Final
Preliminary Geomorphology Report

High Desert Corridor
Palmdale to Apple Valley (State Route 14 to State Route 18)

June 2014

PARSONS
Parsons Transportation Group Inc.
100 West Walnut Street
Pasadena, CA 91124

Contract No.: 07A2912
Caltrans Project No.: 0700000080 (EA: 16720)

Caltrans

Metro

Geomorphology Report

High Desert Corridor (HDC) Project

LOS ANGELES and SAN BERNARDINO COUNTIES, CALIFORNIA
District 07 – LOS ANGELES – NEW 138 - PM 42.4 to PM 74.9
District 08 – SAN BERNARDINO – NEW 138 - PM 0.0 to PM 35.0
Caltrans Project No.: 0700000080 (EA: 16720)

June 2014

STATE OF CALIFORNIA
Department of Transportation

Prepared By: [signature] Date: 6/13/14
Richard Bottcher PE, Lead Author
Parsons
110 West A Street, Suite 1050
San Diego, CA 92101

Approved By: [signature] Date: 6/13/14
Samer Momani
Division of Environmental Planning
California Department of Transportation
District 7
Los Angeles, CA 90012

TABLE OF CONTENTS

SECTIONS

APPENDIX

FIGURES

PARSONS

1 INTRODUCTION

1.1 Report Overview and Purpose

The High Desert Corridor (HDC) project is being undertaken by the California Department of Transportation (Caltrans) in coordination with the Los Angeles County Metropolitan Transportation Authority (Metro) and other partner agencies. The HDC project involves construction of a new, approximately 63-mile-long, east–west corridor, and possible toll or rail facility, between State Route (SR) 14 in Los Angeles County and SR 18 in San Bernardino County. The general location of the project is illustrated in Figure 1-1. The HDC was identified as E-220 in SAFETEA-LU (the Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users) and is officially designated as a high-priority corridor on the National Highway System. The project is proposed as a means of improving mobility and access for people and goods in the rapidly growing Antelope, Victor, and Apple Valley areas of Los Angeles and San Bernardino counties.

To comply with the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), an Environmental Impact Report/Environmental Impact Statement is being prepared. As a technical study that supports the project approval/environmental (PA/ED) document work effort, this Preliminary Geomorphology Report evaluates the potential impact of the proposed HDC project on landforms. With respect to construction of the HDC, this report evaluates: 1) impacts to the drainage patterns assuming incorporation of drainage facilities like cross culverts and longitudinal channels to facilitate the flow of runoff across the alignment corridor; 2) potential erosion concerns due hydromodification (i.e., changes in flow patterns and rates); and 3) mitigation measures proposed for potential hydromodification concerns including incorporation of infiltration basins, detention basins, and channel stabilization both upstream and downstream of the proposed alignment.

1.2 Purpose and Need

The purpose of the proposed action is to improve west-east mobility through the High Desert region of southern California by addressing present and future travel demand and mobility needs within the Antelope and Victor valleys. The proposed action is intended to achieve the following objectives:

- Increase capacity of west-east transportation facilities to accommodate existing and future transportation demand
- Improve travel safety and reliability within the High Desert region
- Improve the regional goods movement network
- Provide improved access and connectivity to regional transportation facilities, including airports and existing and future passenger rail systems, which include the proposed California HSR system and the proposed XpressWest HSR system
- Contribute to state greenhouse gas (GHG) reduction goals through the use of green energy features

The specific needs to be addressed by the proposed action include:

- Recent and future planned population growth within the High Desert region
- Limited and unreliable west-east connectivity within the High Desert region
- Regional demands for goods movement to support the growth of the regional economy

- Future demands for the use of green energy, including sustainability and green energy provisions in state law and policy

1.3 Project Description

The California Department of Transportation (Caltrans), in cooperation with the Los Angeles County Metropolitan Transportation Authority (Metro), proposes construction of the High Desert Corridor (HDC) as a new transportation facility in the High Desert region of Los Angeles and San Bernardino counties. The proposed 63-mile-long west-east facility would provide route continuity and relieve traffic congestion between State Route (SR) 18 and United States Highway 395 (US 395) in San Bernardino County with SR-14 in Los Angeles County. The project would comprise of one or more of the following major components, including highway, tollway, rail transit, bikeway, and recommendation for green energy facilities. Figures 1-1 and 1-2 are project vicinity and location maps, respectively.

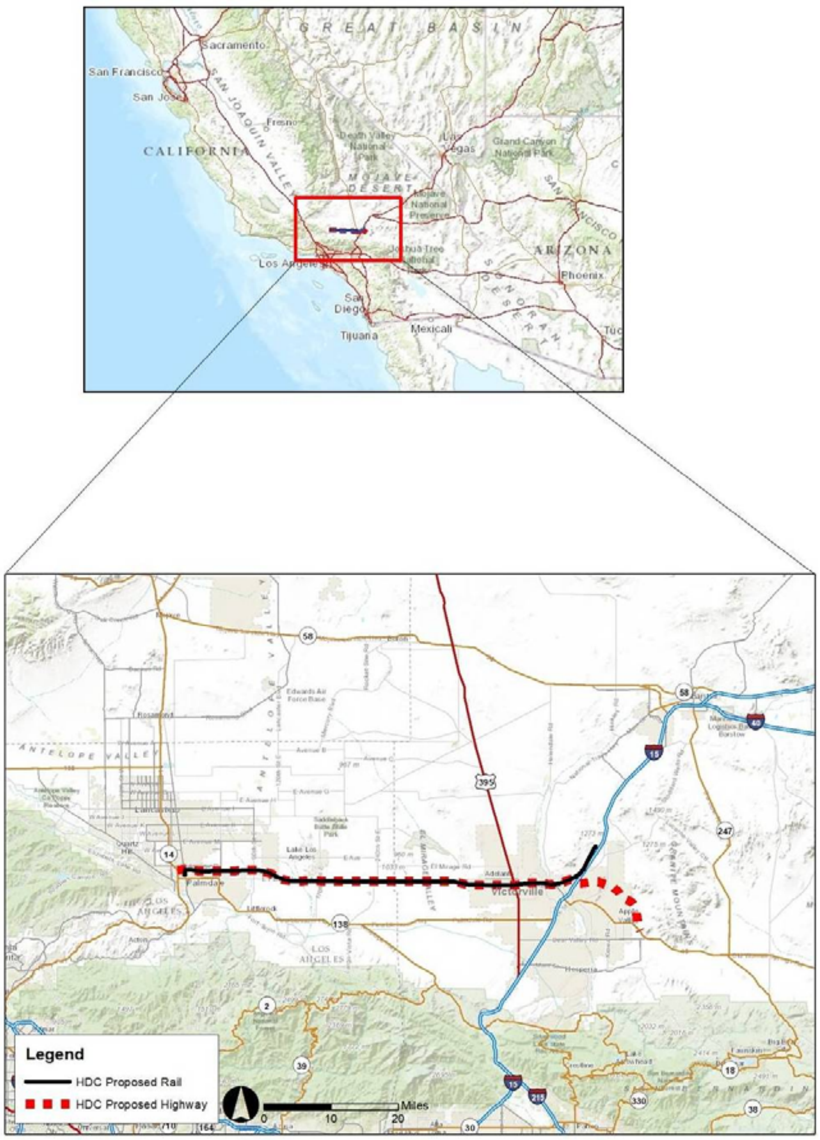
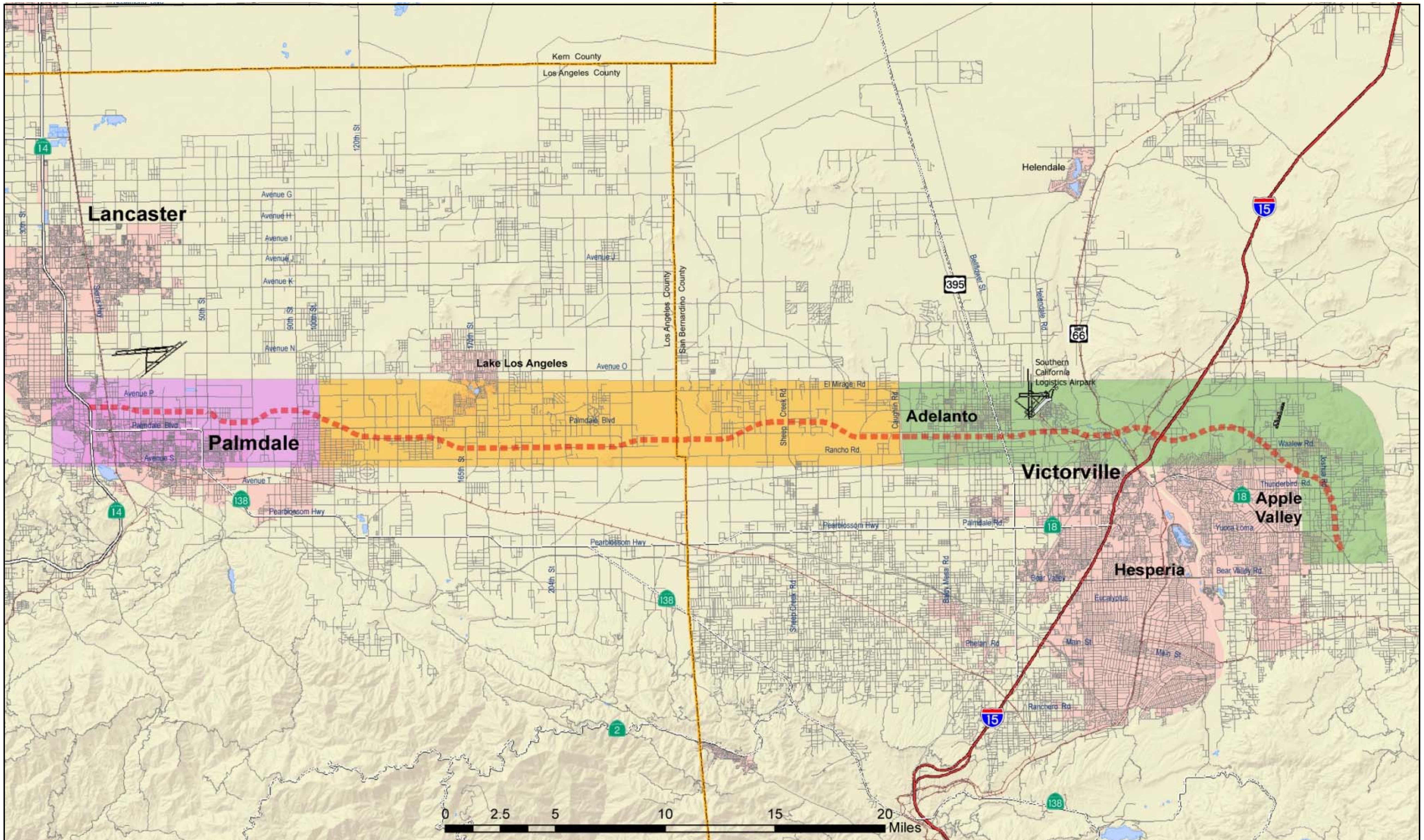


Figure 1-1 Project Vicinity Map



ANTELOPE VALLEY Los Angeles County Lancaster, Palmdale	HIGH DESERT Los Angeles County–San Bernardino County Lake Los Angeles, El Mirage	VICTOR VALLEY San Bernardino County Adelanto, Victorville, Apple Valley, Hesperia

Figure 1-2. Project Location Map

This page intentionally left blank.

1.3.1 Project Alternatives

Several project alternatives and design variations have been considered and evaluated. A No Build Alternative and four build alternatives were selected for detailed evaluation in the Draft Environmental Impact Report/Environmental Impact Statement.

NO BUILD ALTERNATIVE

Under the No Build alternative, no new transportation infrastructure would be built within the project area to connect Los Angeles and San Bernardino Counties aside from existing SR-138 safety corridor improvements in Los Angeles County and SR-18 corridor improvements in San Bernardino County. Traffic circulation and congestion currently experienced on Palmdale Boulevard, Air Expressway, and Happy Trails Highway (existing SR-18) would remain. The no action alternative functions as a baseline to compare against all of the proposed build alternatives.

FREEWAY/EXPRESSWAY ALTERNATIVE (AVENUE P-8, I-15, AND SR-18)

This alternative would consist of a combination of a controlled-access freeway and an expressway. It generally would follow Avenue P-8 in Los Angeles County and just south of El Mirage Road in San Bernardino County. This alternative then extends east to Air Expressway Road near I-15 and curves south, terminating at Bear Valley Road. The incorporation of green energy technologies and a bike path along segments of the alternative would also be considered.

Four physical alignment variations are being considered, including:

- Variation A: Near Palmdale, the freeway/expressway would dip slightly south of the main alignment, approximately between 15th Street East and Little Rock Wash.
- Variation B: East of the county line, the freeway/expressway would flare out slightly south of the main alignment between Oasis Road and Coughlin Road. Variation B1 would be at the same location, but it would flare out a little less and pass through the Krey airfield.
- Variation D: Near the community of Lake Los Angeles, the freeway/expressway would dip slightly south of the main alignment, just south of Avenue R approximately between 180th Street East and 230th Street East.
- Variation E: Near Adelanto and Victorville, the freeway/expressway would dip south of the federal prison.

FREEWAY/TOLLWAY ALTERNATIVE (AVENUE P-8, I-15, AND SR-18)

This alternative would follow the same physical alignment as the Freeway/Expressway Alternative (including Variations A, B, D, and E), but it would have a section between 100th Street East and US 395 operate as a tollway. Details of this operating feature are being evaluated as part of an ongoing P3 analysis. The incorporation of green energy technologies and a bike path would also be considered.

FREEWAY/EXPRESSWAY ALTERNATIVE WITH HIGH-SPEED RAIL (HSR) FEEDER/CONNECTOR SERVICE

This alternative would be the same as the Freeway/Tollway Alternative except that it would also include an HSR Feeder/Connector Service between the cities of Palmdale and Victorville. The HSR Feeder/Connector Service would utilize proven steel wheel-on-steel track technology and have a design speed of 180 miles per hour (mph) with an operating speed of 160 mph. Additional details of this operating feature, including the type of train technology (i.e., electric versus diesel-electric), its location in relation to the HDC (median-running alignment), and its connections to existing and proposed rail stations, are being evaluated as part of an ongoing Rail Alternatives Analysis. The incorporation of green energy technologies and a bike path would also be considered.

FREEWAY/TOLLWAY ALTERNATIVE WITH HIGH-SPEED RAIL FEEDER/CONNECTOR SERVICE

This alternative would be the same as the Freeway/Expressway Alternative except that it would also include an HSR Feeder/Connector Service between the cities of Palmdale and Victorville. The incorporation of green energy technologies and a bike path would also be considered.

2 EXISTING DRAINAGE PATTERN

In general, the hydrologic regime along the entire corridor exhibits the characteristics of an alluvial fan, with several incised streams and channels that cross the project alignment. The landforms of specific interest are those potentially affected by the concentrated flow paths that cross the proposed project corridor. From west to east, the larger water courses are Little Rock Wash, Big Rock Wash, Ossam Wash, Turner Wash, Mojave River and Bell Mountain Wash. These are considered the largest waterways within the project area and, with the exception of Bell Mountain Wash, generally flow northerly across the project site. Streams and creeks such as Mescal Creek and Desert Knolls Wash are also evaluated for landform effects.

As shown in Figure 2-1, the east portion of the project area is located in the Mojave River Watershed, contributing flow to the river at the “Narrows” where the waterbody has perennial flow. The Mojave River includes perennial low-flow channels along the stream bed, and it supports extensive riparian vegetation along its banks and adjacent areas. The west portion of the project area is located in the Antelope Valley watershed, as shown in Figure 2-1. This watershed encompasses approximately 1,220 square miles within Los Angeles County and 143 square miles in San Bernardino County. Numerous streams originating in the mountains and foothills flow across the valley floor and eventually pond in Rosamond Lake and Rogers Dry Lake to the north.

The corridor traverses the northern side of the City of Palmdale. Palmdale has developed a Drainage Master Plan (DMP; 1996) that incorporates a network of storm drains and detention facilities for flood control. It is anticipated that HDC construction will occur prior to construction of the proposed improvements identified in the City’s DMP. Specifically, the HDC proposes to place culverts to accommodate the existing offsite runoff under current conditions. In addition, storm drains proposed in the City’s DMP that cross the corridor will be constructed within the HDC right-of-way limit. After establishment of a Cooperative Agreement between the City of Palmdale and Caltrans, the HDC infiltration basins within the City’s area of service would be connected to the drainage network, which would then facilitate the discharge of runoff. Coordination between Caltrans and the City on the timeline and connection of the DMP is anticipated to occur during the plans, specifications, and estimate (PS&E) phase. Excerpts of the DMP are included in the Preliminary Hydraulics and Hydrology Report, Appendix A.

The offsite drainages crossing the corridor are described in more detail below and shown in Figures 2-2 through 2-4, which are referred to as Hydrology Maps 1, 2, and 3, respectively.

Offsite Hydrology Map 1 (Figure 2-23), shows the western portion of the project alignment. As shown, the tributary area within the City of Palmdale, from SR 14 to Little Rock Wash, drains in a northerly direction across the project alignment. The off-site watershed depicted in this area has been divided into 11 sub-watersheds, labeled as Drainage Areas 1 through 11.

As depicted in Map 1 (Figure 2-2), the watershed area from Little Rock Wash to Big Rock Wash drains northwesterly through the Antelope Valley in an alluvial fan formation toward the Rosamond and Rogers dry lakes. This watershed area has been divided into 10 sub-watersheds, labeled as Drainage Areas 12 through 21.

As shown in Maps 1 and 2 (Figures 2-2 and 2-34), the tributary area from Big Rock Wash to Fremont Wash drains northerly and flows across the project alignment. East of Big Rock Wash, there are numerous streams traversing the project alignment and tributary to Mescal Creek, which flows northwesterly to a dry lake referred to as Lake Los Angeles. Sub-watersheds contributing flow to Mescal Creek include Drainage Areas 22 through 43. Farther east, the runoff generally flows in a northeasterly alignment to Fremont Wash, within the City of Adelanto. Drainage areas contributing flow to this stream include those labeled 44 through 55. This wash eventually drains to the Mojave River, as depicted in Figure 2-3.

As depicted in Map 2 (Figure 2-3), from Fremont Wash to I-15, the off-site drainage areas flow to larger streams such as Turner Wash (Drainage Area 56) and Ossam Wash (Drainage Area 57), which both drain to the Mojave River farther to the north. The Mojave River (Drainage Area 58) also flows northerly under the alignment.

Map 3 (Figure 2-4) shows that runoff generated east of I-15 is conveyed to Bell Mountain Wash (Drainage Area 59 and 60), which flows southerly across the alignment to the Mojave River. Finally, at the east end of the project corridor, the off-site drainage flows in a southwesterly to westerly direction across the project alignment to the Apple Valley Dry Lake (Drainage Areas 61 to 64).

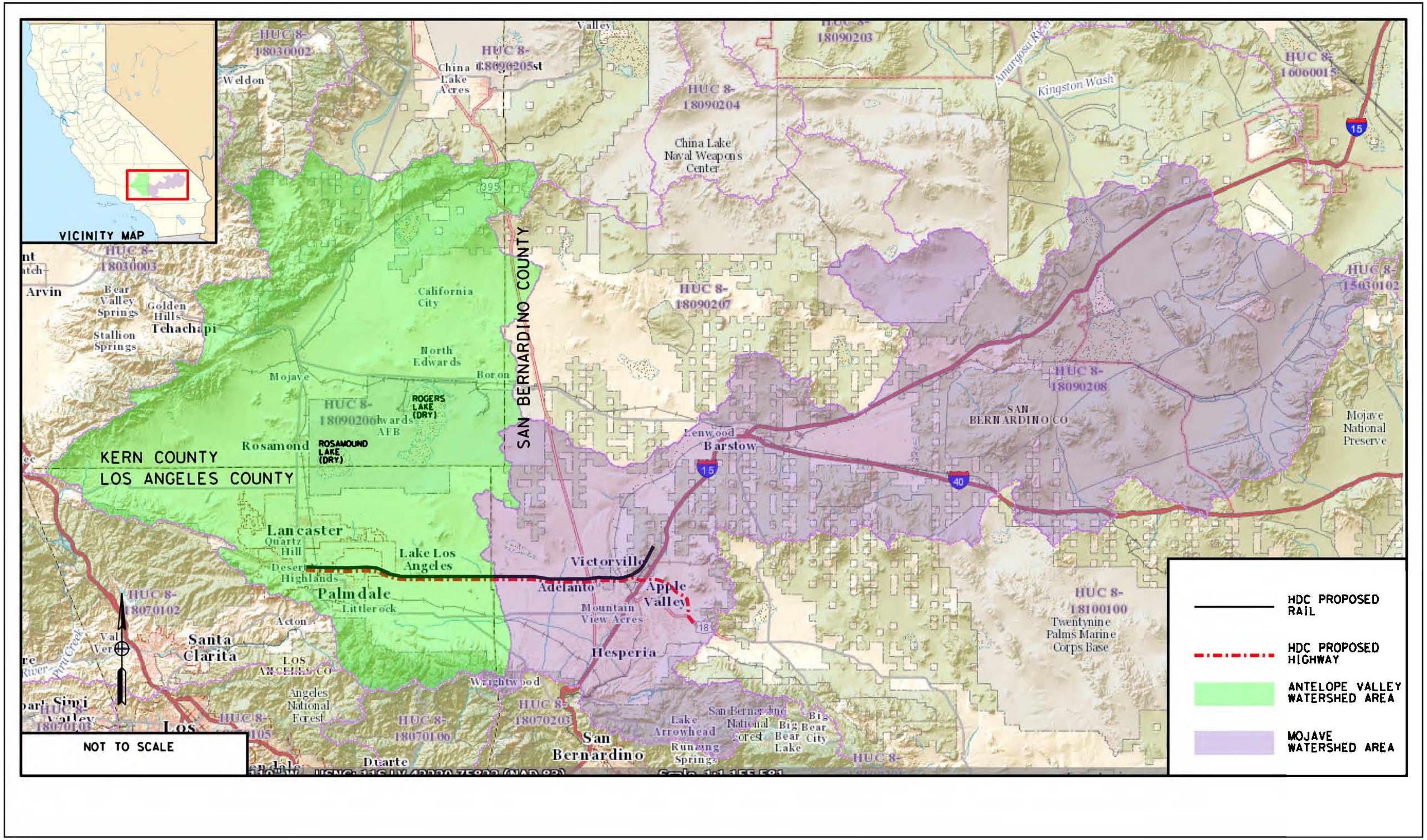


Figure 2-1. HDC within the Antelope Valley and Mojave River Watersheds

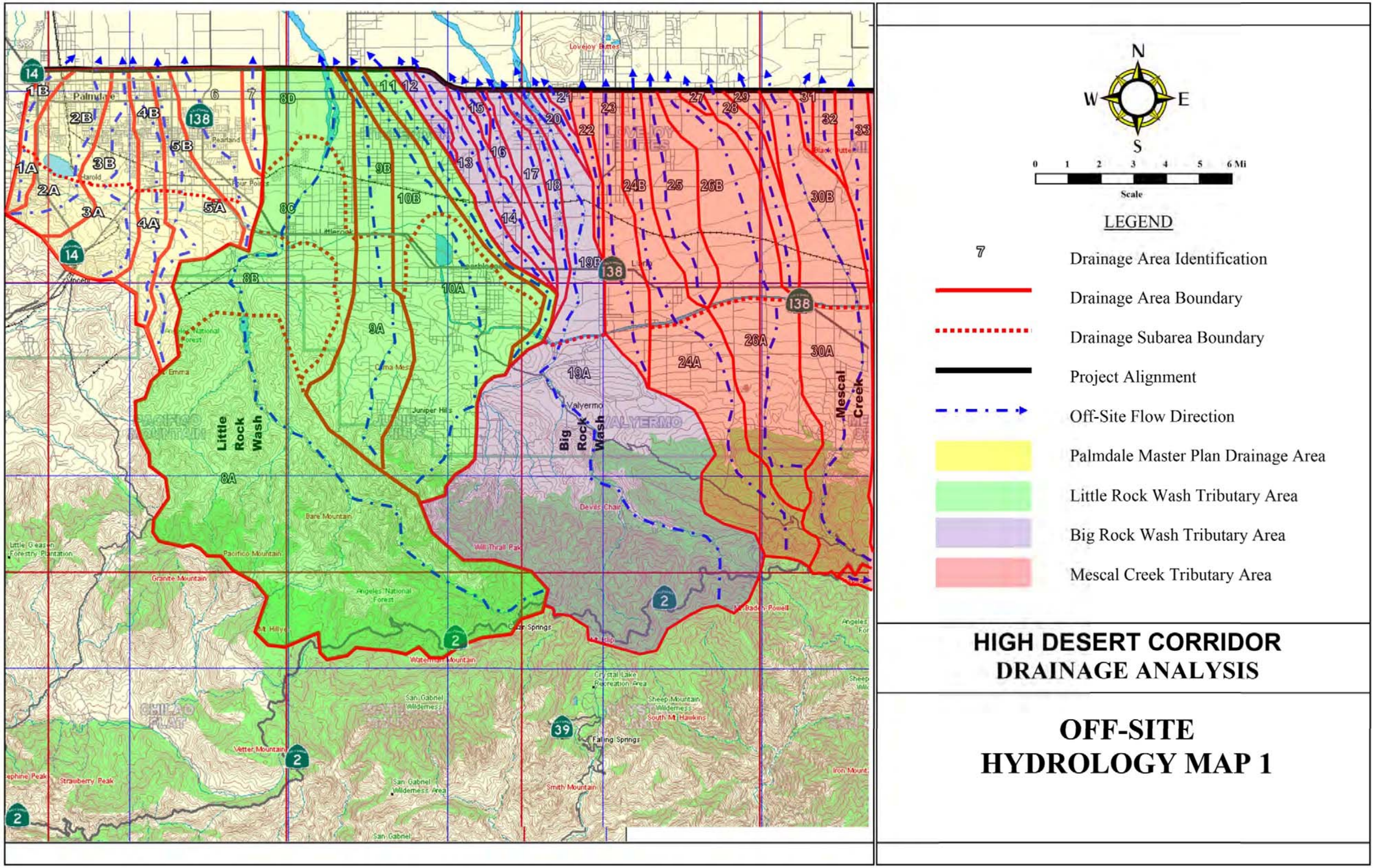


Figure 2-2. Offsite Hydrology Map 1 – Drainage Pattern Little Rock Wash to Mescal Creek

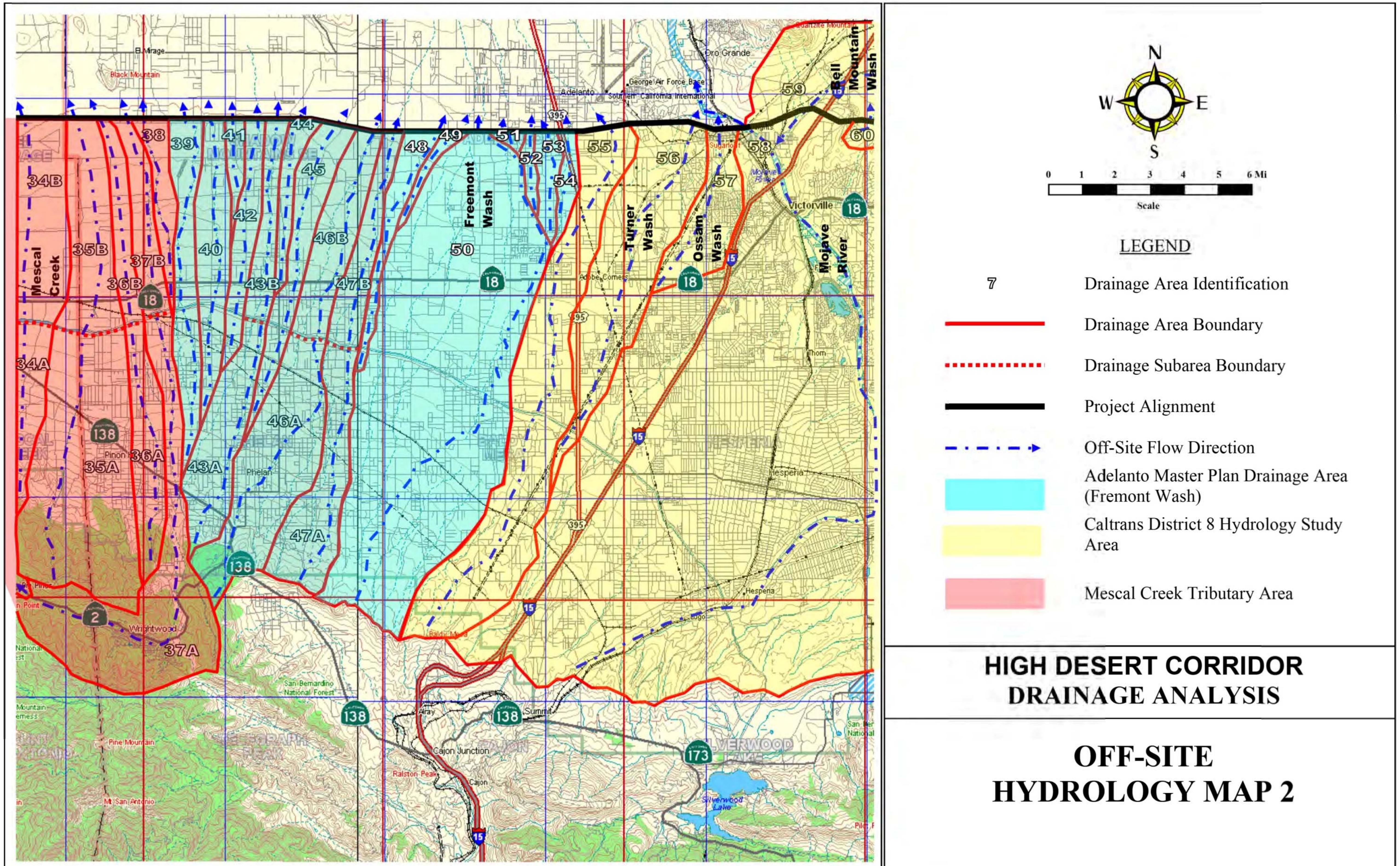


Figure 2-3. Offsite Hydrology Map 2 – Drainage Pattern Freemont Wash to Mojave River

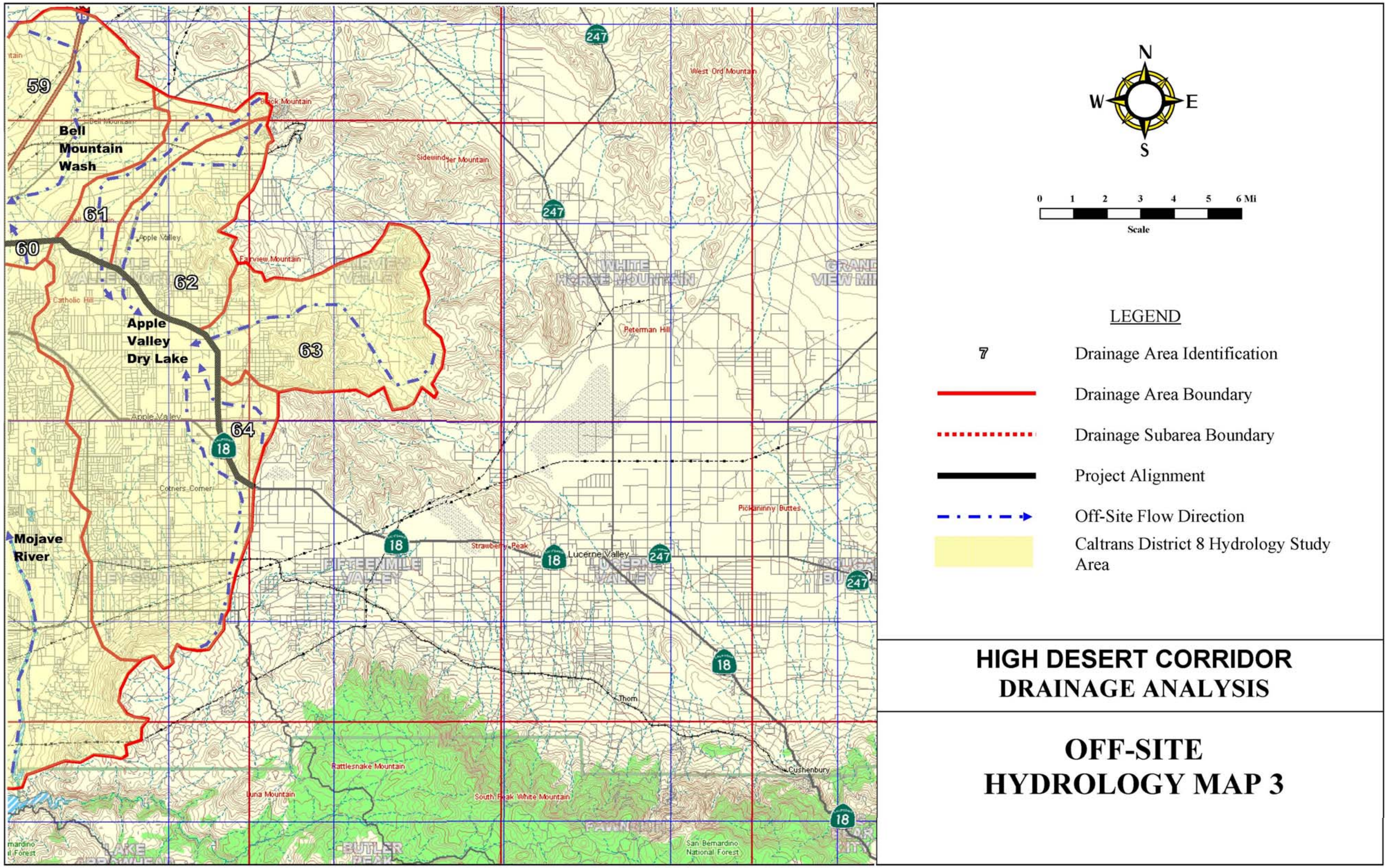


Figure 2-4. Offsite Hydrology Map 3 – Drainage Pattern East Segment of Project

3 FLOOD ZONING

There are several locations along the project with floodplain impacts from longitudinal or transverse encroachments by the project. This section identifies the locations where the project may affect a floodplain. Preliminary recommendations for mitigation and further study are provided.

FEMA designates Special Flood Hazard Areas (SFHAs) according to Zones. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance of flood. The zones are described as:

Zone A – Corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. No BFEs or depths have been determined.

Zone AE – Corresponds to the areas of 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs have been derived from detailed hydraulic analyses and are shown in this zone.

Zone AH – Corresponds to the areas of 100-year shallow flooding with a constant water-surface elevation. Flood depths of 1-foot (0.3-meter) to 3 feet (0.9-meter) (usually areas of ponding); BFEs are derived from detailed hydraulic analyses and are shown at selected intervals in this zone.

Zone AO – Corresponds to the areas of 100-year shallow flooding. Flood depths of 1-foot (0.3-meter) to 3 feet (0.9-meter) (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

Zone AR – Depicts areas protected from flood hazards by flood control structures such as levees that are being restored.

Zone X (dotted) – Other flood areas. Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1-foot (0.3-meter) or with drainage areas less than 1 square mile (2.5 square kilometers [km]); and areas protected by levees from 1% annual chance flood.

Zone X – Areas determined to be outside the 0.2% annual chance floodplain.

An overview of the SFHA located along the entire project alignment is provided in Appendix E. The following are detailed discussion of 100-year flood hazards along the alignment:

As shown in Figure 3-1, near the western terminus of the project, the proposed roadway is located in Flood Zone AO. Specifically, this zone extends from approximately Division Street to Sierra Highway, and between Avenue P-4 and Avenue P-8, as shown in Flood Insurance Rate Map (FIRM) Panels 06037C0700F, 06037C0659F, and 06037C0657F. Here, the project alignment would be elevated more than 6 feet above grade.

The alignment between SR 14 and Division Street is located within Zone X. The alignment from Sierra Highway east to 53rd Street E also traverses Zone X.

Figure 3-1. Flood Maps 06037C0700F, 06037C0659F, and 06037C0657F

According to FIRM Panel 06037C0701F, as shown in Figure 3-2, the project alignment between 70th Street E and east of Little Rock Wash is within Flood Zone A (an area inundated by 100-year flooding, for which no base flood elevations [BFEs] have been established). The alignment is located within Zone X from east of Little Rock Wash to 90th Street E.

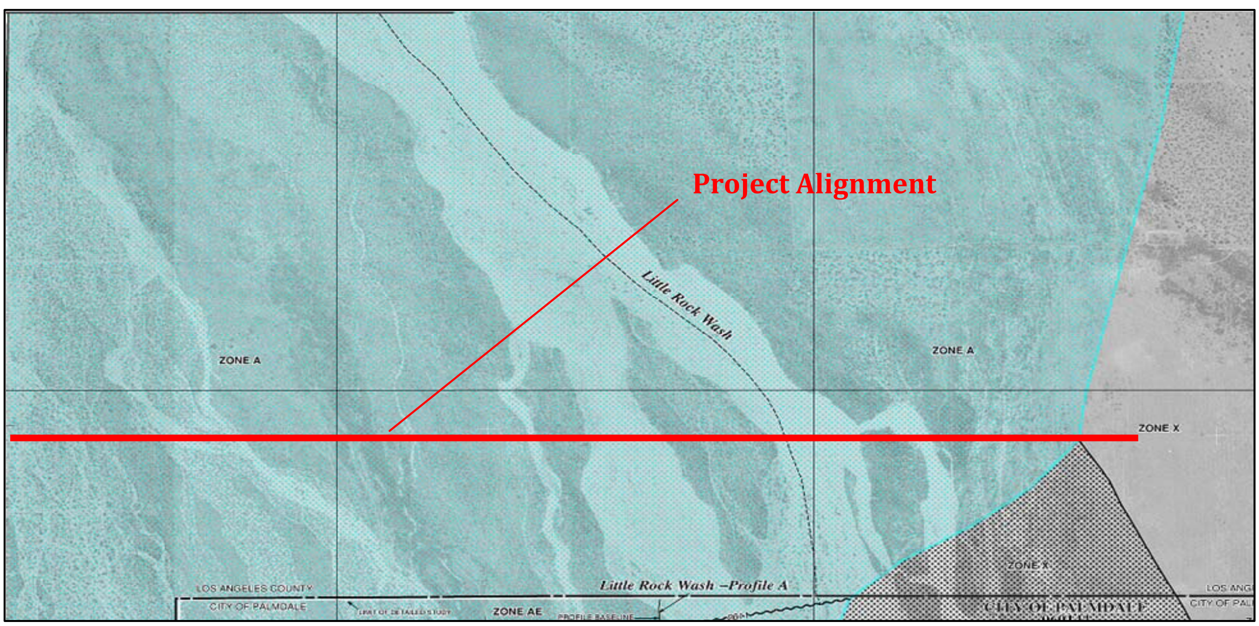


Figure 3-2. Flood Map 06037C0701F

According to FIRM Panel 06037C0750F, as shown in Figure 3-3, the project alignment extending east from south of E Palmdale Boulevard to Big Rock Wash is located within Zone A.

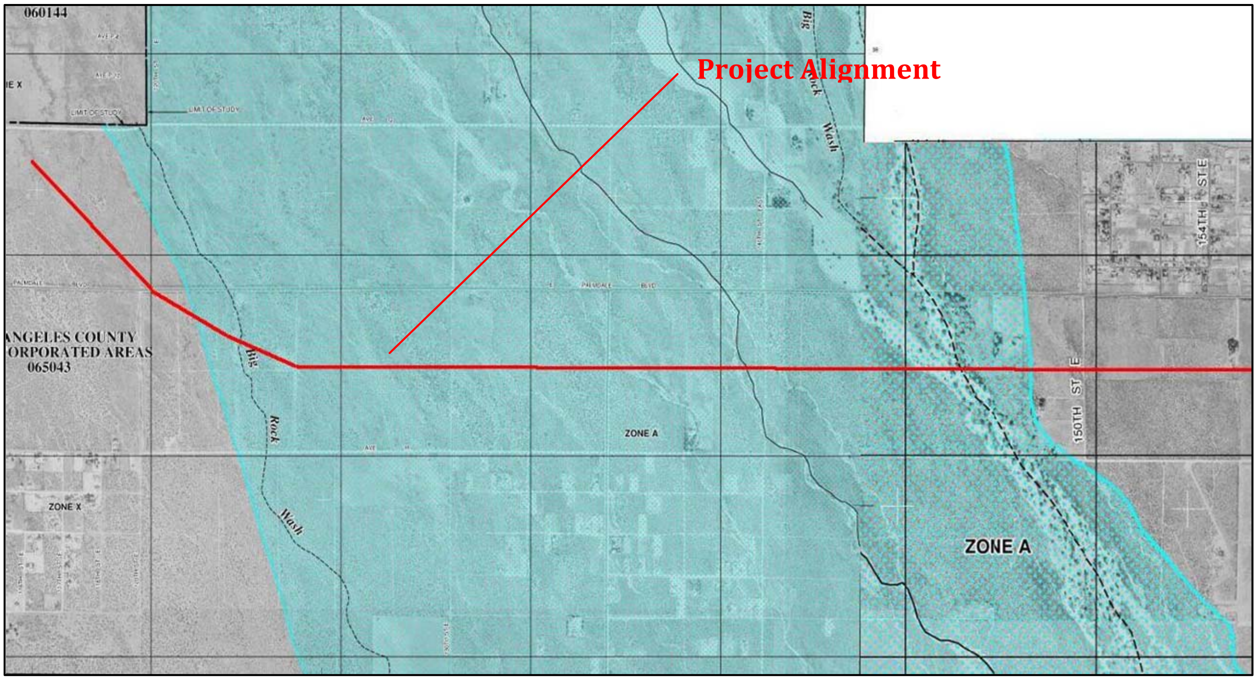


Figure 3-3. Flood Map 06037C0750F

FIRM Panel 06071C5805H, provided in Figure 3-4, indicates Zone A where the project alignment crosses both Turner Wash and Ossam Wash. Where the alignment crosses the Mojave River is labeled Zone AE (a Special Hazard Area inundated by 100-year flooding, for which BFEs have been established).

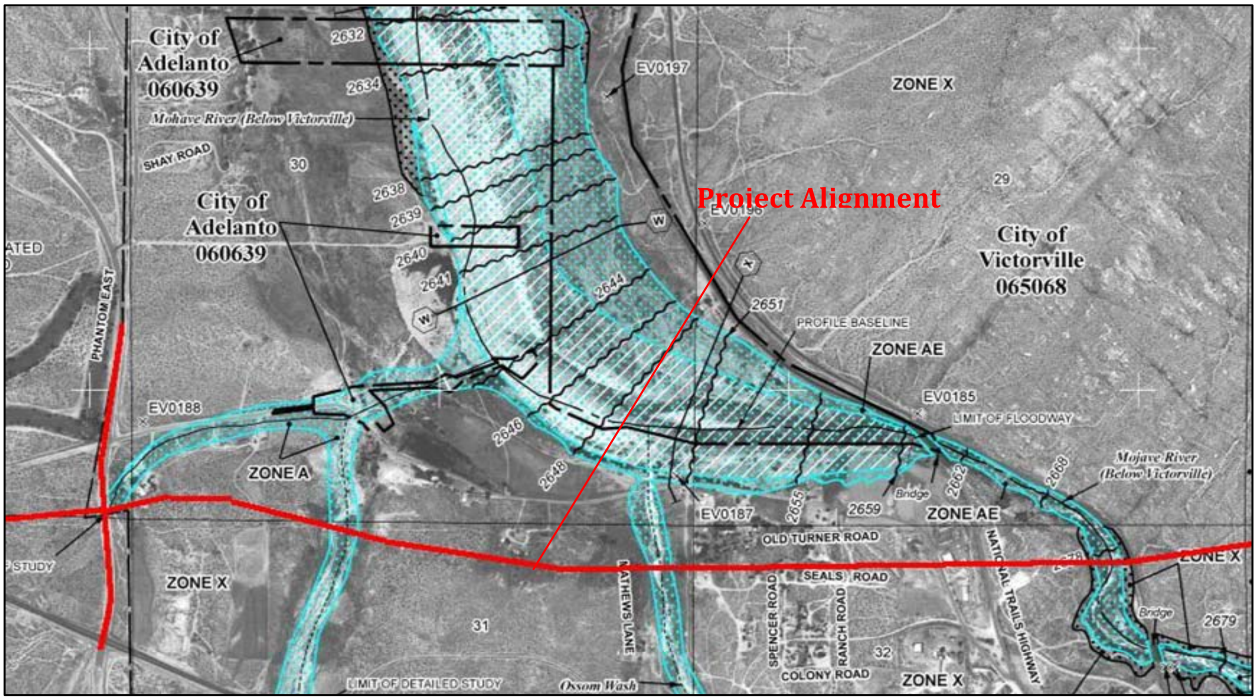


Figure 3-4. Flood Map 06071C5805H

As shown in FIRM Panel 06071C5810H, Figure 3-5, the project alignment across the Bell Mountain Wash to the west of I-15 is within Zone A.

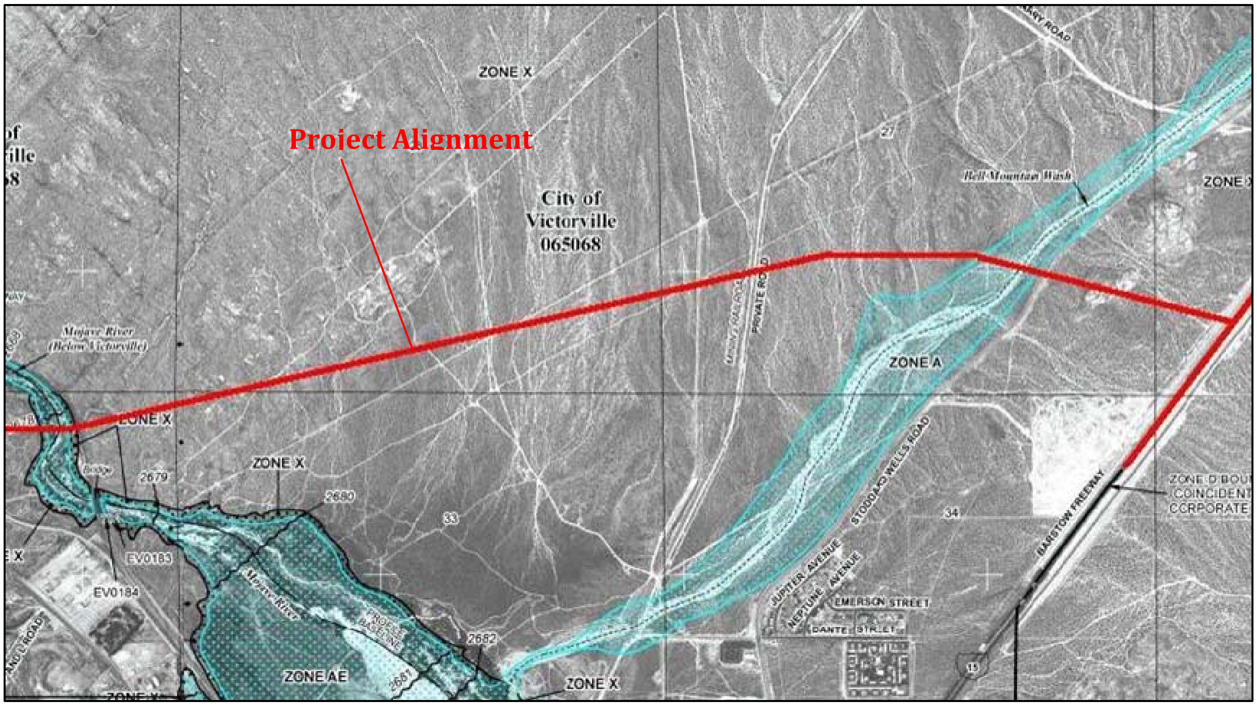


Figure 3-5. Flood Map 06071C5810H

Figure 3-6 shows FIRM Panel 06071C5820H overlain by a project alignment along the I-15 where direct connectors would be constructed as part of the proposed freeway-to-freeway interchange. The alignment crosses the Mojave River within Zone AE in the vicinity of I-15.

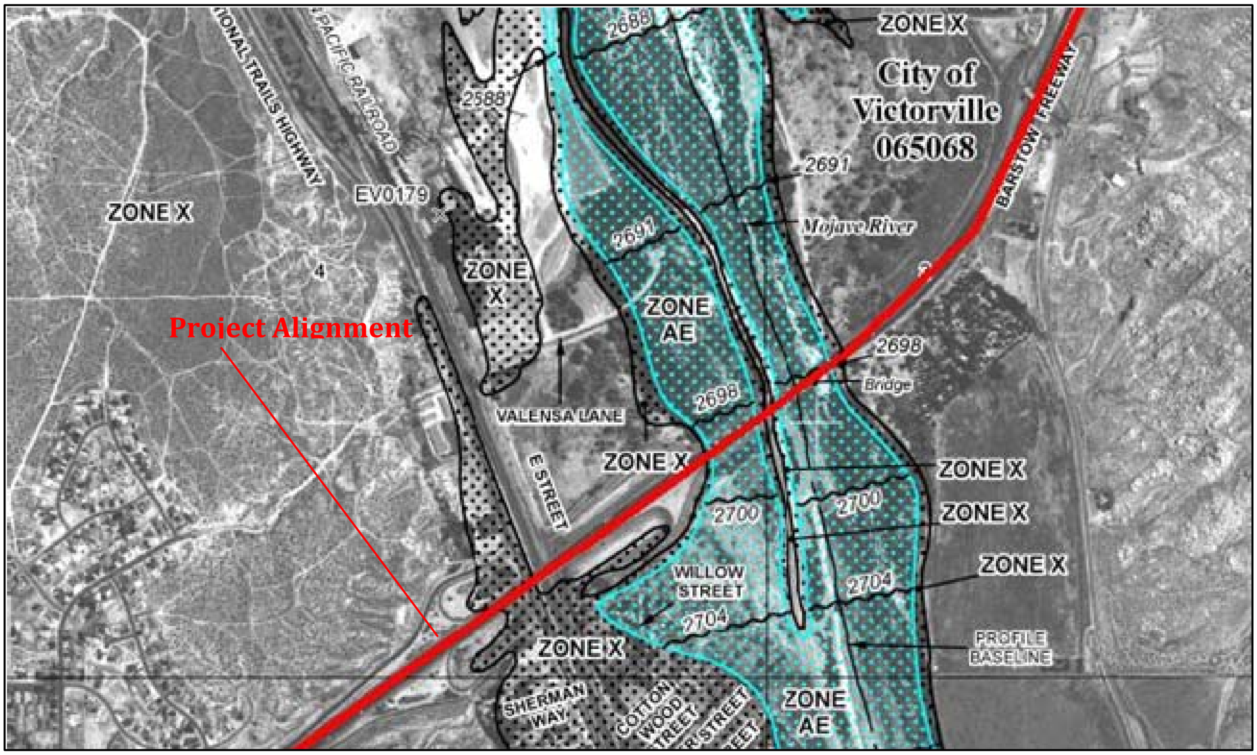


Figure 3-6. Flood Map FM06071C5820H

According to FIRM Panel 06071C5845H, the alignment from south of S Road to Candlewood Road (west of Joshua Road) is within Zone A

Floodplain Mitigation and Risk

It is the intention of this project to minimize floodplain impacts. The HDC profiles were set to protect the roadway from the 100-year storm. For future design considerations, no bridge abutments or embankment would encroach on a regulatory floodway.

The proposed HDC project will adhere to all federal, state, and local agencies policies for floodplain management. Some basic guidelines are:

- Minimize impacts that adversely affect base floodplains;
- Restore and preserve the natural and beneficial floodplain values that are adversely affected;
- Avoid support of incompatible floodplain development; and
- Be consistent with the intent of the Standards and Criteria of the NFIP.

This page intentionally left blank.

4 PROPOSED IMPROVEMENTS

4.1 Proposed Corridor

In general, the corridor will be constructed on fill, and the proposed alignment will be elevated approximately 6 feet above grade. In Palmdale, the alignment crosses the floodplain east of the connection with SR 14, as shown in Figure 3-1. Within this area, the corridor profile is significantly higher than 6 feet above grade.

Infiltration basins, earthen and concrete channels, cross culverts, storm drain pipelines and inlets, riprap energy dissipation devices, and other forms of erosion protection will be constructed so that runoff will be intercepted and conveyed along and across the corridor alignment without the need for pump stations, while minimizing erosion potential. In most cases, these facilities will be placed at or above grade, though in some instances, the facilities may be constructed in cut as long as gravity flow conditions are maintained downstream.

Figure 4-1 is a schematic showing generalized locations of offsite storm drainage facilities. Plans showing the proposed drainage systems are provided in Appendix N of the Preliminary Hydrology and Hydraulics Report.

4.1.1 Embankment Slopes

Existing slopes are relatively flat, less than 2 percent on average. Proposed slopes will generally follow existing grade. Swales and channels will be constructed as flat as possible to minimize erosive flow velocities while maintaining appropriate conveyance capacities. Embankment slopes shall not be steeper than 2:1 (horizontal to vertical) and will be constructed at 4:1 or flatter to the maximum extent practicable to minimize erosion.

4.2 Proposed Drainage System

4.2.1 Drainage Concept

Off-Site System Overview: As shown in Figure 4-1, offsite runoff generally crosses the corridor in a northerly direction. Facilities will be designed for the 100-year storm event to prevent flooding of the proposed corridor and potential flooding upstream and downstream of the corridor. Two alternatives enabling flood flows to cross the proposed corridor are to: (1) mimic existing flow conditions by placing cross culverts at existing flow concentration points along the alignment, or (2) place longitudinal channels along the alignment to divert existing flow to crossings. Because flow diversion would exacerbate downstream flooding conditions and cause associated erosion, the first alternative was chosen as the recommended concept for flood and erosion control along most of the project alignment, thereby minimizing geomorphologic concerns.

Culverts were sized for the 100-year storm flow without producing objectionable backwater effects (maximum headwater of approximately 5 feet) and placed at slopes that would minimize downstream velocities. They were sited along the alignment as dictated by topography, at concentrated flow paths. At this preliminary level, culverts were generally assumed to be reinforced concrete box culverts with a minimum height of 4 feet to reduce clogging potential for sediment buildup. The culverts were placed such that a minimum 2 feet of cover over each culvert could be maintained. The cross culverts were placed to facilitate flow at the upstream toe of embankment and convey the flow perpendicularly across the road to the downstream toe of embankment. Culvert lengths were estimated assuming embankment slopes of 4:1. Each culvert was equipped with inlet/outlet headwalls and downstream energy dissipaters in the form of riprap pads. Numerous longitudinal channels and ditches will also be placed at the edge of right-of-way along the alignment to convey offsite flows to the proposed bridge crossings and cross culverts. Hydrologic and hydraulic calculations for each culvert are provided in the appendices of the Preliminary Hydrology and Hydraulics Report.

Onsite System Overview: The proposed 63-mile-long corridor will create approximately 700 acres of impervious surface overlaying primarily undeveloped land. It will replace sections of corridor along SR 18 in the town of Apple Valley at the east end of the proposed project corridor and sections of corridor within the City of Palmdale at the west end of the corridor. The existing impervious surface along the entire 63–mile corridor was estimated to be approximately 300 acres; hence, the proposed project will create approximately 400 acres of impervious surface. As a result of the increased impervious area, a slight increase in runoff will be exhibited within the various watersheds crossed by the corridor. Because the soils are relatively pervious and groundwater is relatively deep, the installation of infiltration basins or detention basin facilities is practical. In this way, the proposed drainage system will offset the potential increase in flow that could occur due to increases in impervious surfaces.

Sketches of the proposed infiltration basin sites are provided on aerials in Appendix A. Infiltration basins are proposed at most of the interchanges to treat stormwater runoff generated from impervious surfaces and for flow control so that flow rates will mimic existing conditions for both high and low flows.

Bridges: Bridges are proposed over the deeper streams, such as Little Rock Wash, Big Rock Wash, Turner Wash, Ossam Wash, and Mojave River. Cross culverts are proposed at the other waterways traversed by the project alignment, including Grandview Canyon Creek, Graham Canyon Creek, Mescal Creek, Fremont Wash, and Bell Mountain Wash. The crossings are designed to minimize impacts to the upstream and downstream water surface elevations, flow velocities, and overall streambed and embankment configurations. Bridge hydraulic analysis was conducted for the 100-year storm event flow using HEC-RAS computer modeling software provided in the Preliminary Hydrology and Hydraulics Report prepared for this project.

Bridge details are summarized as follows:

- Little Rock Wash: 15-span, 3,000-foot-long bridge with vertical faced abutments (skewed to follow the alignment of the creek); pier width = 7 feet; Q100 = 22,944 cubic feet per second (cfs); V100 = 2 to 4 feet per second (fps); flow depth = 2 to 4 feet; and maximum rise in water surface elevation = 1.0-foot
- Big Rock Wash: 9-span, 1,800-foot-long bridge with vertical faced abutments (skewed to follow the alignment of the creek); pier width = 7 feet; Q100 = 17,268 cfs; V100 = 4 to 5 fps; flow depth = 2 feet; and maximum rise = 0.2-foot
- Turner Wash: Single-span, 180-foot-long bridge with vertical faced abutments, Q100 = 5,299 cfs, V100 = 9 to 13 fps, flow depth = 2 to 3 feet, maximum rise = 0.2-foot
- Ossam Wash: Single-span, 100-foot-long bridge with vertical faced abutments, Q100 = 2,178 cfs, V100 = 9 to 10 fps, flow depth = 4 to 7 feet, maximum rise = 0.7-foot
- Mojave River: Three-span, 320-foot-long bridge with vertical faced abutments, pier width = 7 feet, Q100 = 27,484 cfs, V100 = 6 to 7 fps, flow depth = 17 to 20 feet, maximum rise = 0.2-foot

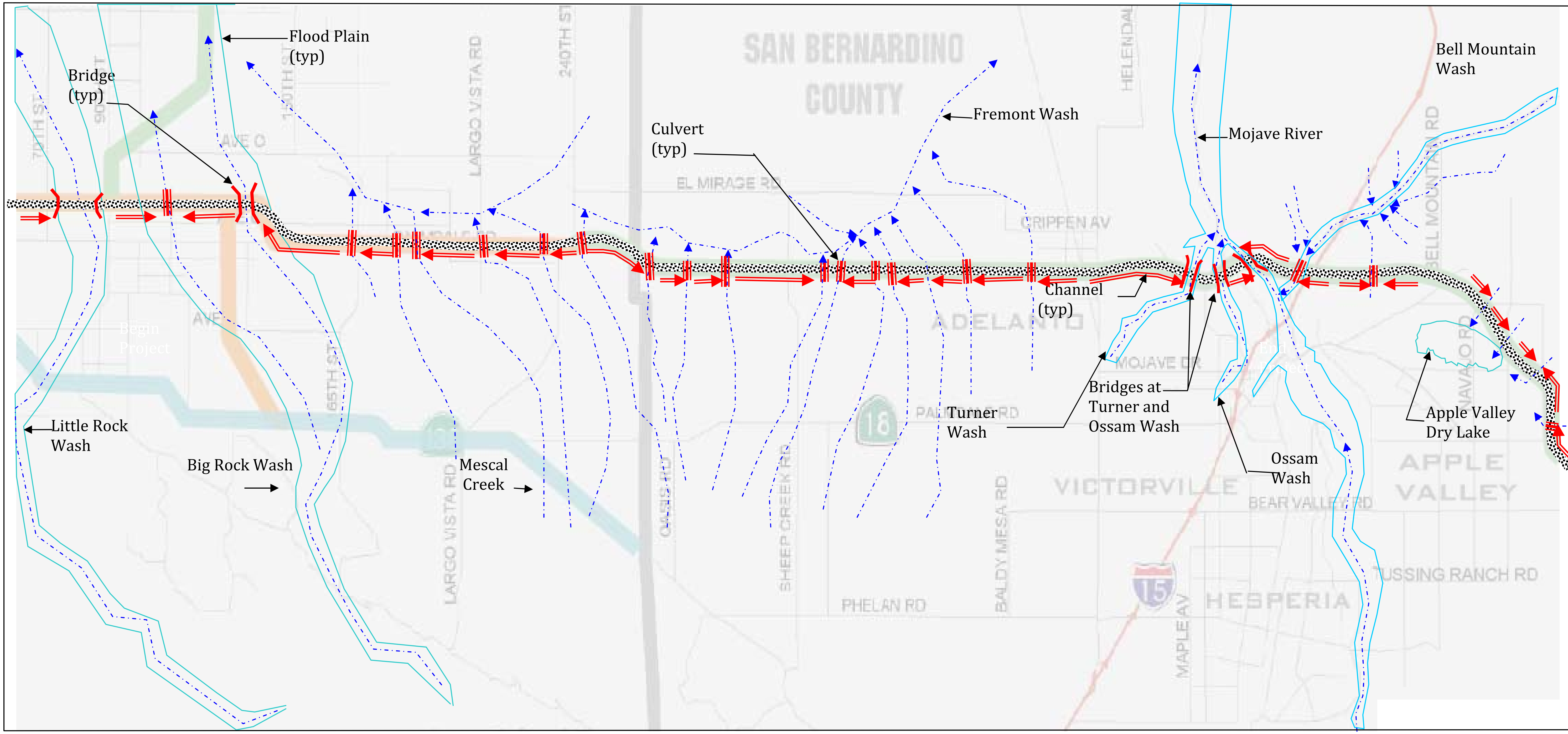


Figure 4-1. High Desert Corridor Proposed Offsite Drainage System Schematic

This page intentionally left blank.

Cross Culverts: One hundred and forty (140) cross culverts are proposed along the corridor in a way to minimize flow diversions and to enable flows to cross at existing flow concentration points, mimicking existing flow conditions along the project alignment. The culverts will enable runoff to cross the new facility without inundating the paved surface and without flooding upstream and downstream properties. Where necessary, vegetated energy dissipaters will be incorporated at the downstream ends of the cross culverts to slow flows down to non-erosive levels. In general, the cross culverts are flat enough (on the order of 0.2 to 0.5 percent slope) to prevent erosion-inducing velocities. Alternatively, culverts other than RCP could likely be utilized. To address agency concerns regarding establishment of vegetation where riprap is to be used, construction of such energy dissipation devices should include placement of 1-foot of top soil above the riprap that will be "flood compacted" to fill the voids within the underlying riprap. The flood compacting will cause the fill to enter the interstices of the riprap, thus allowing vegetation to grow.

The hydraulic analysis for each cross culvert is provided in the Preliminary Hydrology and Hydraulics Report prepared for this project. Note that at this preliminary level, only concrete box culverts and reinforced concrete pipe culverts were evaluated. However, where flow velocities allow, soft bottom culverts could also be used. The minimum height for each culvert is 3 feet. This will ensure maintainability of the culverts if silt buildup is encountered.

Infiltration Basins: Infiltration basins are proposed at most interchanges within the right-of-way to treat and partially contain the on-site pavement runoff of the corridor. The infiltration basins treat runoff by allowing the water quality volume (WQV) to percolate through the soil to ensure flow rates mimic existing conditions. Once the required volume has been retained, runoff shall outlet through spillways or pipe risers where the excess runoff will be conveyed to the culverts. Along the western portion of the alignment, a DMP has been developed that incorporates a network of storm drains and detention facilities for flood control within the City of Palmdale. After construction of the city's DMP, it is proposed that the outflow from the infiltration basins will be tied to the proposed drainage network. In this way, installation of the infiltration basins will alleviate water quality and hydromodification impacts related to the corridor construction. Coordination between Caltrans and the City on the timeline and connection of the DMP is anticipated to occur during the PS&E phase.

Retention Basins (HSR Feeder/Connector Service): Due to clearance requirements for the high speed rail, the HSR Feeder/Connector Service and its variations will require local roads and State Highway 395 to cross beneath the HDC. Local roads will be graded to allow for positive drainage beyond the undercrossing. In a few locations, positive drainage is not feasible. At these locations, the sump condition created will be alleviated by the construction of retention basins near each undercrossing.

Retention basins shall be sized to accommodate the total rainfall volume produced during a 4-day storm period. Basins for local roads will provide sufficient storage to capture a 4-day 25-year storm; and basins for state highways will provide sufficient storage to capture a 4-day 50-year event.

Channels: A series of longitudinal channels placed at the edge of right-of-way to intercept and convey offsite flows to the culverts and bridges are proposed along the corridor. In most instances, where velocities allow it, these channels will be either earthen or vegetated. In some instances, velocities may be too high to allow channels of this type. Where slopes and corresponding flow velocities are too high for earthen or vegetated channels, other forms of erosion protection will be evaluated, including the use of concrete-lined conveyance systems.

This page intentionally left blank.

5 FUTURE DRAINAGE PATTERN

In general, the hydrologic regime along the entire corridor exhibits the characteristics of an alluvial fan with several incised streams and channels that cross the project alignment. With mountains to the south, off-site runoff generally crosses the proposed project corridor in a northerly direction. Because the corridor will be constructed on fill at least 6 feet above existing grades, the new facility will effectively cause a damming effect on the sheet flow and shallow concentrated flow that are currently discharged during storm events across this desert environment. To maintain existing flow patterns and minimize geomorphologic impacts during storm events, drainage structures are planned along the alignment within existing concentrated flow paths so that flow diversions will be minimized. This includes incorporation of five bridges over major rivers and approximately 140 cross culverts. The bridges are planned across Little Rock Wash, Big Rock Wash, Ossam Wash, Mojave River, and Bell Mountain Wash. Numerous longitudinal channels and earthen ditches will be placed at the toe of the upstream embankment of the highway to convey offsite flow to the cross culverts or bridges where required. These conveyance systems will be designed with appropriate erosion control, including channel lining, energy dissipation, streamlined transitions, headwalls, wingwalls, and/or flared-end sections.

The proposed improvements will also create more impervious area, which will generate additional runoff within the various watersheds traversed by the proposed highway facility. This increase in runoff will be mitigated through the use of infiltration basins incorporated in the onsite storm drain systems along the alignment. Onsite runoff will be conveyed to these infiltration basins, which will be located at most interchanges, and will treat and partially contain the flow from the onsite pavement runoff of the corridor.

This page intentionally left blank.

6 IMPACT AND MITIGATION

The overall approach to mitigate potential geomorphologic impacts is to design both on- and off-site drainage systems to maintain existing runoff flow patterns and flow rates across the alignment corridor. These proposed systems are described in Section 4, and include hydromodification control, flood control, and treatment control mechanisms such as infiltration basins, culverts, bridges, channels, ditches, and energy dissipation devices.

The recommendation to incorporate infiltration basins into the project design is based in part on soil type. The soil types within the proposed project limits are predominantly Type A and B soils with relatively high infiltration characteristics. If infiltration is insufficient in some areas for flow and treatment control, then detention basins can be employed.

Infiltration basins retain stormwater runoff and allow it to fully infiltrate the runoff containing most of the pollutants; therefore, it will fully remove litter, settleable solids (debris), TSS (total suspended solids), and pollutants that are attached (adsorbed) to the settled particulate matter. The infiltration basins are proposed to retain and treat the low flows generated from corridor runoff (i.e., the WQV) and reduce the volume of flow that is ultimately discharged. When the runoff exceeds the WQV of the infiltration basin, the runoff will be routed over spillways or into pipe risers where it will be conveyed to the existing flow paths. In this way, installation of the infiltration basins will alleviate the impact of potential hydromodification and water quality impacts related to the proposed project.

Detention basins detain stormwater runoff under quiescent conditions such that sediment and particulates are able to settle before the runoff is discharged. A portion of the detained water is also lost due to infiltration and evaporation.

Cross culverts and bridges will be designed to the maximum extent practicable to minimize flow diversions that could increase flow rates and velocities in existing concentrated flow paths that cross the alignment. In addition to the incorporation of drainage facilities into the project, the following mitigation measures are identified for avoiding or reducing potential erosion impacts:

- Cut and fill slopes will be constructed flat enough to allow revegetation and limit erosion to preconstruction rates;
- The project will be scheduled and phased during construction to minimize soil-disturbing work during the rainy season.
- Erosion control measures will be used to address site soil stabilization and minimize deposition of sediments in the adjacent surface waters both during and after construction.
- Source control best management practices (BMPs) will be used to control sediment flow and shall include application of soil stabilizers such as hydroseeding, netting, erosion control mats, velocity dissipation devices, flared-end sections for culverts, and lined channels.

This page intentionally left blank.

7 CONCLUSION

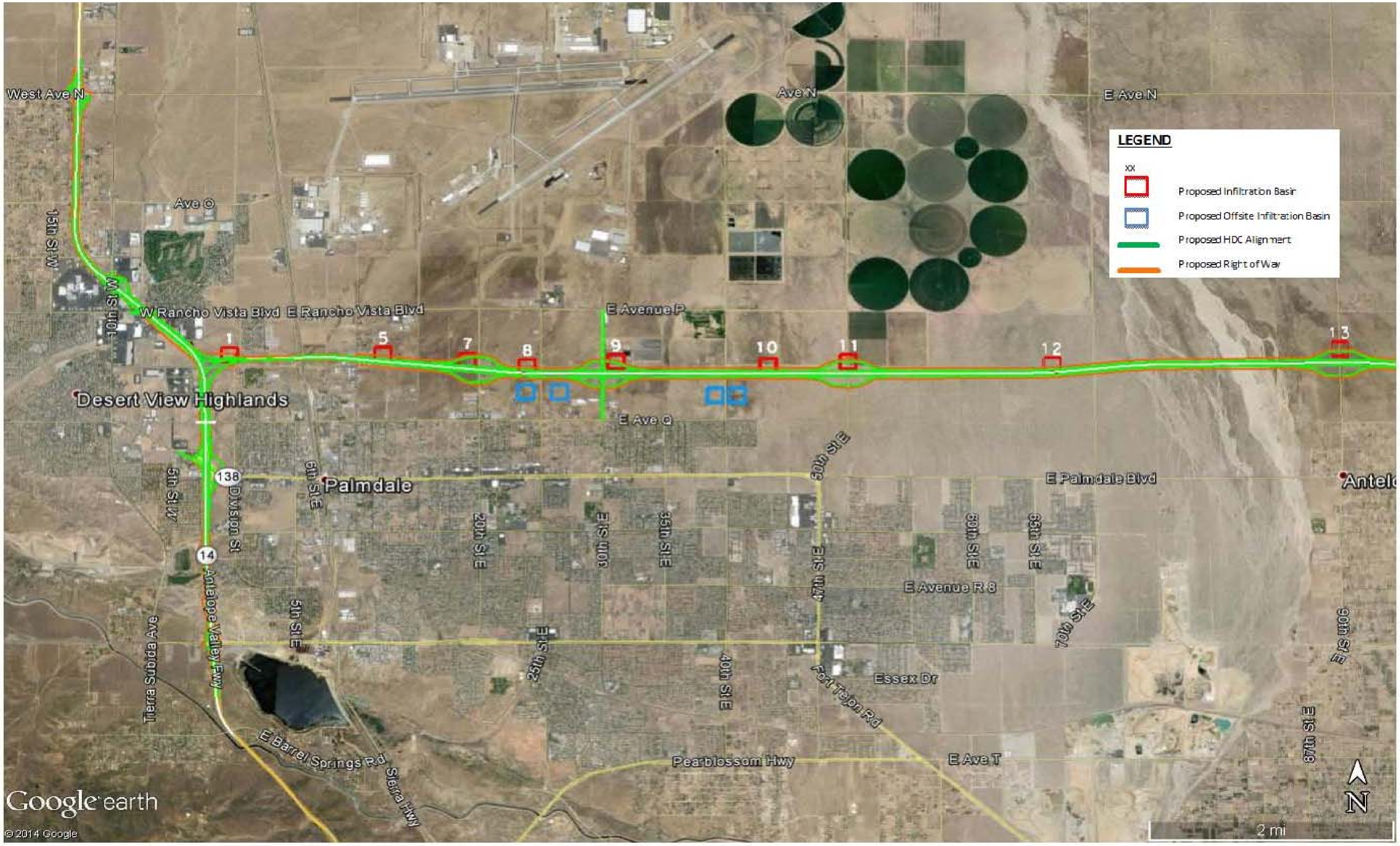
As described previously, the drainage patterns and flow rates across the proposed project corridor will remain unchanged with the incorporation of drainage facility controls into the proposed project. Given this consideration, no significant geomorphologic impacts are anticipated as a result of HDC project construction. Furthermore, with the proper use of temporary BMPs during construction, erosion and associated downstream sediment deposition will also be controlled.

This page intentionally left blank.

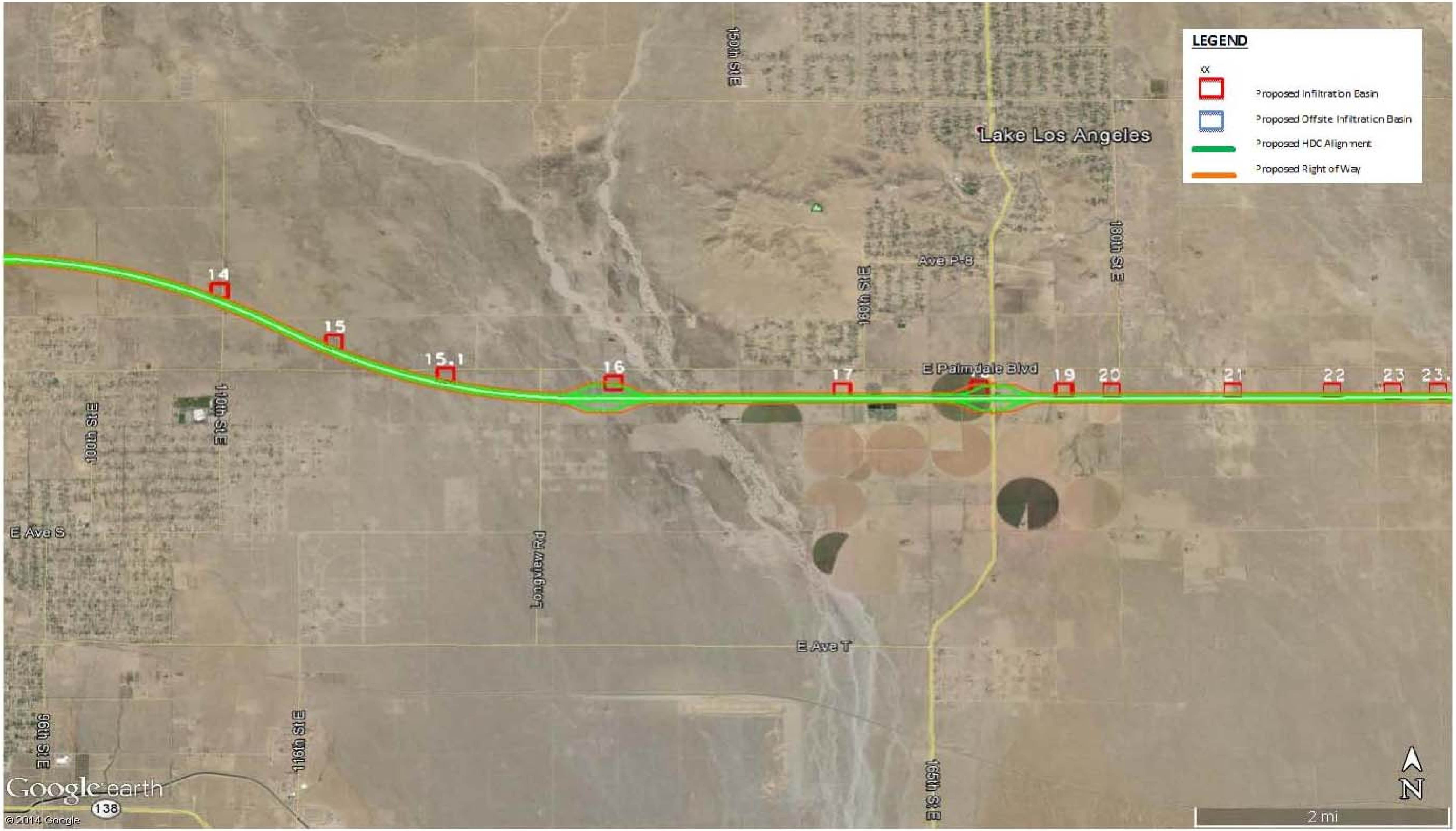
APPENDIX A

PROPOSED INFILTRATION BASIN SITES

This page intentionally left blank.

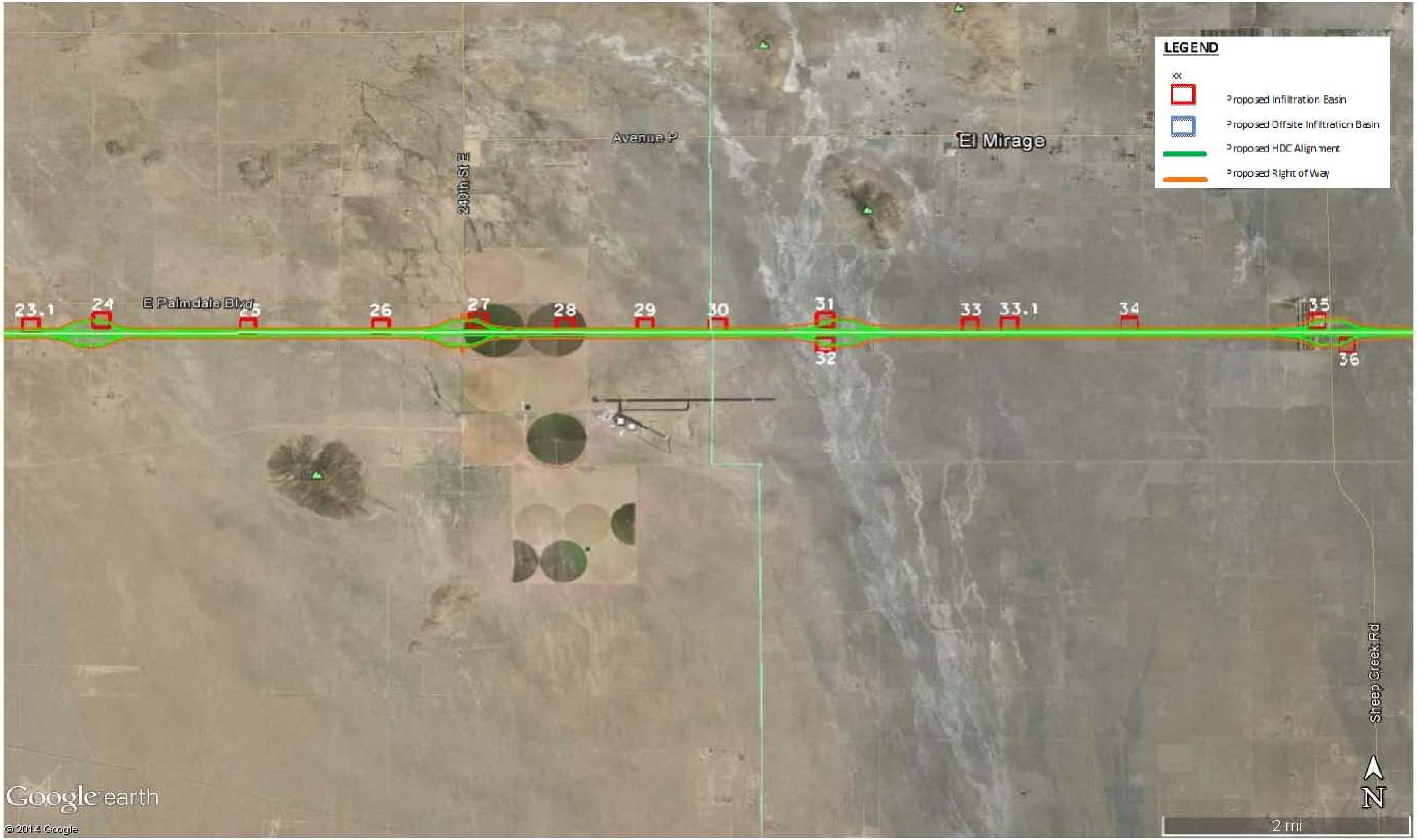


High Desert Corridor Infiltration Basin Layout 1

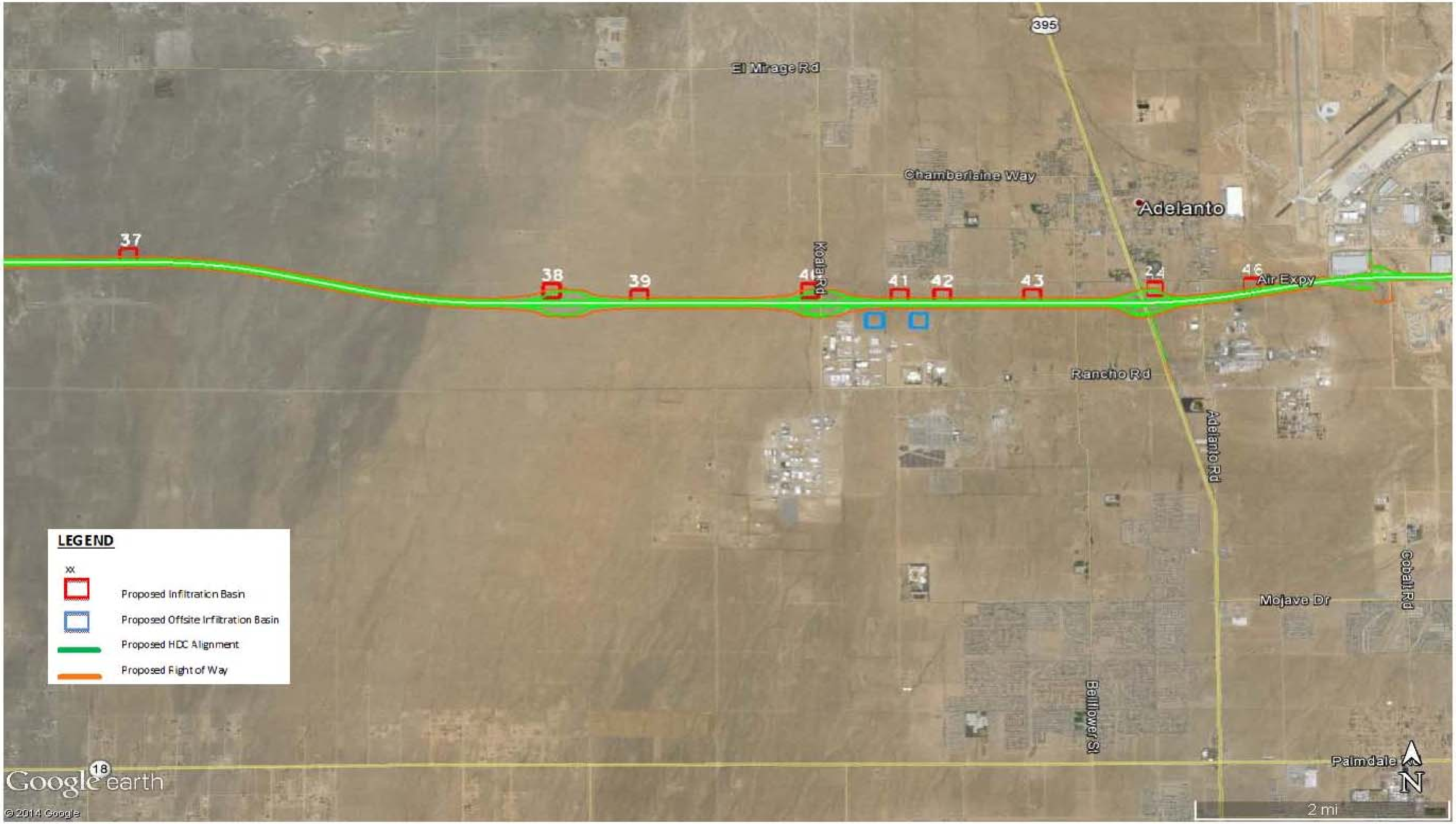


High Desert Corridor Infiltration Basin Layout 2

PARSONS

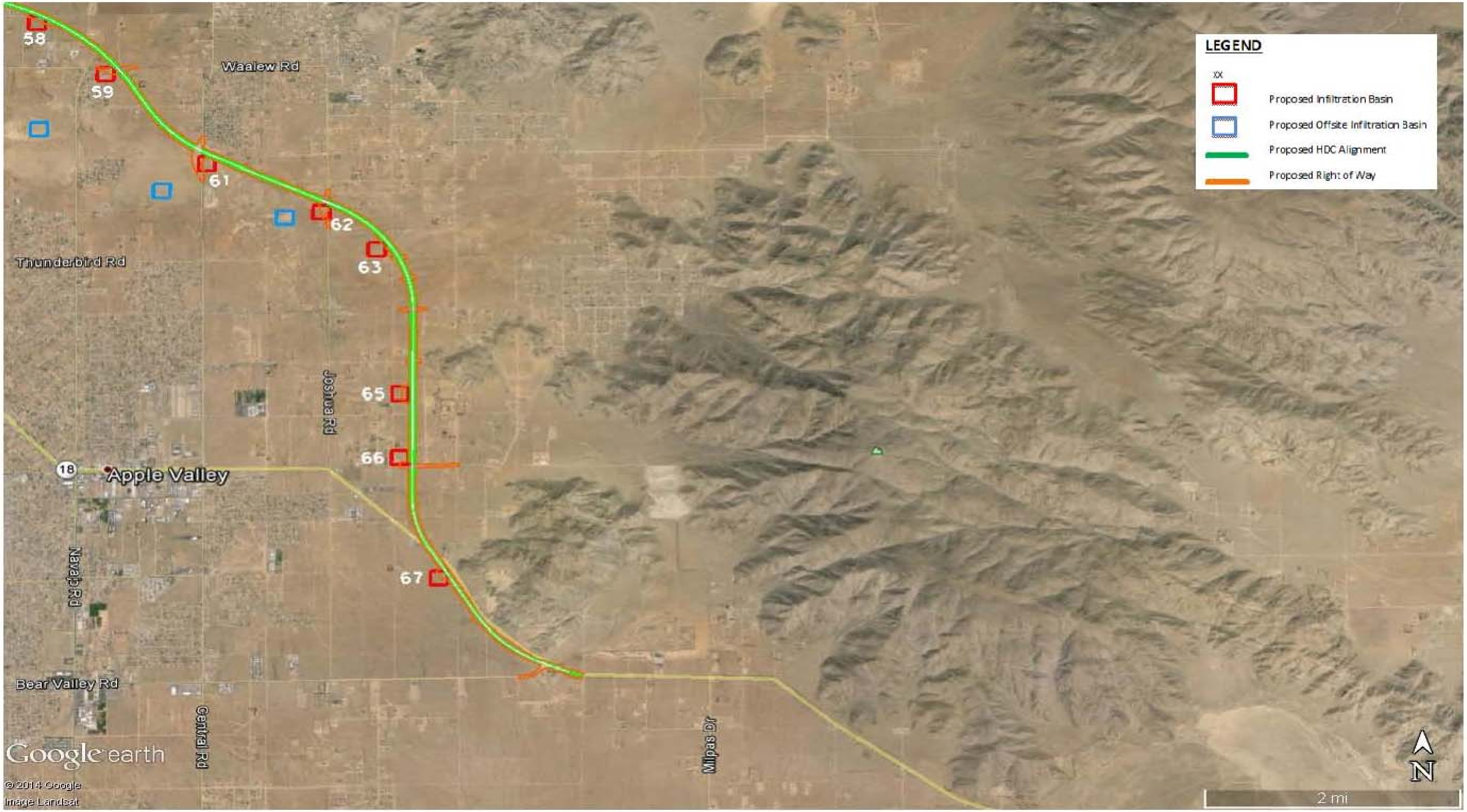


High Desert Corridor Infiltration Basin Layout 3



High Desert Corridor Infiltration Basin Layout 4

High Desert Corridor Infiltration Basin Layout 5



High Desert Corridor Infiltration Basin Layout 6