Appendix H:
Floodplain Evaluation

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Oak Park Properties Specific Plan
City of Pleasant Hill, California

Draft Revised Floodplain Evaluation Report

Prepared for:

CITY OF PLEASANT HILL

Prepared by:

WRECO

August 2019

BN 37454543v2

Oak Park Properties Specific Plan
City of Pleasant Hill, California

Draft Revised Floodplain Evaluation Report

Submitted to:
City of Pleasant Hill

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

_____
Han-Bin Liang, Ph.D., P.E.
Registered Civil Engineer

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Date

August 2019
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Executive Summary

The City of Pleasant Hill proposes to adopt the Oak Park Properties Specific Plan, which is a comprehensive planning document that would establish specific guiding principles for redevelopment of a combined 16.60 acres. The Specific Plan contemplates two development projects (the Civic Project and the Residential Project) within the Specific Plan area's boundaries.

The Civic Project is located along and east of Monticello Avenue, and along Oak Park Boulevard within the plan area. The Civic Project would:

- Develop a new City library and associated parking lot;
- Create a new floodplain drainage system with water detention basins;
- Upgrade three existing outfalls to Grayson Creek (Grayson Creek Outfalls Project);
- Create a new pedestrian trail immediately west of the Grayson Creek Corridor;
- Develop a new park with athletic fields and associated restroom facilities and parking area;
- Redesign and improve Monticello Avenue (between Oak Park Boulevard and Santa Barbara Avenue) to provide one lane in each direction, roadway utility improvements, bicycle lanes, sidewalks, street lights, and landscape improvements; and
- Widen and improve Oak Park Boulevard (between the East Bay Municipal Utility District trail right-of-way and the western plan area boundary) to include a new turn pocket, roadway utility improvements, landscaping, street lights, and upgraded sidewalks on the north side of the street as well as upgrade the traffic signal at the Oak Park Boulevard/Monticello Avenue intersection.
- Pre-cast pedestrian bridge across Grayson Creek, connecting the EBMUD trail to the proposed pedestrian trail on the Civic Project site. The bridge would be constructed once funding is secured.

The Residential Project is located west of Monticello Avenue and north of Oak Park Boulevard within the plan area. The Residential Project would:

- Demolish the existing Contra Costa County Library and vacant administrative offices and remove the associated parking lot and redevelop the site with 34 single-family homes with seven accessory dwelling units; and
- Develop a new pocket park.

Portions of the Civic Project site are located in the Federal Emergency Management Agency (FEMA) Special Flood Hazard Area (SFHA) Zone AE, which represents areas subject to flooding by the 100-year storm event, determined by detailed methods where Base Flood Elevations (BFEs) are shown. At the Civic Project site north of Oak Park Boulevard near Eccleston Ditch/east fork of Grayson Creek, the BFE is 72 feet NAVD 88; south of Oak Park Boulevard near Eccleston Ditch, the BFE is 75 feet NAVD 88. The Residential Project site is not within the FEMA 100-year Floodplain.

The purpose of this Draft Revised Floodplain Evaluation Report is to evaluate the existing and proposed floodplain conditions in and around the Specific Plan area under a 100-year storm event, to minimize the potential impacts to the proposed floodplain upstream and downstream of the Specific Plan area, to verify there are no adverse impacts to properties adjacent to the Specific Plan area, and to recommend any mitigation measures that may be required.

There are two creeks with inadequate capacity that contribute to the flooding conditions at the Specific Plan area. Murderer's Creek is located west of the Specific Plan area. Eccleston Ditch/upper east fork of Grayson Creek is located along the western perimeter of the Specific Plan area. Under existing conditions, overflow from Murderer's Creek during the 100-year storm event escapes the Murderer's Creek drainage system, flows parallel to Oak Park Boulevard, and enters the floodplains of Eccleston Ditch/upper east fork of Grayson Creek. Murderer's Creek overflow flows from the west in an east-northeast direction from Oak Park Boulevard. A portion of this overland flow diverges from Oak Park Boulevard, ponding in the parking lot of the existing library site, located in the Residential Project limits before overflowing onto Monticello Avenue and continuing east-northeastward over the currently undeveloped area within the Civic Project limits. Eccleston Ditch is undersized to convey flows from a 100-year storm event. The overbank flood flow from Eccleston Ditch generally flows from south to north at the Specific Plan area.

Within the Specific Plan area, Projects are anticipated to have impacts on the drainage patterns and the 100-year floodplain, specifically due to proposed grading within the footprint of the new City library and associated parking lots, which will reduce the available floodplain storage. The new projects will include a significant volume of fill that will raise the elevations of these sites effectively out of the proposed 100-year floodplain and will also change the existing drainage patterns in the vicinity of the Specific Plan Area.

Comparisons of hydraulic model results for the existing and proposed conditions in the 100-year storm event led to the development of three recommended mitigation measures to minimize potential impacts upstream and downstream of the Specific Plan area and along Oak Park Boulevard. These three recommended mitigation measures include:

1. A higher capacity storm drain system that will replace an existing, single 24-inch storm drain system within the Civic Project limits. The proposed storm drain system will feature a new alignment that will provide capture with additional drainage inlets and storage with its higher capacity to mimic the existing flooding and drainage patterns of the Specific Plan area.
2. Increasing the flow conveyance capacity of a bioretention basin required for the new library included in the Civic Project limits.
3. Strategic grading of the new sports fields in the Civic Project limits to provide flood storage capacity.

To mitigate for the impacts (increase flows and higher water surface elevations along roadways and properties upstream) due to the decrease in the floodplain footprint at the new library site and the new Residential Project , the existing 24-inch storm drain system, which collects and conveys runoff from Oak Park Boulevard to an updated existing outfall on the west bank of the Eccleston Ditch/upper east fork of Grayson Creek, will be reconfigured. The hydraulic analysis model outputs show that reconfiguring the existing 24-inch storm drain within the Civic Project limits into an extended storm drain systems, with upgraded inlets and larger diameter pipes, will effectively capture and convey runoff from the 100-year storm event in the Specific Plan area to the Eccleston Ditch/upper east fork of Grayson Creek.

To mitigate for the change in the pathway for the overland flood flows west of the Eccleston Ditch/upper east fork of Grayson Creek and the decrease of the overall floodplain footprint of the Specific Plan area, the following measures were included during the development of the Civil and Residential Projects: a) the optimized design of a bioretention basin proposed for stormwater treatment for the new library and its associated parking lot was increased to accept overflow from the creek and Oak Park Boulevard and convey these flows to the new sports field in the northern portion of the Civic Project Limits in larger storm events; b) the grading of the new sports fields was strategically designed to balance the overall cut and fill of both the Civic Project and Residential Project and to minimize fill in the floodplain to the maximum extent practicable. The reconfigured storm drain system is proposed to be connected to the bioretention basin as well as to mitigate for backwater effects in larger storm events.

With implementation of the recommended mitigation, the results of the hydraulic analysis showed the elimination of 100-year floodplain encroachment at the proposed library building and within the Residential Project limits. The model also showed no increase in the proposed condition water surface elevations (WSEs) at the proposed sports field. The remainder of the Specific Plan area had insignificant changes in WSEs in the 100-year storm event. Based on the evaluation of the Specific Plan Area, the floodplain risk—meaning the consequences associated with the probability of flooding attributable to an encroachment—associated with the Specific Plan is expected to be low.

1 GENERAL DESCRIPTION

1.1 Project Description

The City of Pleasant Hill proposes to adopt the Oak Park Properties Specific Plan, which is a comprehensive planning document that would establish specific guiding principles for redevelopment of a combined 16.60 acres. The Specific Plan contemplates two development projects (the Civic Project and the Residential Project) within the Specific Plan area's boundaries.

The Civic Project is located along and east of Monticello Avenue, and along Oak Park Boulevard within the plan area. The Civic Project would:

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- Demolish the existing Contra Costa County Library and vacant administrative offices and remove the associated parking lot and redevelop the site with 34 single-family homes with seven accessory dwelling units; and
- Develop a new pocket park.

The City of Pleasant Hill is situated in central Contra Costa County. See Figure 1 for the Project Location Map, Figure 2 for the Project Aerial Map, and Figure 3 for the Project Site Plan.

1.2 Purpose of Study

The purpose of this Draft Revised Floodplain Evaluation Report is (i) to evaluate the existing and proposed floodplain conditions in and around the Specific Plan area under a 100-year storm event; (ii) to minimize the potential impacts to the proposed floodplain upstream and downstream of the Specific Plan area; (iii) to verify there are no adverse impacts to properties adjacent to the Specific Plan area; and (iv) to recommend mitigation measures to address potentially significant impacts.

1.3 Regulatory Setting

1.3.1 Executive Order 11988 (Floodplain Management, 1977)

Executive Order 11988 (Floodplain Management) directs all federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development, wherever there is a practicable alternative. General Conditions 9 and 10 to the U.S. Army Corps of Engineers Nationwide Permits set forth requirements for management of water flows, and require that activities comply with applicable FEMA-approved state or local floodplain management requirements.

Figure 1. Project Location Map

Source: Environmental Systems Research Institute (ESRI)

Figure 2. Project Aerial Map

Source: Google (2018)

Figure 3. Project Site Plan

Source: DAHLIN (2018)

1.3.2 California's National Flood Insurance Program

The Federal Emergency Management Agency (FEMA) is the nationwide administrator of the National Flood Insurance Program (NFIP), which is a program that was established by the National Flood Insurance Act of 1968 to protect lives and property, and to reduce the financial burden of providing disaster assistance. Under the NFIP, FEMA has the lead responsibility for flood hazard assessment and mitigation, and offers federally-backed flood insurance to homeowners, renters, and business owners in communities that choose to participate in the program. FEMA has adopted the 100-year floodplain as the base flood standard for the NFIP. FEMA is also concerned with construction that would be within a 500-year floodplain for proposed projects that are considered "critical actions," which are defined as any activities where even a slight chance of flooding is too great. FEMA issues the Flood Insurance Rate Maps (FIRMs) for communities that participate in the NFIP. These FIRMs present delineations of flood hazard zones.

In California, nearly all of the state's flood-prone communities participate in the NFIP, which is locally administered by the California Department of Water Resources' (DWR) Division of Flood Management. Under California's NFIP, communities have a mutual agreement with state and federal governments to regulate floodplain development according to certain criteria and standards, which are further detailed in the NFIP.

1.3.3 Contra Costa County Floodplain Data

As part of the NFIP, typically, each county (or community) has a Flood Insurance Study (FIS), which is used to locally develop FIRMs and Base Flood Elevations (BFEs). Contra Costa County's effective FIS was used for the Specific Plan area.

1.4 Vertical Datum

The Project references the North American Vertical Datum of 1988 (NAVD 88).

2 AFFECTED ENVIRONMENT

2.1 Watershed Description

The *Contra Costa County Watershed Atlas* (2004) identifies the Specific Plan area as being within the Grayson Creek sub-watershed, which is part of the larger Walnut Creek watershed. Grayson Creek is a stream in Contra Costa County that flows northeasterly 7.4 miles from its origin in Briones Regional Park to its mouth at Pacheco Slough, which connects to Suisun Bay. The Specific Plan area is located between two tributaries to Grayson Creek: 1) Murderer's Creek, approximately 0.3 miles to the west; and 2) Eccleston Ditch/east fork of Grayson Creek, less than 0.1 miles to the east.

2.2 Receiving Water Bodies

The receiving water bodies for the Civic Project and the Residential Project are Eccleston Ditch/upper east fork of Grayson Creek. Eccleston Ditch is a man-made channel that connects downstream to the upper east fork of Grayson Creek. On-site runoff from the Civic Project is conveyed through a system of inlets and storm drains that outfalls into Eccleston Ditch/east fork of Grayson Creek.

2.3 FEMA Floodplains

FEMA's National Flood Hazard Layer (NFHL) is a geospatial database that contains current effective flood hazard data. The NFHL shows three flood zones in the vicinity of the Civic Project and Residential Project (Figure 4): Zone AE, Zone X (shaded), and Zone X (unshaded). Zone AE represents a Special Flood Hazard Area (SFHA) subject to flooding by the 100-year (base) flood event determined by detailed methods where Base Flood Elevations (BFEs) are shown. Zone X (shaded) represents moderate flood hazard areas that are between the limits of the 100-year flood and the 500-year flood. Zone X (unshaded) represents areas of minimal flood hazard—these areas are outside the SFHA and higher than the elevation of the 500-year flood.

Portions of the Civic Project are located in FEMA SFHA Zone AE. At the Civic Project, north of Oak Park Boulevard near the upper east fork of Grayson Creek, the BFE is 72 ft NAVD 88; south of Oak Park Boulevard near Eccleston Ditch, the BFE is 75 ft NAVD 88 (Figure 5). The Residential Project site is not within the FEMA 100-year Floodplain.

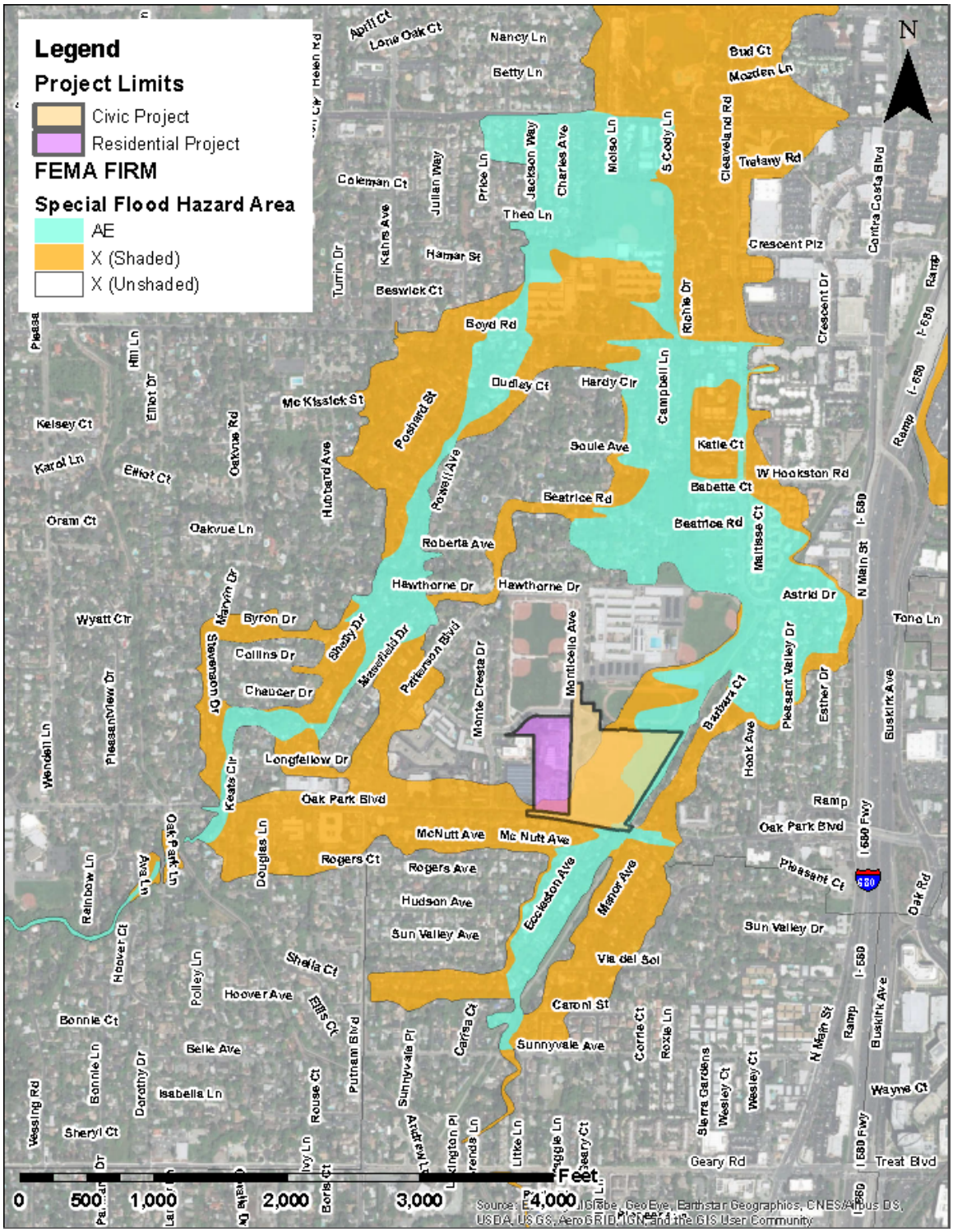

Figure 4. FEMA Special Flood Hazard Area in Project Vicinity

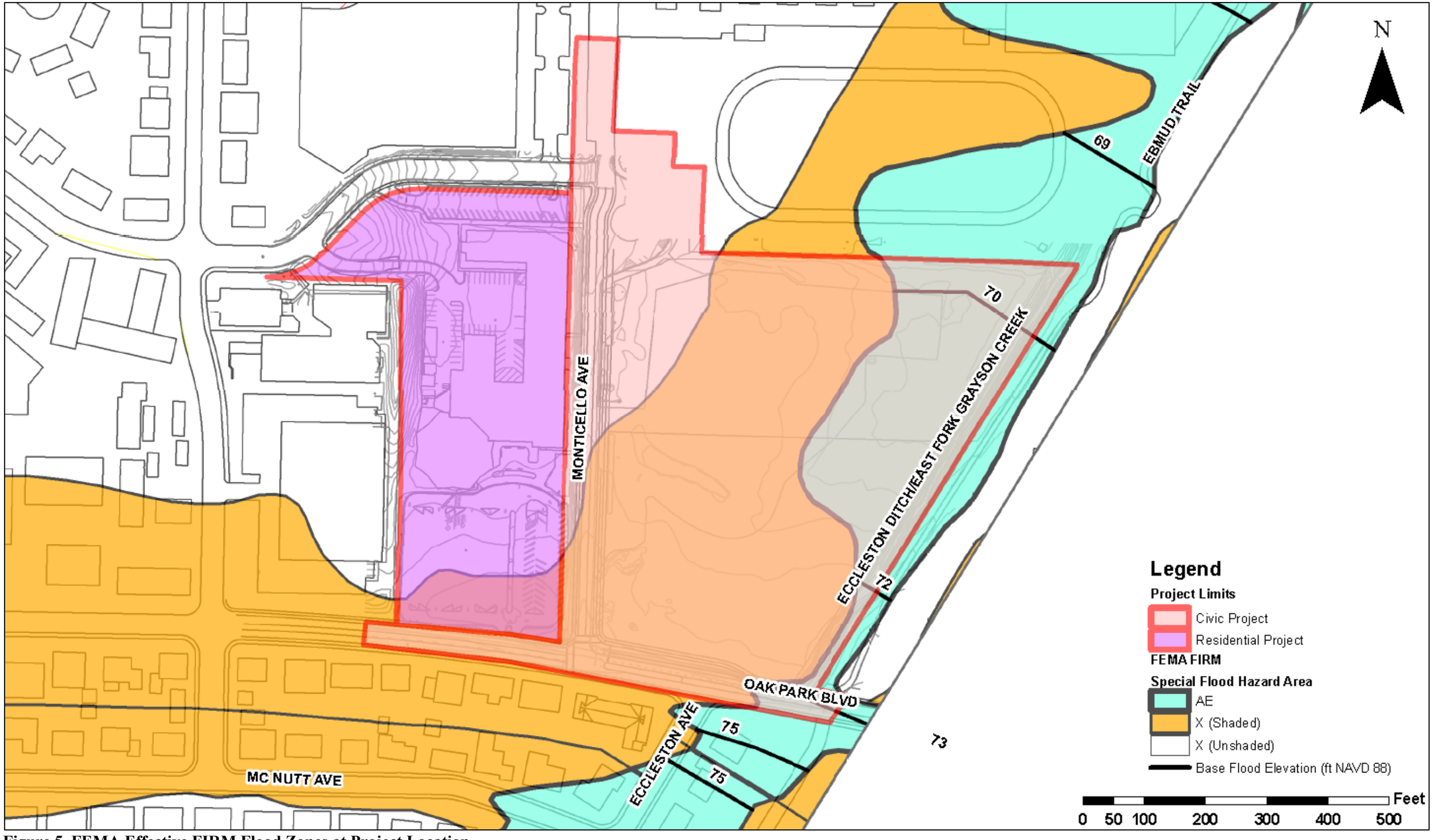

Figure 5. FEMA Effective FIRM Flood Zones at Project Location

3 HYDROLOGY AND HYDRAULICS

The hydrologic and hydraulic analyses in in the vicinity of the Specific Plan area were performed by combining the information available from the previous studies performed in its vicinity. Table 1 shows the list of resources obtained for the hydrologic and hydraulic analysis.

Table 1. List of Resources Obtained for Hydrologic and Hydraulic Analysis

Agency	Obtained Resource	Date Received
BCJ	Topo map of existing open space/ proposed library and ball field	March 20, 2018
BKF Engineers	Topo map of Eccleston Ditch/East Fork Grayson Creek and St. Lawrence	August 24, 2018
City of Pleasant Hill	Topo map of City of Pleasant Hill with half-ft contour	March 2017
	As-Builts at the Project location	August 7, 2018 and October 4, 2018
Sherwood Engineers	Conceptual grading plan for Proposed Library, Parking Lot, and Ball Field	October 16, 2018
U.S. Army Corps of Engineers	Grayson and Murderer's Creeks, California. Feasibility Scoping Meeting Document, SPD F3 Milestone, DRAFT	March 2017
	One-dimensional hydraulic model of Grayson and Murderers Creek	

3.1 Hydrologic Assessment

USACE's *Grayson and Murderer's Creeks Draft Feasibility Report* (USACE 2007) provided the hydrologic analysis of Grayson Creek watershed. The sub-basin map from their hydrology study is shown in Figure 6. The peak 100-year flows from the sub-basins in the vicinity of the Specific Plan area are summarized in Table 2.

Table 2. Peak 100-year Flows from Grayson Creek Sub-basins

Sub-basin	Peak 100-year flow (cfs)	Sub-basin	Peak 100-year flow (cfs)
1	681	7	486
2	400	8E1	178
3	604	8W1	217
4	475	8E2	117
5	603	8W2	85
6	121		

Source: USACE 2007

Note: See Figure 6 for the sub-basin locations.

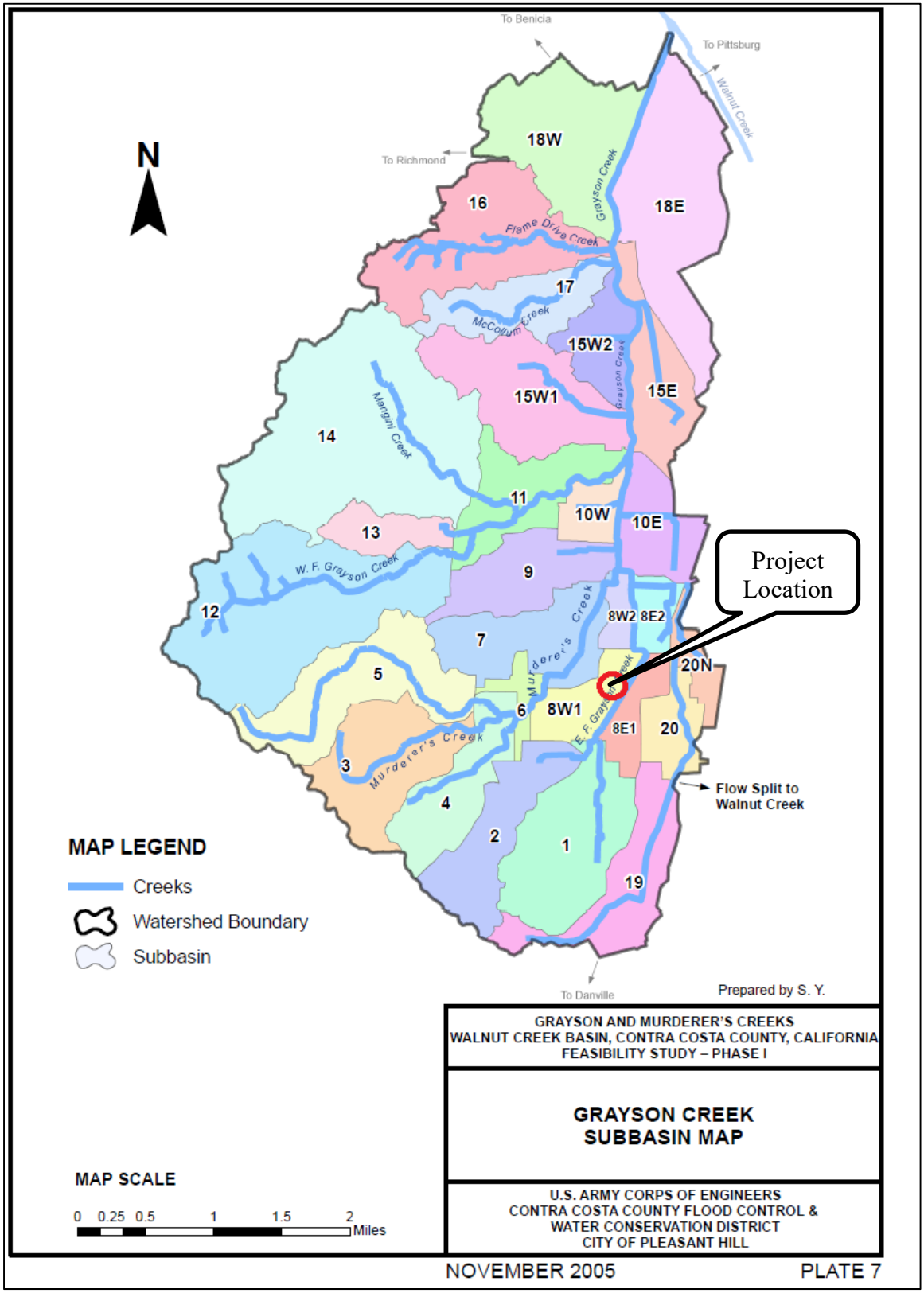

Figure 6. Grayson-Murderer's Creek Sub-Basin Map

Source: USACE 2007

3.2 Hydraulic Assessment

3.2.1 Overview of Hydraulic Analysis

Innovyze's InfoWorks ICM software was used to perform the combined one- and two-dimensional hydraulic analysis in the Project vicinity. ICM is an integrated one-dimensional and two-dimensional hydrodynamic simulation, incorporating both above- and below-ground elements of catchments. This software was chosen because of its ability to combine one-dimensional open channel flows and a full two-dimensional mesh solution for the floodplain flows.

The ICM hydraulic model for the Project vicinity is composed of a one-dimensional riverine model, two-dimensional floodplain model, inflow hydrographs assigned into the one- and two-dimensional components of the hydraulic model, and geometric features assigned in the model to represent the existing and proposed library site. The following sections describe each of the components in the ICM hydraulic model for this Project.

3.2.2 One-Dimensional Riverine Model

The ICM hydraulic model for this Project included one-dimensional riverine models of Grayson Creek, Murderer's Creek, and its tributaries. The hydraulic model of Grayson and Murderer's Creek prepared by USACE for Grayson and Murderer's Creeks Draft Feasibility Report were imported into the ICM hydraulic model to use as the base file for the one-dimensional riverine component of the ICM hydraulic model. Figure 7 shows limits of the base HEC-RAS model.

Figure 8 illustrates the location, alignment, and limits of the one-dimensional riverine models included in the ICM hydraulic model. The base HEC-RAS model included waterways representing the overbank flood flows on the city streets. The geometry of the channel cross-sections was extended beyond the main channel of the waterway and therefore, the channel cross-sections in the InfoWorks ICM hydraulic model were trimmed to only include the main channel of Grayson Creek (Eccleston Ditch) and Murderer's Creek.

The input parameters in the base hydraulic model, such as main channel geometry of the channel cross-sections, distance between cross-sections, Manning's roughness coefficients assigned to each cross-section, and bridge dimensions, generally remained unchanged from the base hydraulic model.

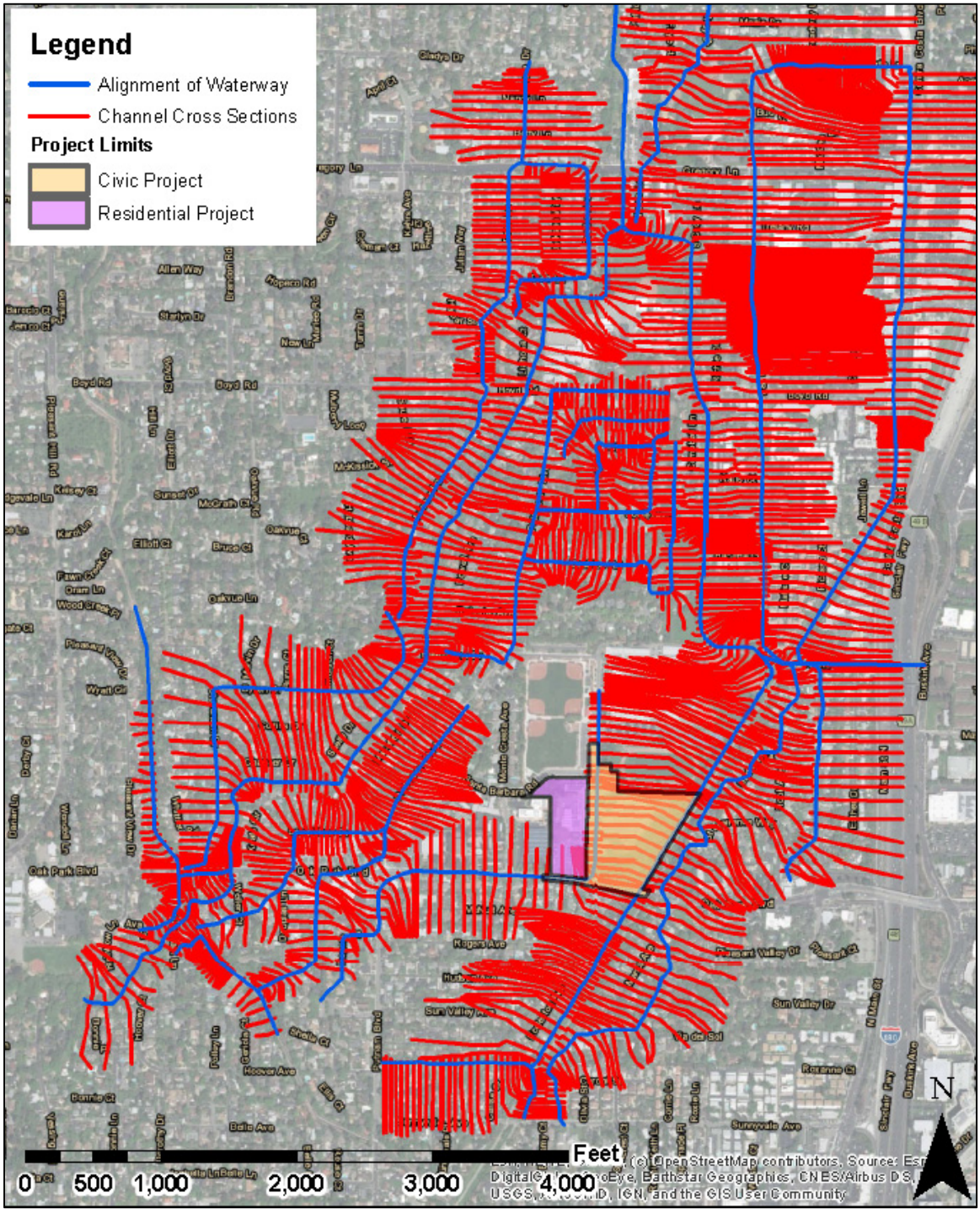

Figure 7. Plan View of Base HEC-RAS Model

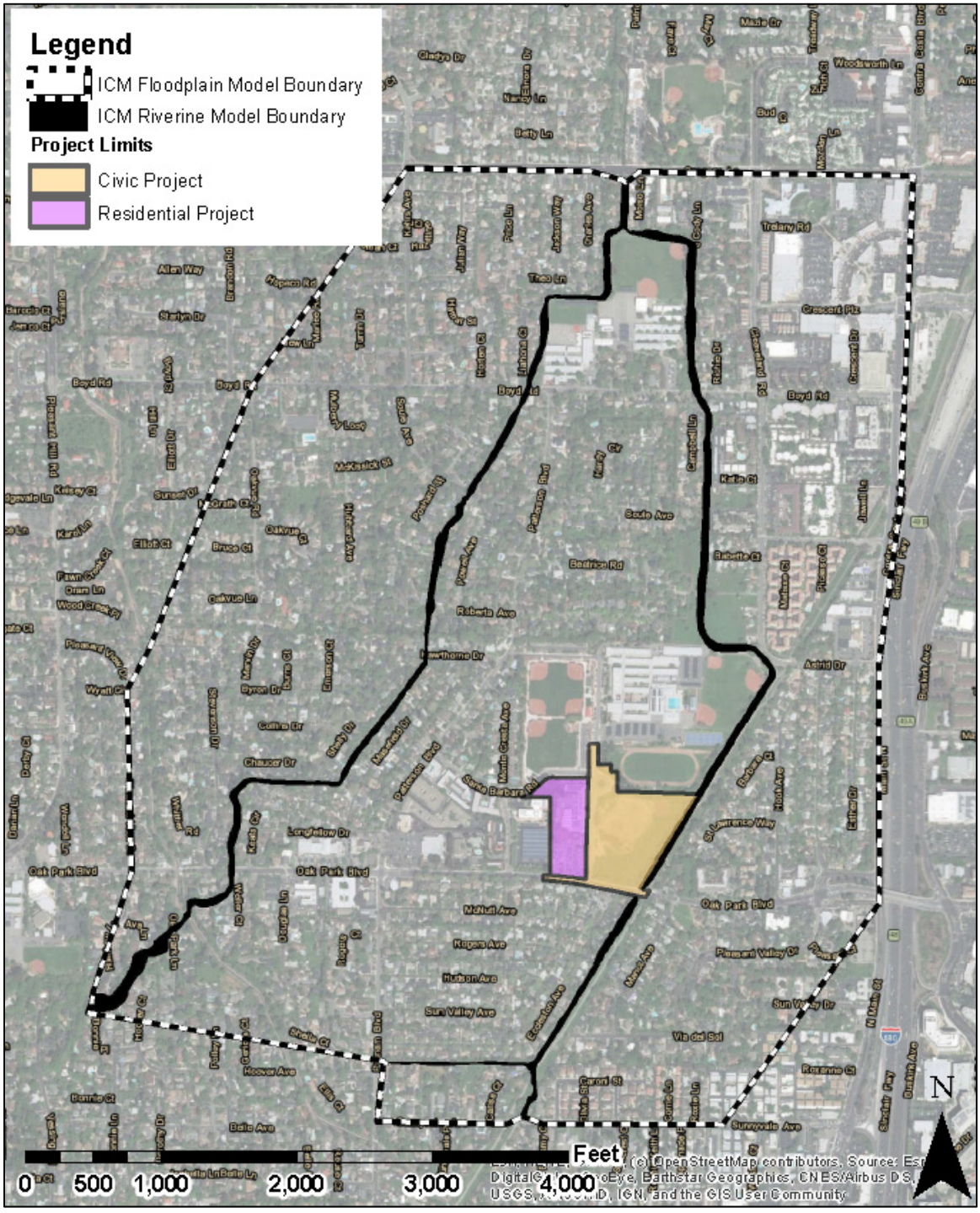

Figure 8. Limits and Locations of the One-Dimensional Riverine Model Component in the ICM Hydraulic Model

3.2.3 One-Dimensional Storm Drain Model

InfoWorks ICM can perform hydraulic analysis of the one-dimensional storm drain system in the combined one-and two-dimensional hydraulic model. The following as-builts and survey information provided by the City of Pleasant Hill were included in the existing condition hydraulic models at the Project location:

- 1750 Oak Park Boulevard & 77 Santa Barbara Road, Contract No. W.O.5296 (1963)
- Improvement Plan Subdivision 5167 (1977)
- Central Contra Costa Sanitary District, District Sewering Project No. 2656 (1977)
- Oak Park Boulevard Improvement, File No. E-3761-61 (1960)
- Surveys at the Project location provided by the City of Pleasant Hill (Received on August 7, 2018)
- Street Improvement Plan Project No 39 Oak Park Boulevard
- Walnut Creek Basin – Pleasant Hill School, Project No. 190016 (04/30/1991)

Two proposed storm drain systems were added into the hydraulic model to mitigate potential floodplain impacts from the proposed Civic Project. Figure 9 and Figure 10 shows the existing and proposed storm drain systems at the Civic Project location included in the InfoWorks ICM hydraulic model.

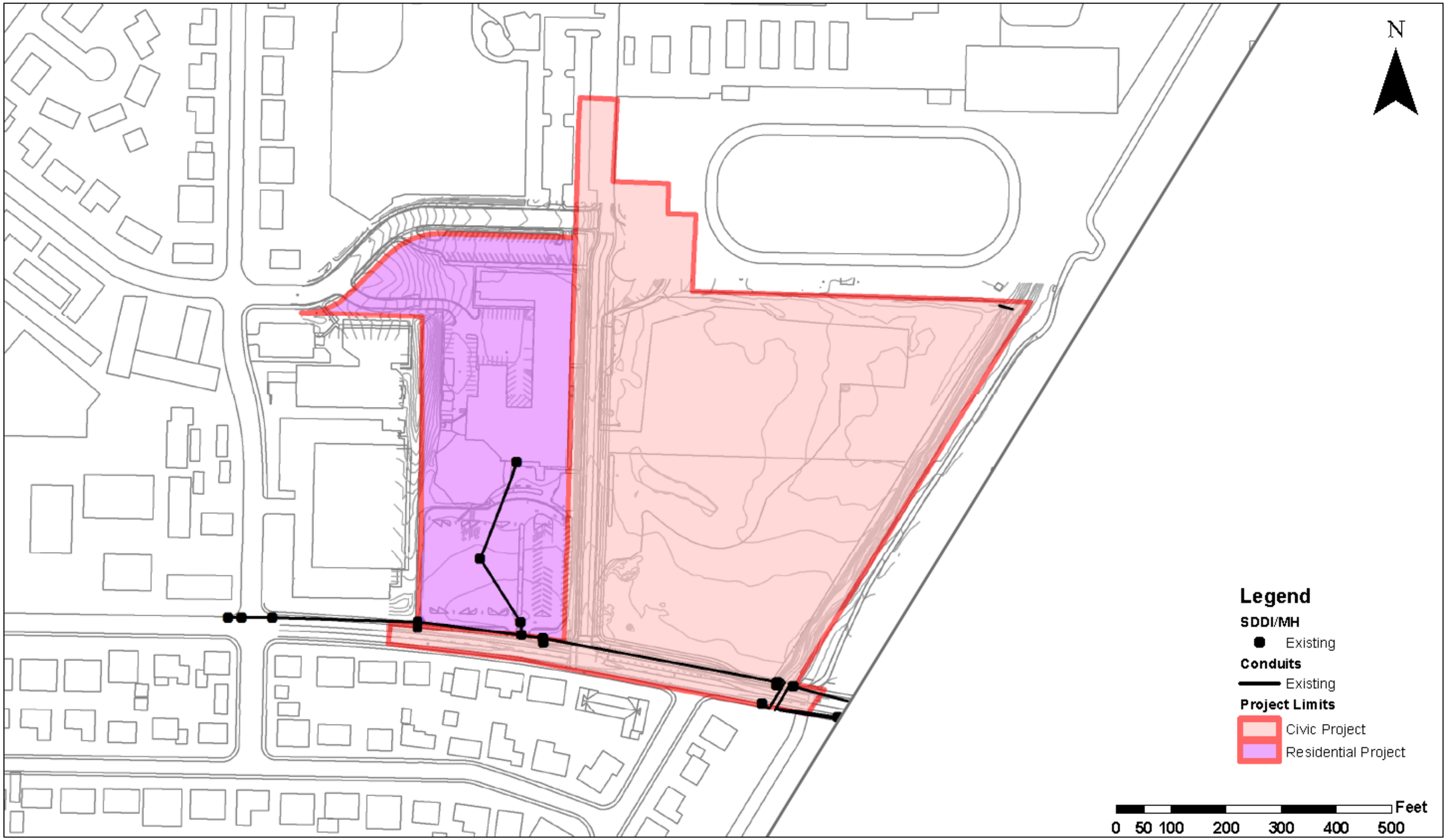

Figure 9. Existing Condition Storm Drain Systems

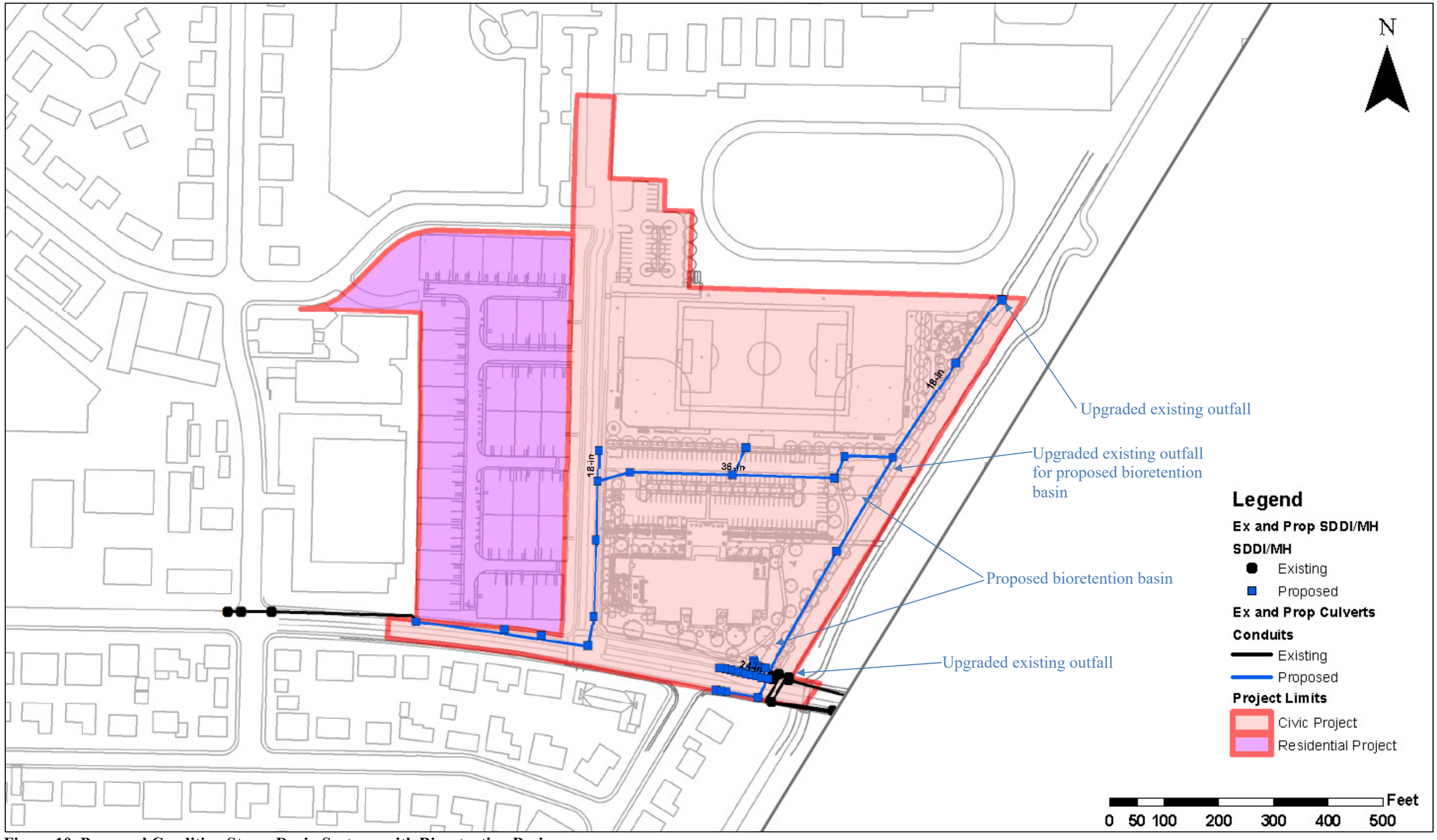

Figure 10. Proposed Condition Storm Drain Systems with Bioretention Basin

3.2.4 Two-Dimensional Floodplain Model

The two-dimensional floodplain component of the InfoWorks ICM hydraulic model for the existing and proposed conditions were created by combining terrain files provided by the City of Pleasant Hill, BCJ, BKF Engineers, and Sherwood Engineers (proposed condition only). At locations covered by more than one terrain files, the more recent survey data was selected to develop a combined terrain file for the hydraulic analysis. Figure 11 and Figure 12 illustrate the ground elevations for the existing and proposed conditions.

The ground elevation within the limits of the InfoWorks ICM model varies from approximately 50 feet NAVD 88 at the northern/downstream limit of the model to approximately 113 feet NAVD 88 at the southwestern/upstream model limits. The total area in the hydraulic model is approximately 780 acres.

The two-dimensional floodplain component of the InfoWorks ICM model are represented by polygon meshes with elevations based on the existing and proposed condition terrain files. The mesh size varied from 10 to 40 square feet in the Specific Plan area. The mesh size for the areas downstream of the Specific Plan area varied from 10 to 500 square feet. Overall, the two-dimensional floodplain for the InfoWorks ICM model is composed of approximately 696,000 polygons.

The two-dimensional floodplain model and one-dimensional riverine model for the Project are connected using the bank flow connections, which enabled overbank flood flow to leave and re-enter between the two modeling components. The two-dimensional floodplain model and one-dimensional storm drain model are connected using the storm drain inlets, manholes, and outlet structures, which enable storm drain systems to capture and/or release the overland flood flows on the two-dimensional floodplain model at the locations where these structures are assigned in the hydraulic model.

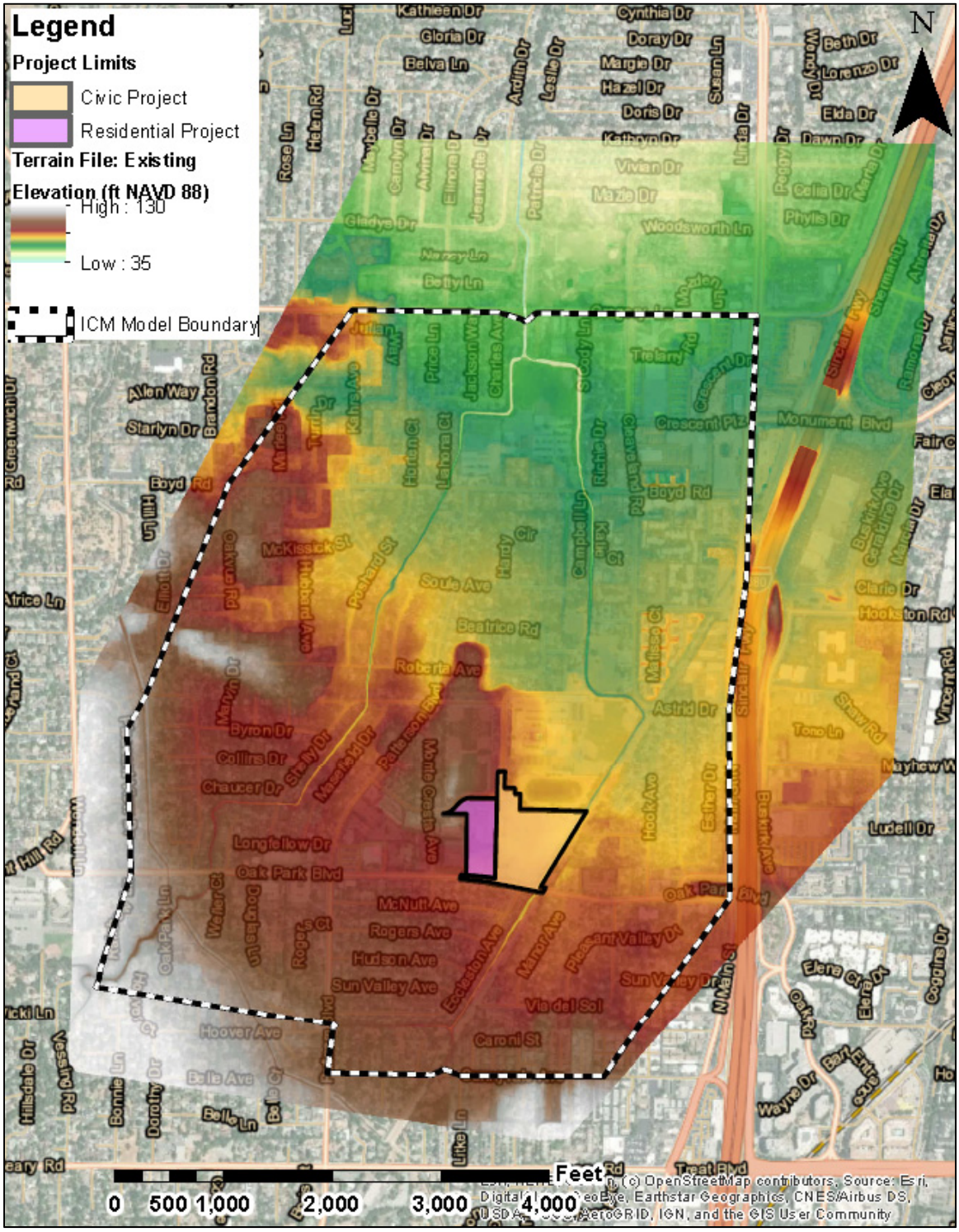

Figure 11. Existing Condition Terrain File

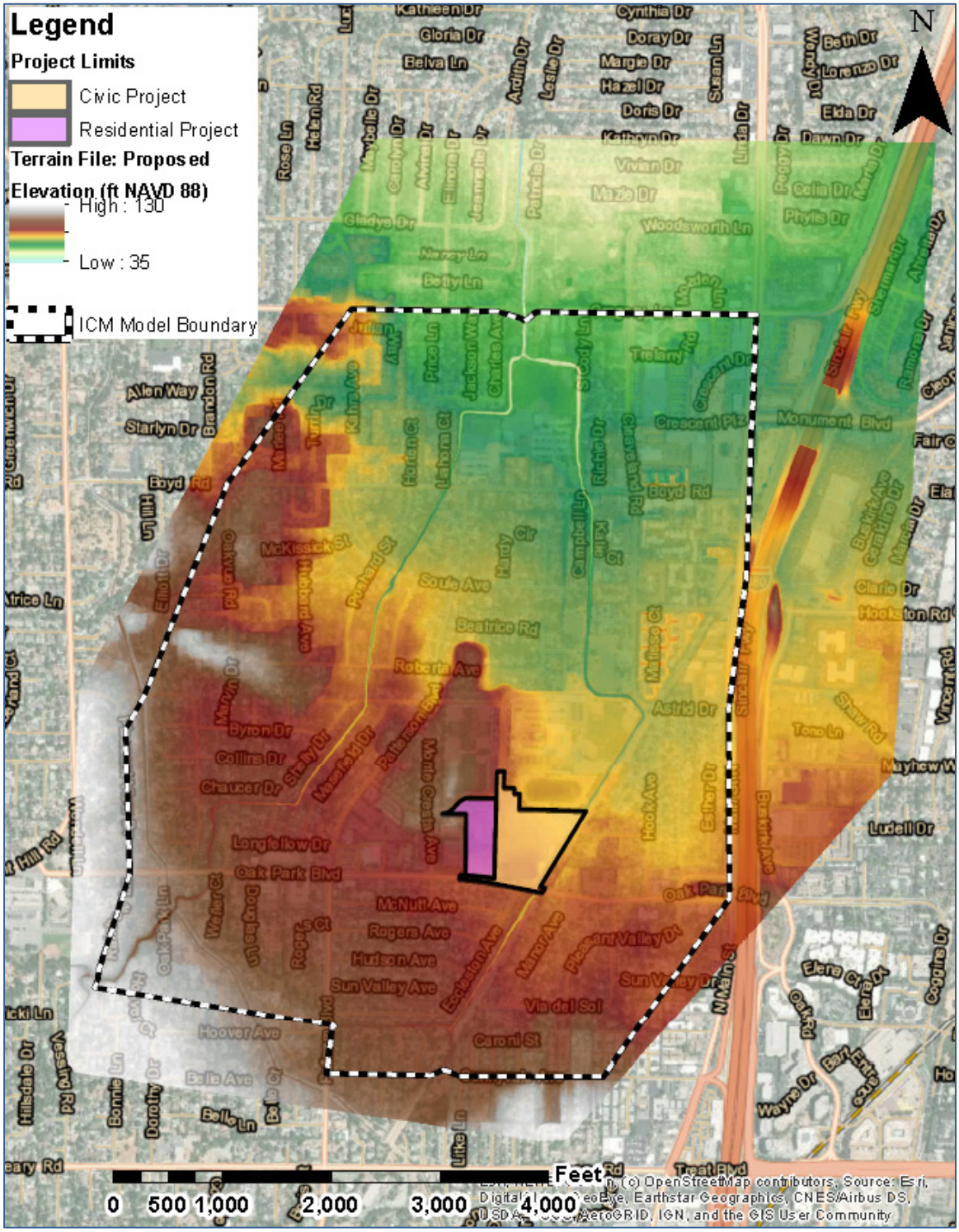

Figure 12. Proposed Condition Terrain File

3.2.5 Inflow Hydrograph

The peak of the 100-year hydrographs selected for the hydraulic analysis for the Project are shown in Table 2 in Section 3.1: Hydrologic Assessment. The locations where inflows from the sub-basins enter the hydraulic model are shown in Figure 13. The 100-year hydrograph at each inflow location is shown in Figure 14.

The locations of the inflow in the ICM hydraulic model were selected to best conform to the inflow locations assigned in the base HEC-RAS model prepared for the *Grayson and Murderer's Creeks Draft Feasibility Report*. The peak 100-year flow for Murderer's Creek, receiving runoff from sub-basins 3, 4, 5, is not equivalent to the sum of the peak 100-year flows shown in Table 2 because of the flood flow attenuation on upstream of the limit of the hydraulic model. The inflow locations for sub-basins 8E2 and 8E1 are split into two locations to match with the setup of the base HEC-RAS model prepared for the *Grayson and Murderer's Creeks Draft Feasibility Report*.

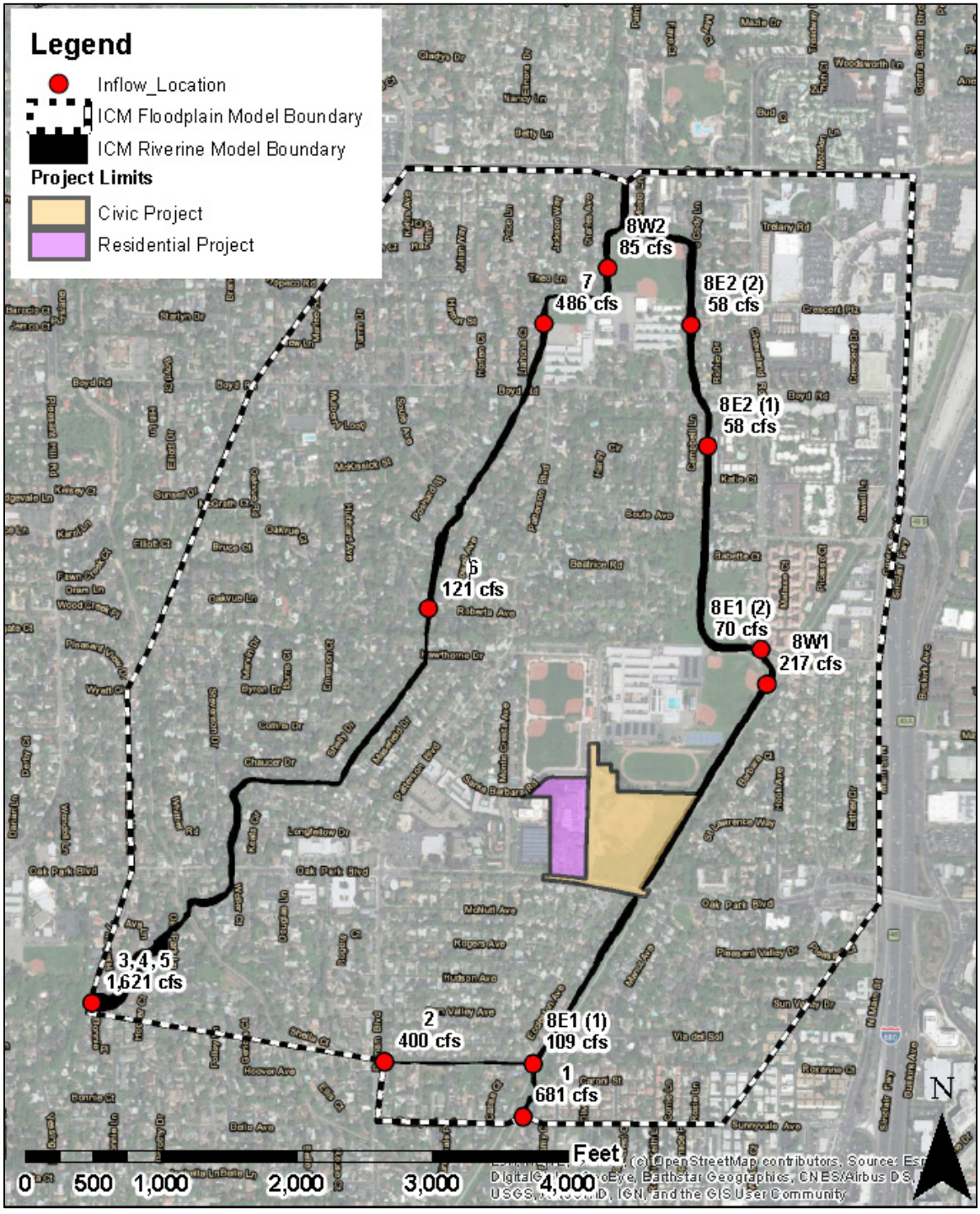

Figure 13. Inflow Locations in the ICM Hydraulic Model

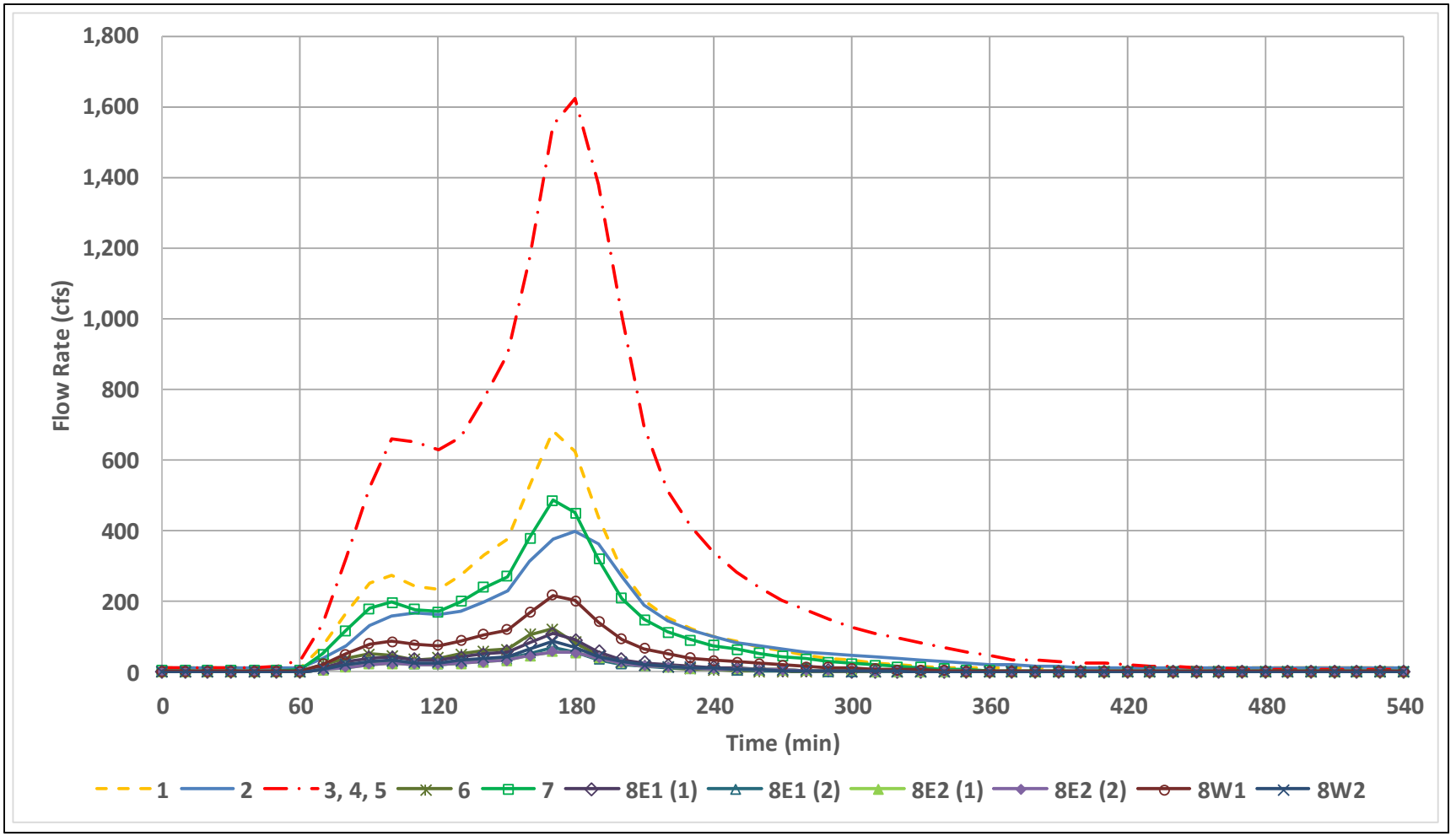

Figure 14. 100-year Flow Hydrographs for Hydraulic Analysis

Source: USACE 2007

3.2.6 Modeling Assumptions

According to the as-built files provided by the City of Pleasant Hill and Google Street view, there are existing storm drain inlets along Oak Park Boulevard on west of the storm drain inlets included in hydraulic model. These storm drain inlets were not included in the existing and proposed condition hydraulic models because culvert sizes were not available. Therefore, it was assumed the storm drain inlets on Oak Park Boulevard not included in the hydraulic model would not intercept overbank spill flow from Murderer's Creek during the 100-year storm event.

The grading for the proposed development on the existing library site was not available at the time of hydraulic modeling. In the proposed condition hydraulic model, a floodwall was placed around the parcel line of the existing library/proposed residential development to prevent flood flows from entering their property.

3.2.7 Hydraulic Analysis Outputs

The maximum extents of the modeled 100-year and 500-year floodplains for the existing and proposed condition hydraulic analyses are shown in Figure 15 and Figure 16, respectively.

Figure 17 and Figure 18 show the existing and proposed 100-year water surface elevations (WSEs) with respective existing and proposed contour grading. The comparison of the existing and proposed 100-year WSEs at the Specific Plan area shows the elimination of 100-year floodplain encroachment at the proposed library building within the Civic Project limits and proposed Residential Project. The outputs also show a decrease in WSEs at the proposed sports field north of the proposed library parking lot. The changes to the 100-year WSE at other locations throughout the Specific Plan area would be insignificant.

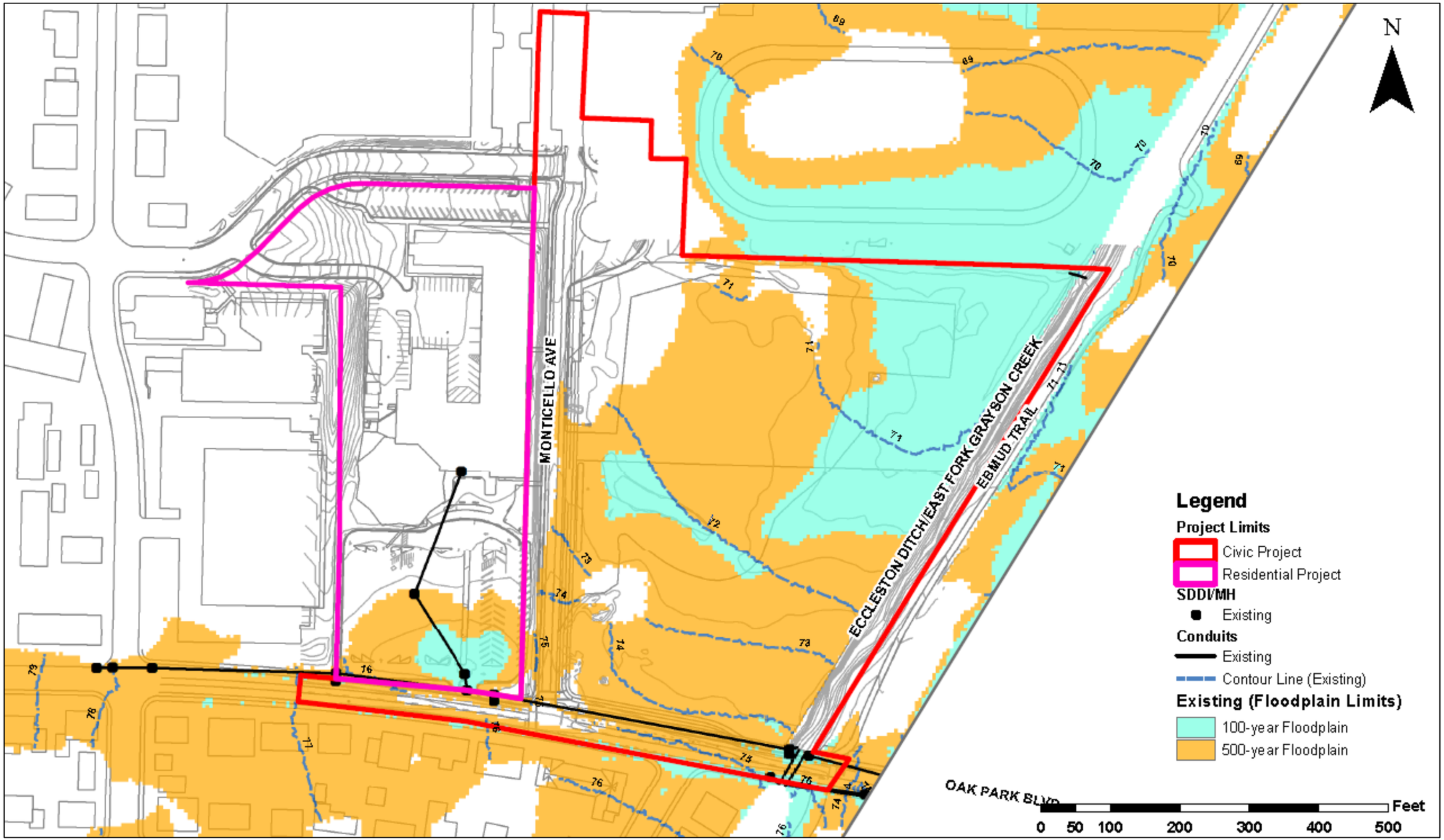

Figure 15. Existing Conditions 100-year and 500-year Floodplain Model at Project Site

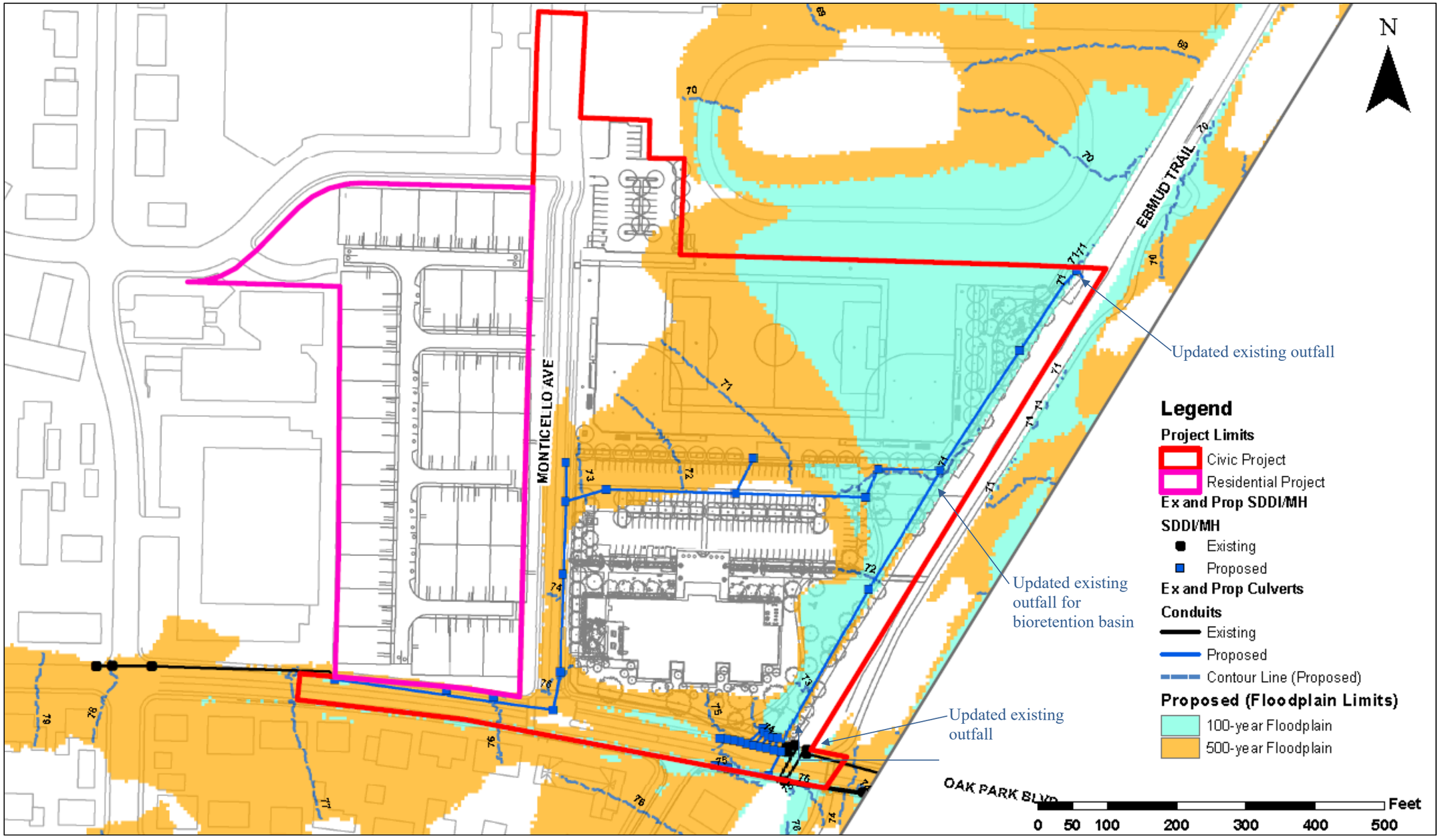

Figure 16. Proposed Conditions 100-year and 500-year Floodplain Model at Project Site

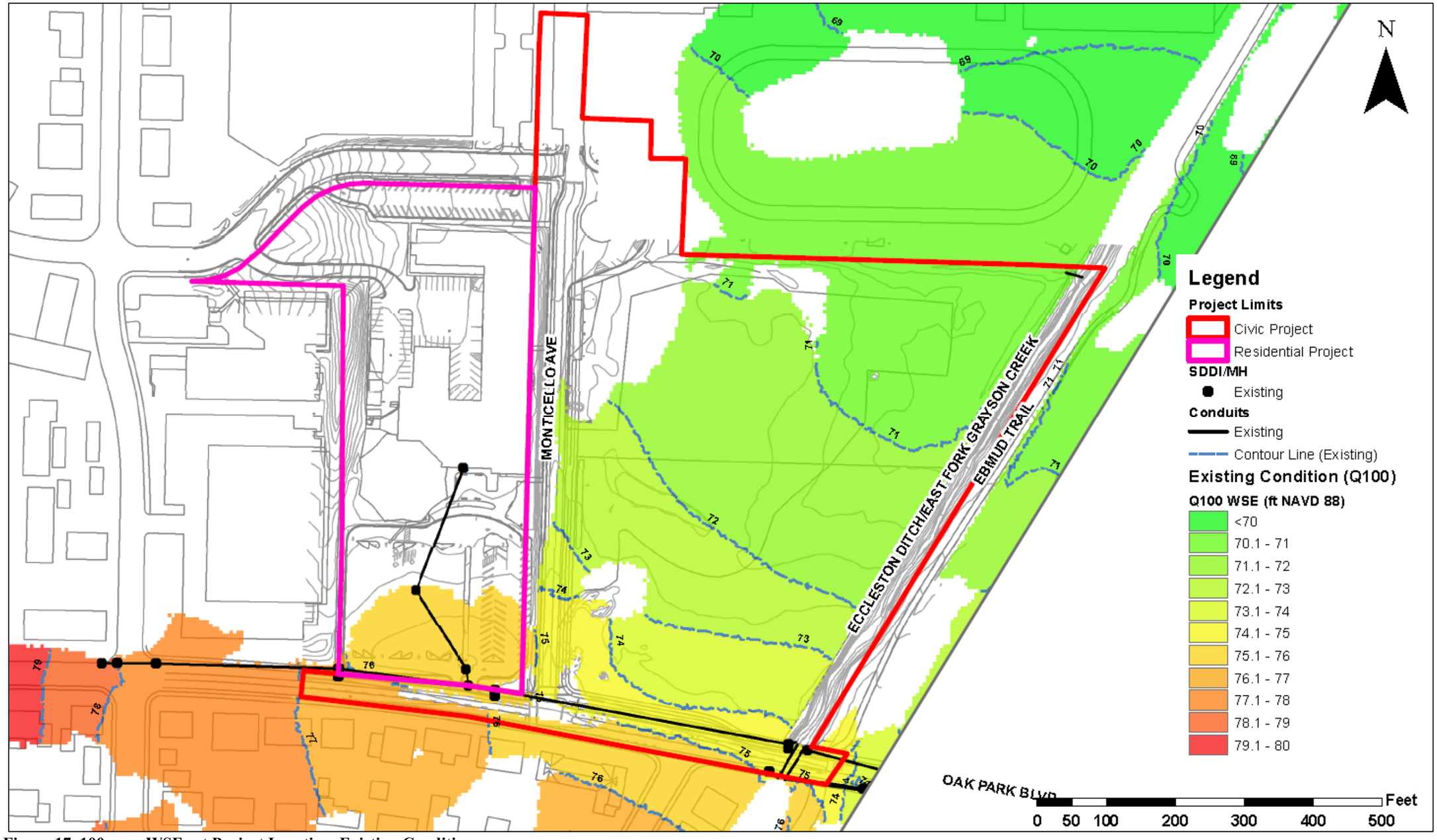

Figure 17. 100-year WSEs at Project Location, Existing Condition

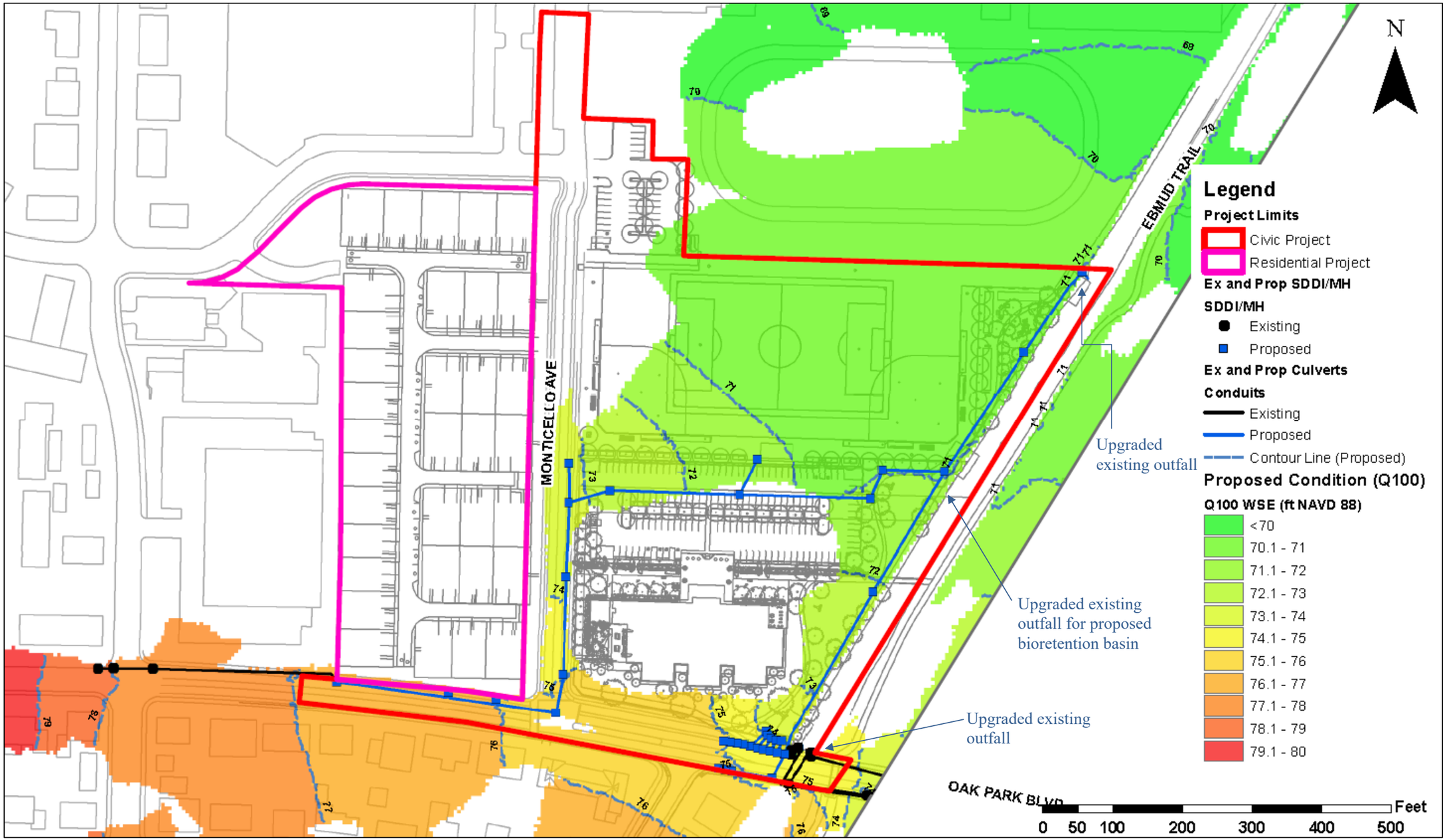

Figure 18. 100-year WSEs at Project Location, Proposed Condition

4 PROJECT EVALUATION

The Civic Project and Residential Project will avoid, to the maximum extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. This section analyzes the impacts associated with these Projects.

4.1 Risk Assessment

Risk shall mean the consequences associated with the probability of flooding attributable to an encroachment. It shall include the potential for property loss and hazard to life.

The potential floodplain risk factors associated with the implementation of a proposed Civil Project and Residential Project includes but is not limited to: 1) change in land use, 2) cut/fill inside the 100-year floodplain, 3) change to existing drainage pattern, and 4) change in the 100-year WSEs. The specific measures proposed to mitigate the potential floodplain impacts associated with these Projects are summarized under Section 4.2: Mitigation Measures.

Change in Land Use

The proposed Civil Project and Residential Project will change land use in the Specific Plan area. The relocation of the Pleasant Hill-Contra Costa County Library and construction of the sports fields will develop an empty, open-field parcel on the east side of Monticello Avenue. The existing library parcel will be redeveloped with residential buildings. The hydraulic analysis (Section 3: Hydrology and Hydraulics) indicates that any potential backwater effects caused by the new library footprint would be mitigated by the proposed storm drainage systems, the proposed bioretention basin, and the proposed grading of the sports field.

Cut/Fill Inside the 100-Year Floodplain

The proposed library site and associated parking lot and the Residential Project will be raised above the 100-year floodplain (Figure 15 and Figure 16). There are also areas of cut within the proposed sports field within the Civic Project and at the proposed bioretention basin. The Civil Project will balance the cut and fill volumes to minimize fill inside the floodplain to the best extent practicable.

Change to Existing Drainage Pattern

The Civic Project and Residential Project do not propose to significantly alter existing overall drainage patterns. Under existing conditions, overflow from Murderer's Creek during the 100-year storm event escapes the Murderer's Creek drainage system flows parallel to Oak Park Boulevard, and enters the floodplains of Eccleston Ditch/upper east fork of Grayson Creek. Murderer's Creek overflow flows from the west in an east-northeast direction from Oak Park Boulevard. A portion of this overland flow diverges from Oak Park Boulevard, ponding in the parking lot of the existing library site, located in the Residential Project limits before overflowing onto Monticello Avenue and continuing east-northeastward over the currently undeveloped area within the Civic

Project limits. Eccleston Ditch is undersized to convey flows from a 100-year storm event. The overbank flood flow from Eccleston Ditch generally flows from south to north at the Specific Plan area. See Figure 17 for 100-year WSEs for the existing condition.

The drainage pattern for the proposed 100-year floodplain would maintain the general direction of flow towards Grayson Creek. Outputs of the hydraulic analyses of the proposed condition show that the proposed mitigation measures, detailed in the next section, would mimic the existing overland drainage flow pattern within the public right-of-way by conveying the design storm runoff easterly along Oak Park Boulevard, northerly along Monticello Avenue to upgraded existing outfalls in Grayson Creek. The mitigation measures would also create appropriate areas or footprints that can store overflow from the Eccleston Ditch/upper east fork of Grayson Creek in larger storm events (Figure 18).

Change in the 100-Year Water Surface Elevation
As discussed in Section 3.2.7: Hydraulic Analysis Outputs, the comparison of the existing and proposed 100-year WSEs within the Specific Plan area shows the elimination of 100-year floodplain encroachment at the proposed library building and proposed Residential Project limits. The outputs also show WSE no increase at the proposed sports field north of the proposed library parking lot. The changes to the 100-year WSEs at other locations would be insignificant and therefore, no adverse impacts associated with changes in WSEs are anticipated.

Water depths will increase in the sports fields to accommodate the floodplain storage volume displaced by the new library and residential development sites. Safety signs and special measures will be provided as safety considerations.

4.2 Mitigation Measures

Comparisons of hydraulic model results for the existing and proposed conditions in the 100-year storm event led to the development of three recommended mitigation measures to minimize potential impacts upstream and downstream of the Specific Plan area and along Oak Park Boulevard. As mentioned in the preceding subsection, based on the outputs of the existing and proposed conditions, there are no adverse impacts associated with proposed changes in the WSEs. The three recommended mitigation measures are detailed in the following:

Proposed Storm Drainage Systems
To mitigate for the impacts (increase flows and higher WSEs along roadways and properties upstream) due to the decrease in the floodplain footprint within the Specific Plan area, the existing single 24-inch drainage system along Oak Park Boulevard will be extended and reconfigured, and will drain to two upgraded existing outfalls to Eccleston Ditch/upper east fork of Grayson Creek (Figure 10).

The western leg of the storm drain system would upsize the existing 24-inch storm drain pipe currently located along Oak Park Boulevard on the south side of the new residential

development. The western leg would diverge from its existing alignment by turning northward along the east side of Monticello Avenue and then extend eastward along the northern end of the new library parking lot, combine with the eastern leg of the storm drain system, then turn northward to an upgraded existing outfall at the east fork of Grayson Creek. By replacing the existing 24-inch diameter storm drain with 36-inch diameter storm drain pipes within the Civic Project limits, the drainage pattern of the western leg alignment will mimic the existing overland-flow drainage pattern through the parking lot of the existing library by providing additional underground capacity for 100-year storm event. The western leg will include drainage inlets along the northern perimeter of the new library parking lot that will allow overflow from the system to be directed to and stored within the new sports fields. The top-of-grade elevation of the proposed inlets would be set slightly lower than the pavement elevation of the proposed parking lot. This elevation difference would allow stormwater to overtop at the overflow drainage inlets first and would lower the hydraulic grade line elevation of the proposed storm drain system upstream of the proposed overflow drainage inlet. This overflow feature would be utilized for runoff generated during larger or multiple back-to-back rain events, which would result in high tailwater conditions within the east fork of Grayson Creek and would also reduce the discharge capacity of the proposed storm drain system.

An eastern leg of the system begins east of Eccleston Avenue and conveys runoff eastward to a upgraded, existing outfall at Eccleston Ditch/east fork of Grayson Creek just north of Oak Park Boulevard and to a junction with the western leg of the system before continuing northward to an upgraded, existing outfall at Eccleston Ditch/east fork of Grayson Creek on the northern end of the Civic Project. The existing 24-inch and 30-inch diameter storm drains would be upsized to 36-inch or larger diameter pipes to increase the capacity of the system to accommodate the 100-year storm event by providing additional underground capacity. Similar to the western leg, the eastern leg will direct overflow to the proposed bioretention basin, as necessary due to runoff generated during larger or multiple back-to-back rain events and/or due to tailwater conditions within the east fork of Grayson Creek (see below for details).

Bioretention Basin

The site plan for the proposed library site includes a bioretention basin for stormwater treatment. The proposed basin is adjacent to Eccleston Ditch/upper east fork of Grayson Creek (Figure 10). To mitigate for the change in path for the overland flood flows west of the Eccleston Ditch/upper east fork of Grayson Creek as well as the decrease of the overall floodplain footprint of the Civic Project area, the size of bioretention basin was increased to also serve as an additional flood flow path for the 100-year storm event, as shown in Figure 16. Detailed specifications of the bioretention basin will be provided during the design phase.

Proposed Grading of New Sports Fields

Under the existing condition, the extent of the 100-year floodplain (flood depth greater than 1-foot) covers approximately the eastern third of the new sports fields (Figure 5 and Figure 15). The proposed grading (Figure 18) of the new sports fields was strategically designed to balance the overall cut and fill of both the Civic Project and Residential

Project to minimize fill in the floodplain to the best extent possible. Since the proposed sports field is unlikely to be used during larger rain events, the grading of the new sports fields was designed so it can serve as a basin for additional floodplain storage with the current outfall replaced for proper drainage to prevent ponding. The hydraulic model results for the proposed condition in the 100-year event indicates the entire area of the new sports fields will have a depth of water ranging from approximately 0.1-foot to 4-feet, with the extent of the 100-year floodplain (flood depth greater than 1-foot) anticipated to cover approximately the eastern half of the new sports fields. This measure will also mitigate for the change in path for the overland flood flows west of the Eccleston Ditch/upper east fork of Grayson Creek as well as the decrease of the overall floodplain footprint of the Specific Plan area.

4.3 Coordination with Local, State, and Federal Water Resources and Floodplain Management Agencies

Coordination with FEMA and other environmental permitting agencies, such as USACE, California Department of Fish and Wildlife, and the Regional Water Quality Control Board, may be needed for the following possible activities including, but not limited to:

- the filing of the Conditional Letter of Map Revision for the Civic Project, if necessary,
- the subsequent filing of the Letter of Map Revision for the Civic Project, if necessary, and
- the permitting for updating three existing outfalls along the upper east fork of Grayson Creek.

5 REFERENCES

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