APPENDIX F

Hydrology Reports

WEST YOST ASSOCIATES
Consulting Engineers

TECHNICAL MEMORANDUM

DATE: November 4, 2016 Project No.: 001-10-15-60
SENT VIA: EMAIL

TO: Tim Burke, City of Vacaville
Fred Buderi, City of Vacaville

FROM: Millicent Cowley-Crawford, PE, RCE #66597
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SUBJECT: Robert's Ranch Hydrology and Water Quality Evaluation

INTRODUCTION

The Robert's Ranch project is a proposed development project in the City of Vacaville (City). West Yost Associates (West Yost) is assisting the City with the preparation of an EIR for the project. As a part of that work, West Yost has reviewed the project site and other sources of data related to stormwater conditions. In addition, we have reviewed previous drainage studies conducted for the Brighton Landing project, and conducted hydrologic modeling of the proposed Robert's Ranch project. Based on those activities, we have prepared this Technical Memorandum that describes the existing conditions, provides our comments on the drainage study prepared by the project proponent, describes the potential project impacts on hydrology and water quality, and presents recommended mitigation measures.

EXISTING CONDTIONS

Surface Water Resources

The proposed project site is located in the Old Alamo Creek watershed. Old Alamo Creek is a modified water body that was formerly the downstream portion of Alamo Creek. Alamo Creek originates on the eastern slopes of Mount Vaca and then flows through the City before joining Ulatis Creek roughly six miles downstream (east) of the project site. Ulatis Creek continues flowing to the east and southeast and ultimately drains to the Sacramento River via Cache Slough. Old Alamo Creek is located north of Elmira Road, just north of the project site (see Figure 1).

During the 1960s, several features of the lower Ulatis Creek watershed were modified to protect local agricultural lands from damaging floods, which had historically occurred along several of the major creeks in the area, including Alamo Creek. One of the modifications involved the redirection of flows from Alamo Creek into a new channel along a more southerly alignment. The new channel became known as New Alamo Creek, and the existing channel downstream of the redirection point became known as Old Alamo Creek.

As a result of the modifications to Alamo Creek, the drainage area to the current Old Alamo Creek was reduced to a localized section of eastern Vacaville plus additional unincorporated areas to the east. The portion of the Old Alamo Creek watershed upstream of the unincorporated Town of Elmira is indicated in Figure 1. The tributary area draining to the creek from this area is approximately 990 acres.

On the project site, runoff occurs as sheet flow traveling from west to east until joining one of the small agricultural ditches on the site. The ditches convey runoff to the eastern boundary of the project and on to the existing Solano Irrigation District Frost Canal located west of the Union Pacific Railroad (UPRR). The Frost Canal conveys runoff north to Old Alamo Creek near Elmira Road. During significant storm events, the Frost Canal is known to overtop its banks. During such events, flows from the canal will flood the adjacent areas and spill to the east, over a dirt road, and into a ditch located immediately adjacent to the UPRR. This ditch conveys runoff north to a point just south of Elmira Road where a culvert conveys runoff to the east side of the railroad. Runoff is then conveyed north for a short distance in a ditch before joining Old Alamo Creek.

Topography and Soils

The topography at the project site is flat with slopes ranging from 0.2 to 0.3 to percent. The ground at the site slopes uniformly from west to east. According to soil data from the Natural Resources Conservation Service, the predominant soils at the site include Brentwood clay loam, Rincon clay loam, and Capay silty clay loam. These soils are generally considered to have moderate potential for erosion. The soils fall within Hydrologic Soils Groups B, C, and D, which have infiltration capacities ranging from moderate (Group B) to very low (Group D).

100-Year and 200-Year Floodplains

According to the Flood Insurance Rate Map 06095C0281E, which was published FEMA in May 2009, the project site is not subject to flooding during a 100-year storm. Flooding has been identified downstream (east) of the project site along the Frost Canal and UPRR (see Figure 2). Runoff from the project site flows to this floodplain area and contributes to the flooding.

In response to Senate Bill 5, the California Department of Water Resources has prepared preliminary (i.e. Best Available) maps depicting the estimated 200-year floodplain for the Sacramento-San Joaquin Valley. These best available maps were reviewed and the project site was determined to be outside of a known 200-year floodplain.

Surface Water Quality

The Sacramento River has been identified as providing a number of beneficial uses including municipal, agricultural, and recreational water supply, and fish and wildlife habitat. Water quality in the river is affected by a number of sources including agricultural runoff, mining activities, stormwater runoff, erosion, and treated wastewater discharges. The Sacramento River is listed as impaired under the 303(d) list for chlordane, DDT, dieldrin, mercury, PCB's, and unknown toxicity (*State Water Resources Control Board, 2010 Integrated Report (Clean Water Act Section 303(d) List/305(b) Report)*).

PROPOSED PROJECT – STORM DRAIN MODELING STUDY

Phillipi Engineering, Inc. (PEI) prepared a Storm Drain Modeling Study for the Brighton Landing project, the adjacent property to the north of Roberts' Ranch, in March 2011, and an update was prepared in 2015. The study presents the preliminary evaluation of the storm drainage requirements for both the Roberts' Ranch and Brighton Landing projects. Computer modeling was prepared to determine the peak flows and runoff volumes from the site for existing conditions and post-project conditions, and to size a detention basin downstream of the projects. The detention basin was proposed to provide mitigation of flood flow increases from both the Roberts' Ranch and the Brighton Landing development projects. The detention basin is also proposed to provide stormwater quality treatment. The original computer modeling that accompanied the March 2011 study was revised by PEI and provided to West Yost in January 2012; West Yost updated the original models to be consistent with proposed Roberts' Ranch project and the completed detention basin pump configuration. Furthermore, several adjustments to model parameters and rainfall input were made to be consistent with the City's Storm Drain Design Standards (2006) and the Solano County Water Agency's Hydrology Manual (June 1999).

POTENTIAL PROJECT IMPACTS AND RECOMMENDED MITIGATION MEASURES

West Yost evaluated the proposed project to determine the potential impacts of the project related to hydrology and water quality. Our findings are provided below.

1. Violates Water Quality Standards or Waste Discharge Requirements

Construction of the project would result in earth disturbing activities such as site clearing and grading for construction of roads, parking areas, building pads, and park areas. Disturbed areas exposed to rainfall could lead to an increase in erosion and the discharge of sediment to receiving waters resulting in a degradation of water quality. Additional pollutants can be introduced during construction from vehicular use, construction materials, and construction waste products. These activities can introduce pollutants such as nutrients, metals, pesticides, oils and grease, and trash. The potential impacts of the project on water quality during construction are considered significant and could result in a violation of water quality standards.

Implementation of the proposed project would convert the existing agricultural lands to urban uses. Urban development creates new pollution sources including higher levels of vehicle emissions, vehicle maintenance wastes, pesticides, fertilizers, household hazardous wastes, and pet wastes. As a result, the runoff from an urban area may have a higher concentration of pollutants than the pre-development runoff from the same area. This project plans to convey runoff to the detention basin constructed with the Brighton Landing project. This detention basin will provide both stormwater quality treatment and flood control storage for the runoff from the project. To provide stormwater quality treatment, a detention basin must detain stormwater for a period of time before it is discharged to the downstream receiving waters. The detention time allows particles and the associated pollutants to settle out. The minimum detention time required to achieve sufficient pollutant settling typically ranges from 24 to 48 hours. Based on the hydrologic modeling prepared as a part of the Storm Drain Modeling Study (PEI, 2015), it appears that the detention basin and the associated pump station can be configured to provide sufficient settling time to achieve adequate stormwater quality treatment. The pump station has been modeled with, under ultimate buildout, two 12 cubic feet per second (cfs) and three 22 cfs pumps (total pumping capacity of

about 90 cfs). The capacity of the first pump and when it starts will be critical to the stormwater quality treatment benefits by the detention basin. Model tests by West Yost indicate that the capacity and start time of the first pump could be adjusted to allow for sufficient settling time without causing the maximum 100-year water surface elevation to encroach into the required detention basin freeboard of 3 feet.

- **Impact HYDRO-1.1**: Construction activities could substantially degrade water quality resulting in a violation of water quality standards.

  Mitigation Measure HYDRO-1.1: The applicant shall comply with the NPDES General Permit for Discharges of Storm Water Discharge Associated with Construction Activities issued by the SWRCB. The Construction General Permit requires the development and implementation of a SWPPP. The SWPPP must contain a site map(s) which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP must list Best Management Practices (BMPs) the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

  BMPs to prevent or reduce potential erosion control could include mulch covering, temporary seeding, soil stabilizers, binders, fiber rolls, temporary vegetation, and permanent seeding. BMPs to control sediment that may be introduced into runoff could include silt fences, straw wattles, and sediment basins. BMPs for controlling run-on and runoff include could control berms and swales that direct runoff away from sensitive areas. Source control BMPs that prevent pollutants from entering runoff could include establishment of vehicle fueling and maintenance areas and material storage areas that are either covered or are designed to control runoff.

  Significance After Mitigation: Provided that appropriate BMPs are implemented to prevent erosion, control sediment, control runoff, and prevent pollutants from entering runoff during construction of the project, the impact would be reduced to Less-Than-Significant.

- **Impact HYDRO-1.2**: Runoff generated from the urban land-uses proposed with the project could substantially degrade water quality resulting in a violation of water quality standards.

  Mitigation Measure HYDRO-1.2: The applicant shall incorporate BMPs into the project design to reduce urban pollutants in runoff in accordance with the requirements of the City's Storm Drain Design Standards, the City's Stormwater Management Plan, and the City's NPDES stormwater permit. The applicant may use the proposed detention basin as a BMP to provide stormwater quality treatment if it is configured to meet the design requirements of an extended detention basin in accordance with the California Storm Water Best Management Practices Handbook, which is referenced by the City's design standards.

Extended detention basins reduce pollutants in runoff by allowing particles and associated pollutants to settle. Other viable BMPs include infiltration techniques such as infiltration trenches and infiltration basins. Infiltration type BMPs reduce pollutants by allowing runoff to infiltrate into the underlying soil, which filters out pollutants. Infiltration techniques are most appropriate in areas with highly pervious soils (Hydrologic Soils Types A and B), so the suitability of infiltration techniques at the project will be depend on specific soil conditions. Biofiltration BMPs include vegetated swales and buffer strips and bioretention. These types of BMPs reduce pollutants in runoff through filtering by the vegetation and subsoil and infiltration into the underlying soils. Source control BMPs, which prevent pollutants from entering runoff, include directing roof spouts to pervious areas, use of porous pavements, enclosing trash storage areas, and providing signs at storm drain inlets to educate the public.

Significance After Mitigation: Provided that BMPs are followed to reduce the potential for pollutants to enter runoff and to remove pollutants from runoff to the Maximum Extent Practicable, the impact would be reduced to *Less-Than-Significant.*

2. Substantially Depletes Groundwater Supplies or Substantially Interferes with Groundwater Recharge

Groundwater impacts were not evaluated by West Yost.

3. Substantially Alters Existing Drainage Pattern Resulting in Substantial Erosion or Siltation

The proposed project will convert the existing agricultural lands to residential, commercial, school, and park land uses. This will increase the impervious surfaces on the site and will significantly alter the existing drainage pattern, which will cause an increase in the peak flows and volumes discharged from the site during storm events. According to the updated hydrologic modeling prepared by West Yost, without construction of the detention basin, the proposed development of the watershed could increase the 10-year peak flow from 330 cfs to 455 cfs and the 100-year peak flow from 550 cfs to 710 cfs. The increased flows could result in substantial erosion or siltation downstream if they were discharged directly to the downstream receiving water. However, the project will use the existing detention basin east of the project boundary that will detain storm flows. Flows from the project are to be conveyed into the detention basin via an underground pipe network for storms up to the 10-year event. For larger storms, flows in excess of the pipe system capacity will be conveyed overland in the streets and directed into the detention basin. A pump station constructed at the detention basin will discharge flows from the basin at rates well below the existing peak flow rates. According to the revised modeling, with the detention basin, the 10-year and 100-year peak flows from the watershed will be 37 cfs and 83 cfs, respectively. As a result, the detention basin would prevent the project from causing a significant impact due to an increase in erosion or siltation downstream. However, there is insufficient detail included in the storm drainage study to insure that all flows, including those in excess of the pipe system, will be adequately directed into the detention basin and the downstream conveyence. Therefore, the possibility for increased downstream erosion or siltation is considered a potentially significant impact.

- **Impact HYDRO-3.1:** Increased runoff generated from the urban land-uses proposed with the project could cause an increase in erosion or siltation downstream of the project if runoff is not adequately conveyed to the proposed detention basin.

  Mitigation Measure HYDRO-3.1: See Mitigation Measure HYDRO-5.1.

  Significance After Mitigation: Provided that a Storm Drain Master Plan (SDMP) is prepared to meet the requirements specified in Mitigation Measure HYDRO-5, the impact would be *Less-Than-Significant.*

4. Substantially Alters Existing Drainage Pattern or Increases the Rate or Amount of Surface Runoff Resulting in Flooding

As discussed previously, development of the project would significantly increase the stormwater runoff rates in the watershed without construction of the detention basin. The 10-year peak flow would be increased from 330 cfs to 455 cfs and 100-year peak flow from 550 cfs to 710 cfs. These flow increases could exacerbate the existing flooding problem downstream of the project that has been identified by FEMA. However, the project will use the existing detention basin at the downstream end of the project to detain storm flows and pump them out at a rate well below the 10-year peak flow. This is an acceptable approach for mitigating the potential impacts of the project on downstream flooding. However, sufficient detail was not provided to determine whether the project drainage facilities will adequately direct all flows, including overland flows during the 100-year storm, into the basin. As a result, the possibility of increasing the area subject to flooding downstream is considered a potentially significant impact.

Although peak discharges from the project site are proposed to be reduced significantly with construction of the detention basin, the duration of peak discharges will be extended substantially, from about nine hours under pre-development conditions to about 24 hours under post-development conditions. The project will add an additional two pumps to the existing pump station that was constructed with the Brighton Landing project. This will increase the capacity of the pump station to about 100 cfs, which exceeds the capacity of the existing downstream channel. An existing culvert downstream of the detention basin was determined to have a capacity of about 10 to 15 cfs, and it is assumed that flow rates greater than about 15 cfs will result if overtopping of the downstream channel and result in flooding. The project will increase the peak discharge from the detention basin from about 45 cfs to about 100 cfs during a 100-year storm event. The extended peak flow from the detention basin will exceed the capacity of the downstream conveyance for an additional 15 hours. Furthermore, the total volume of water discharged from the detention basin that is above the existing channel capacity will increase from about 85 acre-feet to about 120 acre-feet, about 40 percent increase, during a 100-year storm event. As a result, the possibility of increasing the area subject to flooding downstream is considered a potentially significant impact.

- **Impact HYDRO-4.1**: Increased runoff generated from the urban land-uses proposed with the project could cause an increase in the area subject to flooding downstream of the project if runoff is not adequately conveyed to the detention basin that was constructed with the Brighton Landing project.

  Mitigation Measure HYDRO-4.1: See Mitigation Measure HYDRO-5.1.

- **Impact HYDRO-4.2:** Increased runoff generated from the urban land-uses proposed with the project will result in an increase in the volume of runoff and combined with the increased discharge rate from the detention basin could result in an increase in area subject to flooding downstream of the project.

  Mitigation Measure HYDRO-4.2: Conduct a hydraulic analysis of the conveyance facilities downstream of the detention basin to determine the capacity of the downstream conveyance, the extent of flooding under pre- and post-development conditions, and to identify the necessary mitigation measures that would reduce the area subject to flooding to pre-development levels.

  Significance After Mitigation: Provided that a SDMP is prepared to meet the requirements specified in Mitigation Measure HYDRO-5 and HYDRO-4.2 is implemented, the impact would be *Less-Than-Significant.*

5. Creates or Contributes Runoff Water Exceeding Stormwater Drainage System Capacity or Provides Substantial Additional Polluted Runoff

The proposed project will significantly increase the amount of impervious cover on the site, which will cause a significant increase in runoff rates compared to existing rates. The project will include a detention basin downstream of the project boundary that will mitigate for potential increases in flow and will also provide stormwater quality treatment. On-site runoff from the project will be conveyed to the detention basin via an underground pipe network that will be constructed in accordance with the City's Standard Specifications and Drawings (PEI, 2015). The pipe sizes will vary from 15 to 72 inches in diameter. The proposed pipe network will be sized to convey the peak flow from the 10-year storm in accordance with the City standards. Flows from storms larger than the 10-year event must be safely conveyed overland in the streets to the detention basin. City standards require the flow from the 100-year storm water surface elevation to be no more than 0.5 feet above the centerline elevation of a road and must be at least 1.0 foot below building pads. Detailed pipe sizing calculations and overland release calculations are not included in the project drainage report and the adequacy of the proposed on-site systems could not be evaluated. Therefore, the possibility for the proposed on-site stormwater system to be exceeded by a storm event is considered a potentially significant impact.

- **Impact HYDRO-5.1**: The proposed project could create runoff water that exceeds the proposed storm drain system and the existing downstream system.

Mitigation Measure HYDRO-5.1: The project applicant shall have a SDMP, prepared by a registered civil engineer, that identifies the specific improvements that will that adequately collect and convey storm water from proposed project and convey those flows downstream within increasing the area subject to flooding under pre-project conditions. The SDMP shall provide the necessary calculations to adequately demonstrate that the proposed drainage facilities adequately convey the design runoff from the project and adequately mitigate the impacts of increased runoff. In accordance with the City's Storm Drain Design Standards, the SDMP shall be prepared prior to the approval of the tentative map and shall include, but is not limited to, the following items:

- A topographic map of the drainage shed and adjacent areas as necessary to define the study boundary. The map shall show existing and proposed ground elevations (including preliminary building pads), with drainage sub-shed areas in acres, and the layout of the proposed drainage improvements.
- A map showing analysis points, proposed street grades, storm drainage facilities, and overland release paths with required easement locations for overland flow across private property.
- Preliminary pipe sizes with hydraulic grade lines, design flows, inverts, and proposed ground elevations at analysis points. This information is to be provided on the map showing the layout of the proposed drainage facilities.
- Downstream improvements and maintenance activities necessary to convey storm flows such that the area subject to flooding will not increase with the proposed project.
- Proposed alteration required to avoid any increase in peak flow or areas subject to flooding. An example of such alterations could include the following, or others:
  - Adjustment to grading plans
  - Adjustment to storm drainage system
  - Adjustment to pump station operations
  - Downstream improvements along the existing conveyance (Frost Canal and Old Alamo Creek)
- Summary of the detention basin and pump station including:
  - Additional pumping capacity added with this project.
  - Summary of detention storage capacity.
  - Proposed operations plan

Significance After Mitigation: *Less-Than-Significant.*

6. Substantially Degrades Water Quality

Construction activities could lead to an increase in erosion and the discharge of sediment from the site. Construction activities also introduce other pollution sources that could increase the concentration of pollutants in site runoff. Therefore, construction activities could result in a temporary degradation of water quality, which is potentially significant impact.

Urban development can cause an increase in the pollutant concentration of runoff from a watershed compared to pre-developed conditions. The proposed project intends to mitigate for the potential stormwater quality impacts by constructing a detention basin downstream of the project. However, the proposed configuration of the detention basin as described in the storm drainage study (PEI, 2015) would not provide a sufficient detention time to achieve adequate treatment. Therefore, the possibility of the project to degrade water quality is considered a potentially significant impact.

- **Impact HYDRO-6.1**: Runoff generated from the urban land-uses proposed with the project could substantially degrade water quality.

  Mitigation Measure HYDRO-6.1: See Mitigation Measure HYDRO 1.2.

Significance After Mitigation: Provided that BMPs are followed as described in Mitigation Measure HYDRO-2, the impact would be reduced to *Less-Than-Significant.*

7. Places Housing within a 100-year Flood Hazard Area

Based on the FEMA Flood Insurance Rate Map (Panel 06095C0281E, May 4, 2009), the proposed project will not place housing with a 100-year flood hazard area.

8. Places Structures within a 100-year Flood Hazard Area Resulting in Impeded or Redirected Flood Flows

Based on the FEMA Flood Insurance Rate Map (Panel 06095C0281E, May 4, 2009), the proposed project will not place structures within a 100-year flood hazard area.

9. Exposes People or Structures to Significant Risks Involving Flooding

In response to SB 5, the California Department of Water Resources has prepared preliminary (i.e. Best Available) maps depicting the estimated 200-year floodplain for the Sacramento-San Joaquin Valley. These best available maps were reviewed and the project site was determined to be outside of a known 200-year floodplain.

The proposed project will increase peak flows and runoff volumes generated within the project site. On-site flows will be collected in an underground storm drain system and conveyed to a detention basin. Flows in excess of the pipe system will flow to the detention basin in streets. The detention basin will provide flood control storage that will serve to mitigate for the project's potential impacts downstream. The storm drainage study for the project lacks sufficient detail to determine if the proposed storm drainage pipe system and overland flow paths will effectively deliver runoff to the detention basin without producing flooding within the project. Therefore, the possibility that the project exposes people to flooding within and downstream of the project is considered a potentially significant impact.

- **Impact HYDRO-9.1**: The project could expose people or structures to significant flood risks.

  Mitigation Measure HYDRO-9.1: See Mitigation Measure HYDRO 5.1.

  Significance After Mitigation: Provided that a SDMP is prepared to meet the requirements specified in Mitigation Measure HYDRO-5, the impact would be *Less-Than-Significant.*

10. Inundation by Seiche, Tsunami, or Mudflow

The project site is not located in an area that is subject to inundation by seiche, tsunami, or mudflow.

POTENTIAL CUMULATIVE IMPACTS

The proposed project and other potential cumulative projects in the vicinity of the project site, including growth resulting from build-out of the City's General Plan, would be required to comply with the NPDES General Permit for Discharges of Storm Water Discharge Associated with Construction Activities issued by the State Water Resources Control Board. This permit requires

projects to implement measures to prevent impacts, individual and cumulative, to water quality during construction. In addition, projects would also be required to comply with the City's NPDES stormwater permit from the CVRWQCB and their Stormwater Management Plan which prevent impacts to water quality after construction of a project. Therefore, the potential for cumulative impacts to water quality is less than significant.

The proposed project and other potential projects that could contribute to cumulative impacts would also be subject to local, state, and federal regulations designed to minimize individual and cumulative impacts related to stormwater runoff rates and flooding. The implementation of mitigation measures for the proposed project and anticipated mitigation measures for other projects that will be required to maintain compliance with these regulations and will reduce the potential cumulative impacts to a less than significant level.

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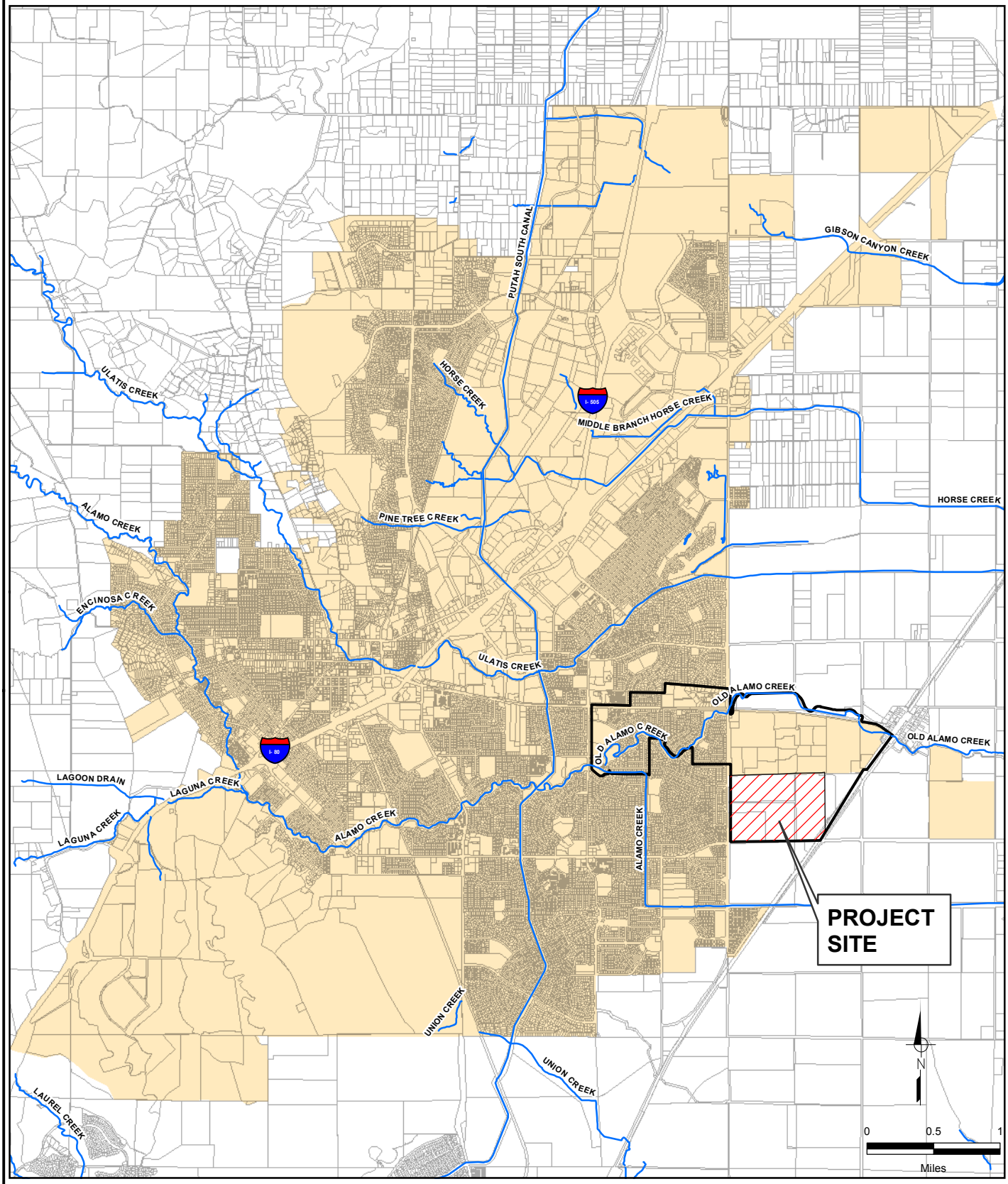

LEGEND

- Creek/Drain
- Roberts' Ranch Project Site
- Old Alamo Creek Watershed
- Vacaville City Limits

FIGURE 1

ROBERTS' RANCH EIR

SURFACE WATER RESOURCES

VACAVILLE

WEST YOST ASSOCIATES

Consulting Engineers

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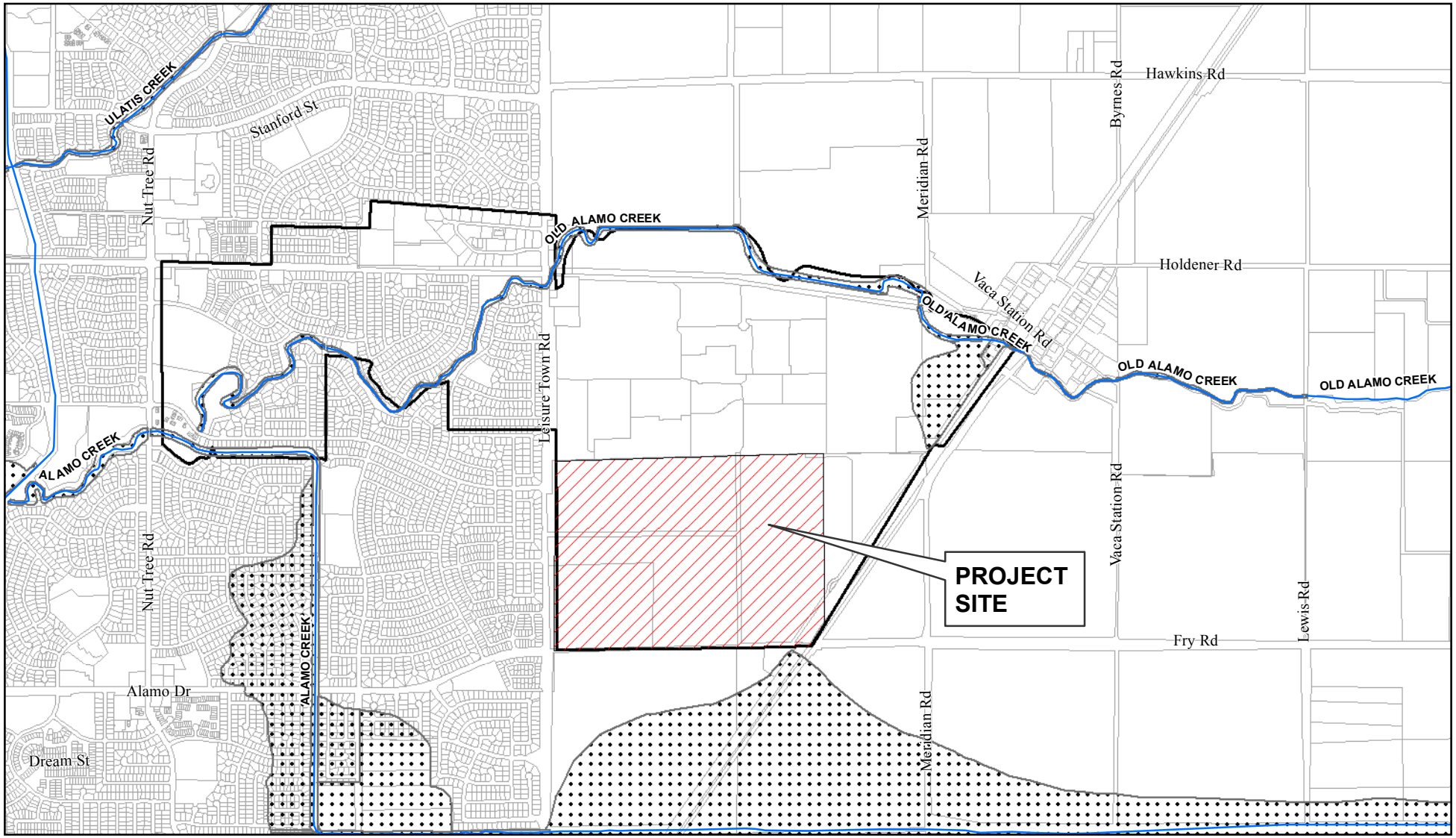


LEGEND

- Creek/Drain
- 100-Year FEMA Flood Plain
- Roberts' Ranch Project Site

N

0 1,000 2,000

Feet

FIGURE 2

ROBERTS' RANCH EIR

100-YEAR FEMA FLOOD PLAIN

VACAVILLE

WEST YOST ASSOCIATES

Consulting Engineers

State Regional Water Quality Control Board Requirements

1. Prior to issuance of a grading permit, Developer shall demonstrate to the City Engineer and Director of Public Works that the proposed development meets the requirements of the City of Vacaville MS4/Phase 2 storm water general permit and corresponding design standards as issued by the State Regional Water quality Control Board.

2. Developer shall install and demonstrate to the City Engineer and Director of Public Works that the project development meets the requirements of the State Regional Water Quality Control Board's "Best Management Practices" and the Solano County Urban Runoff Clean Water Program and any City of Vacaville ordinances in effect at the time of improvement plan approval to mitigate storm water pollution and erosion at any time during construction,

3. Developer shall submit prepare a Storm Water Pollution Prevention Plan (SWPPP) for review by the City Engineer in conjunction with the submittal of the Improvement Plans, Grading Plans, and Final Map.

4. Developer shall demonstrate to the City Engineer that the project meets the requirements of the State Regional Water Quality Control Board's "Best Management Practices" and Storm Water Permit requirements and the City's NPDES permit to mitigate storm water pollution and erosion.

5. For developments of one acre or greater, the applicant shall file a "Notice of Intent" with the Regional Water Quality Control Board and shall prepare a Storm Water Prevention Plan and Monitoring Plan. Questions regarding these requirements should be directed to the Utilities Division at (707) 449-6263.

6. Developer shall install "Drains to Bay" decals on all catch basins and install a water quality "storm-cepter" inlet or equivalent method to remove potential surface runoff impurities of the drainage from the subdivision to the satisfaction of the City Engineer and Director of Public Works prior to occupancy of any building or residential unit.

Storm Water Studies

7. In those cases where a Storm Water study was required as a part of the development proposal, all recommendations from such study shall be incorporated into the final project designs, grading plans, or improvement plans unless otherwise approved by the Director of Public Works and City Engineer.

Storm Drain Improvements

8. In conjunction with the submittal of the subdivision improvement plans, grading plans, and Final Map, a comprehensive storm water management plan prepared

by a Civil Engineer licensed by the State of California Developer shall be submitted to the City Engineer. In addition to any other requirements of the City Engineer and Director of Public Works, the storm water management plan shall include storm drain system calculations and if applicable, a comprehensive hazardous materials spill prevention and response plan to reduce the potential for impacts upon aquatic habitats.

9. In conjunction with the submittal of the subdivision improvement plans, grading plans, comprehensive storm water management plan, and Final Map, Developer shall submit a hydrology and hydraulic analysis signed and stamped by an Engineer licensed by the State of California to verify the adequacy, size and location of proposed storm drainage improvements. Final sizing of pipes and the type and location of drainage structures shall be reviewed by the City Engineer during the plan check process and shall be revised at the direction of the City Engineer.

10. Where required by the City Engineer and/or Director of Public Works, the hydraulic analyses shall include provisions for future storm water pumping stations.

11. The design and construction of all public storm drainage improvements shall conform to the City of Vacaville Public Works Department Standard Plans and Specifications for Public Improvements, latest edition, unless otherwise approved by the City Engineer and any Special Conditions of Approval.

12. The on-site and off-site drainage improvements shall be designed and constructed to handle the drainage of the entire parcel per the latest City of Vacaville drainage design criteria and specifications to the satisfaction of the City Engineer. Rainfall intensities used shall be those found in the 1999 Solano County Water Agency Hydrology Manual. Along with construction documents for the storm system, the Developer shall submit the hydrology and hydraulic calculations for a 10-year event prepared by a Civil Engineer, licensed in the State of California, showing that the hydraulic grade line of a 10-year storm event (starting at the 100 year water surface of the creek or system that the project will discharge to) will be a minimum of 18" below the top of the curb, and that the 100 year event can adequately drain into nearby City streets or open spaces without inundating the building pad and surrounding properties.

13. Developer shall create a map of the drainage system showing hydraulic flows and hydraulic grade lines (HGL), and 100-year flood water surface elevation of designated receiving public or private storm water conveyance facilities and verifying that all pipes and pavement elevations comply with City criteria.

14. All proposed public storm drain improvements including connections to the existing or proposed storm drain system shall be shown on the improvement plans and constructed as part of the subdivision improvements.

15. All on-site and off-site storm drain lines and structures needed to serve the subdivision shall be constructed to the satisfaction of the City Engineer and Director of Public Works prior to occupancy of the first residential building.

16. Local drainage must not drain over the surface directly into the public right-of-way without being piped and connected directly into the City Storm Drain line, unless approved by the City Engineer and the Director of Public Works.

17. The Developer shall install a water quality system in each drainage line discharging to the creek or to a City storm drain system that will remove sediment, trash and oils from the developed site to the satisfaction of the City Engineer and the Director of Public Works.

18. All pipes in City streets shall be publicly maintained and all pipes in private streets shall be maintained by a Home Owners Association or similar entity.

19. Underground on-site private storm drain pipes shall be designed for a minimum 10-year storm with a minimum 15 minute time of concentration for a tributary area defined by the property boundary using the Solano County Drainage Design Manual and the associated hydrology calculations shall be submitted to the City Engineer.

20. No blockage of existing drainage shall be allowed.

21. The developer shall dedicate any necessary land for open channels, detention/retention basins, and pump stations as may be necessary to serve the project unless otherwise approved by the City Engineer and/or these Conditions of Approval.

22. Access to drainage easements shall be a minimum of 15' wide. The City requires points of access in order to get into the easements to perform maintenance activities. Easements may be required thru a number of lots to obtain said access. Developer shall dedicate easements on the Final Map as determined to be necessary by the City Engineer.

23. The site shall be graded such that storm water from the project is discharged from the site into an approved public drainage facility. No increase in runoff will be allowed from this project onto an adjacent property unless adequate private easements have been established. Design of on-site drainage is subject to review and approval by the City Engineer and/or Building Official.

24. The Conditions, Covenants, and Restrictions shall include provisions requiring the homeowners to maintain any and all of the drainage facilities on their property free and clear of debris and obstructions at all times.

25. The Developer shall construct the "grassy swales" or similar improvements in locations as required by the City Engineer to meet RWQCB requirements.

Overland Release

26. The Developer shall design the subdivision to City Standards such that, in the event that the storm drain pipe and inlets become clogged or flows exceed the capacity of the drainage system, the site will release drainage overland to the next available drainage inlet, public right-of-way or drainage system.

Lot Drainage

27. Developer shall provide adequate drainage for each lot and construct storm drainage swales, pipes, thru curb drains and inlet connection points to the street drainage system so each lot drainage and storm drain system can tie into the public storm drain system without surface flow over the public sidewalk or proposed private lots. Only natural existing drainage will be allowed to cross property lines, and all new lot improvements shall be tied to a drainage system to properly dispose of the lot drainage within the lot boundary unless drainage easements are obtained. Existing drainage across property lines will be allowed provided that all man made improvements on the uphill lot that causes additional or concentrated drainage to flow to an acceptable drainage system before it reaches the down hill lot. If this occurs, the uphill property must collect the drainage and dispose into a storm drain system or other method as approved by the City Engineer.

28. Developer's Engineer shall submit a stamped and signed calculation showing to the satisfaction of the City Engineer that all building pads will be protected from a 100-year flood. Prior to the issuance of a building permit on any parcel or lot created by this Subdivision, a Surveyor or Civil Engineer licensed by the State of California shall certify that the pad elevation for any such parcel or lot and the approved drainage system is as shown on the grading plan.

Non-Stormwater Discharges

Discharges other than stormwater (non-stormwater discharges) to the storm drain system are prohibited unless approved by the Public Works Director. Non-stormwater discharges include, but are not necessarily limited to, discharges from the washing of motorized vehicles, airplanes, trailers, and recreational vehicles.

City of Vacaville

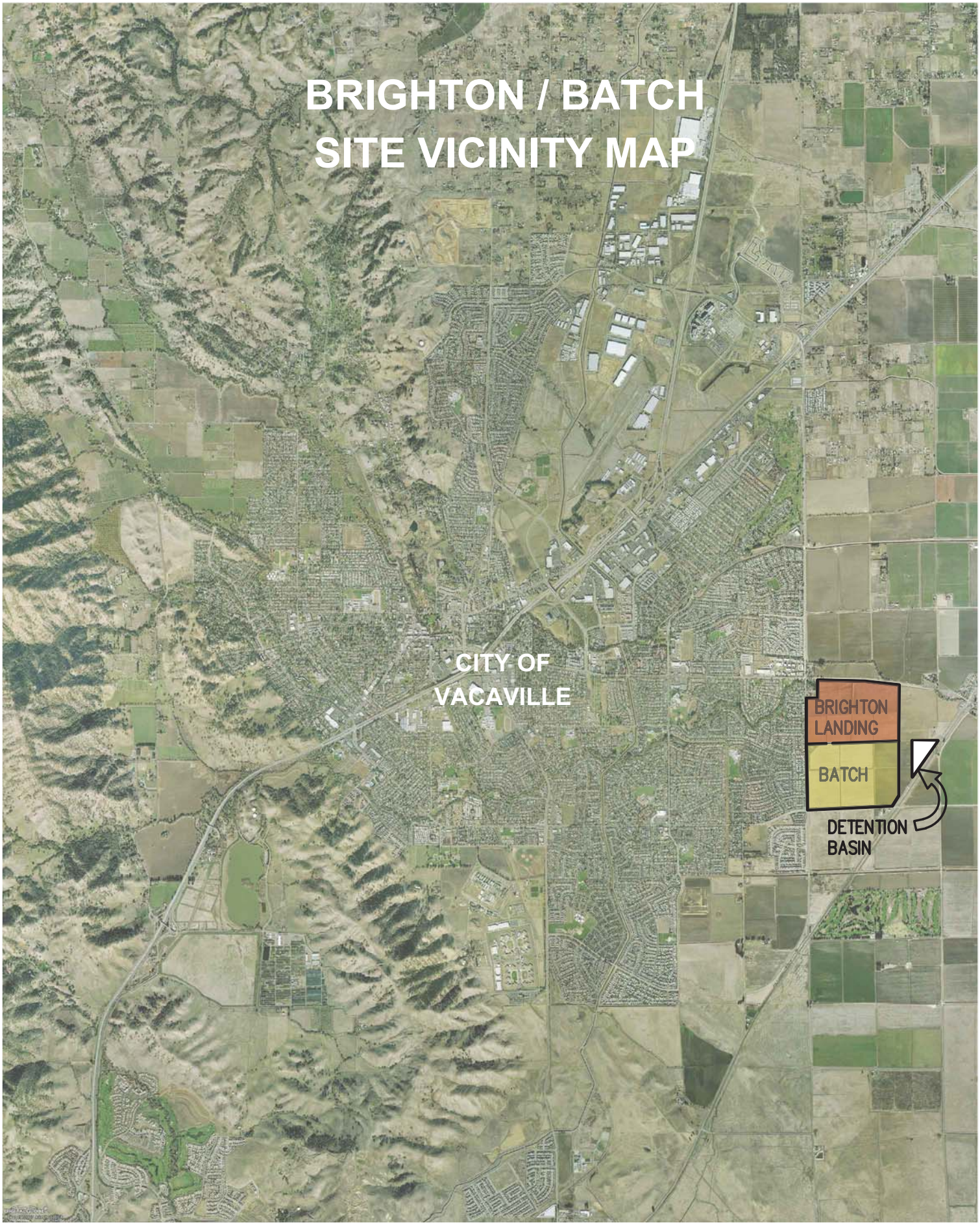
Brighton Landing

Storm Drain Modeling Study Update

January 2015

PHILLIPPI ENGINEERING, INC.
CIVIL ENGINEERING - LAND SURVEYING
THOMAS A. PHILLIPPI, R.C.E. #32067
P.O. BOX 6556 • 425 MERCHANT STREET, SUITE 200 • VACAVILLE, CA 95696-6556
OFFICE (707) 451-6556 • FAX (707) 451-6555 • EMAIL: pei@phillippieng.com

BRIGHTON / BATCH
SITE VICINITY MAP



City of Vacaville

Brighton Landing
Storm Drain Modeling Study Update

January 2015

1.0 Purpose

This report is being prepared to analyze the design storm drain flow rates generated by the proposed developments, and size the proposed detention facilities that the Brighton Landing and Batch projects will need to construct in order to provide adequate detention storage capacity and off-site discharge for the ultimate build out condition.

2.0 EXISTING SITE

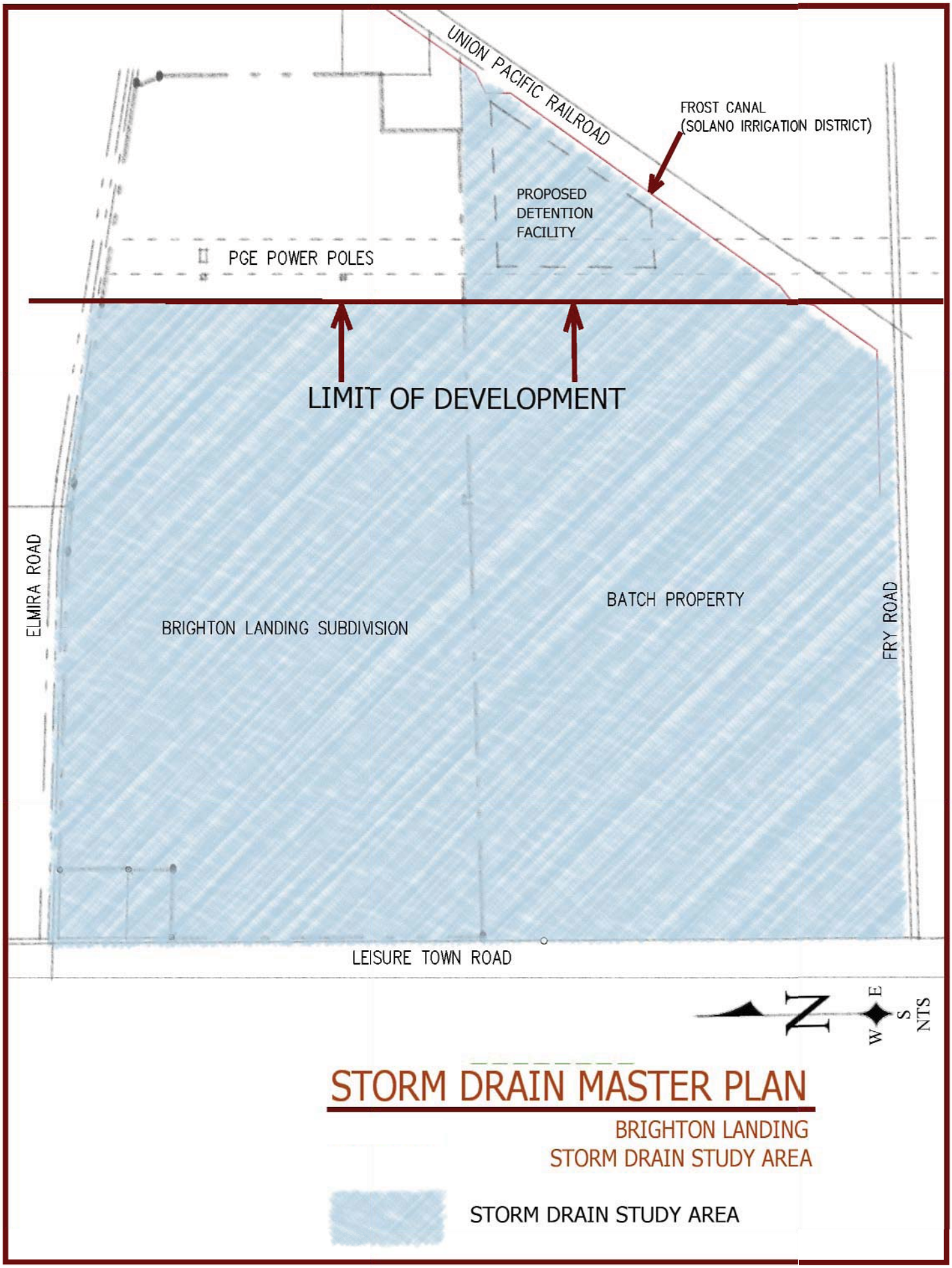
The total Brighton Landing project area comprises 217.7± acres and is bounded by Leisure Town Road on the west, Elmira Road to the north, PG&E Towers to the east and the Batch Property to the south. The Batch project consists of 253.3± acres and is bounded by Fry Road to the south, Leisure Town Road to the west, PG&E towers and Union Pacific railroad to the east, and the Brighton Landing project area to the north. The overall storm drain study area consists of the Brighton Landing project area and the Batch Property (See Figure 2.2).

Both the Brighton Landing and Batch sites are zoned and actively utilized for agriculture. The Brighton Landing site is within the City of Vacaville city limits. The Batch site is within the City of Vacaville sphere of influence, but will require annexation as a part of the development entitlement. The properties are used to grow a variety of crops and is at times flood irrigated. The property generally slopes gently from the west to the east. The proposed development sites for Brighton Landing, Batch, and the detention basin / pump station sites are located within Zone X (Areas determined to be outside of the 0.2% annual chance floodplain) or as Shaded Zone X (Areas of 0.2% annual chance flood; areas of 1% chance flood with average depths of less than 1 foot) as denoted on FEMA FIRM Panels 06095C0283E and 06095C0281E. The area north and east of the pump station site adjacent to the railroad tracks, north to Old Alamo Creek, has been denoted as within Zone AE (Base Flood Elevation determined) with a BFE of 78±.

3.0 EXISTING CONDITION

The 100-Year return event generates approximately 261.9 cubic feet per second (cfs) of runoff from the Brighton Landing Subdivision area, while 347.1cfs± is generated by the Batch Property, resulting in a total runoff of 607.6cfs±.

The Solano Irrigation District (SID) has an open channel irrigation facility named the Frost Canal. This irrigation service provides irrigation water to the agricultural lands west of the Union Pacific Railroad bound by Elmira Road to the north, Fry Road to the south, and Leisure Town Road to the west. The Frost Canal terminates within the boundaries of the Brighton Landing and Batch project limits. Any irrigation water conveyed through the Frost Canal that is not distributed to the adjoining agricultural lands is discharged into the Frost Spill. The Frost Spill conveys the unused irrigation water south to Fry Road, continues east parallel to and north of



STORM DRAIN MASTER PLAN

BRIGHTON LANDING
STORM DRAIN STUDY AREA

STORM DRAIN STUDY AREA

Fry Rd. At the western side of the Union Pacific right-of-way, the Frost Spill turns north and continues parallel to the railroad right-of-way for approximately 4,600± liner feet, at which point the Spill diverts from the railroad R/W traveling around the western boundary of three existing residential parcels where the Spill discharges into Old Alamo Creek.

Although the Frost Spill was only designed with the capacity to convey irrigation overflow water, it also collects storm water from the properties west of the spill canal and east of Leisure Town Rd. The existing terrain for both the Brighton Landing and Batch properties generally slope from west to east with an approximate slope of 0.2% to 0.3%, with the land being utilized for row style crops. The crops are oriented such that they are irrigated from the west edge and irrigation water is conveyed through planting rows serving as water swales conveying the water in an easterly direction. Any excess irrigation water is collected by interim cut-off ditches which convey the unused irrigation water to a more defined earthen channel which combines the flow from the various cut-off swales and conveys the combined flow east to the Frost Spill channel, where the water is discharged into the spill channel and ultimately conveyed to Old Alamo Creek.

Storm water is conveyed in the same pattern from west to east through the planting row swales. As with the irrigation water, the storm water is collected in the cut-off swales, directed to the collection channel and conveyed to the Frost Spill, where the storm water discharges into the Spill channel. However, the storm water flows in the 10-yr and 100-yr storms significantly exceed the capacity of the existing Frost Spill which intercepts the storm water. In a storm event, the Frost Spill receives storm water discharged through several discharge pipes along the alignment parallel with the railroad. As the storm water exceeds the capacity of the discharge culverts to convey the flows, the excess flows releases in a northern direction. At a point approximately 3,400± feet from Fry Rd there is a 24” culvert in the Frost Spill which provides vehicular crossing over the existing channel. At this crossing location, the existing culvert has capacity for 10cfs±. This existing culvert was sized for its primary function, which is to serve as a conveyance of excess irrigation water for which it is minimally adequate for the flow rate of irrigation water discharged into the canal. However, the culvert is significantly undersized for even the 10-year storm event, for which it receives 250cfs±, being 240cfs± in excess of the capacity of the canal culver. Therefore the 10-year storm event easily overwhelms the culvert far surpassing the ability of the crossing culvert to convey the storm water. The storm water within the channel backs up against the crossing until such a point that the water surface exceeds the top of bank grades at approximately elevation 76.2±. At this same point, any storm water not conveyed into the Frost Spill, through discharge pipes, is directed overland to the vehicle crossing location, at which point the overland water combines with the storm water which has backed up against the crossing culvert. The combined flow spills over the crossing and canal to the east.

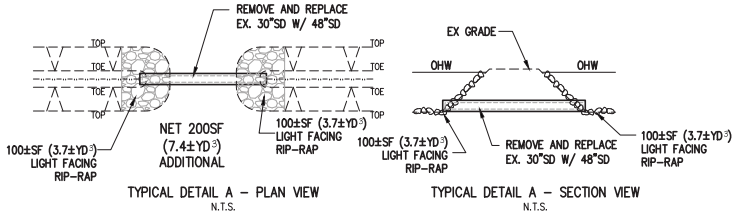
As the Frost Spill continues north from the existing southernmost vehicle crossing discussed above, the spill canal is separated from the Railroad by an existing county road which has not been maintained. This roadway continues north between the canal and railroad R/W for approximately 1,200± feet at which point the Frost Spill turns west to travel around the western limits of the existing residential parcels. The existing road continues parallel with the railroad R/W in a northeasterly direction to the intersection with Elmira Road.

As the storm water exceeds the capacity of the Frost Spill, at an elevation of 76.2± the water begins overtopping and flowing into the existing roadway section. A Second vehicle crossing over the Frost Spill is located at approximately 700± feet northeast of the first vehicle crossing. As the storm water within the canal, combined with surface runoff from the agricultural land to

SUMMARY FILL TABLE

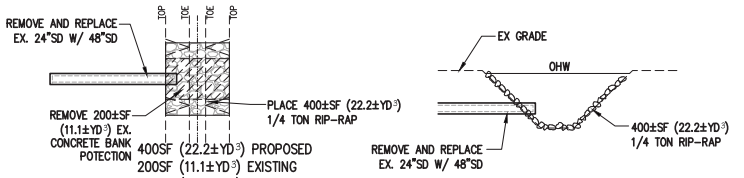
AREA CALCULATION:

DETAIL A X2:	200SF X 2 =	400SF
DETAIL B X1:	200SF X 1 =	200SF
DETAIL C X1:	400SF X 1 =	400SF
DETAIL D X1:	50SF X 1 =	50SF
DETAIL E X1:	200SF X 1 =	200SF
TOTAL		1250SF



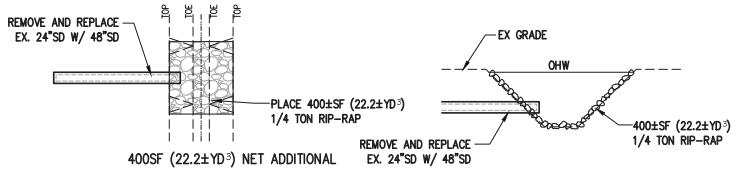
TYPICAL DETAIL A – PLAN VIEW
N.T.S.

TYPICAL DETAIL A – SECTION VIEW
N.T.S.



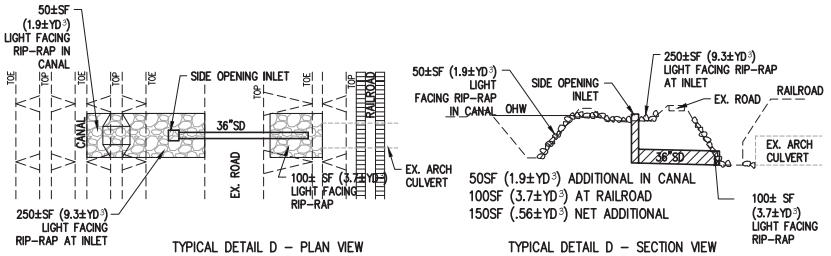
TYPICAL DETAIL B – PLAN VIEW
N.T.S.

TYPICAL DETAIL B – SECTION VIEW
N.T.S.



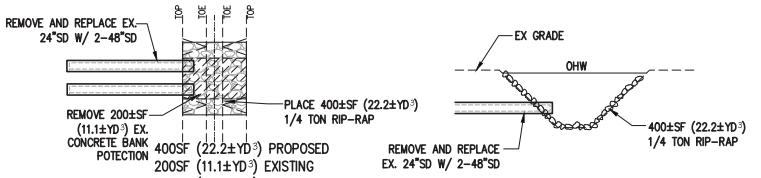
TYPICAL DETAIL C – PLAN VIEW
N.T.S.

TYPICAL DETAIL C – SECTION VIEW
N.T.S.



TYPICAL DETAIL D – PLAN VIEW
N.T.S.

TYPICAL DETAIL D – SECTION VIEW
N.T.S.



TYPICAL DETAIL E – PLAN VIEW
N.T.S.

TYPICAL DETAIL E – SECTION VIEW
N.T.S.

PROJECT NAME/LOCATION:

FIGURE 3: BRIGHTON LANDING PROJECT FROST DRAIN CONNECTIONS

DESIGNED BY:	VAB	ISSUE DATE:	01/09/2014
DRAFTED BY:	VAB	PROJECT NO.:	250120
CHECKED BY:	AFH, II	DWG FILENAME:	250120EX8

PHILLIPPI ENGINEERING
CIVIL ENGINEERING - LAND SURVEYING
425 MERCHANT STREET VACAVILLE, CA 95688
P.O.BOX 6556 VACAVILLE, CA 95696
OFFICE (707) 451-6556 FAX (707) 451-6555

COUNTY ROAD (CALIFORNIA PACIFIC ROAD)
EAST OF AND PERPENDICULAR TO THE UNION PACIFIC RAILROAD
DRAINAGE CONDITION DURING LESS THAN A 2-YEAR STORM EVENT

North of RR culvert looking southwest

Frost Spill Vehicle Crossing at southern limit of existing road

County Road (California Pacific Road) at southern vehicle crossing of Frost Spill

Southern end of County Road looking Northeast


Existing culvert under Union Pacific Railroad R/W

Old Alamo Creek at Elmira / South A Street looking west

SID irrigation canal conveying overtopping storm water

the west, the combined storm water flows again exceeds the capacity of the Frost Spill crossing culvert, resulting in an overtopping spill at an elevation of approximately 76.0±. The storm water that spills over the Frost Spill at this point flows into the existing roadway and is combined with the storm water from the southern overtopping point. As the storm water within the Frost Spill continues northeasterly within the channel, the eastern top of bank drops to an elevation of 76.4± creating another point at which the channel bank is exceeded by the water surface further releasing storm water into the existing roadway section.

Storm water which enters the existing roadway is conveyed north to a point 50± feet from the southernmost existing residential parcel, at which point the storm water is conveyed under and through the railroad R/W through an existing brick lined arch culvert with a flow line elevation of 71.8±. The point within the existing county road perpendicular to the railroad crossing is a localized low point in the roadway. As the existing county road continues north, from the existing culvert, the roadway elevation increases preventing the storm water from continuing to flow further north adjacent to the existing residential parcels.

The storm water is conveyed from the east side of the railroad R/W northeast through on open swale to Old Alamo Creek just south of and parallel with Elmira Rd. Storm water conveyed into Old Alamo Creek continues in an easterly direction following the water course of Old Alamo Creek.

At the location of the railroad culvert crossing east of the railroad R/W SID has an irrigation channel conveying water from the southwest to the northeast. This channel has a siphon to provide a maintenance vehicular crossing of their channel. Just north of this siphon, the channel turns east crossing the existing South A Street through an additional siphon facility. As the storm water builds up within the swale east of the railroad tracks the water surface eventually builds up such that the water begins to overtop the existing SID vehicle crossing and ultimately spills into the SID channel prior to the South A Street crossing siphon. Any storm water which enters the SID channel would be conveyed through the siphon across South A Street continuing easterly within the channel.

It was recorded that on March 24, 2011, in the proposed area of Vacaville, received 1.34 inches of rain over a 24hr period. Per the Solano County Water Agency Hydrology Manual, for a mean annual rainfall region of 24 inches and a 24hr storm, the 1.34 inches of rain would represent less than a 2 year storm, which is the smallest storm interval that the County hydrology methodology represents. During this storm event it was observed onsite that the storm water which is released from the Batch and Brighton Landing properties in the existing condition exceeded the capacity of the Frost Spill, resulting in storm water flowing within and completely inundating the existing county road ultimately conveying the storm water east under the railroad right-of-way and into both Old Alamo Creek and the SID irrigation channel east of the railroad.

The existing storm water course does not have adequate capacity within the Frost Spill channel to convey existing storm water that is tributary to it. However the overflow water course routes the storm water under the railroad right of way and into existing facilities which convey the storm water through existing defined water courses to the east. This water course is utilized by any storm generating more than the 10±cfs as restricted by the existing vehicular crossing culvert within the Frost Spill Channel. The drainage issues described above in conjunction with the downstream drainage issues can further be confirmed by the FEMA FIRMs denoting the localized area around the canal crossings north to Old Alamo Creek as within the 100-yr flood plain.

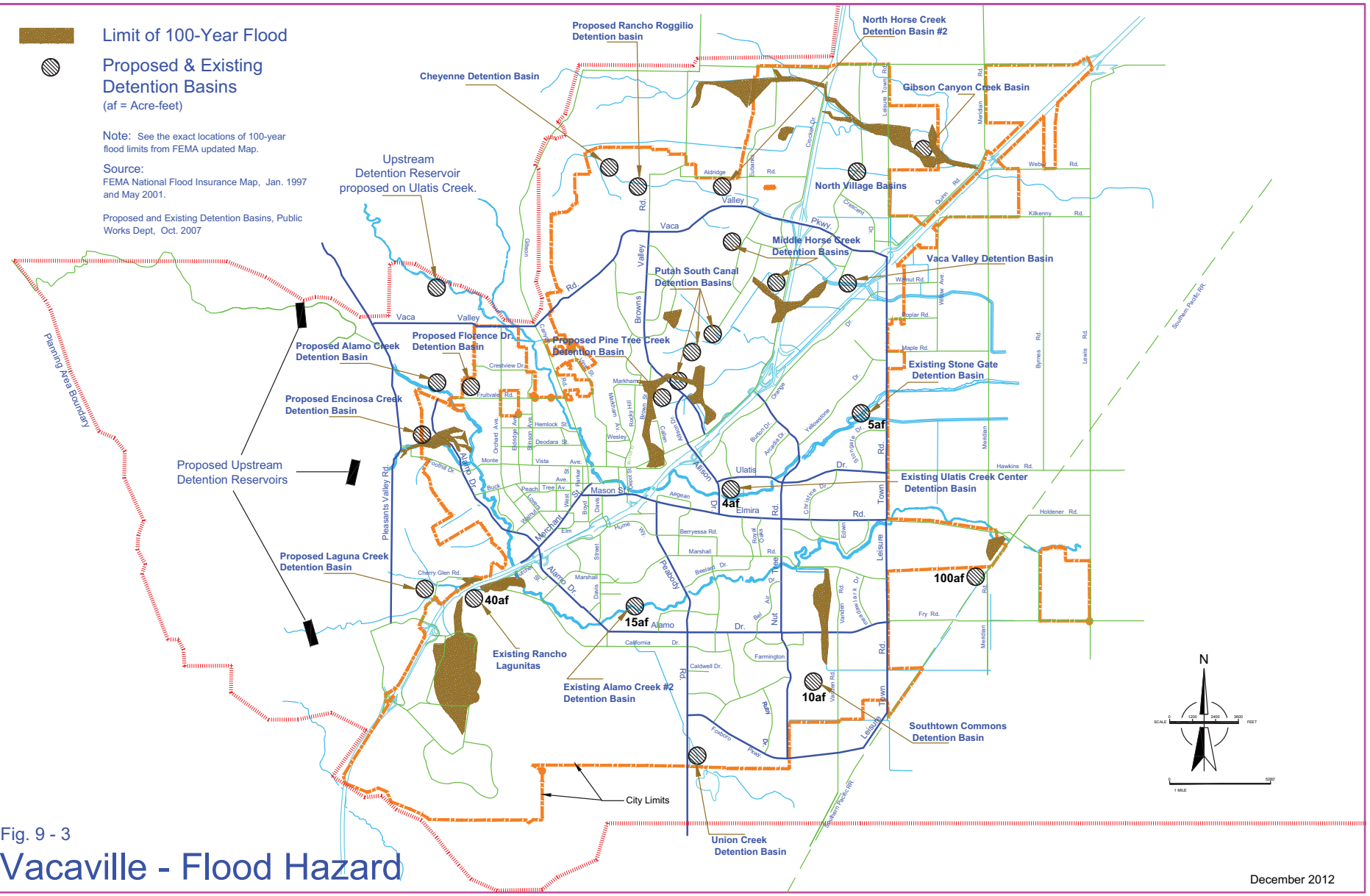


Fig. 9 - 3

Vacaville - Flood Hazard

December 2012

NOTES TO USERS

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 10N. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

Cross section line

Transect line

87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

4278000 mN — 1000-meter Universal Transverse Mercator grid values, zone 10N

600000 FT — 5000-foot grid ticks: California State Plane coordinate system, zone II (FIPSZONE 0402), Lambert Conformal Conic projection

DX5510 X — Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
May 4, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0281E

FIRM

FLOOD INSURANCE RATE MAP

SOLANO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 281 OF 730

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SOLANO COUNTY	060631	0281	E
VACAVILLE, CITY OF	060373	0281	E

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

MAP NUMBER
06095C0281E

EFFECTIVE DATE
MAY 4, 2009

Federal Emergency Management Agency

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NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- Cross section line
- Transect line
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4376000 mN — 1000-meter Universal Transverse Mercator grid values, zone 10N
- 600000 FT — 5000-foot grid ticks: California State Plane coordinate system, zone II (FIPSZONE 0402), Lambert Conformal Conic projection
- DX5510 X — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
May 4, 2009

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0283E

FIRM

FLOOD INSURANCE RATE MAP

SOLANO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 283 OF 730

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SOLANO COUNTY	060631	0283	E
VACAVILLE, CITY OF	060373	0283	E

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

MAP NUMBER
06095C0283E

EFFECTIVE DATE
MAY 4, 2009

Federal Emergency Management Agency

4.0 METHODOLOGY

Due to the necessity of a detention facility, pre-development and post-development 100-Year return storm event must be analyzed using HEC-HMS software.

Each development is divided into various subsheds and routed toward the downstream detention facility. The subsheds for the Brighton Landing Subdivision are organized based on planned topography and conveyance facilities; the subsheds for the Batch Property are organized generically in the absence of topographic and conveyance facility planning.

The rainfall distribution and rainfall depth is used for a 24-hour duration of the 10-Year and 100-Year events. Using the *Solano County Water Agency June 1999 Hydrology Manual* to determine the mean annual precipitation of the project area for the appropriate storm events, with mean annual precipitation rate of 24 (as noted in the Isohyetal Map of Solano Country Mean Annual Precipitation Figure), the City of Vacaville unit rainfall distribution, shown in Table DS 4-2 of the *City of Vacaville Design Standards*, can be amplified to create rainfall distribution patterns for larger events that follow the historical rainfall patterns observed in Vacaville.

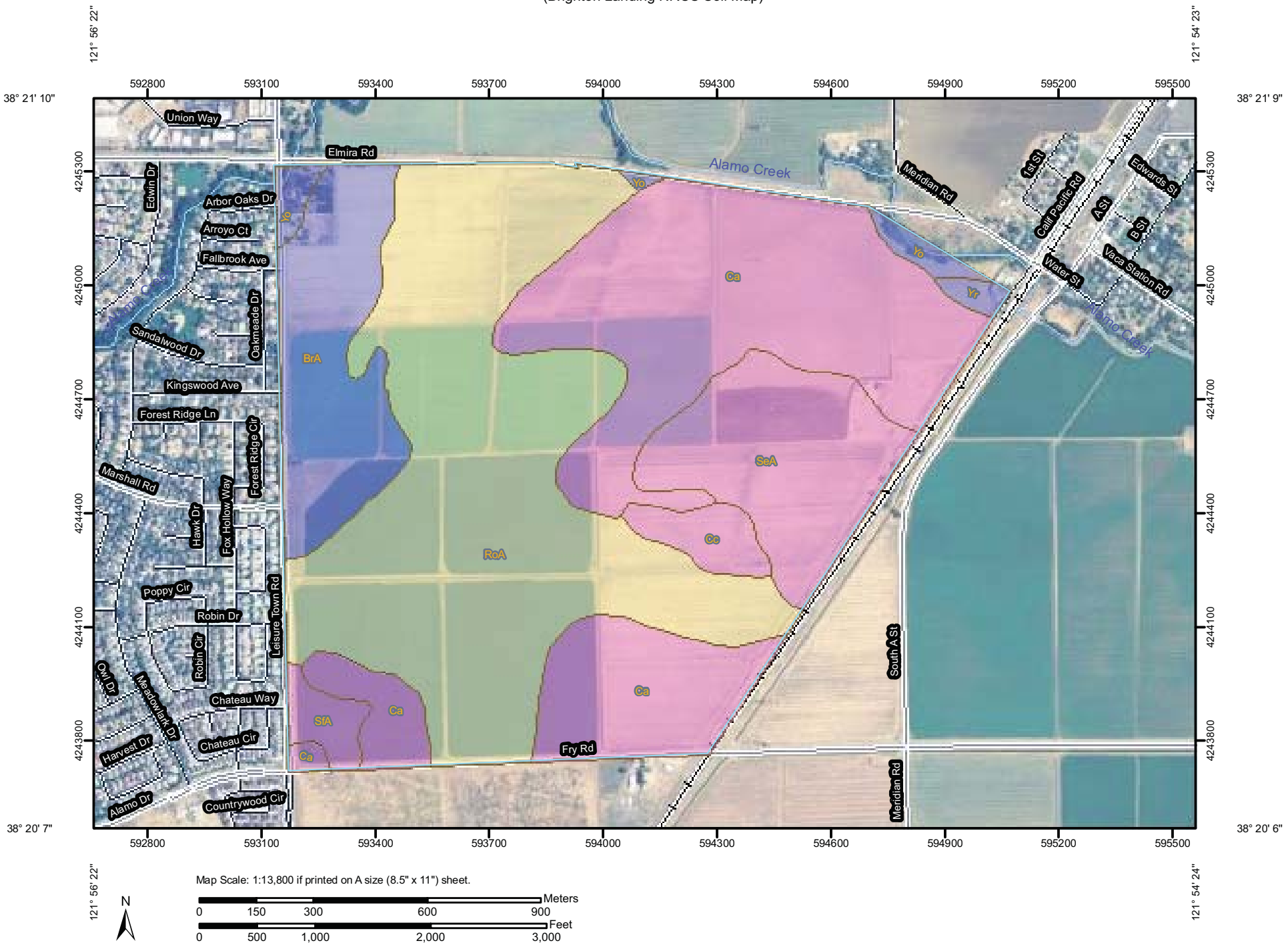
Initial and constant rainfall losses are set in the model to determine how much rainfall is lost to initial saturation of terrain and the continued infiltration of water into the ground during the course of the storm. This information will allow the model to transform rainfall excess into runoff.

The computed results from HEC-HMS include peak discharge, total precipitation, total loss, total excess, total direct runoff, total baseflow, and discharge. Additionally, maximum flows into the detention facility, maximum water levels, and start and stop times for basin discharge are shown. Subshed summaries, rainfall diagrams, flow hydrographs and reservoir storage and flow charts are included in the appendix of this report.

HEC-HMS performed the computations for this model using the Kinematic Wave Transform Method.

Detailed onsite computations for the storm water conveyance systems of both projects will be performed with Autodesk Storm and Sanitary Analysis 2011 at later times.

Hydrologic Soil Group—Solano County, California
(Brighton Landing NRCS Soil Map)



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BRIGHTON/250120
PROPOSED SHED.DWG

ISSUE DATE: 01/24/12
PROJECT NO.: 250120
SHEET NO.: OF

PROJECT NAME/LOCATION:
BRIGHTON LANDING
VACAVILLE CA

DRAWING TITLE:

PEI PHILLIPPI ENGINEERING
CIVIL ENGINEERING - LAND SURVEYING
425 MERCHANT STREET VACAVILLE, CA 95688
P.O.BOX 6556 VACAVILLE, CA 95696
OFFICE (707) 451-6556 FAX (707) 451-6555

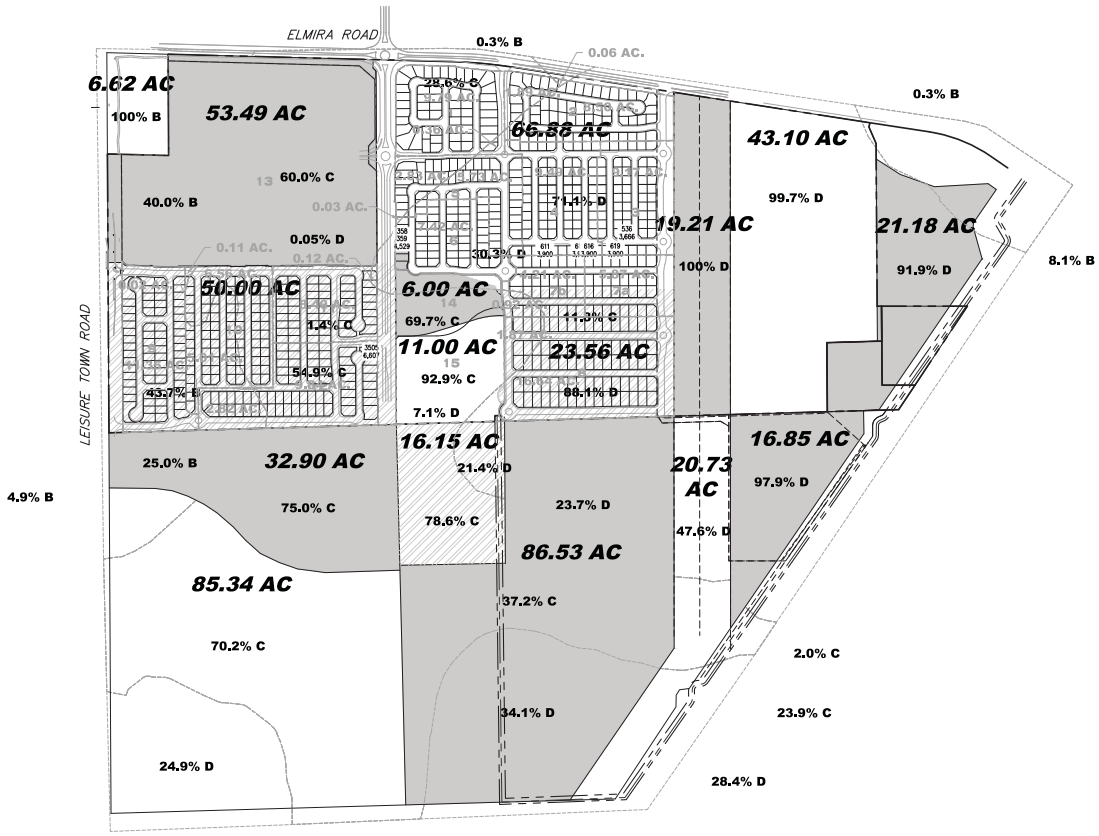
DESIGNED BY:
DRAFTED BY:
CHECKED BY:

APPROVED

APPROVED BY:
CITY ENGINEER CE NO.:
DATE OF APPROVAL

REGISTERED PROFESSIONAL ENGINEER
THOMAS A. PHILLIPPI
No. 32067
Exp. 12-31-12
CIVIL
STATE OF CALIFORNIA

SCALE:
HORIZ.: 1"=400'



SCALE:
HORIZ.: 1"=400'

APPROVED BY:
CITY ENGINEER
DATE OF APPROVAL
CE NO.:

PHILLIPPI ENGINEERING
CIVIL ENGINEERING · LAND SURVEYING
2425 3RD STREET, SUITE 201
SACRAMENTO, CA 95818
OFFICE (707) 451-4556
VACAVILLE, CA 95688
FAX (707) 451-4555

APPROVED

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

PROJECT NAME/LOCATION:
BRIGHTON LANDING
VACAVILLE CA

DRAWING TITLE:
PROPOSED SHED AREAS
SOIL CLASIFICATION

DRAWING FILE:
P: 250120/HYDRO/
BRIGHTON/250120
PROPOSED SHED.DWG

ISSUE DATE:
01/24/12

SHEET NO.:

PROJECT NO.:
250120

OF

Brighton Landing

Soil Class Weighted Constant Loss Rate

Developed Condition

Land Use	NRCS Soil Class		
Constant Loss Rate	B	C	D
Residential	0.18	0.1	0.05
School	0.165	0.085	0.035
Park	0.19	0.11	0.06
Commercial	0.162	0.082	0.032
Open Space	0.2	0.12	0.07

	NRCS Soil Class			Total	Area	Weighted
Basin No	B	C	D	Area	Sq Mi	Loss Rate
Batch 1	4.19	59.89	21.25	85.33	0.1333	0.09
Batch 2	8.22	24.68		32.9	0.0514	0.12
Batch 3		12.7	3.45	16.15	0.0252	0.07
Batch 4		33.86	52.66	86.52	0.1352	0.07
Batch Buffer		15.76	4.96	20.72	0.0324	0.10
Ex Residence	6.62			6.62	0.0103	0.16
Brighton Village 1		9.79	0.36	10.15	0.0159	0.10
Brighton Village 2		1.89	8.5	10.39	0.0162	0.06
Brighton Village 3			9.17	9.17	0.0143	0.05
Brighton Village 4			9.49	9.49	0.0148	0.05
Brighton Village 5		2.83	5.73	8.56	0.0134	0.07
Brighton Village 6		0.3	7.42	7.72	0.0121	0.05
Brighton Village 7a			5.87	5.87	0.0092	0.05
Brighton Village 7b		0.92	4.21	5.13	0.0080	0.06
Brighton Village 8		1.87	16.64	18.51	0.0289	0.06
Brighton Village 9	11.35	0.02		11.37	0.0178	0.18
Brighton Village 10	5.01	6.56		11.57	0.0181	0.13
Brighton Village 11		8.4	0.12	8.52	0.0133	0.10
Brighton Village 12		9.84	2.82	12.66	0.0198	0.09
Elementary School		10.22	0.78	11	0.0172	0.08
High School	21.4	32.09		53.49	0.0836	0.12
Park 1		4.18	1.82	6	0.0094	0.09
Detention Basin		0.4	18.6	19	0.0297	0.07

5.0 STORM DRAIN PROJECT AREA

The total area considered with in this analysis of storm drainage includes both Brighton Landing Subdivision and the adjacent Batch Property to the south, with the overall area being bound to the west by Leisure Town Road, to the north by Elmira Road, to the east by existing power poles and railroad facilities, and to the south by Fry Road. Brighton Landing Subdivision contributes approximately 217.7 acres of watershed to the basin and the Batch Property contributes approximately 253.3 acres. In total, the basin will received approximately 471.0 acres of developed area runoff.

6.0 PROPOSED CONDITION

The Brighton Landing and Batch projects will construct necessary storm drain facilities to convey on-site storm water to the detention basin, constructed by the development, located east of the two development's common boundary line.

This detention basin in its ultimate configuration will contain 120acre-ft± of storage and serve to mitigate the increase in storm water flows, resulting from both the Brighton Landing project and the adjoining Batch property, in the ultimate developed condition to significantly less than predevelopment conditions. Due to topographic restrictions, the detention facility will be equipped with pumping equipment to provide discharge of accumulating storm water, with an anticipated maximum pumping capacity of 100cfs±. The pump will be located in a sump that will be designed to provide an efficient minimum running time for the pump in order to prevent excessive starting and stopping of the pump. The detention pond will utilize a pump station to convey the storm water, at a controlled rate, to the existing Solano Irrigation District Frost Spill Canal. In the existing condition, the Frost Spill Canal accepts the existing storm water from both the Brighton Landing parcels and adjoining Batch parcels to the west of the canal. The existing pipes discharging into the Frost Spill channel and the existing vehicle crossing culverts within the Frost Spill, as discussed in the existing conditions section, will be removed and replaced with upsized culverts to minimize the potential for plugging, as well as limit the restrictions that will cause overtopping of the canal. Additionally a side spillway weir will be installed within the Frost Spill perpendicular to the existing railroad culvert. This spill will be installed in the attempt to control the overflow point and direct the overflow water to the railroad culvert in a more controlled manner.

The detention basin will also serve as the development water quality device. As a result, the pump station discharge flow rate will be limited to the single 40hp pump up to a water surface elevation of 64.75. This elevation will provide a total of 11.25acre-ft of storage that equates to the volume based water quality criteria for the developed condition for both Brighton Landing and Batch properties.

The Brighton Landing subdivision will develop prior to any development within the Batch property south of Brighton Landing. It is the intent to develop Brighton Landing in multiple phases as villages may be constructed by multiple home builders. The current proposal will initially mass grade the first six phases of the project, with full improvements to be installed as individual villages are acquired and constructed by

respective home builders. The remainder of the project will develop as builders acquire and build respective villages within the project.

The full build out of the Brighton Landing development will convey the project storm water through a series of piped storm drain networks. The storm water from the southeast corner of the project will be conveyed though a 84-inch storm drain pipe to the proposed detention pond. It is proposed that the initial development will construct a piped storm drain network within the limits of the respective phase of development. The remaining downstream drainage required from the village limit to the detention pond shall be conveyed on an interim basis through a combination of off-site interim and permanent storm drain pipe facilities. Any interim storm drain improvements shall be replaced by future village phases within the limits of their respective project limits. The 84-inch storm drain transmission main from the southeast corner of the project to the detention pond is proposed to be constructed prior to the completion of the first village, as reflected in the Brighton Landing Village 1-6 Mass Grading plans.

The complete detention pond is intended to serve the full build out of both Brighton Landing and Batch projects, including their respective school and park sites. Therefore there is significantly more capacity available than would be necessary for initial village development, or even the full build out of the Brighton Landing project. As such the detention pond discharge pump station will be phased with conveyance flow rates appropriate to mitigate the increase in peak storm water flow rates from the respective proportion of the development. The remaining undeveloped areas will be conveyed through an open channel around the detention basin discharging directly to the Frost Canal without detention, functioning similar to the existing condition.

The first village development will require the construction of the complete detention basin and the phase 1 pump station improvements. It is anticipated that detention basin will contain the ultimate pond storage capacity with this initial phase. The phase I pump station will consist of 2-40hp pumps. The pump station will utilize a single 40hp pump, with a discharge of approximately 10cfs± as the controlled outfall discharge. The second pump will serve as a redundant pump for the pump station phase 1 configuration. The development of the first eight villages utilizing the phase 1 detention basin pump station will result in the following peak 100yr flow rate:

Brighton Landing Developed Villages 1-8 & Park	149.6cfs	
Detention Basin Discharge	11.9cfs	(Elev 74.3)
Brighton Landing Existing / Undeveloped	174.4cfs	
Batch Existing	363.4cfs	
Total discharge tributary to the Frost Spill	538.7cfs±	

The 40hp pump configuration will operate as the low flow / water quality discharge pump in the build out condition.

With the development beyond village 8 within the Brighton Landing project, the detention basin pump station will be improved to the second phase consisting of the original 2-40hp pumps and 2-125hp pumps. The second 125hp pump will serve as a redundant pump for the phase 2 pump station configuration. This configuration will serve development through the build out of the Brighton Landing development, resulting in the following peak 100-year flow rate:

Brighton Landing Build out Developed to Basin	316.1cfs±	
Detention Basin Discharge	44.9cfs±	(Elev 73.6)
Batch Existing	363.4cfs±	
Total discharge tributary to the Frost Spill	408.3cfs±	

This Phase 2 configuration assumes that the Brighton Landing subdivision has fully built out prior to any development within the Batch project.

Prior to any development within the Batch project, the pump station shall be improved to the third phase consisting of the 2-40hp pumps and 2-125hp pumps, already installed by previous phases, plus the final 2-125hp pumps completing the ultimate pump configuration. This configuration will serve the complete development of both Brighton Landing and Batch developments, including their respective school sites and parks, resulting in the following peak 100-year flow rate:

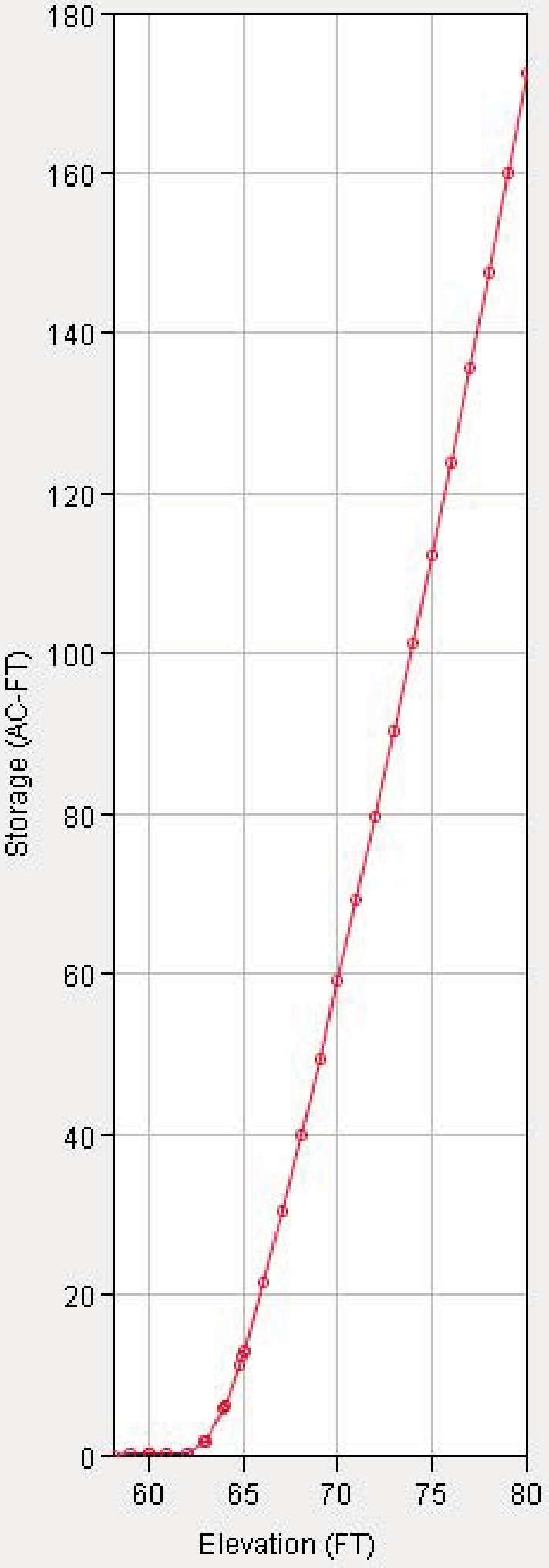
Batch Build out Developed To Basin	363.4cfs±	
Brighton Landing Build out Developed to Basin	316.1cfs±	
Total Inflow at Detention Basin	706.9cfs±	
Total discharge from Basin tributary to the Frost Spill	100.3cfs±	(Elev 75.2)

The fourth 125hp pump will serve as the redundant pump for the ultimate pump configuration.

As the proposed development is constructed and more of the areas within the Brighton Landing and Batch projects are routed into the detention basin, the developed peak flow discharge from the combined discharge is reduces further at each consecutive pump station phase.

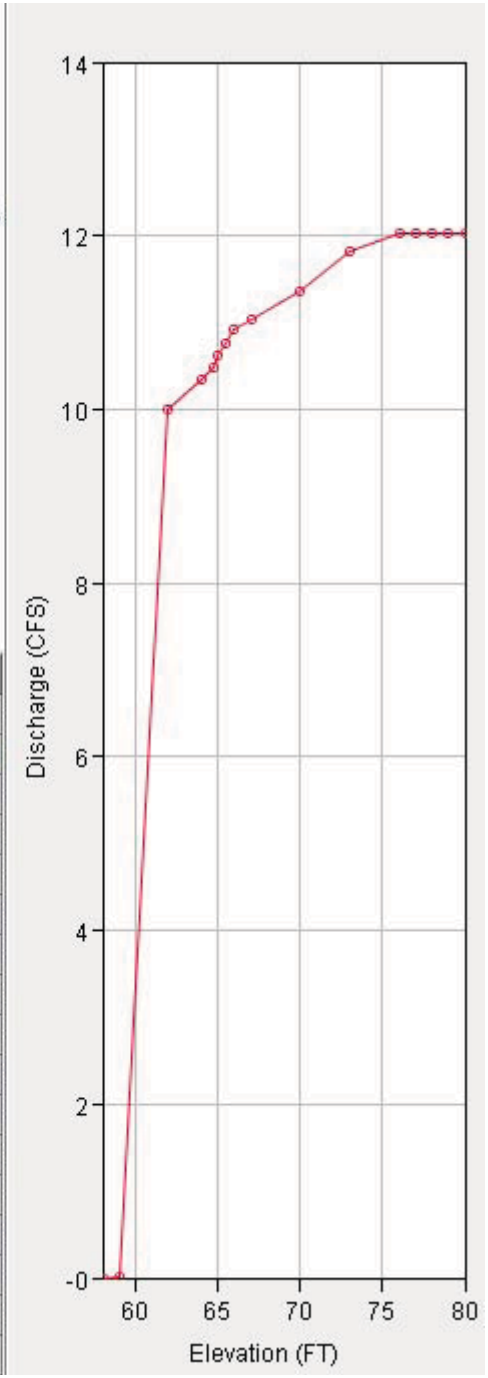
Phase 1
Elevation - Storage Functions
Detention Basin

Elevation (FT)	Storage (AC-FT)
58.00	0.0000000
59.00	0.0050000
59.90	0.0070000
60.00	0.0100000
60.90	0.0110000
62.00	0.2113600
62.90	1.5630000
63.00	1.7132000
63.90	5.6756001
64.00	6.1159000
64.74	11.2500000
64.90	12.3470001
65.00	13.0389996
66.00	21.3770008
67.00	30.4349995
68.00	39.7639999
69.00	49.3479996
70.00	59.1910019
71.00	69.2779999
72.00	79.6620026
73.00	90.2949982
74.00	101.1999969
75.00	112.3700027
76.00	123.8099976
77.00	135.5299988
78.00	147.5299988
79.00	159.8399963
80.00	172.5099945



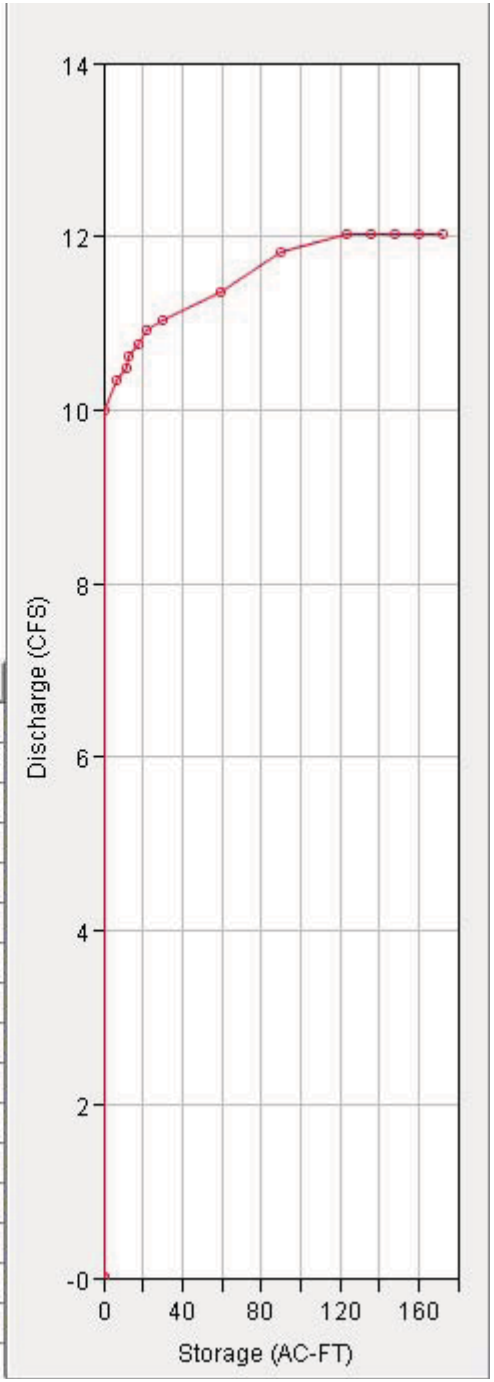
Phase 1
Elevation - Discharge Functions
2-40hp

Elevation (FT)	Discharge (CFS)
58.00	0.000
59.00	0.001
62.00	10.000
64.00	10.340
64.74	10.480
65.00	10.630
65.50	10.770
66.00	10.920
67.00	11.030
70.00	11.360
73.00	11.810
76.00	12.030
77.00	12.030
78.00	12.030
79.00	12.030
80.00	12.030



Phase 1
Storage - Discharge Functions
2-40hp

Storage (AC-FT)	Discharge (CFS)
0.0000000	0.000
0.0050000	0.001
0.2113600	10.000
6.1159000	10.340
11.2500000	10.480
13.0389996	10.630
18.0417995	10.770
21.3770008	10.920
30.4349995	11.030
59.1910019	11.360
90.2949982	11.810
123.8099976	12.030
135.5299988	12.030
147.5299988	12.030
159.8399963	12.030
172.5099945	12.030



Phase 2
Elevation - Discharge Functions
1-125hp

Elevation (FT)	Discharge (CFS)
58.00	0.000
59.00	0.001
62.00	10.000
64.00	10.340
64.74	10.480
65.00	43.400
65.50	43.400
66.00	44.200
67.00	44.900
70.00	44.900
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76.00	44.900
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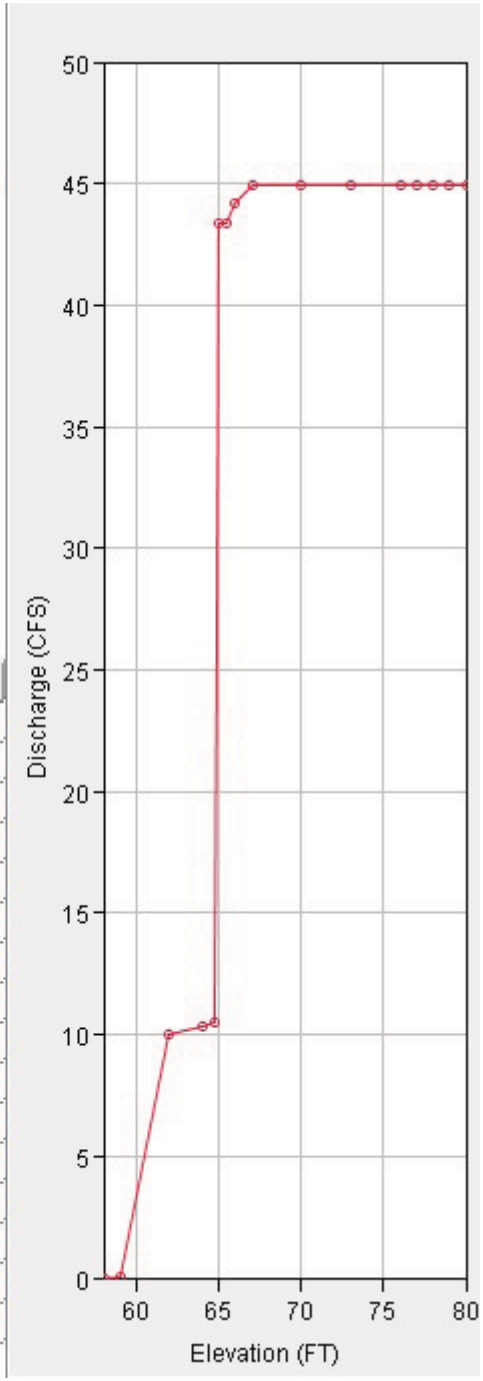
78.00	44.900
79.00	44.900
80.00	44.900



Phase 2
Storage - Discharge Functions
1-125hp

Storage (AC-FT)	Discharge (CFS)
0.0000000	0.000
0.0050000	0.001
0.2113600	10.000
6.1159000	10.340
11.2500000	10.480
13.0389996	43.400
18.0417995	43.400
21.3770008	44.200
30.4349995	44.900
59.1910019	44.900
90.2949982	44.900
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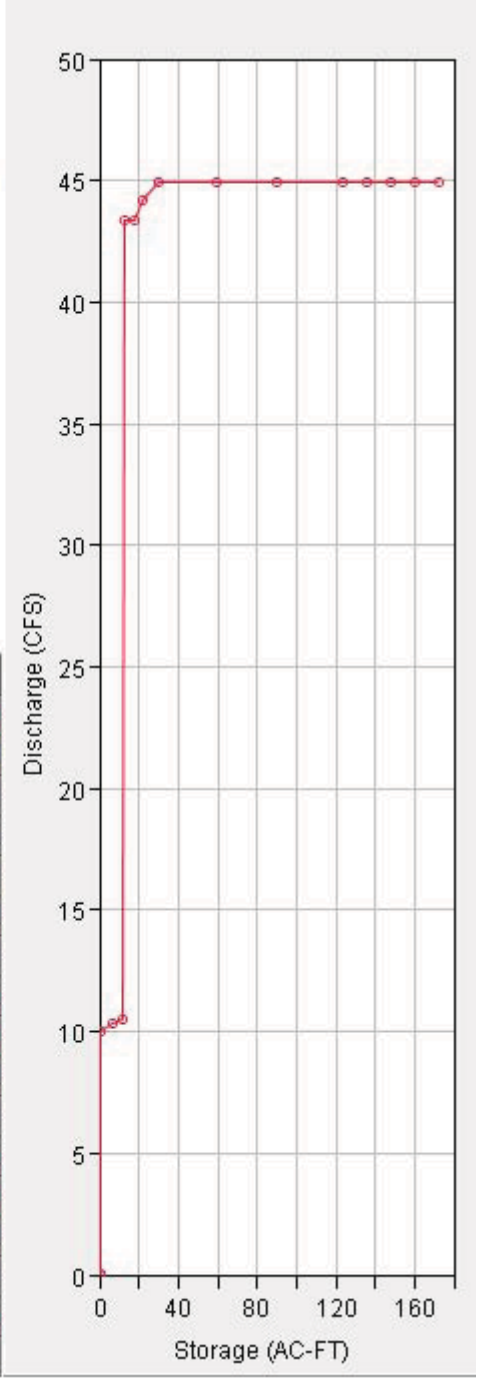
159.8399963	44.900
172.5099945	44.900



The effect of the development discharge was analyzed in an attempt to quantify the expected positive or negative impact on the downstream drainage within Old Alamo Creek as it conveys storm water to the east through the township of Elmira. Building on a preliminary analysis prepared by the City of Vacaville for the Easterly Sewer Treatment Plant, we modified a hydraulic model representing the Old Alamo Creek to represent the contributing storm water flows under the scenarios of pre-development, build out of the Brighton Landing development with an undeveloped Batch site, and the ultimate build out of both Brighton Landing and Batch developments. As stated above, due to the significant storm water storage capacity of the detention basin, the discharge flow rate out of the detention basin through the pump station is significantly less than the pre-development condition.

Including storm water flows from existing developments west of Leisure Town Road, the development areas of both Brighton Landing and Batch developments and also the undeveloped portion east of the Brighton Landing development, we have determined the flow rates within Old Alamo Creek under the scenarios described above to be as follows:

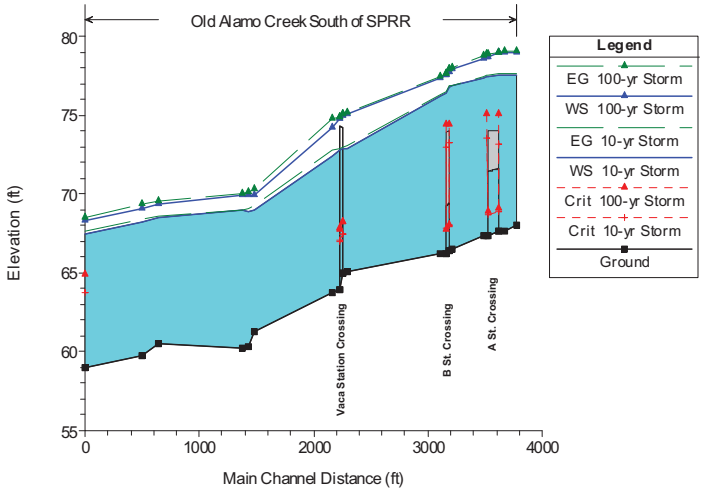
	10-yr		100-yr	
	Flow Rate (cfs)	Water Surface (ft)[1]	Flow Rate (cfs)	Water Surface (ft)[1]
Existing	594	77.5	955	78.92
Brighton Landing Build Out (Batch Undeveloped)	500	77.2	756	78.2
Brighton Landing and Batch Ultimate Build Out	316	76.4	448	77

[1] Water surface elevation upstream side of the culvert crossing at A St.

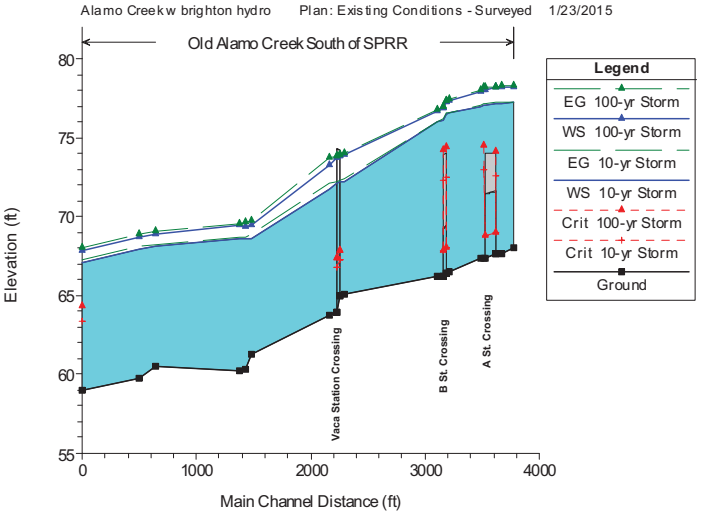
As noted above, as more of the proposed development within the Brighton Landing and Batch properties occurs more of the storm water discharge is reduced due to the fact that it is detained within the detention basin. This storm water detention correlates to a decrease in the peak flow rate within Old Alamo Creek resulting in a corresponding decrease in the peak storm water surface elevation within the creek. The discharge flow rate from the pump station is set by the flow rate of the pumps. Therefore there is little variation in peak pump discharge between the 10-yr and 100-yr storms. As such, since we have shown that the resulting peak storm water flow discharge in the developed condition has been significantly reduced for the 10-yr and 100-yr storm, it can also be deduced that all storm intervals falling between the 10-yr and 100-yr storms will also be reduced from the existing condition.

Storm Water Profile of Old Alamo Creek
Pre-Development, Brighton Landing Build Out, and Batch Build Out

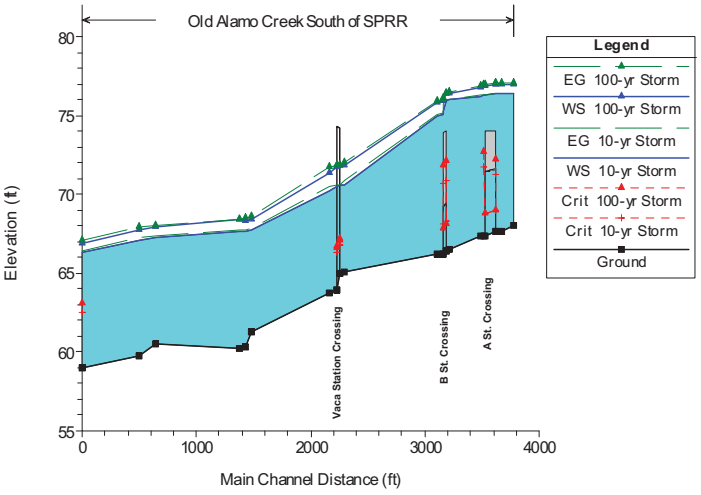
Old Alamo Creek Existing Condition



Old Alamo Creek Brighton Build Out Batch Existing



Old Alamo Creek Brighton Landing and Batch Build Out



Old Alamo Creek

Existing Condition

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Cl
South of SF	3778.5	10-yr Storn	594	68	77.56		77.62	0.000196	1.89	322.39	54.7	0.13
South of SF	3778.5	100-yr Stor	955	68	78.95		79.04	0.000264	2.47	398.24	54.7	0.16
South of SF	3670.5	10-yr Storn	594	67.6	77.54		77.6	0.000181	1.88	316.69	44	0.12
South of SF	3670.5	100-yr Stor	955	67.6	78.91		79.01	0.000279	2.53	376.97	44	0.15
South of SF	3622.5	10-yr Storn	594	67.6	77.54	73.13	77.59	0.000121	1.73	368.59	57.5	0.11
South of SF	3622.5	100-yr Stor	955	67.6	78.92	75.1	79	0.00017	2.3	447.67	57.5	0.14
South of SF	3571.5	Culvert										
South of SF	3520.5	10-yr Storn	594	67.4	77.41	73.57	77.5	0.003427	2.67	258.9	57	0.19
South of SF	3520.5	100-yr Stor	955	67.4	78.71	75.1	78.85	0.004196	3.34	332.96	57	0.21
South of SF	3486.5	10-yr Storn	594	67.33	77.34		77.41	0.001686	2.22	289.92	45	0.14
South of SF	3486.5	100-yr Stor	955	67.33	78.61		78.74	0.002509	3.01	346.87	45	0.18
South of SF	3217.5	10-yr Storn	594	66.5	76.83		76.9	0.002136	2.31	300.36	65	0.15
South of SF	3217.5	100-yr Stor	955	66.5	77.86		77.99	0.003105	3.05	367.43	65	0.19
South of SF	3189.5	10-yr Storn	594	66.45	76.75	73.21	76.84	0.002785	2.5	272.12	61	0.16
South of SF	3189.5	100-yr Stor	955	66.45	77.74	74.4	77.88	0.004192	3.29	332.56	61	0.2
South of SF	3173.25	Culvert										
South of SF	3157	10-yr Storn	594	66.24	76.37	73	76.47	0.003136	2.68	259.54	63	0.18
South of SF	3157	100-yr Stor	955	66.24	77.49	74.4	77.65	0.004186	3.42	330.01	63	0.21
South of SF	3109	10-yr Storn	594	66.2	76.23		76.32	0.003115	2.63	261.64	65	0.18
South of SF	3109	100-yr Stor	955	66.2	77.29		77.44	0.00419	3.38	331.01	65	0.22
South of SF	2293	10-yr Storn	594	65.05	72.91		73.05	0.005329	2.84	199.92	70	0.23
South of SF	2293	100-yr Stor	955	65.05	75.02		75.16	0.001992	2.21	347.8	70	0.15
South of SF	2259	10-yr Storn	594	65	72.87	67.46	72.94	0.001549	2.23	266.9	55.77	0.14
South of SF	2259	100-yr Stor	955	65	74.97	68.22	75.09	0.001746	2.79	342.33	145.5	0.16
South of SF	2241.5	Bridge										
South of SF	2224	10-yr Storn	594	63.98	72.81	66.99	72.88	0.000638	2.11	281.77	110.37	0.13
South of SF	2224	100-yr Stor	955	63.98	74.79	67.75	74.9	0.000783	2.71	352.33	123	0.15
South of SF	2165	10-yr Storn	594	63.77	72.38		72.76	0.00889	4.97	119.51	23.8	0.39
South of SF	2165	100-yr Stor	955	63.77	74.24		74.75	0.009402	5.73	167.18	30.87	0.4
South of SF	1477	10-yr Storn	594	61.32	68.96		69.21	0.003303	4.03	149.79	42.59	0.32
South of SF	1477	100-yr Stor	955	61.32	69.93		70.32	0.004615	5.07	193.04	46.44	0.39
South of SF	1430	10-yr Storn	594	60.3	68.9		69.08	0.001818	3.43	182.94	62.16	0.29
South of SF	1430	100-yr Stor	955	60.3	69.9		70.14	0.002035	4.03	246.99	65.35	0.32
South of SF	1380	10-yr Storn	594	60.22	68.93		69	0.000538	2.27	301.23	111.5	0.17
South of SF	1380	100-yr Stor	955	60.22	69.96		70.04	0.000562	2.5	416.97	113.5	0.17
South of SF	639	10-yr Storn	594	60.53	68.46		68.55	0.000674	2.51	245.88	59.2	0.19
South of SF	639	100-yr Stor	955	60.53	69.34		69.5	0.000967	3.33	300.81	65.9	0.23
South of SF	500	10-yr Storn	679	59.8	68.21		68.4	0.001623	3.68	207.97	85.15	0.28
South of SF	500	100-yr Stor	1040	59.8	69.1		69.32	0.00162	4.08	290.69	95	0.29
South of SF	0	10-yr Storn	679	58.97	67.42	63.73	67.6	0.001562	3.62	211.38	86.15	0.28
South of SF	0	100-yr Stor	1040	58.97	68.31	64.93	68.52	0.00156	4.02	294.6	95	0.28

Old Alamo Creek

Brighton Landing Build Out Batch Undeveloped Condition

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
South of SF	3778.5	10-yr Storn	500	68	77.21		77.25	0.000168	1.69	302.92	54.7	0.12
South of SF	3778.5	100-yr Stor	756	68	78.2		78.28	0.000231	2.18	357.43	54.7	0.15
South of SF	3670.5	10-yr Storn	500	67.6	77.19		77.23	0.000149	1.66	301.2	44	0.11
South of SF	3670.5	100-yr Stor	756	67.6	78.18		78.25	0.000228	2.19	344.55	44	0.14
South of SF	3622.5	10-yr Storn	500	67.6	77.19	72.55	77.23	0.000102	1.54	348.29	57.5	0.1
South of SF	3622.5	100-yr Stor	756	67.6	78.18	74.06	78.24	0.000146	2	405.12	57.5	0.12
South of SF	3571.5	Culvert										
South of SF	3520.5	10-yr Storn	500	67.4	77.05	73	77.13	0.003089	2.44	238.36	57	0.17
South of SF	3520.5	100-yr Stor	756	67.4	78.03	74.5	78.15	0.003799	2.99	294.37	57	0.2
South of SF	3486.5	10-yr Storn	500	67.33	76.99		77.05	0.001418	1.97	274.2	45	0.13
South of SF	3486.5	100-yr Stor	756	67.33	77.95		78.05	0.002071	2.59	317.22	45	0.16
South of SF	3217.5	10-yr Storn	500	66.5	76.56		76.62	0.001787	2.06	282.92	65	0.14
South of SF	3217.5	100-yr Stor	756	66.5	77.33		77.42	0.002592	2.66	332.64	65	0.17
South of SF	3189.5	10-yr Storn	500	66.45	76.49	72.48	76.56	0.002295	2.23	256.65	61	0.15
South of SF	3189.5	100-yr Stor	756	66.45	77.23	74.4	77.34	0.003443	2.88	301.23	61	0.18
South of SF	3173.25	Culvert										
South of SF	3157	10-yr Storn	500	66.24	76.1	72.27	76.18	0.002658	2.4	242.38	63	0.16
South of SF	3157	100-yr Stor	756	66.24	76.86	74.17	76.99	0.003753	3.07	290.3	63	0.2
South of SF	3109	10-yr Storn	500	66.2	75.98		76.05	0.002615	2.35	245.47	65	0.17
South of SF	3109	100-yr Stor	756	66.2	76.68		76.81	0.00376	3.02	291.38	65	0.2
South of SF	2293	10-yr Storn	500	65.05	72.24		72.4	0.009228	3.37	152.57	70	0.29
South of SF	2293	100-yr Stor	756	65.05	73.88		74.01	0.003124	2.46	267.56	70	0.18
South of SF	2259	10-yr Storn	500	65	72.2	67.24	72.27	0.001497	2.06	243.18	53.12	0.14
South of SF	2259	100-yr Stor	756	65	73.83	67.81	73.93	0.001673	2.51	301.37	129.77	0.15
South of SF	2241.5	Bridge										
South of SF	2224	10-yr Storn	500	63.98	72.16	66.77	72.21	0.000605	1.94	258.19	86.04	0.13
South of SF	2224	100-yr Stor	756	63.98	73.77	67.35	73.86	0.000705	2.39	315.91	119.7	0.14
South of SF	2165	10-yr Storn	500	63.77	71.74		72.09	0.009004	4.77	104.75	22.79	0.39
South of SF	2165	100-yr Stor	756	63.77	73.28		73.72	0.009116	5.34	141.65	25.24	0.4
South of SF	1477	10-yr Storn	500	61.32	68.62		68.83	0.002859	3.67	136.9	34.19	0.3
South of SF	1477	100-yr Stor	756	61.32	69.44		69.76	0.003892	4.55	170.85	44.31	0.35
South of SF	1430	10-yr Storn	500	60.3	68.56		68.72	0.001696	3.21	162.71	56.36	0.28
South of SF	1430	100-yr Stor	756	60.3	69.4		69.6	0.001914	3.71	214.5	64.17	0.31
South of SF	1380	10-yr Storn	500	60.22	68.58		68.65	0.000535	2.2	262.12	110.8	0.17
South of SF	1380	100-yr Stor	756	60.22	69.44		69.52	0.000545	2.38	358.4	112.5	0.17
South of SF	639	10-yr Storn	500	60.53	68.15		68.23	0.000598	2.28	227.86	56.95	0.18
South of SF	639	100-yr Stor	756	60.53	68.9		69.02	0.000804	2.89	272.82	62.58	0.21
South of SF	500	10-yr Storn	585	59.8	67.9		68.08	0.001622	3.53	182.85	77.37	0.28
South of SF	500	100-yr Stor	841	59.8	68.65		68.86	0.001624	3.88	248.36	95	0.29
South of SF	0	10-yr Storn	585	58.97	67.11	63.34	67.28	0.001562	3.48	185.93	78.37	0.27
South of SF	0	100-yr Stor	841	58.97	67.86	64.31	68.06	0.001561	3.82	252.17	95	0.28

Old Alamo Creek

Brighton Landing and Batch Ultimate Build Out Condition

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
South of SF	3778.5	10-yr Storn	316	68	76.41		76.43	0.000108	1.25	259.28	54.7	0.1
South of SF	3778.5	100-yr Stor	448	68	77		77.04	0.000151	1.58	291.66	54.7	0.12
South of SF	3670.5	10-yr Storn	316	67.6	76.4		76.42	0.000086	1.19	266.42	44	0.08
South of SF	3670.5	100-yr Stor	448	67.6	76.99		77.02	0.000131	1.53	292.24	44	0.1
South of SF	3622.5	10-yr Storn	316	67.6	76.4	71.3	76.42	0.000063	1.11	302.78	57.5	0.08
South of SF	3622.5	100-yr Stor	448	67.6	76.99	72.22	77.02	0.000091	1.42	336.56	57.5	0.1
South of SF	3571.5		Culvert									
South of SF	3520.5	10-yr Storn	316	67.4	76.26	71.73	76.3	0.002198	1.89	193.29	55.28	0.14
South of SF	3520.5	100-yr Stor	448	67.4	76.85	72.65	76.92	0.002864	2.29	226.77	57	0.17
South of SF	3486.5	10-yr Storn	316	67.33	76.22		76.25	0.000856	1.42	239.48	45	0.1
South of SF	3486.5	100-yr Stor	448	67.33	76.8		76.84	0.001259	1.82	265.34	45	0.12
South of SF	3217.5	10-yr Storn	316	66.5	75.96		75.99	0.001066	1.49	243.82	65	0.11
South of SF	3217.5	100-yr Stor	448	66.5	76.42		76.47	0.001578	1.9	273.28	65	0.13
South of SF	3189.5	10-yr Storn	316	66.45	75.92	70.91	75.96	0.001315	1.61	221.76	61	0.11
South of SF	3189.5	100-yr Stor	448	66.45	76.36	72.06	76.42	0.002007	2.06	248.13	61	0.14
South of SF	3173.25		Culvert									
South of SF	3157	10-yr Storn	316	66.24	75.09	70.69	75.15	0.002194	1.96	178.55	63	0.14
South of SF	3157	100-yr Stor	448	66.24	75.92	71.85	75.99	0.002417	2.25	230.84	63	0.16
South of SF	3109	10-yr Storn	316	66.2	74.98		75.04	0.002188	1.91	180.98	64.53	0.15
South of SF	3109	100-yr Stor	448	66.2	75.81		75.87	0.002368	2.19	234.33	65	0.16
South of SF	2293	10-yr Storn	316	65.05	70.54		70.83	0.023364	4.29	73.63	24.51	0.44
South of SF	2293	100-yr Stor	448	65.05	71.8		72.02	0.013514	3.79	123.13	62.15	0.35
South of SF	2259	10-yr Storn	316	65	70.58	66.75	70.63	0.001484	1.71	185.13	47.75	0.13
South of SF	2259	100-yr Stor	448	65	71.8	67.1	71.86	0.001475	1.96	228.66	51.65	0.14
South of SF	2241.5		Bridge									
South of SF	2224	10-yr Storn	316	63.98	70.54	66.29	70.58	0.000562	1.58	200.37	56.6	0.12
South of SF	2224	100-yr Stor	448	63.98	71.75	66.64	71.81	0.000588	1.84	243.75	76.58	0.12
South of SF	2165	10-yr Storn	316	63.77	70.16		70.47	0.009625	4.42	71.5	18.59	0.4
South of SF	2165	100-yr Stor	448	63.77	71.35		71.69	0.009178	4.67	95.95	22.16	0.4
South of SF	1477	10-yr Storn	316	61.32	67.7		67.83	0.001986	2.85	110.81	26.26	0.24
South of SF	1477	100-yr Stor	448	61.32	68.41		68.6	0.002598	3.44	130.18	28.86	0.28
South of SF	1430	10-yr Storn	316	60.3	67.63		67.75	0.001424	2.7	117.93	39.41	0.25
South of SF	1430	100-yr Stor	448	60.3	68.34		68.49	0.001623	3.08	150.94	52.68	0.27
South of SF	1380	10-yr Storn	316	60.22	67.63		67.69	0.000492	1.93	165.02	61.18	0.15
South of SF	1380	100-yr Stor	448	60.22	68.36		68.42	0.000535	2.15	237.5	110.37	0.16
South of SF	639	10-yr Storn	316	60.53	67.3		67.35	0.000438	1.79	180.19	55.06	0.15
South of SF	639	100-yr Stor	448	60.53	67.95		68.02	0.00055	2.15	216.71	56.51	0.17
South of SF	500	10-yr Storn	401	59.8	67.07		67.22	0.001606	3.12	130.21	38.64	0.27
South of SF	500	100-yr Stor	533	59.8	67.71		67.88	0.001622	3.44	168.38	72.52	0.28
South of SF	0	10-yr Storn	401	58.97	66.28	62.53	66.43	0.001563	3.09	131.86	40.95	0.27
South of SF	0	100-yr Stor	533	58.97	66.92	63.11	67.09	0.001561	3.39	171.28	73.52	0.27

7.0 CONCLUSION

The project impact to existing downstream facilities will be significantly decreased with the construction of the Brighton Landing Subdivision and its included storm water detention facility. As calculated, the detention facility will adequately store and discharge the 10-Year and 100-Year events for the combined post-development runoff of Brighton Landing Subdivision and the Batch Property. With the construction of the proposed detention basin and pump station the development will reduce the post development discharging peak storm water flow from the existing total flow of 607.6cfs± to an ultimate pump station discharge peak flow rate for the ultimate development of both Brighton Landing and Batch projects to 100.3cfs±. Therefore, the development of the Brighton Landing and Batch parcels will significantly reduce the peak runoff which it contributes to the storm water flow within the downstream Old Alamo Creek east of the railroad tracks.

The review of the downstream hydraulics determined that the flow rate and water surface within Old Alamo Creek is reduced from the existing condition with the development of the Brighton Landing development. The peak flow rate and peak water surface within the creek is further decreased with the ultimate build out of the Batch property. While the condition of the downstream drainage within Old Alamo Creek may contain issues not specifically discussed or addressed with this study, the intent of this analysis was to confirm that the development of the Brighton Landing and Batch developments would not create a negative impact to the downstream drainage system. Through the analysis of this study it was determined that not only was the peak flow rate and peak water surface within Old Alamo Creek not increased, but was decreased through the development of the two projects and the effects of the detention basin and storm water pump station.

As such, we can state that the peak storm water flows contributed by the Brighton Landing and Batch projects in the post development condition will result in a positive impact to the downstream system through the reduction in peak storm water flows and peak water surface elevations within Old Alamo Creek from what has been contributed by the properties in the existing pre-development condition. As such, the development has surpassed its obligation to not negatively impact downstream properties with the interim and ultimate post-development peak storm water flows.