4
R-JG1	1715	20	0.012	0.06	12	4
R-G2	696	10	0.014	0.06	8	4
R-BE2	2228	40	0.018	0.06	4	4
R-BE3	3684	70	0.019	0.06	4	4
R-J	7913	700	0.088	0.06	4	4
R-BE4	3993	80	0.020	0.06	4	4
R-BE5	574	20	0.035	0.06	6	4
R-JM	6854	105	0.015	0.06	4	4

Notes
- Modeling parameters calculated per the Santa Clara County Drainage Manual for use with the Muskingum Cunge Routing Method
- Model parameters extracted from the workmap included as Figure 9.

Table 5. HEC-HMS modeled peak flow rates

	2 year	10 year	100 year
	cfs	*cfs*	*cfs*
Pre-project Condition	78.8	279.2	841.5
Post-project Condition	78.6	268.1	789.3

FIGURES



Balance Hydrologics, Inc.

Figure 1. Location map for the San Juan Oaks project site

AERIAL IMAGERY SOURCE: JUNE 2013 AERIAL PHOTOMAPPING SERVICES

REGIONAL MAP

DEL WEBB AT SAN JUAN OAKS

SAN BENITO COUNTY, CALIFORNIA

800 0 800 1600 2400 Feet

SCALE: 1" = 800'

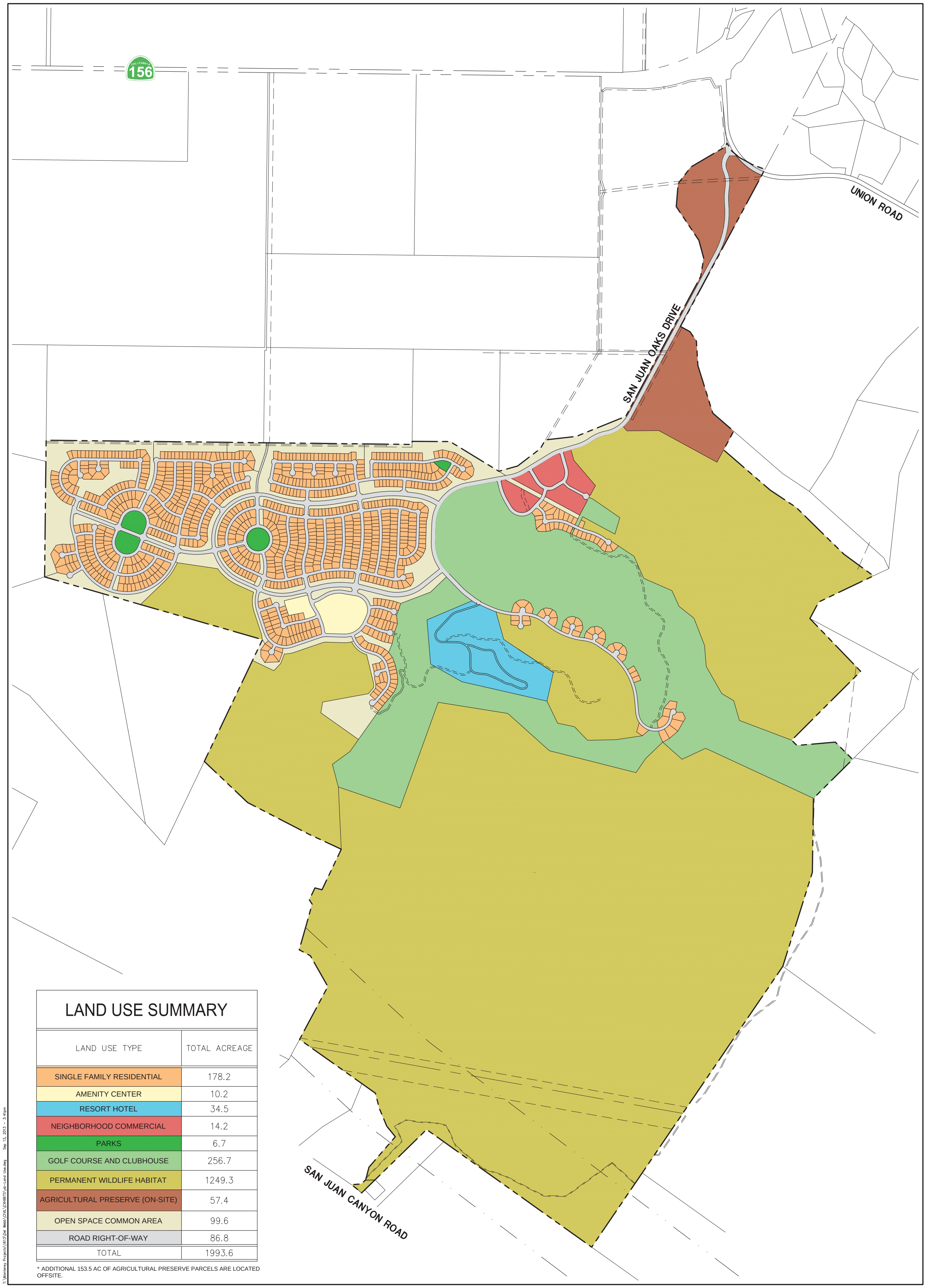
Whitson Engineers
9699 Blue Larkspur Lane | Suite 105 | Monterey, CA 93940 | 831 64 -5225 F 831 373-5065
Civil Engineering ■ Land Surveying ■ Project Management | www.whitsonengineers.com

WE

JULY 7, 2013
Sheet 1 of 1

1" = 800'

Figure 2. Project site boundary



LAND USE SUMMARY

LAND USE TYPE	TOTAL ACREAGE
SINGLE FAMILY RESIDENTIAL	178.2
AMENITY CENTER	10.2
RESORT HOTEL	34.5
NEIGHBORHOOD COMMERCIAL	14.2
PARKS	6.7
GOLF COURSE AND CLUBHOUSE	256.7
PERMANENT WILDLIFE HABITAT	1249.3
AGRICULTURAL PRESERVE (ON-SITE)	57.4
OPEN SPACE COMMON AREA	99.6
ROAD RIGHT-OF-WAY	86.8
TOTAL	1993.6

* ADDITIONAL 153.5 AC OF AGRICULTURAL PRESERVE PARCELS ARE LOCATED OFFSITE.

LAND USE MAP
DEL WEBB at SAN JUAN OAKS
SAN BENITO COUNTY, CALIFORNIA

600 0 600 1200 1800 Feet
SCALE: 1" = 600'

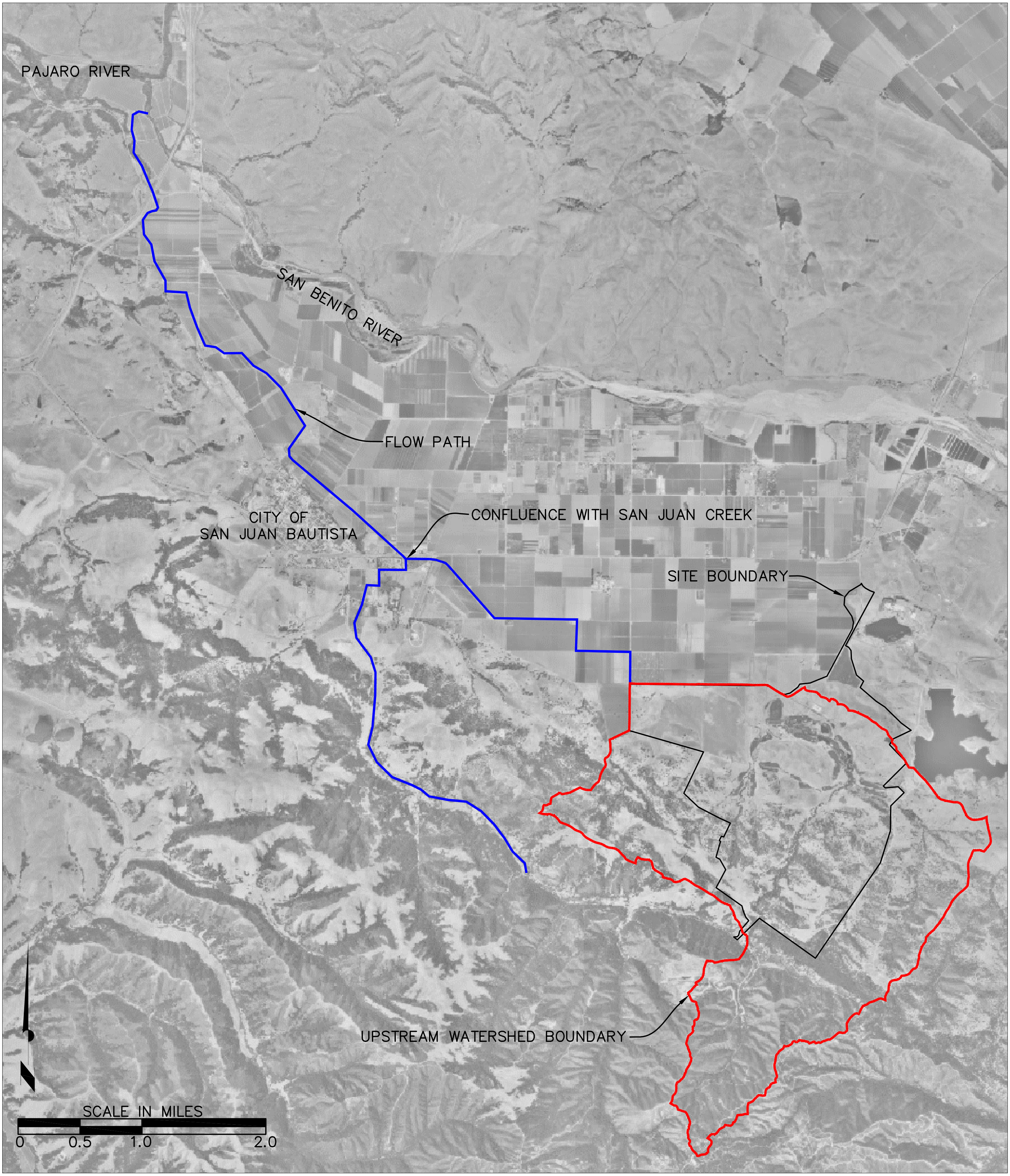
Whitson Engineers
9699 Blue Larkspur Lane | Suite 105 | Monterey, CA 93940 | **831 64 -5225 F 831 373-5065**
CIVIL ENGINEERING ■ LAND SURVEYING ■ PROJECT MANAGEMENT | www.whitsonengineers.com

WE

SEPT 10, 2013
Sheet 1 of 1

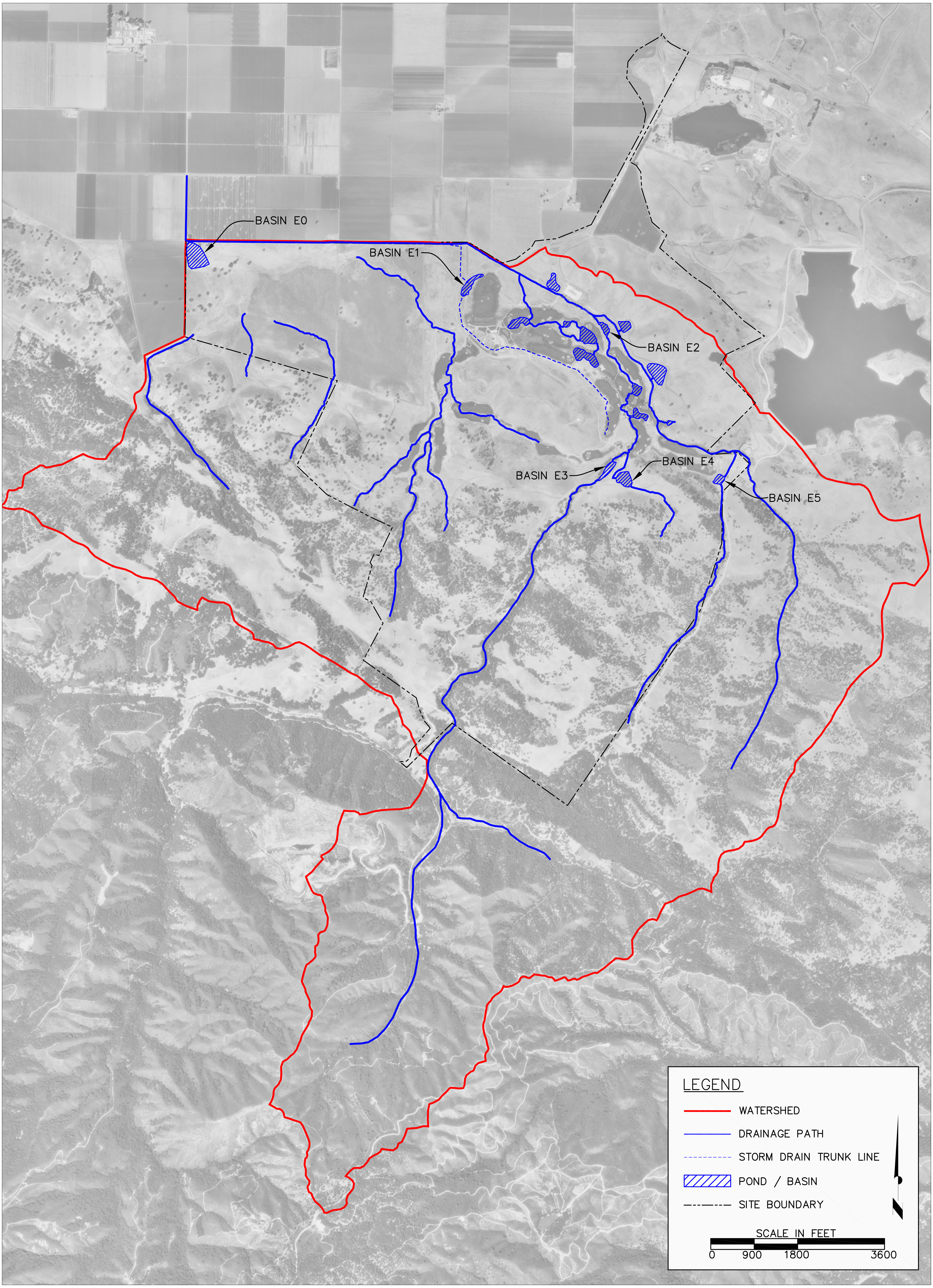
1" = 600'

Figure 3. Project land plan



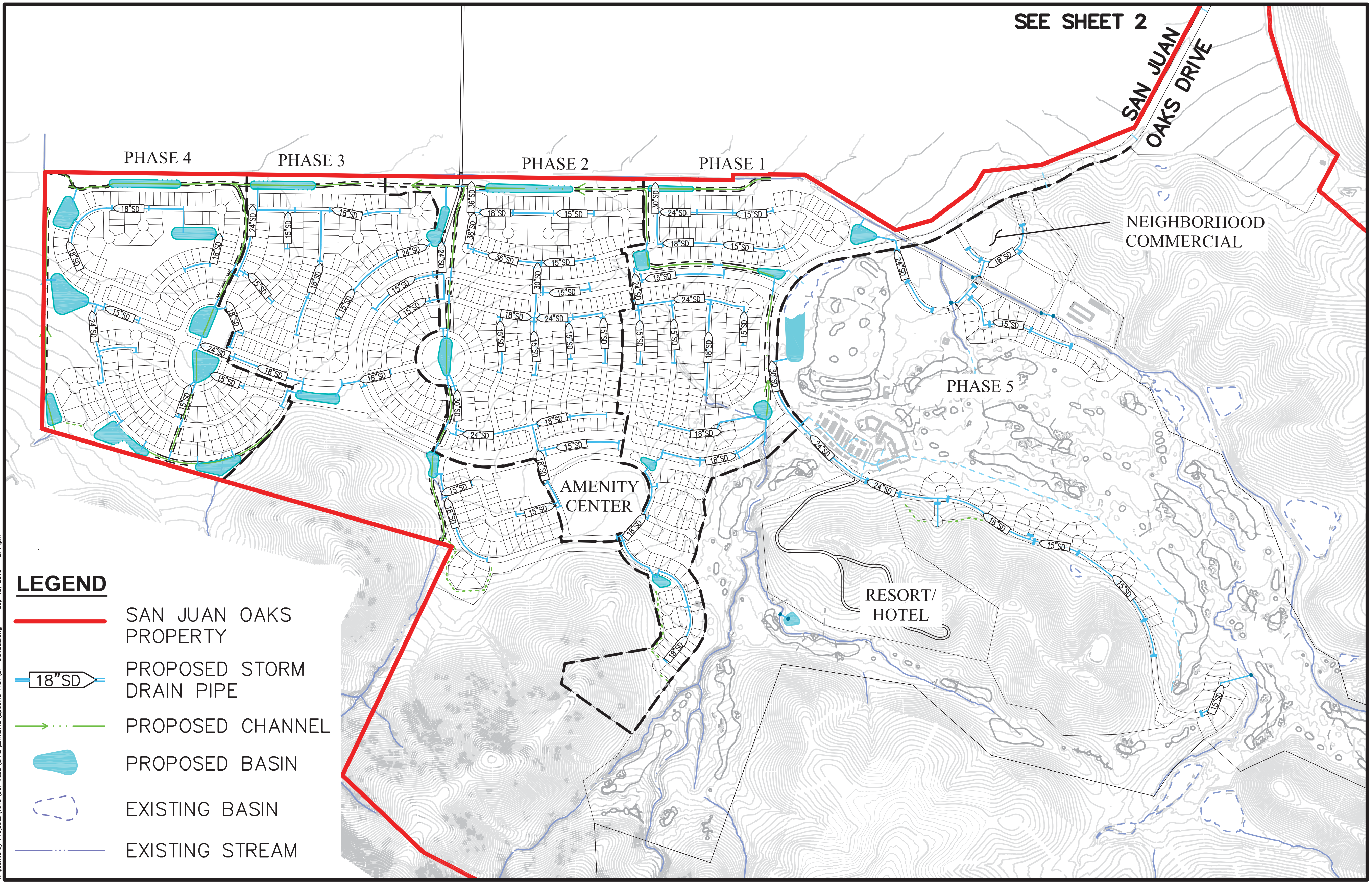
Balance Hydrologics, Inc.

Figure 4. Flow path from the project site to the San Benito River



Balance Hydrologics, Inc.

Figure 5. Existing drainage patterns



PROPOSED STORM DRAIN SYSTEM

DELL WEBB at SAN JUAN OAKS

SAN BENITO COUNTY, CALIFORNIA

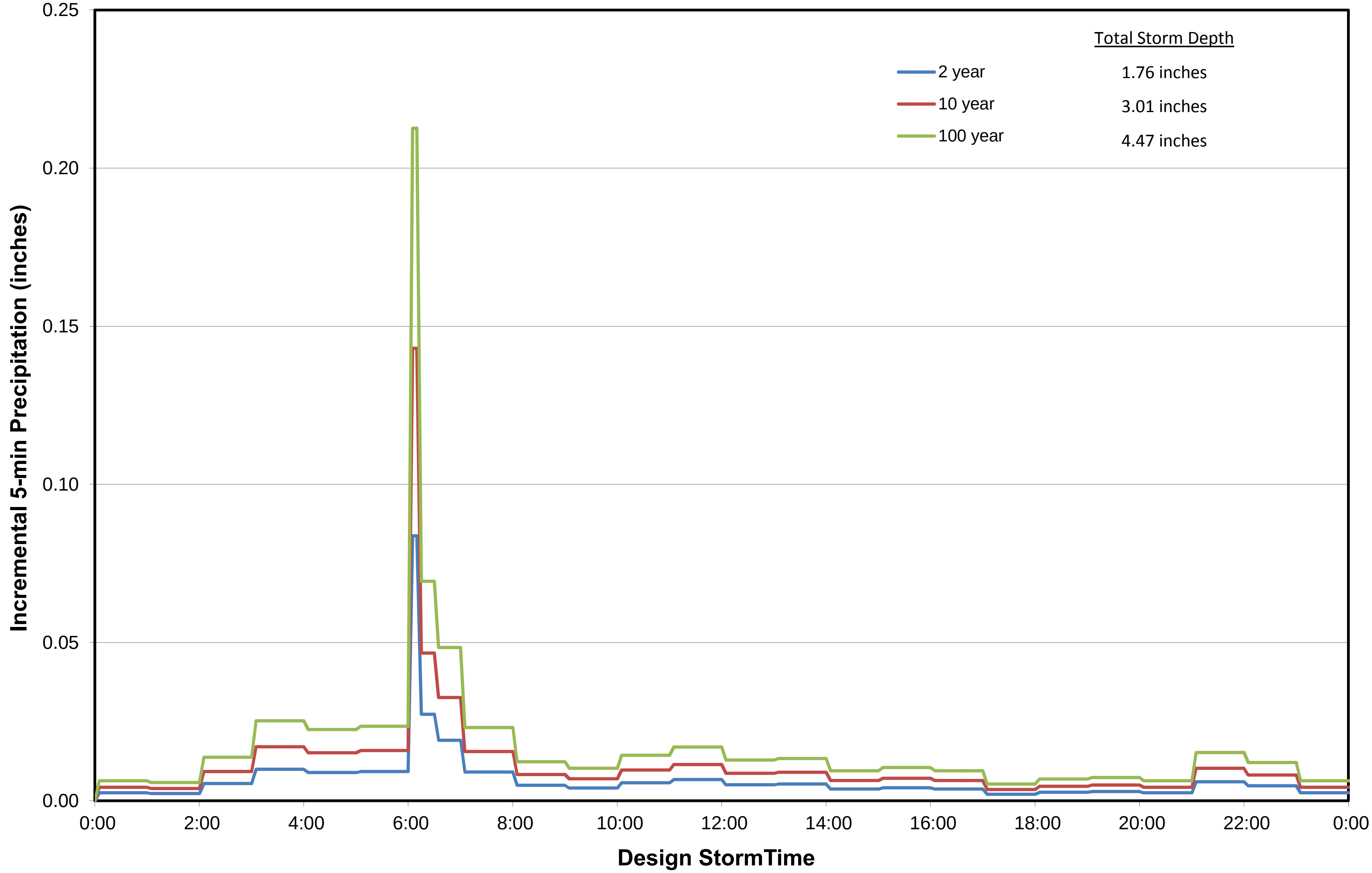
Whitson Engineers
9699 Blue Larkspur Lane | Suite 105 | Monterey, CA 93940 | 831 649-5225 | F 831 373-5065
Civil Engineering ■ Land Surveying ■ Project Management | www.whitsonengineers.com

Project No.: 1613.08

9/10/2013
Sheet 1 of 2

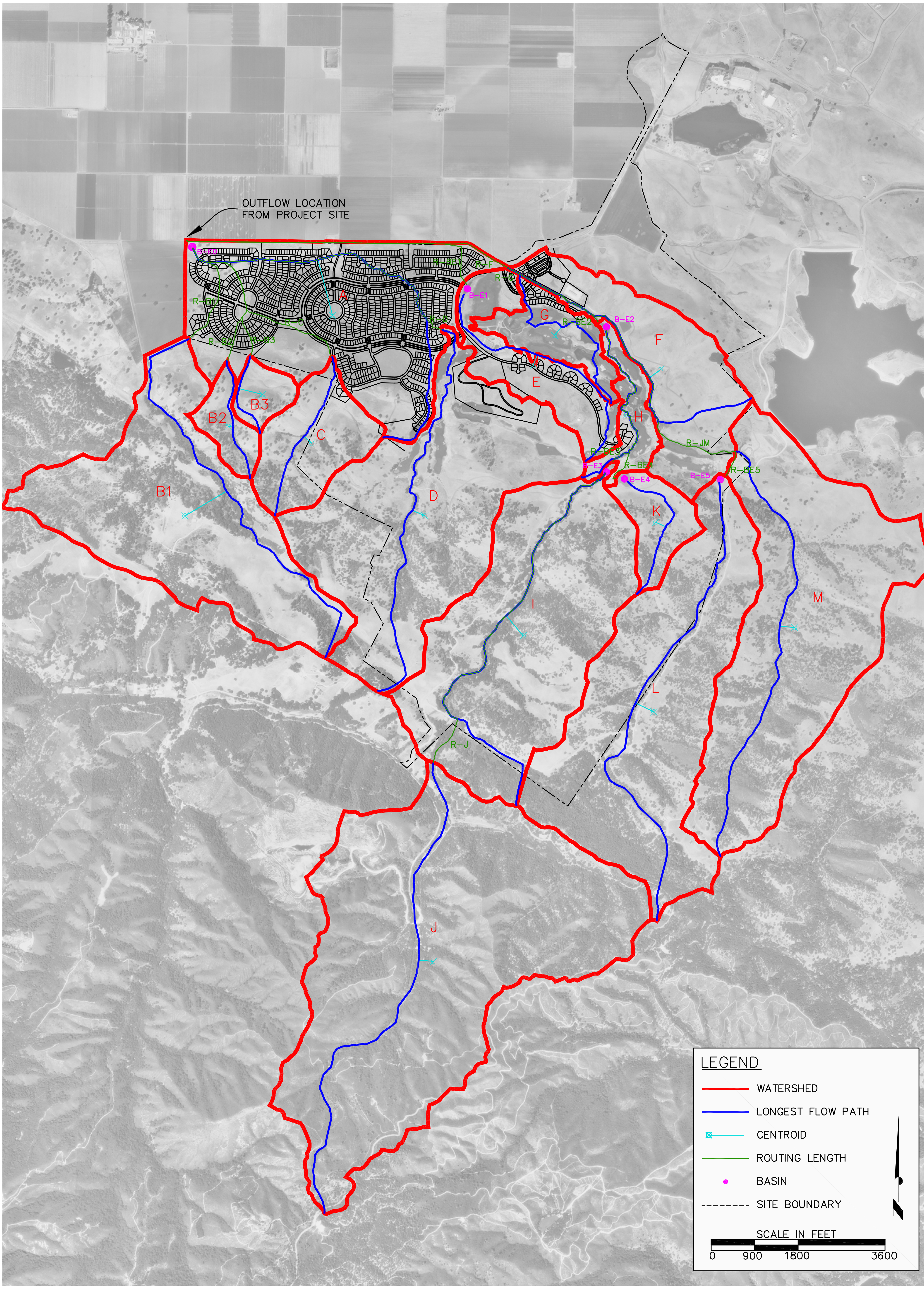
1"=12000'

Figure 6. Proposed project stormwater infrastructure



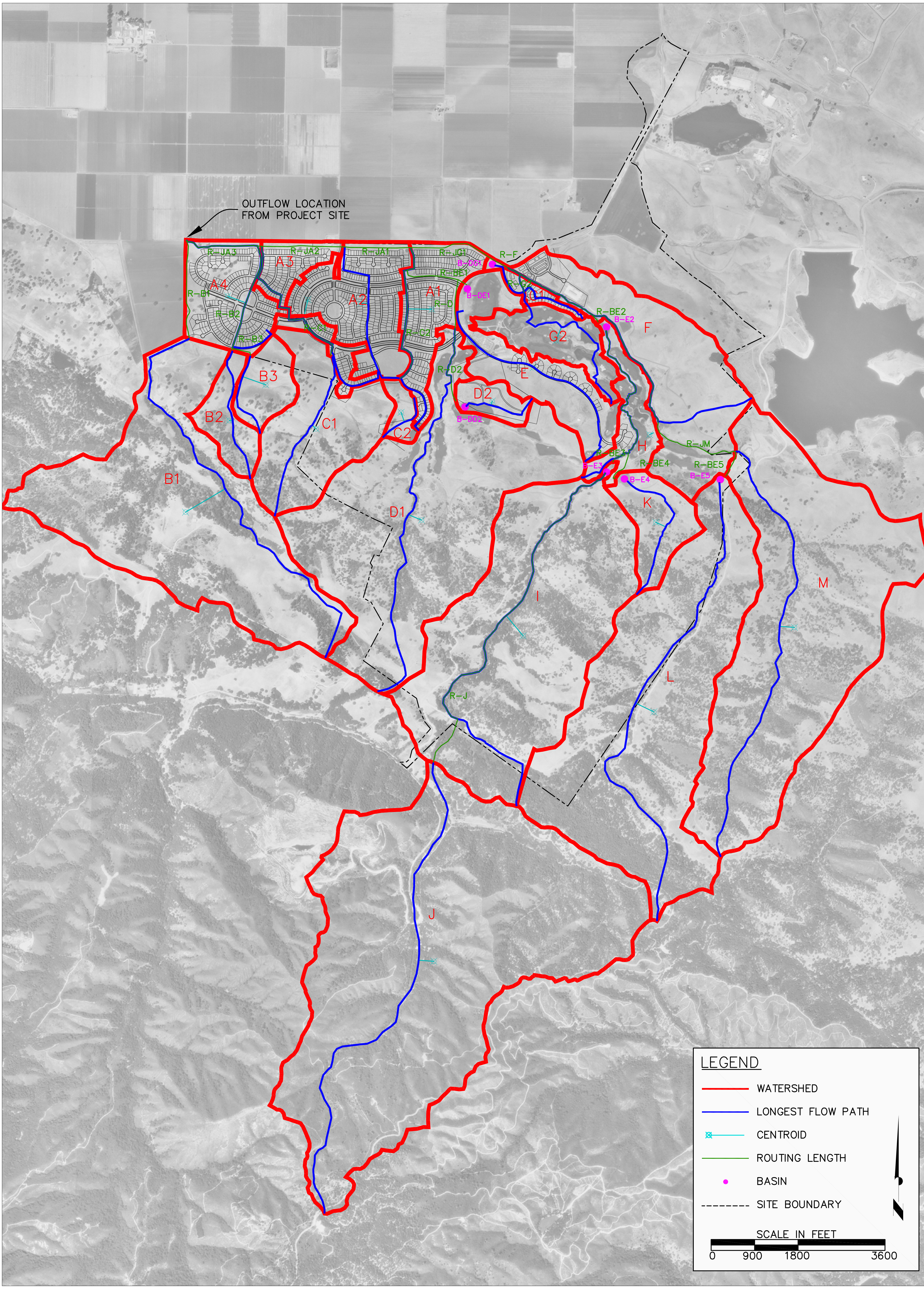
Balance Hydrologics, Inc.

Figure 7 odeled Design Storms



Balance Hydrologics, Inc.

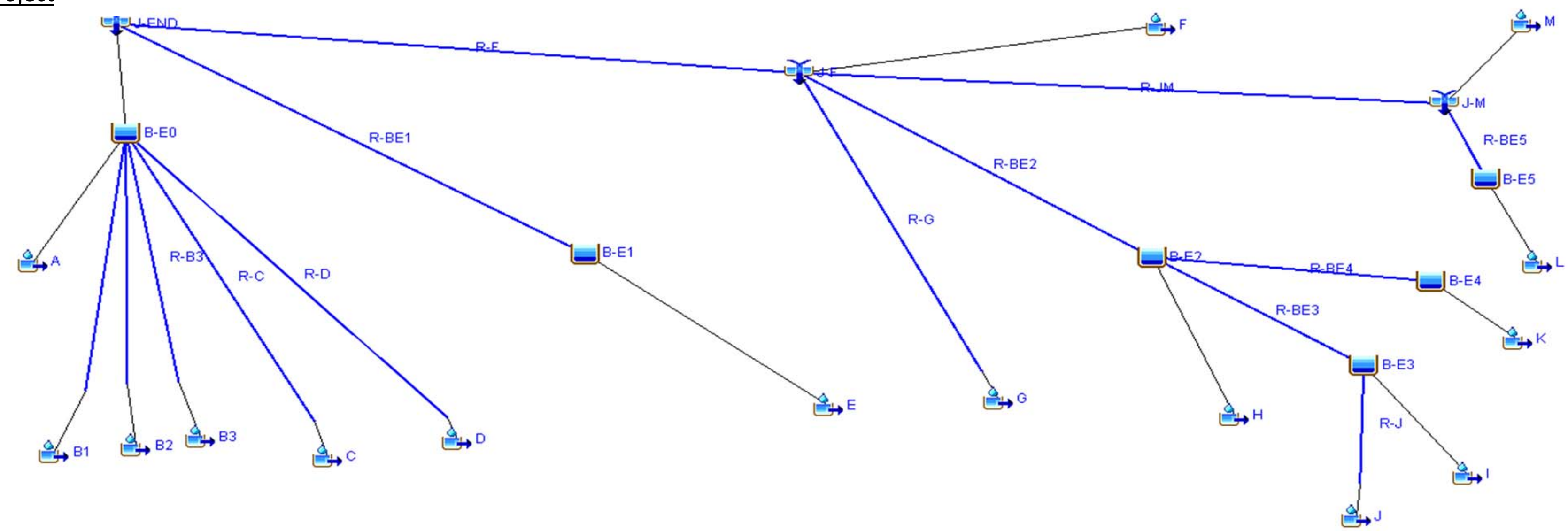
Figure 8. Pre-project hydrologic modeling workmap



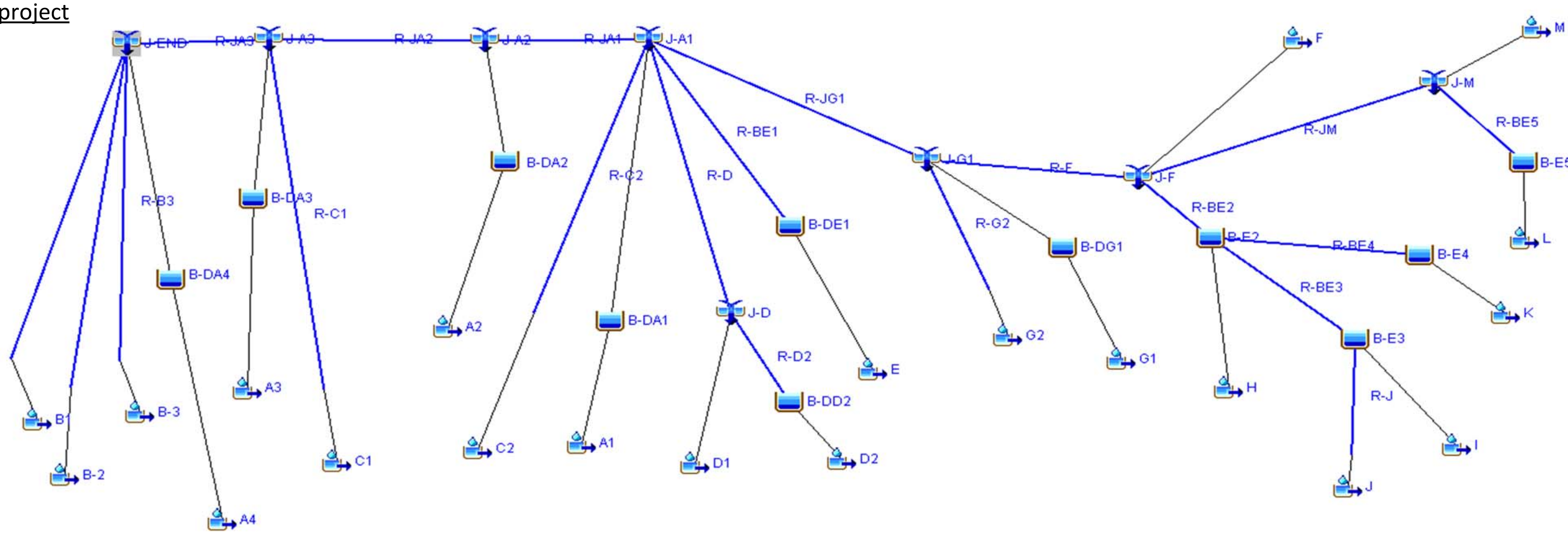
Balance Hydrologics, Inc.

Figure 9. Post-project hydrologic modeling workmap

Pre-project

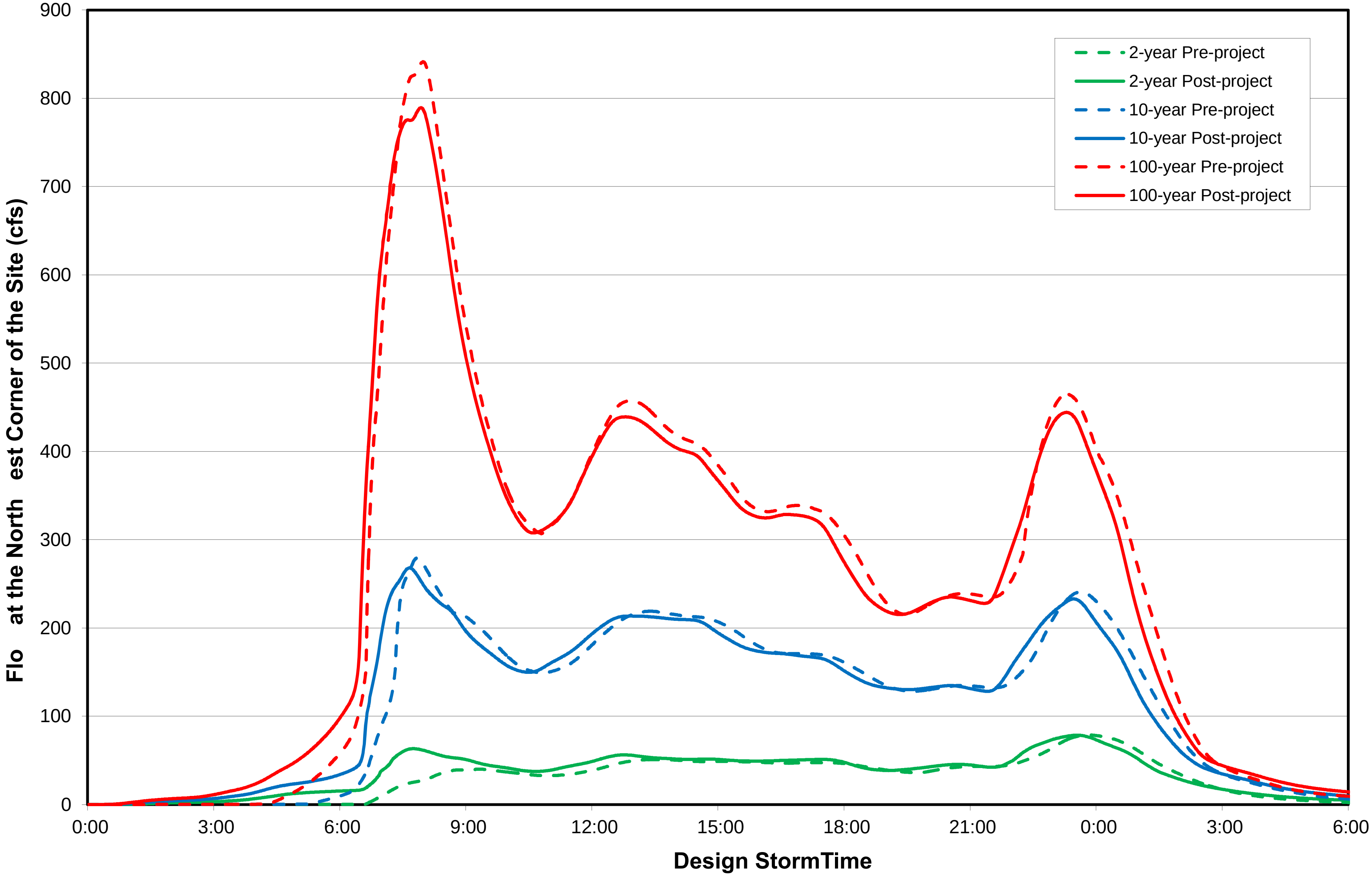


Post-project



Balance Hydrologics, Inc.

Figure 10 Pre- and post-pro ect hydrologic modeling schematics



Balance Hydrologics, Inc.

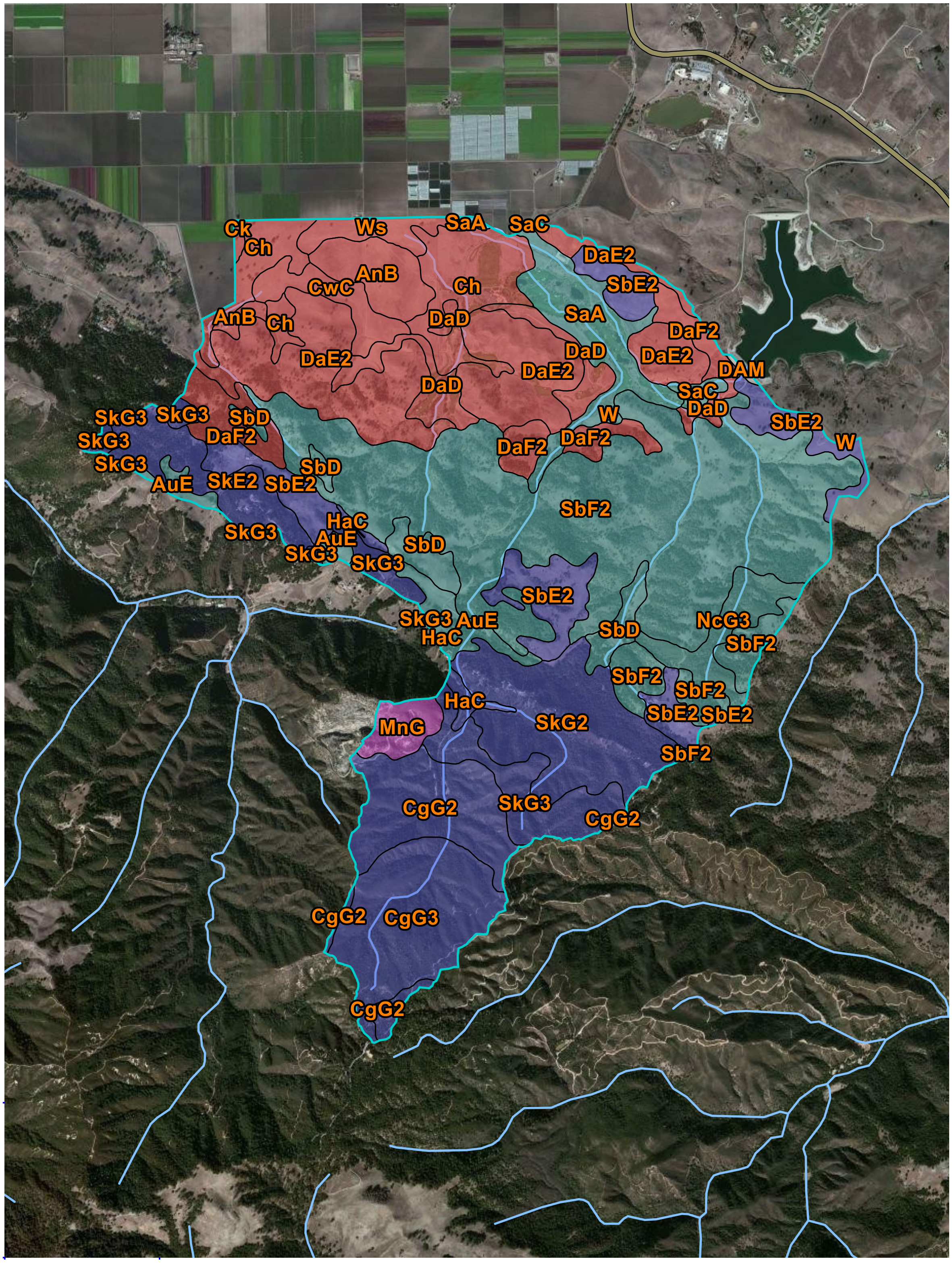
Figure 11 HEC-H S modeled flo hydrographs

APPENDICES

APPENDIX A

NRCS Soils   apping

121° 30' 33" W
121° 25' 49" W
36° 50' 28" N
36° 50' 28" N



36° 45' 26" N
36° 45' 26" N
121° 30' 33" W
121° 25' 49" W

Map Scale: 1:45,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 2000, 4000, 8000, 12000

Map projection: Web Mercator Corner coordinates: WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

Soil Survey Area: San Benito County, California
Survey Area Data: Version 12, Feb 3, 2012

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

Date(s) aerial images were photographed: Oct 26, 2010—Sep 17, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Benito County, California (CA069)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AnB	Antioch loam, 2 to 5 percent slopes	D	96.6	2.3%
AuE	Auberry fine sandy loam, 15 to 30 percent slopes	C	80.2	1.9%
CgG2	Cieneba gravelly sandy loam, 30 to 75 percent slopes, e roded	B	211.3	5.0%
CgG3	Cieneba gravelly sandy loam, 15 to 75 percent slopes, s everely eroded	B	262.0	6.3%
Ch	Clear Lake clay	D	220.3	5.3%
Ck	Clear Lake clay, saline	D	4.6	0.1%
CwC	Cropley clay, 2 to 9 percent slopes	D	63.9	1.5%
DaD	Diablo clay, 9 to 15 percent slopes	D	112.7	2.7%
DaE2	Diablo clay, 15 to 30 percent slopes, eroded	D	475.4	11.3%
DaF2	Diablo clay, 30 to 50 percent slopes, eroded	D	147.7	3.5%
DAM	Dam		3.0	0.1%
HaC	Hanford coarse sandy loam, 2 to 9 percent slopes	B	23.2	0.6%
MnG	Mined land and Dumps	A	48.2	1.1%
NcG3	Nacimiento loam, 30 to 75 percent slopes, severely erod ed	C	88.3	2.1%
SaA	Salinas clay loam, 0 to 2 percent slopes	C	160.4	3.8%
SaC	Salinas clay loam, 2 to 9 percent slopes	C	14.4	0.3%
SbD	San Benito clay loam, 9 to 15 percent slopes	C	86.0	2.1%
SbE2	San Benito clay loam, 15 to 30 percent slopes, eroded	B	278.7	6.7%
SbF2	San Benito clay loam, 30 to 50 percent slopes, eroded	C	1,172.6	28.0%

Hydrologic Soil Group— Summary by Map Unit — San Benito County, California (CA069)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
SkE2	Sheridan coarse sandy loam, 15 to 30 percent slopes, eroded	B	126.9	3.0%
SkG2	Sheridan coarse sandy loam, 30 to 75 percent slopes, er oded	B	290.8	6.9%
SkG3	Sheridan coarse sandy loam, 30 to 75 percent slopes, severely eroded	B	175.9	4.2%
W	Water		1.8	0.0%
Ws	Willows sandy loam	D	45.9	1.1%
Totals for Area of Interest			**4,190.6**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

APPENDIX B

E isting Basin odeling Parameters

E isting Basin 0 (north est corner of Del Web site)

Lower Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	214.80	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	214.80	feet

Overflow Riser Parameters

Radius	0.00	feet
Riser flowline	214.80	feet

Overflow Weir Parameters

Notch angle	179.60	degrees
Weir flowline	216.50	feet

			Lo er Orifice			Upper Orifice			Overflo Riser			Overflo Weir		
Elevation	**Area**	**Storage**	**Area**	**Head**		**Area**	**Head**		**Head**	**C**		**Head**		**(total)**
ft	*ft²*	*ft³*	*ft²*	*ft*	*ft³/s*	*ft²*	*ft*	*ft³/s*	*ft*	*-*	*ft³/s*	*ft*	*ft³/s*	*ft³/s*
214.8	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
215.0	7800	800	0.0	0.2	0.0	0.0	0.2	0.0	0.2	-	0.0	0.0	0.0	0.0
216.0	112100	60700	0.0	1.2	0.0	0.0	1.2	0.0	1.2	-	0.0	0.0	0.0	0.0
217.0	474800	354200	0.0	2.2	0.0	0.0	2.2	0.0	2.2	-	0.0	0.5	127.9	127.9
218.0	838700	1010900	0.0	3.2	0.0	0.0	3.2	0.0	3.2	-	0.0	1.5	1993.5	1993.5

E isting Basin 1 (north est of clubhouse)

<u>Lower Orifice Parameters</u>

Orifice width	1.00	feet
Orifice height	0.75	feet
Orifice flowline	247.00	feet

<u>Upper Orifice Parameters</u>

Orifice width	1.00	feet
Orifice height	0.75	feet
Orifice flowline	253.00	feet

<u>Overflow Riser Parameters</u>

Radius	1.00	feet
Riser flowline	255.50	feet

<u>Overflow Weir Parameters</u>

Notch angle	179.50	degrees
Weir flowline	257.50	feet

			Lo er Orifice			Upper Orifice			Overflo Riser			Overflo Weir		
Elevation	**Area**	**Storage**	**Area**	**Head**		**Area**	**Head**		**Head**	**C**		**Head**		**(total)**
ft	*ft^2*	*ft^3*	*ft^2*	*ft*	*ft^3/s*	*ft^2*	*ft*	*ft^3/s*	*ft*	-	*ft^3/s*	*ft*	*ft^3/s*	*ft^3/s*
246.3	12800	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
247.0	21000	11800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
248.0	26300	35500	0.8	0.6	2.9	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	2.9
249.0	30900	64100	0.8	1.6	4.6	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	4.6
250.0	35700	97400	0.8	2.6	5.9	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	5.9
251.0	40800	135600	0.8	3.6	6.9	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	6.9
252.0	46100	179100	0.8	4.6	7.8	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	7.8
253.0	51800	228000	0.8	5.6	8.6	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	8.6
254.0	58300	283100	0.8	6.6	9.3	0.8	0.6	2.9	0.0	3.9	0.0	0.0	0.0	12.1
255.0	65800	345100	0.8	7.6	10.0	0.8	1.6	4.6	0.0	3.9	0.0	0.0	0.0	14.6
256.0	76000	416000	0.8	8.6	10.6	0.8	2.6	5.9	0.5	3.3	7.4	0.0	0.0	23.8
257.0	98000	503000	0.8	9.6	11.2	0.8	3.6	6.9	1.5	1.3	15.6	0.0	0.0	33.6
258.0	135700	619800	0.8	10.6	11.8	0.8	4.6	7.8	2.5	1.0	24.8	0.5	102.3	146.7
259.0	247900	811600	0.8	11.6	12.3	0.8	5.6	8.6	3.5	1.0	41.1	1.5	1594.8	1656.8

E isting Basin 2 (southeast of maintenance building)

Lower Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	291.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	291.00	feet

Overflow Riser Parameters

Radius	0.00	feet
Riser flowline	0.00	feet

Overflow Weir Parameters

Notch angle	168.00	degrees
Weir flowline	295.00	feet

			Lo er Orifice			Upper Orifice			Overflo Riser			Overflo Weir		
Elevation	Area	Storage	Area	Head		Area	Head		Head	C		Head		(total)
ft	ft^2	ft^3	ft^2	ft	ft^3/s	ft^2	ft	ft^3/s	ft	-	ft^3/s	ft	ft^3/s	ft^3/s
291.0	5600	0	0.0	0.0	0.0	0.0	0.0	0.0	291.0	-	0.0	0.0	0.0	0.0
292.0	9700	7600	0.0	1.0	0.0	0.0	1.0	0.0	292.0	-	0.0	0.0	0.0	0.0
293.0	13800	19400	0.0	2.0	0.0	0.0	2.0	0.0	293.0	-	0.0	0.0	0.0	0.0
294.0	18800	35700	0.0	3.0	0.0	0.0	3.0	0.0	294.0	-	0.0	0.0	0.0	0.0
295.0	24900	57500	0.0	4.0	0.0	0.0	4.0	0.0	295.0	-	0.0	0.0	0.0	0.0
296.0	32700	86400	0.0	5.0	0.0	0.0	5.0	0.0	296.0	-	0.0	1.0	24.0	24.0
297.0	41600	123500	0.0	6.0	0.0	0.0	6.0	0.0	297.0	-	0.0	2.0	135.9	135.9
298.0	50600	169600	0.0	7.0	0.0	0.0	7.0	0.0	298.0	-	0.0	3.0	374.5	374.5

E isting Basin 3 (southcentral end of golf course on the   est side of the channel)

Lower Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	346.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	346.00	feet

Overflow Riser Parameters

Radius	1.00	feet
Riser flowline	360.00	feet

Overflow Weir Parameters

Weir width	12.00	feet
Weir flowline	362.50	feet

			Lo er Orifice			Upper Orifice			Overflo Riser			Overflo Weir		
Elevation	Area	Storage	Area	Head		Area	Head		Head	C		Head		(total)
ft	ft²	ft³	ft²	ft	ft³/s	ft²	ft	ft³/s	ft	-	ft³/s	ft	ft³/s	ft³/s
346.0	1000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
347.0	3000	2000	0.0	1.0	0.0	0.0	1.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
348.0	5800	6300	0.0	2.0	0.0	0.0	2.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
349.0	9700	14100	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
350.0	13500	25700	0.0	4.0	0.0	0.0	4.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
351.0	17000	41000	0.0	5.0	0.0	0.0	5.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
352.0	20300	59600	0.0	6.0	0.0	0.0	6.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
353.0	23500	81500	0.0	7.0	0.0	0.0	7.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
354.0	25600	106100	0.0	8.0	0.0	0.0	8.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
355.0	27600	132600	0.0	9.0	0.0	0.0	9.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
356.0	29900	161400	0.0	10.0	0.0	0.0	10.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
357.0	32900	192800	0.0	11.0	0.0	0.0	11.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
358.0	35200	226800	0.0	12.0	0.0	0.0	12.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
359.0	37800	263300	0.0	13.0	0.0	0.0	13.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
360.0	40500	302500	0.0	14.0	0.0	0.0	14.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0
361.0	43200	344300	0.0	15.0	0.0	0.0	15.0	0.0	1.0	2.0	12.9	0.0	0.0	12.9
362.0	46200	389000	0.0	16.0	0.0	0.0	16.0	0.0	2.0	1.0	18.0	0.0	0.0	18.0
363.0	49600	436800	0.0	17.0	0.0	0.0	17.0	0.0	3.0	1.0	32.6	0.5	14.1	46.8
364.0	53100	488200	0.0	18.0	0.0	0.0	18.0	0.0	4.0	1.0	50.3	1.5	73.4	123.7
365.0	57000	543300	0.0	19.0	0.0	0.0	19.0	0.0	5.0	1.0	70.2	2.5	158.0	228.2
366.0	63100	603300	0.0	20.0	0.0	0.0	20.0	0.0	6.0	1.0	92.3	3.5	1000.0	1092.3

E isting Basin 4 (southcentral end of golf course on the east side of the channel)

Lower Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	360.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	360.00	feet

Overflow Riser Parameters

Radius	0.00	feet
Riser flowline	360.00	feet

Overflow Weir Parameters

Weir width	7.00	feet
Weir flowline	371.00	feet

			Lo er Orifice			Upper Orifice			Overflo Riser			Overflo Weir		
Elevation	**Area**	**Storage**	Area	Head		Area	Head		Head	C		**Head**		**(total)**
ft	*ft²*	*ft³*	ft²	ft	ft³/s	ft²	ft	ft³/s	ft	-	ft³/s	*ft*	*ft³/s*	*ft³/s*
360.0	100	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
361.0	22200	11100	0.0	1.0	0.0	0.0	1.0	0.0	1.0	-	0.0	0.0	0.0	0.0
362.0	30700	37600	0.0	2.0	0.0	0.0	2.0	0.0	2.0	-	0.0	0.0	0.0	0.0
363.0	36900	71400	0.0	3.0	0.0	0.0	3.0	0.0	3.0	-	0.0	0.0	0.0	0.0
364.0	42100	110900	0.0	4.0	0.0	0.0	4.0	0.0	4.0	-	0.0	0.0	0.0	0.0
365.0	46900	155500	0.0	5.0	0.0	0.0	5.0	0.0	5.0	-	0.0	0.0	0.0	0.0
366.0	51600	204700	0.0	6.0	0.0	0.0	6.0	0.0	6.0	-	0.0	0.0	0.0	0.0
367.0	56100	258600	0.0	7.0	0.0	0.0	7.0	0.0	7.0	-	0.0	0.0	0.0	0.0
368.0	60600	316900	0.0	8.0	0.0	0.0	8.0	0.0	8.0	-	0.0	0.0	0.0	0.0
369.0	65300	379900	0.0	9.0	0.0	0.0	9.0	0.0	9.0	-	0.0	0.0	0.0	0.0
370.0	70100	447600	0.0	10.0	0.0	0.0	10.0	0.0	10.0	-	0.0	0.0	0.0	0.0
371.0	76500	520900	0.0	11.0	0.0	0.0	11.0	0.0	11.0	-	0.0	0.0	0.0	0.0
372.0	87400	602900	0.0	12.0	0.0	0.0	12.0	0.0	12.0	-	0.0	1.0	23.3	23.3
373.0	98100	695700	0.0	13.0	0.0	0.0	13.0	0.0	13.0	-	0.0	2.0	200.0	200.0

E isting Basin 5 (east of golf course)

Lower Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	376.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	376.00	feet

Overflow Riser Parameters

Radius	0.00	feet
Riser flowline	376.00	feet

Overflow Weir Parameters

Notch angle	161.00	degrees
Weir flowline	379.30	feet

			Lo er Orifice			Upper Orifice			Overflo Riser			Overflo Weir		
Elevation	**Area**	**Storage**	Area	Head		Area	Head		Head	C		Head		(total)
ft	*ft*^{2}	*ft*^{3}	*ft*^{2}	*ft*	*ft*^{3}/*s*	*ft*^{2}	*ft*	*ft*^{3}/*s*	*ft*	-	*ft*^{3}/*s*	*ft*	*ft*^{3}/*s*	*ft*^{3}/*s*
376.0	2800	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
377.0	18400	10600	0.0	1.0	0.0	0.0	1.0	0.0	1.0	-	0.0	0.0	0.0	0.0
378.0	27200	33400	0.0	2.0	0.0	0.0	2.0	0.0	2.0	-	0.0	0.0	0.0	0.0
379.0	33500	63800	0.0	3.0	0.0	0.0	3.0	0.0	3.0	-	0.0	0.0	0.0	0.0
380.0	42900	102000	0.0	4.0	0.0	0.0	4.0	0.0	4.0	-	0.0	0.7	6.2	6.2
381.0	59900	153400	0.0	5.0	0.0	0.0	5.0	0.0	5.0	-	0.0	1.7	56.9	56.9
382.0	73800	220300	0.0	6.0	0.0	0.0	6.0	0.0	6.0	-	0.0	2.7	1000.0	1000.0

APPENDIX C

Proposed Basin odeling Parameters

Developed Basin A1

Lower Orifice Parameters

Orifice width	1.10	feet
Orifice height	1.10	feet
Orifice flowline	0.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	0.00	feet

Overflow Weir Parameters

Weir width	8.00	feet
Weir flowline	5.00	feet

			Lo er Orifice			Upper Orifice			Overflo Weir		
Elevation	Area	Storage	Area	Head		Area	Head		Head		(total)
ft	*ft*^{2}	*ft*^{3}	*ft*^{2}	*ft*	*ft*^{3}*/s*	*ft*^{2}	*ft*	*ft*^{3}*/s*	*ft*	*ft*^{3}*/s*	*ft*^{3}*/s*
0.0	39000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	41900	40400	1.1	1.0	3.7	0.0	1.0	0.0	0.0	0.0	3.7
2.0	44800	83800	1.2	1.5	7.0	0.0	2.0	0.0	0.0	0.0	7.0
3.0	47900	130100	1.2	2.5	9.1	0.0	3.0	0.0	0.0	0.0	9.1
4.0	51000	179500	1.2	3.5	10.8	0.0	4.0	0.0	0.0	0.0	10.8
5.0	54300	232100	1.2	4.5	12.3	0.0	5.0	0.0	0.0	0.0	12.3
6.0	57600	288100	1.2	5.5	13.6	0.0	6.0	0.0	1.0	26.6	40.2

Notes

1. Developed Basin A1 represents a composite of Basins D1A, D1B, D1C, D1D, D1E, and D1G as shown on the project Vesting Tentative Map.

Developed Basin A2

Lower Orifice Parameters

Orifice width	1.70	feet
Orifice height	1.70	feet
Orifice flowline	0.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	0.00	feet

Overflow Weir Parameters

Weir width	6.00	feet
Weir flowline	4.50	feet

			Lo er Orifice			Upper Orifice			Overflo Weir		
Elevation	Area	Storage	Area	Head		Area	Head		Head		(total)
ft	ft^2	ft^3	ft^2	ft	ft^3/s	ft^2	ft	ft^3/s	ft	ft^3/s	ft^3/s
0.0	35000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	37700	36400	1.7	1.0	5.7	0.0	1.0	0.0	0.0	0.0	5.7
2.0	40500	75500	2.9	1.2	14.9	0.0	2.0	0.0	0.0	0.0	14.9
3.0	43400	117400	2.9	2.2	20.4	0.0	3.0	0.0	0.0	0.0	20.4
4.0	46400	162300	2.9	3.2	24.7	0.0	4.0	0.0	0.0	0.0	24.7
5.0	49500	210300	2.9	4.2	28.3	0.0	5.0	0.0	0.5	7.1	35.4
6.0	52700	261400	2.9	5.2	31.6	0.0	6.0	0.0	1.5	36.7	68.3

Notes

1. Developed Basin A2 represents a composite of Basins D2A, D2B, and D2C as shown on the project Vesting Tentative Map.

Developed Basin A3

Lower Orifice Parameters

Orifice width	0.80	feet
Orifice height	0.80	feet
Orifice flowline	0.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	0.00	feet

Overflow Weir Parameters

Weir width	5.00	feet
Weir flowline	5.00	feet

			Lo er Orifice			Upper Orifice			Overflo Weir		
Elevation	**Area**	**Storage**	**Area**	**Head**		**Area**	**Head**		**Head**		**(total)**
ft	*ft²*	*ft³*	*ft²*	*ft*	*ft³/s*	*ft²*	*ft*	*ft³/s*	*ft*	*ft³/s*	*ft³/s*
0.0	31000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	33500	32300	0.6	0.6	2.4	0.0	1.0	0.0	0.0	0.0	2.4
2.0	36200	67100	0.6	1.6	3.9	0.0	2.0	0.0	0.0	0.0	3.9
3.0	38900	104700	0.6	2.6	5.0	0.0	3.0	0.0	0.0	0.0	5.0
4.0	41800	145100	0.6	3.6	5.8	0.0	4.0	0.0	0.0	0.0	5.8
5.0	44700	188300	0.6	4.6	6.6	0.0	5.0	0.0	0.0	0.0	6.6
6.0	47800	234600	0.6	5.6	7.3	0.0	6.0	0.0	1.0	16.7	23.9

Notes

1. Developed Basin A3 represents a composite of Basins D3A, D3B, and D3C as shown on the project Vesting Tentative Map.

Developed Basin A4

Lower Orifice Parameters

Orifice width	0.20	feet
Orifice height	0.20	feet
Orifice flowline	0.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	0.00	feet

Overflow Weir Parameters

Weir width	0.00	feet
Weir flowline	5.00	feet

			Lo er Orifice			Upper Orifice			Overflo Weir		
Elevation	**Area**	**Storage**	**Area**	**Head**		**Area**	**Head**		**Head**		**(total)**
ft	*ft²*	*ft³*	*ft²*	*ft*	*ft³/s*	*ft²*	*ft*	*ft³/s*	*ft*	*ft³/s*	*ft³/s*
0.0	233000	0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	239900	236400	0.04	0.9	0.2	0.0	1.0	0.0	0.0	0.0	0.2
2.0	246900	479800	0.04	1.9	0.3	0.0	2.0	0.0	0.0	0.0	0.3
3.0	254000	730300	0.04	2.9	0.3	0.0	3.0	0.0	0.0	0.0	0.3
4.0	261200	987900	0.04	3.9	0.4	0.0	4.0	0.0	0.0	0.0	0.4
5.0	268500	1252700	0.04	4.9	0.4	0.0	5.0	0.0	0.0	0.0	0.4
6.0	275900	1524900	0.04	5.9	0.5	0.0	6.0	0.0	1.0	0.0	0.5

Notes

1. Developed Basin A4 represents a composite of Basins D4A, D4B, D4C, D4D, D4E, D4F, D4G, D4H, and D4I as shown on the project Vesting Tentative Map.

Developed Basin G1

Lower Orifice Parameters

Orifice width	0.15	feet
Orifice height	0.15	feet
Orifice flowline	0.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	0.00	feet

Overflow Weir Parameters

Weir width	0.90	feet
Weir flowline	5.00	feet

			Lo er Orifice			Upper Orifice			Overflo Weir		
Elevation	Area	Storage	Area	Head		Area	Head		Head		(total)
ft	*ft^2*	*ft^3*	*ft^2*	*ft*	*ft^3/s*	*ft^2*	*ft*	*ft^3/s*	*ft*	*ft^3/s*	*ft^3/s*
0.00	12000	0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.00	13600	12800	0.02	0.9	0.1	0.0	1.0	0.0	0.0	0.0	0.1
2.00	15300	27300	0.02	1.9	0.2	0.0	2.0	0.0	0.0	0.0	0.2
3.00	17100	43500	0.02	2.9	0.2	0.0	3.0	0.0	0.0	0.0	0.2
4.00	19000	61500	0.02	3.9	0.2	0.0	4.0	0.0	0.0	0.0	0.2
5.00	21000	81600	0.02	4.9	0.2	0.0	5.0	0.0	0.0	0.0	0.2
6.00	23100	103600	0.02	5.9	0.3	0.0	6.0	0.0	1.0	3.0	3.3

Developed Basin D2

Lower Orifice Parameters

Orifice width	0.80	feet
Orifice height	0.80	feet
Orifice flowline	0.00	feet

Upper Orifice Parameters

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	0.00	feet

Overflow Weir Parameters

Weir width	3.00	feet
Weir flowline	5.00	feet

			Lo	er Orifice			Upper Orifice		Overflo	Weir	
Elevation	Area	Storage	Area	Head		Area	Head		Head		(total)
ft	*ft^2*	*ft^3*	*ft^2*	*ft*	*ft^3/s*	*ft^2*	*ft*	*ft^3/s*	*ft*	*ft^3/s*	*ft^3/s*
0.0	2000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	2700	2300	0.6	0.6	2.4	0.0	1.0	0.0	0.0	0.0	2.4
2.0	3500	5400	0.6	1.6	3.9	0.0	2.0	0.0	0.0	0.0	3.9
3.0	4400	9300	0.6	2.6	5.0	0.0	3.0	0.0	0.0	0.0	5.0
4.0	5300	14200	0.6	3.6	5.8	0.0	4.0	0.0	0.0	0.0	5.8
5.0	6400	20100	0.6	4.6	6.6	0.0	5.0	0.0	0.0	0.0	6.6
6.0	7600	27100	0.6	5.6	7.3	0.0	6.0	0.0	1.0	10.0	17.3

Developed Basin 1 (adapted E isting Basin 1)

<u>Lower Orifice Parameters</u>

Orifice width	0.60	feet
Orifice height	0.60	feet
Orifice flowline	246.30	feet

<u>Upper Orifice Parameters</u>

Orifice width	0.00	feet
Orifice height	0.00	feet
Orifice flowline	246.30	feet

<u>Overflow Weir Parameters</u>

Weir width	10.00	feet
Weir flowline	255.00	feet

			Lo er Orifice			Upper Orifice			Overflo Weir		
Elevation	**Area**	**Storage**	**Area**	**Head**		**Area**	**Head**		**Head**		**(total)**
ft	*ft*^{2}	*ft*^{3}	*ft*^{2}	*ft*	*ft*^{3}*/s*	*ft*^{2}	*ft*	*ft*^{3}*/s*	*ft*	*ft*^{3}*/s*	*ft*^{3}*/s*
246.3	64000	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
247.0	66500	45700	0.4	0.4	1.1	0.0	0.7	0.0	0.0	0.0	1.1
248.0	70200	114100	0.4	1.4	2.1	0.0	1.7	0.0	0.0	0.0	2.1
249.0	74100	186200	0.4	2.4	2.7	0.0	2.7	0.0	0.0	0.0	2.7
250.0	78000	262200	0.4	3.4	3.2	0.0	3.7	0.0	0.0	0.0	3.2
251.0	82000	342200	0.4	4.4	3.6	0.0	4.7	0.0	0.0	0.0	3.6
252.0	86100	426200	0.4	5.4	4.0	0.0	5.7	0.0	0.0	0.0	4.0
253.0	90300	514400	0.4	6.4	4.4	0.0	6.7	0.0	0.0	0.0	4.4
254.0	94600	606900	0.4	7.4	4.7	0.0	7.7	0.0	0.0	0.0	4.7
255.0	99000	703700	0.4	8.4	5.0	0.0	8.7	0.0	0.0	0.0	5.0
256.0	103500	804900	0.4	9.4	5.3	0.0	9.7	0.0	1.0	33.3	38.6
257.0	108100	910800	0.4	10.4	5.6	0.0	10.7	0.0	2.0	94.2	99.8
258.0	112900	1021300	0.4	11.4	5.9	0.0	11.7	0.0	3.0	173.0	178.9
259.0	117700	1136500	0.4	12.4	6.1	0.0	12.7	0.0	4.0	266.4	272.5

APPENDIX D

HEC-H S odel Output

Project: 213074_HMS_9-11-13 Simulation Run: PRE 100YR

Start of Run: 01Jan2000, 00:00 Basin Model: Pre-Project
End of Run: 02Jan2000, 12:00 Meteorologic Model: 100yr 24hr
Compute Time: 11Sep2013, 10:58:50 Control Specifications: 36hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J	1.2671	67.1	01Jan2000, 22:20	0.9273
R-J	1.2671	67.1	01Jan2000, 22:35	0.9274
I	0.7125	148.5	01Jan2000, 06:52	1.9217
B-E3	1.9796	171.5	01Jan2000, 07:32	1.2356
R-BE3	1.9796	171.4	01Jan2000, 07:42	1.2356
K	0.0905	36.6	01Jan2000, 06:21	2.2384
B-E4	0.0905	6.6	01Jan2000, 23:07	0.3821
R-BE4	0.0905	6.6	01Jan2000, 23:32	0.3822
H	0.0799	23.3	01Jan2000, 06:42	2.2384
B-E2	2.1500	181.8	01Jan2000, 07:45	1.2281
R-BE2	2.1500	181.7	01Jan2000, 07:51	1.2281
M	0.7849	161.8	01Jan2000, 06:54	1.9217
L	0.7562	112.4	01Jan2000, 07:02	1.6272
B-E5	0.7562	112.4	01Jan2000, 07:03	1.6009
R-BE5	0.7562	112.4	01Jan2000, 07:05	1.6009
J-M	1.5411	270.0	01Jan2000, 07:00	1.7643
R-JM	1.5411	268.8	01Jan2000, 07:20	1.7642
F	0.3042	73.5	01Jan2000, 06:51	2.1008
G	0.1063	31.4	01Jan2000, 06:42	2.2604
R-G	0.1063	31.4	01Jan2000, 06:43	2.2604
J-F	4.1016	477.4	01Jan2000, 07:41	1.5210
R-F	4.1016	469.4	01Jan2000, 08:05	1.5207
D	0.7275	204.8	01Jan2000, 06:52	2.3212
R-D	0.7275	201.7	01Jan2000, 07:20	2.3200
B1	0.6495	91.9	01Jan2000, 06:56	1.5569
R-B1	0.6495	91.8	01Jan2000, 07:06	1.5569

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A	0.6213	213.9	01Jan2000, 06:52	2.6670
C	0.1731	78.2	01Jan2000, 06:23	2.4911
R-C	0.1731	76.4	01Jan2000, 06:43	2.4903
B2	0.0578	30.6	01Jan2000, 06:18	2.4911
R-B2	0.0578	29.4	01Jan2000, 06:37	2.4901
B3	0.0462	31.7	01Jan2000, 06:15	2.6670
R-B3	0.0462	29.5	01Jan2000, 06:34	2.6649
B-E0	2.2754	537.4	01Jan2000, 07:18	2.2197
E	0.1698	77.5	01Jan2000, 06:27	2.6711
B-E1	0.1698	13.6	01Jan2000, 14:11	2.6142
R-BE1	0.1698	13.6	01Jan2000, 15:05	2.5862
J-END	6.5468	841.5	01Jan2000, 07:58	1.7913

Project: 213074_HMS_9-11-13 Simulation Run: PRE 10YR

Start of Run: 01Jan2000, 00:00 Basin Model: Pre-Project
End of Run: 02Jan2000, 12:00 Meteorologic Model: 10yr 24hr
Compute Time: 11Sep2013, 10:58:59 Control Specifications: 36hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J	1.2671	28.5	01Jan2000, 22:20	0.3029
R-J	1.2671	28.5	01Jan2000, 22:40	0.3029
I	0.7125	50.2	01Jan2000, 07:12	0.9082
B-E3	1.9796	57.2	01Jan2000, 22:49	0.4712
R-BE3	1.9796	57.2	01Jan2000, 23:02	0.4712
K	0.0905	13.4	01Jan2000, 06:22	1.1288
B-E4	0.0905	0.0	01Jan2000, 00:00	0.0000
R-BE4	0.0905	0.0	01Jan2000, 00:00	0.0000
H	0.0799	9.1	01Jan2000, 06:45	1.1288
B-E2	2.1500	60.5	01Jan2000, 23:09	0.4669
R-BE2	2.1500	60.4	01Jan2000, 23:17	0.4669
M	0.7849	54.9	01Jan2000, 07:13	0.9082
L	0.7562	32.0	01Jan2000, 07:23	0.7143
B-E5	0.7562	27.5	01Jan2000, 22:42	0.6880
R-BE5	0.7562	27.5	01Jan2000, 22:44	0.6880
J-M	1.5411	62.3	01Jan2000, 08:00	0.8002
R-JM	1.5411	62.3	01Jan2000, 08:26	0.8001
F	0.3042	27.3	01Jan2000, 06:58	1.0349
G	0.1063	12.4	01Jan2000, 06:45	1.1475
R-G	0.1063	12.4	01Jan2000, 06:47	1.1475
J-F	4.1016	137.6	01Jan2000, 23:09	0.6519
R-F	4.1016	137.1	01Jan2000, 23:40	0.6517
D	0.7275	84.6	01Jan2000, 06:56	1.1885
R-D	0.7275	83.6	01Jan2000, 07:33	1.1876
B1	0.6495	24.9	01Jan2000, 07:21	0.6697
R-B1	0.6495	24.8	01Jan2000, 07:34	0.6697

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A	0.6213	100.7	01Jan2000, 06:55	1.4466
C	0.1731	33.0	01Jan2000, 06:24	1.3135
R-C	0.1731	32.4	01Jan2000, 06:48	1.3130
B2	0.0578	12.8	01Jan2000, 06:19	1.3135
R-B2	0.0578	12.3	01Jan2000, 06:42	1.3131
B3	0.0462	14.3	01Jan2000, 06:15	1.4466
R-B3	0.0462	13.2	01Jan2000, 06:38	1.4456
B-E0	2.2754	214.2	01Jan2000, 07:35	1.1269
E	0.1698	35.9	01Jan2000, 06:28	1.4600
B-E1	0.1698	7.4	01Jan2000, 14:19	1.4268
R-BE1	0.1698	7.4	01Jan2000, 15:25	1.4238
J-END	6.5468	279.2	01Jan2000, 07:49	0.8369

Project: 213074_HMS_9-11-13 Simulation Run: PRE 2YR

Start of Run:	01Jan2000, 00:00	Basin Model:	Pre-Project
End of Run:	02Jan2000, 12:00	Meteorologic Model:	2yr 24 hr
Compute Time:	11Sep2013, 10:59:10	Control Specifications:	36hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J	1.2671	4.0	01Jan2000, 23:09	0.0174
R-J	1.2671	4.0	01Jan2000, 23:42	0.0174
I	0.7125	11.7	01Jan2000, 22:21	0.2389
B-E3	1.9796	12.9	01Jan2000, 23:29	0.0475
R-BE3	1.9796	12.9	01Jan2000, 23:49	0.0475
K	0.0905	2.0	01Jan2000, 22:02	0.3490
B-E4	0.0905	0.0	01Jan2000, 00:00	0.0000
R-BE4	0.0905	0.0	01Jan2000, 00:00	0.0000
H	0.0799	1.7	01Jan2000, 22:14	0.3490
B-E2	2.1500	13.5	02Jan2000, 00:01	0.0478
R-BE2	2.1500	13.5	02Jan2000, 00:13	0.0478
M	0.7849	12.8	01Jan2000, 22:22	0.2389
L	0.7562	9.2	01Jan2000, 22:28	0.1527
B-E5	0.7562	8.5	01Jan2000, 23:20	0.1264
R-BE5	0.7562	8.5	01Jan2000, 23:23	0.1264
J-M	1.5411	20.2	01Jan2000, 23:11	0.1837
R-JM	1.5411	20.2	01Jan2000, 23:46	0.1837
F	0.3042	5.7	01Jan2000, 22:21	0.3052
G	0.1063	2.3	01Jan2000, 22:14	0.3630
R-G	0.1063	2.3	01Jan2000, 22:16	0.3630
J-F	4.1016	37.8	01Jan2000, 23:39	0.1261
R-F	4.1016	37.7	02Jan2000, 00:22	0.1261
D	0.7275	15.8	01Jan2000, 22:22	0.3808
R-D	0.7275	15.7	01Jan2000, 23:17	0.3805
B1	0.6495	7.4	01Jan2000, 22:22	0.1345
R-B1	0.6495	7.4	01Jan2000, 22:41	0.1345

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
A	0.6213	24.0	01Jan2000, 07:14	0.5277
C	0.1731	5.6	01Jan2000, 07:05	0.4501
R-C	0.1731	5.6	01Jan2000, 07:41	0.4501
B2	0.0578	1.9	01Jan2000, 07:03	0.4501
R-B2	0.0578	1.9	01Jan2000, 07:40	0.4505
B3	0.0462	2.7	01Jan2000, 06:16	0.5277
R-B3	0.0462	2.4	01Jan2000, 06:54	0.5278
B-E0	2.2754	40.4	01Jan2000, 23:34	0.3590
E	0.1698	8.0	01Jan2000, 06:34	0.5507
B-E1	0.1698	3.2	01Jan2000, 14:15	0.5205
R-BE1	0.1698	3.2	01Jan2000, 15:35	0.5200
J-END	6.5468	78.8	01Jan2000, 23:48	0.2172

Project: 213074_HMS_9-11-13 Simulation Run: POST 100YR

Start of Run:	01Jan2000, 00:00	Basin Model:	Post-Project
End of Run:	02Jan2000, 12:00	Meteorologic Model:	100yr 24hr
Compute Time:	11Sep2013, 13:15:33	Control Specifications:	36hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J	1.2671	67.1	01Jan2000, 22:20	0.9273
R-J	1.2671	67.1	01Jan2000, 22:35	0.9274
I	0.7125	148.5	01Jan2000, 06:52	1.9217
B-E3	1.9796	171.5	01Jan2000, 07:32	1.2356
R-BE3	1.9796	171.4	01Jan2000, 07:42	1.2356
K	0.0905	36.6	01Jan2000, 06:21	2.2384
B-E4	0.0905	6.6	01Jan2000, 23:07	0.3821
R-BE4	0.0905	6.6	01Jan2000, 23:31	0.3822
H	0.0808	26.2	01Jan2000, 06:41	2.4057
B-E2	2.1509	182.7	01Jan2000, 07:45	1.2348
R-BE2	2.1509	182.6	01Jan2000, 07:51	1.2348
M	0.7849	161.8	01Jan2000, 06:54	1.9217
L	0.7562	112.4	01Jan2000, 07:02	1.6272
B-E5	0.7562	112.4	01Jan2000, 07:03	1.6009
R-BE5	0.7562	112.3	01Jan2000, 07:05	1.6009
J-M	1.5411	269.6	01Jan2000, 07:00	1.7643
R-JM	1.5411	268.3	01Jan2000, 07:20	1.7642
F	0.3034	78.2	01Jan2000, 06:50	2.2180
J-F	3.9954	464.1	01Jan2000, 07:41	1.5136
R-F	3.9954	463.8	01Jan2000, 07:43	1.5136
G2	0.0930	27.1	01Jan2000, 06:42	2.2384
R-G2	0.0930	27.1	01Jan2000, 06:46	2.2384
G1	0.0215	23.1	01Jan2000, 06:13	3.7240
B-DG1	0.0215	2.1	01Jan2000, 12:15	2.2080
J-G1	4.1099	478.7	01Jan2000, 07:42	1.5337
R-JG1	4.1099	478.1	01Jan2000, 07:47	1.5336

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1	0.7000	199.5	01Jan2000, 06:50	2.3212
D2	0.0367	41.3	01Jan2000, 06:10	3.2463
B-DD2	0.0367	15.5	01Jan2000, 06:19	3.2463
R-D2	0.0367	15.4	01Jan2000, 06:28	3.2464
J-D	0.7367	212.4	01Jan2000, 06:49	2.3673
R-D	0.7367	212.3	01Jan2000, 06:56	2.3673
E	0.1647	85.5	01Jan2000, 06:19	2.5747
B-DE1	0.1647	5.0	02Jan2000, 00:10	1.2737
R-BE1	0.1647	5.0	02Jan2000, 01:52	1.1735
A1	0.1194	114.0	01Jan2000, 06:16	3.8155
B-DA1	0.1194	35.9	01Jan2000, 07:07	3.8045
C2	0.0234	18.0	01Jan2000, 06:13	2.6670
R-C2	0.0234	17.6	01Jan2000, 06:25	2.6679
J-A1	5.1541	637.8	01Jan2000, 07:44	1.6990
R-JA1	5.1541	635.7	01Jan2000, 07:48	1.6988
A2	0.1650	157.5	01Jan2000, 06:16	3.8155
B-DA2	0.1650	64.0	01Jan2000, 06:44	3.8154
J-A2	5.3191	671.0	01Jan2000, 07:48	1.7645
R-JA2	5.3191	667.8	01Jan2000, 07:52	1.7641
C1	0.2170	101.5	01Jan2000, 06:22	2.4911
R-C1	0.2170	100.5	01Jan2000, 06:31	2.4909
A3	0.0851	68.3	01Jan2000, 06:21	3.8155
B-DA3	0.0851	21.4	01Jan2000, 07:16	3.7500
J-A3	5.6212	713.1	01Jan2000, 07:52	1.8222
R-JA3	5.6212	710.5	01Jan2000, 07:57	1.8218
B1	0.6655	94.1	01Jan2000, 06:56	1.5569
R-B1	0.6655	94.1	01Jan2000, 07:02	1.5569
A4	0.1344	94.6	01Jan2000, 06:26	3.8155
B-DA4	0.1344	0.4	01Jan2000, 18:29	0.1324
B-2	0.0642	32.5	01Jan2000, 06:19	2.4911
R-B2	0.0642	30.2	01Jan2000, 06:41	2.4882

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
B-3	0.0617	47.4	01Jan2000, 06:13	2.6670
R-B3	0.0617	41.1	01Jan2000, 06:33	2.6615
J-END	6.5470	789.3	01Jan2000, 07:55	1.7746

Project: 213074_HMS_9-11-13 Simulation Run: POST 10YR

Start of Run: 01Jan2000, 00:00 Basin Model: Post-Project
End of Run: 02Jan2000, 12:00 Meteorologic Model: 10yr 24hr
Compute Time: 11Sep2013, 13:14:47 Control Specifications: 36hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J	1.2671	28.5	01Jan2000, 22:20	0.3029
R-J	1.2671	28.5	01Jan2000, 22:40	0.3029
I	0.7125	50.2	01Jan2000, 07:12	0.9082
B-E3	1.9796	57.2	01Jan2000, 22:49	0.4712
R-BE3	1.9796	57.2	01Jan2000, 23:03	0.4712
K	0.0905	13.4	01Jan2000, 06:22	1.1288
B-E4	0.0905	0.0	01Jan2000, 00:00	0.0000
R-BE4	0.0905	0.0	01Jan2000, 00:00	0.0000
H	0.0808	11.2	01Jan2000, 06:44	1.2609
B-E2	2.1509	60.6	01Jan2000, 23:09	0.4721
R-BE2	2.1509	60.6	01Jan2000, 23:17	0.4721
M	0.7849	54.9	01Jan2000, 07:13	0.9082
L	0.7562	32.0	01Jan2000, 07:23	0.7143
B-E5	0.7562	27.5	01Jan2000, 22:42	0.6880
R-BE5	0.7562	27.5	01Jan2000, 22:45	0.6880
J-M	1.5411	62.2	01Jan2000, 08:01	0.8001
R-JM	1.5411	62.2	01Jan2000, 08:28	0.8001
F	0.3034	32.0	01Jan2000, 06:54	1.1443
J-F	3.9954	133.2	01Jan2000, 23:10	0.6497
R-F	3.9954	133.1	01Jan2000, 23:11	0.6497
G2	0.0930	10.6	01Jan2000, 06:45	1.1288
R-G2	0.0930	10.6	01Jan2000, 06:51	1.1289
G1	0.0215	14.3	01Jan2000, 06:13	2.3875
B-DG1	0.0215	1.1	01Jan2000, 23:05	0.8844
J-G1	4.1099	138.3	01Jan2000, 23:11	0.6617
R-JG1	4.1099	138.3	01Jan2000, 23:17	0.6617

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1	0.7000	82.2	01Jan2000, 06:54	1.1885
D2	0.0367	23.1	01Jan2000, 06:10	1.9626
B-DD2	0.0367	6.1	01Jan2000, 07:02	1.9626
R-D2	0.0367	6.1	01Jan2000, 07:12	1.9627
J-D	0.7367	88.3	01Jan2000, 06:54	1.2270
R-D	0.7367	88.2	01Jan2000, 07:02	1.2270
E	0.1647	38.6	01Jan2000, 06:20	1.4059
B-DE1	0.1647	3.6	02Jan2000, 00:06	0.8839
R-BE1	0.1647	3.6	02Jan2000, 01:54	0.8119
A1	0.1194	70.8	01Jan2000, 06:16	2.4563
B-DA1	0.1194	11.4	01Jan2000, 08:08	2.4513
C2	0.0234	8.1	01Jan2000, 06:13	1.4466
R-C2	0.0234	8.0	01Jan2000, 06:29	1.4475
J-A1	5.1541	183.1	01Jan2000, 23:15	0.7924
R-JA1	5.1541	183.0	01Jan2000, 23:20	0.7922
A2	0.1650	97.8	01Jan2000, 06:16	2.4563
B-DA2	0.1650	29.1	01Jan2000, 07:10	2.4562
J-A2	5.3191	208.7	01Jan2000, 07:30	0.8438
R-JA2	5.3191	207.5	01Jan2000, 07:38	0.8435
C1	0.2170	42.7	01Jan2000, 06:23	1.3135
R-C1	0.2170	42.4	01Jan2000, 06:35	1.3134
A3	0.0851	42.5	01Jan2000, 06:21	2.4563
B-DA3	0.0851	6.1	01Jan2000, 08:20	2.4312
J-A3	5.6212	231.2	01Jan2000, 07:35	0.8857
R-JA3	5.6212	230.2	01Jan2000, 07:42	0.8854
B1	0.6655	25.5	01Jan2000, 07:21	0.6697
R-B1	0.6655	25.5	01Jan2000, 07:29	0.6697
A4	0.1344	58.9	01Jan2000, 06:26	2.4563
B-DA4	0.1344	0.3	02Jan2000, 00:42	0.1040
B-2	0.0642	13.6	01Jan2000, 06:20	1.3135
R-B2	0.0642	12.7	01Jan2000, 06:47	1.3118

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
B-3	0.0617	21.4	01Jan2000, 06:13	1.4466
R-B3	0.0617	18.2	01Jan2000, 06:39	1.4437
J-END	6.5470	268.1	01Jan2000, 07:38	0.8569

Project: 213074_HMS_9-11-13 Simulation Run: POST 2YR

Start of Run:	01Jan2000, 00:00	Basin Model:	Post-Project
End of Run:	02Jan2000, 12:00	Meteorologic Model:	2yr 24 hr
Compute Time:	11Sep2013, 13:15:54	Control Specifications:	36hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
J	1.2671	4.0	01Jan2000, 23:09	0.0174
R-J	1.2671	4.0	01Jan2000, 23:42	0.0174
I	0.7125	11.7	01Jan2000, 22:21	0.2389
B-E3	1.9796	12.9	01Jan2000, 23:29	0.0475
R-BE3	1.9796	12.9	01Jan2000, 23:49	0.0475
K	0.0905	2.0	01Jan2000, 22:02	0.3490
B-E4	0.0905	0.0	01Jan2000, 00:00	0.0000
R-BE4	0.0905	0.0	01Jan2000, 00:00	0.0000
H	0.0808	2.2	01Jan2000, 07:12	0.4354
B-E2	2.1509	13.6	02Jan2000, 00:01	0.0512
R-BE2	2.1509	13.6	02Jan2000, 00:13	0.0512
M	0.7849	12.8	01Jan2000, 22:22	0.2389
L	0.7562	9.2	01Jan2000, 22:28	0.1527
B-E5	0.7562	8.5	01Jan2000, 23:20	0.1264
R-BE5	0.7562	8.5	01Jan2000, 23:23	0.1264
J-M	1.5411	20.2	01Jan2000, 23:11	0.1837
R-JM	1.5411	20.1	01Jan2000, 23:46	0.1837
F	0.3034	6.9	01Jan2000, 06:50	0.3974
J-F	3.9954	36.8	01Jan2000, 23:43	0.1286
R-F	3.9954	36.8	01Jan2000, 23:46	0.1286
G2	0.0930	2.0	01Jan2000, 22:14	0.3490
R-G2	0.0930	2.0	01Jan2000, 22:23	0.3491
G1	0.0215	7.4	01Jan2000, 06:13	1.2800
B-DG1	0.0215	0.2	01Jan2000, 07:30	0.4445
J-G1	4.1099	38.2	01Jan2000, 23:42	0.1352
R-JG1	4.1099	38.2	01Jan2000, 23:50	0.1352

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
D1	0.7000	15.3	01Jan2000, 22:20	0.3808
D2	0.0367	9.8	01Jan2000, 06:10	0.9407
B-DD2	0.0367	3.8	01Jan2000, 06:20	0.9407
R-D2	0.0367	3.8	01Jan2000, 06:33	0.9409
J-D	0.7367	17.1	01Jan2000, 07:19	0.4087
R-D	0.7367	17.1	01Jan2000, 07:31	0.4087
E	0.1647	9.3	01Jan2000, 06:20	0.5446
B-DE1	0.1647	2.0	01Jan2000, 23:20	0.4336
R-BE1	0.1647	2.0	02Jan2000, 01:54	0.3994
A1	0.1194	36.7	01Jan2000, 06:16	1.3196
B-DA1	0.1194	7.5	01Jan2000, 07:19	1.3172
C2	0.0234	1.5	01Jan2000, 06:14	0.5277
R-C2	0.0234	1.5	01Jan2000, 06:43	0.5282
J-A1	5.1541	57.7	01Jan2000, 23:24	0.2119
R-JA1	5.1541	57.6	01Jan2000, 23:30	0.2118
A2	0.1650	50.7	01Jan2000, 06:16	1.3196
B-DA2	0.1650	16.9	01Jan2000, 07:07	1.3195
J-A2	5.3191	62.2	01Jan2000, 23:28	0.2462
R-JA2	5.3191	62.1	01Jan2000, 23:37	0.2460
C1	0.2170	7.1	01Jan2000, 07:05	0.4501
R-C1	0.2170	7.1	01Jan2000, 07:24	0.4502
A3	0.0851	22.0	01Jan2000, 06:21	1.3196
B-DA3	0.0851	4.2	01Jan2000, 08:11	1.3130
J-A3	5.6212	68.9	01Jan2000, 23:28	0.2701
R-JA3	5.6212	68.8	01Jan2000, 23:37	0.2699
B1	0.6655	7.6	01Jan2000, 22:22	0.1345
R-B1	0.6655	7.6	01Jan2000, 22:34	0.1345
A4	0.1344	30.4	01Jan2000, 06:26	1.3196
B-DA4	0.1344	0.3	02Jan2000, 00:35	0.0826
B-2	0.0642	2.1	01Jan2000, 07:04	0.4501
R-B2	0.0642	2.1	01Jan2000, 07:46	0.4503

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
B-3	0.0617	4.0	01Jan2000, 06:14	0.5277
R-B3	0.0617	3.1	01Jan2000, 06:59	0.5276
J-END	6.5470	78.6	01Jan2000, 23:32	0.2565