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Draft Tier 1 Environmental Impact Statement and Preliminary Section 4(f) Evaluation

Appendix E13, Water Resources Technical Memorandum

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U.S. Department of Transportation Federal Highway Administration

ADOT

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Acronyms

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AMA	Active Management Areas
AZPDES	Arizona Pollutant Discharge Elimination System
BMPs	Best Management Practices
CAP	Central Arizona Project
CAVSARP	Central Avra Storage and Recovery Project
CFR	Code of Federal Regulations
CWA	Clean Water Act
DOT	Department of Transportation
EO	Executive Order
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FR	Federal Register
FUP	Floodplain Use Permit
I	Interstate
MS4	Municipal Separate Storm Sewer System
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System
NWI	National Wetland Inventory
OAW	Outstanding Arizona Water
PWS	Public Water Systems
ROW	Right-of-Way
SAVSARP	Southern Avra Valley Storage and Recovery Project
SDWA	Safe Drinking Water Act
SFHA	Special Flood Hazard Areas
SSA	Sole Source Aquifer
Study Area	I-11 Corridor Study Area
TNW	Traditional Navigable Water
US	United States

USACE	United States Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

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E13.1 PURPOSE OF REPORT

Federal, state, and local governments developed programs and regulations to protect and manage water resources. Water resources within the Interstate 11 (I-11) Corridor Study Area (Study Area) may be used for drinking water, agriculture, industrial processes, transportation, and recreation. Other water resources also may include wetlands and floodplains, which function as natural flood control systems that reduce the speed and volume of runoff, and improve water quality as well as provide habitat essential to a healthy ecosystem. Construction activities and development associated with transportation could potentially increase stormwater runoff, increasing the risk of degrading water quality and affecting aquatic habitats such as waters of the United States (US), including wetlands.

This technical study identifies water resources within the Study Area as shown on **Figure E13-1** (I-11 Corridor Study Area [Nogales to Wickenburg]). It should be noted that the Study Area differs from the Analysis Area used for water resources, as defined in Section E13.2 (Analysis Area). The Study Area is largely based on the results of the previous *I-11 and Intermountain West Corridor Study*, in combination with public and agency input received during the scoping period, as documented in the *Purpose and Need Statement*, available on the study website (i11study.com/Arizona/Documents.asp). This document identifies potential effects on water resources associated with the 2,000-foot-wide Build Corridor Alternatives within an Analysis Area that is situated within the larger Study Area.

The analysis of the Corridor Options is presented by section (South, Central, North). This analysis pertains to six categories of water resources, as further defined below: sensitive waters (includes Outstanding Arizona Waters [OAWs], Active Management Areas [AMAs], and Sole Source Aquifers [SSAs]), impaired waters, groundwater, waters of the US, wetlands, and floodplains.

This document is designed to support an informed comparison of the Build Corridor Alternatives and No Build Alternative being evaluated in this Draft Tier 1 Environmental Impact Statement and Preliminary Section 4(f) Evaluation. The methodology used for effects evaluation combines qualitative and quantitative assessments. Impacts assessed herein include effects of sediment and chemical pollution on surface water resources (e.g., streams, lakes, ponds, wetlands) and groundwater. This assessment also addresses placement of fill material in waters, wetlands, and floodplains, which can impact surface water and groundwater quality. However, it should be noted that this Draft Tier 1 review is designed to evaluate the impacts at a high level. Design features and actual alignment of the corridor will be defined during the Tier 2 analysis.

E13.1.1 Regulatory Guidance

This section contains a brief explanation of the regulatory requirements for activities that may impact water resources. Applicable laws and guidance related to water resources include federal, state, and local regulations. The following is a summary of the regulations that are pertinent to the Study Area.

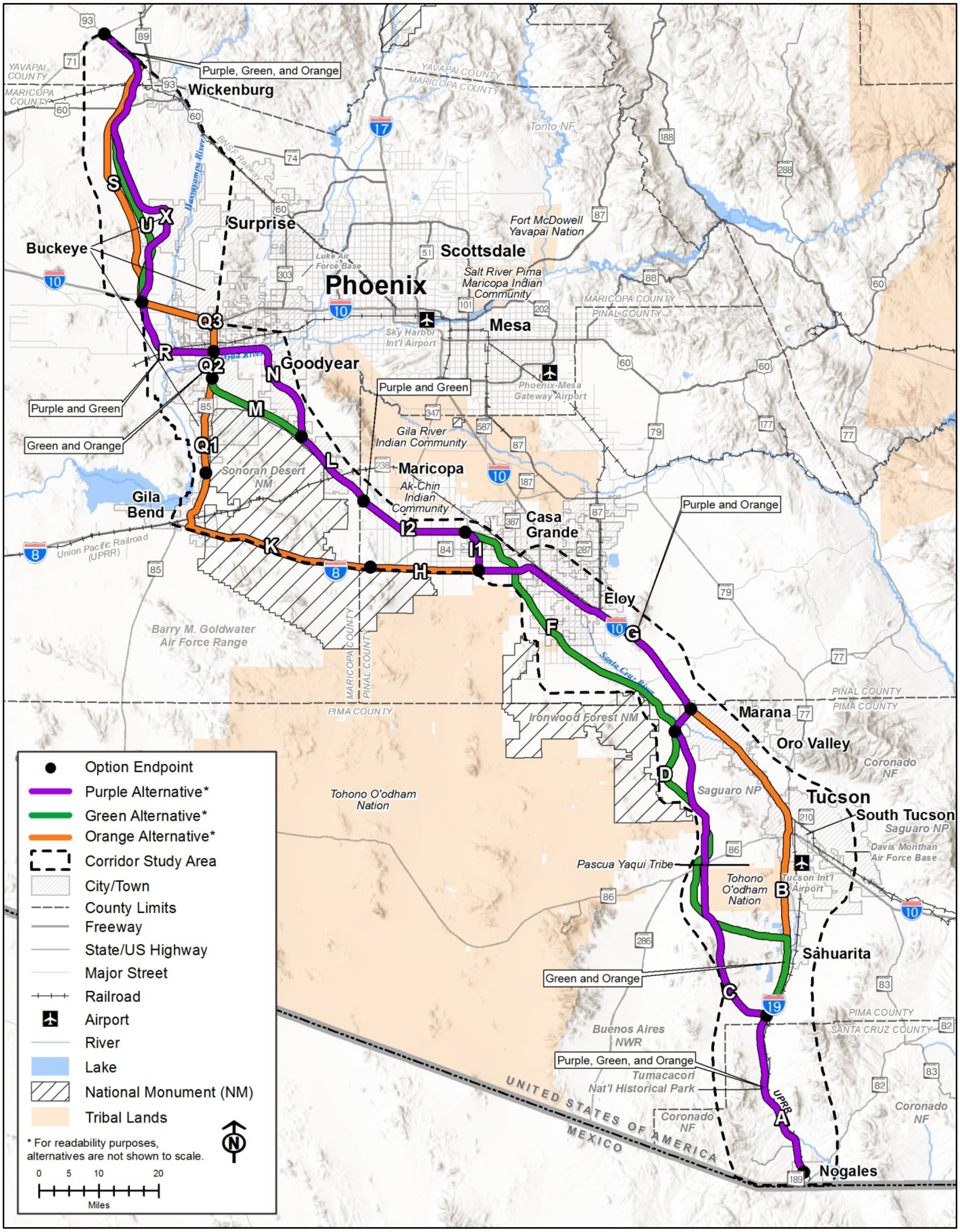

Figure E13-1 I-11 Corridor Study Area (Nogales to Wickenburg)

E13.1.1.1 Federal

Clean Water Act (CWA). The CWA establishes the basic structure for regulating discharges of pollutants into waters of the US and regulating quality standards for surface waters through Sections 404, 401, 402, and 303(d) of the Act.

- Section 404 of the CWA regulates the discharge of dredged or fill materials into waters of the US under Section 404 (33 US Code [USC] section 1344). Under the CWA Section 404, the US Army Corps of Engineers (USACE) regulates the discharge of dredged or fill materials (including from construction activities) into waters of the US. Waters of the US include traditional navigable waters (TNWs), relatively permanent tributaries, and adjacent wetlands, as defined in 33 Code of Federal Regulations (CFR) 328.3(a). Jurisdictional wetlands in Arizona are regulated as special aquatic sites (40 CFR section 230.41).
- Section 401 of the CWA requires a State Water Quality Certification to show that the proposed project will comply with state water quality standards for any activity that results in a discharge to a waterbody (33 USC part 1341). Section 401 of the CWA requires that the activities covered by the Section 404 permit are certified per the state's applicable effluent limitations and water quality standards. In Arizona, Section 401 certification is administered by the Arizona Department of Environmental Quality (ADEQ) if the action is entirely on non-Tribal lands. If any portion of the action occurs within or affects waters of the US on Tribal lands, the Section 401 certification would be obtained from either the US Environmental Protection Agency (USEPA) or the respective Tribe.
- Section 402 of the CWA formed the National Pollutant Discharge Elimination System (NPDES), which regulates pollutant discharges, including stormwater, into waters of the US. NPDES permits set specific discharge limits for point-source pollutants and outline special conditions and requirements for projects to reduce water quality impacts (33 USC section 1342). Permits require that projects be designed to protect waters of the US. Construction projects that will disturb more than 1 acre of land must comply with the requirements of the NPDES Construction General Permit, which, among other provisions, requires preparation and implementation of a Stormwater Pollution Prevention Plan (ADEQ 2013). NPDES permits on non-Tribal lands in Arizona are administered by the state under the Arizona Pollutant Discharge Elimination System (AZPDES). Pollutant discharges on Tribal lands must be permitted through USEPA Region 9.
- Section 402(p) of the CWA also falls under NPDES and requires implementation of controls for discharges from storm sewers. Two permit types, or "phases," are available under this regulation depending on the size and type of operator. Phase I regulations (64 Federal Register [FR] 68722) require discharges from large construction sites, certain industrial activities, and operators of "medium" or "large" Municipal Separate Stormwater Sewer Systems (MS4s) (MS4s that serve a population of 100,000 or greater), to obtain a permit and implement a stormwater management program. The Phase II Regulations (64 FR 68722) require smaller operators to obtain a permit for their stormwater discharges. Both types of permits require controls to reduce the discharge of pollutants to the maximum extent practicable. ADEQ was delegated authority to implement AZPDES permitting for MS4 operators in 2002.
- Section 303(d) of the CWA requires states, territories, and authorized Tribes to develop a list of water quality-impaired segments of waterways (33 USC section 1313(d)). The 303(d) list includes waterbodies that do not meet water quality standards for the specified beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions

establish priority rankings for waterbodies on their 303(d) lists and implement a process, called Total Maximum Daily Loads, to meet water quality standards.

Rivers and Harbors Appropriation Act. The USACE has jurisdiction over flood protection systems under Section 14 of the Rivers and Harbors Appropriation Act (33 USC section 408).

Federal Regulation of Land Development in Flood Control Basins. Under Policy Guidance Letter No. 32 and Regulation 1110-2-240, the USACE evaluates land development proposals within reservoirs and flood control basins (USACE 2016, 1993).

National Flood Insurance Program (NFIP). The Federal Emergency Management Agency (FEMA) issues flood zone maps on a countywide level. The NFIP describes the floodplain management building requirements delineating policies for development in floodplains (44 CFR sec 59-65). Section 60.3 (d)(3) of the NFIP regulations states that a community is to "prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base (100-year) flood discharge" (FEMA 2000).

Floodplain Management Department of Transportation (DOT) Order 5650.2 "Floodplain Management and Protection." The purpose of DOT Order 5650.2 is to ensure that proper consideration is given to the avoidance and mitigation of adverse floodplain impacts by DOT actions, planning programs and budget requests (USDOT 1979).

Executive Order (EO) 11988. EO 11988: Floodplain management requires federal agencies "… to avoid, to the 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." (42 FR 26951). This EO establishes an eight-step process that agencies should carry out as part of the decision-making process on projects with the potential to impact floodplains.

EO 13690. EO 13690 amended EO 11988 to improve the Nation's resilience to current and future flood risk, and established the Federal Flood Risk Management Standard (80 FR 6425). EO 13690 guides agencies to use a higher flood elevation and expanded flood hazard area than the base flood to ensure climate change and that other future changes are more adequately accounted for in agency decisions. Another requirement is that federal agencies shall use, where possible, natural systems, ecosystem processes, and nature-based approaches in federal actions and alternatives.

EO 11990. As written in 1977,"Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities…" and, per National Environmental Policy Act (NEPA), "shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use. In making this finding the head of the agency may take into account economic, environmental and other pertinent factors." (42 FR 26961]).

Safe Drinking Water Act (SDWA) of 1974 (42 USC section 300 et seq.). The SDWA protects drinking water supplies in areas where there are few or no alternative sources to the groundwater resource and where, if contamination occurred, using an alternative source would be extremely expensive (USEPA 2016). USEPA defines a SSA as one where:

- The aquifer supplies at least 50 percent of the drinking water for its service area.
- There are no reasonably available alternative drinking water sources should the aquifer become contaminated.

The USEPA is authorized by Section 1424(e) of the SDWA of 1974 (76 FR 19261) to review federally funded proposed projects within SSAs.

Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act requires federal agencies to consult with the US Fish and Wildlife Service (USFWS) before undertaking or approving water projects that would control or modify surface water (16 USC section 662).

E13.1.1.2 State

Groundwater Management Code. The 1980 Groundwater Code recognized the need to aggressively manage the state's groundwater resources to support the growing economy. Areas with heavy reliance on mined groundwater were identified and designated as AMAs. The 1980 Groundwater Code established five AMAs: Phoenix, Tucson, Prescott, Pinal, and Santa Cruz. In 2016, Arizona Revised Statute 45 Chapter 2 updated the Groundwater Management Code of 1980.

Underground Water Storage and Recovery Program and Underground Water Storage, Savings, and Replenishment Act. The Underground Water Storage and Recovery Program and the Underground Water Storage, Savings, and Replenishment Act were established in 1986 and 1994, respectively, and together define the recharge program for Arizona (Arizona Revised Statute 45-801 et seq.; Arizona Administrative Code [AAC] R12-12-151). The recharge program and associated permits are administered by the Arizona Department of Water Resources (ADWR).

Outstanding Arizona Waters. The AAC section R18-11-112 defines Arizona's OAWs. These are waters that meet the following conditions:

> A surface water that is perennial, free-flowing, has water quality that meets or is better than applicable water quality standards, and meets one or both of the following: (1) The surface water is of "exceptional recreational or ecological significance," or (2) threatened or endangered species are known to be associated with the waterbody and maintenance and protection of existing water quality is essential to the maintenance of the threatened or endangered species or the surface water provides critical habitat (AAC R18-11-112[D]) (ADEQ 2017a).

Aquifer Water Quality Standards. The ADEQ has adopted Aquifer Water Quality Standards (AAC R18-11 Article 4). Groundwater standards in Arizona are the Safe Drinking Water Standards established for Public Water Systems (PWS) and surface water standards for the Domestic Water Source designated use (ADEQ 2017b).

E13.1.1.3 Local

County flood control districts require a Floodplain Use Permit (FUP) in cases where a project encroaches into a floodplain. Approval of a FUP typically requires development of a hydraulic computer model to demonstrate that structures, berms, or other facility components located within the floodplain will not result in increased potential for flooding or erosion. This level of detail is not available at this stage of the planning process and will be addressed, as appropriate, during Tier 2 studies. The following county flood control districts would evaluate the need for and review any FUPs during a Tier 2 project assessment:

- Santa Cruz County Flood Control District
- Pima County Regional Flood Control District
- Pinal County Flood Control District
- Flood Control District of Maricopa County
- Yavapai County Flood Control District

ADEQ requires Phase I MS4 permits for operators that serve populations greater than 100,000 (ADEQ 2017c). Operators holding MS4 permits within the Study Area include Arizona Department of Transportation (ADOT), Pima County, City of Phoenix, and City of Tucson. Each permittee implements its own MS4 program under its AZPDES permit. MS4 permittees must develop individual programs to manage and treat stormwater discharges to the maximum extent practicable. For example, ADEQ issued the ADOT MS4 Permit on July 17, 2015, with an effective date of August 16, 2015. ADOT's Stormwater Management Plan identifies the program and procedures implemented by ADOT to minimize, to the extent practicable, the release of pollutants to and the discharge of pollutants from the ADOT MS4 (ADOT 2017). Pima County developed a Stormwater Management Program to ensure the quality of stormwater discharges were managed to the maximum extent practicable (Pima County 2013), and the City of Tucson passed Stormwater Management Ordinance Number 10209 in 2005 (City of Tucson 2005).

The Pima County Department of Environmental Quality has been delegated authority from the ADEQ to enforce applicable requirements of AAC Title 18, Chapters 4 and 5 relating to PWS. Pima County's PWS Program reviews and approves plans for water line extensions, modifications, or relocations of PWS that serve 15 or more connections, or 25 or more people, for more than 60 days a year (Pima County 2017).

E13.2 ANALYSIS AREA

The Analysis Area for water resources includes the Corridor Options, a 0.5-mile buffer around the Corridor Options, and areas extending beyond the 0.5-mile buffer where water resources have a direct surface connection to those crossed by the Corridor Options (e.g., major rivers, where sediment could be transported more than 0.5 mile under certain conditions). The general 0.5-mile Analysis Area is based on potential for alternatives to affect surface water flow, sediment transport, and infiltration to groundwater.

The following list describes water resources evaluated in this report:

- Sensitive waters: water resources with a special, formal designation from a state or local agency such as OAWs, AMAs, and SSAs. SSA and AMA boundaries are generally coterminous with hydrologic basin boundaries, and areas of AMAs that extend beyond the Analysis Area (especially if upstream of the Corridor Options) were generally not included. Quantities and sources of water for these resources have not yet been defined and would be analyzed in the Tier 2 study, with particular consideration given to the portion of the area potentially affected within an SSA (USEPA 2017).
- Impaired waters: waterbodies with chronic or recurring monitored violations of the applicable numeric and/or narrative water quality criteria are referred to as "impaired." Surface water quality consists of the physical, chemical, and biological characteristics of a waterbody. Impaired waters can be caused by both point sources and nonpoint sources. Point sources are usually from a direct source such as industrial or sewage treatment plants to a lake, river, or stream. Nonpoint sources are usually the result of rainfall or snowmelt moving over and/or through the ground, picking up pollutants that are eventually deposited in lakes, rivers, and streams. These types of pollutants include:
  - Fertilizers, herbicides, and insecticides from agricultural lands;
  - Oil, grease, and toxic chemicals from urban runoff;
  - Sediment from improperly managed construction sites or eroding stream banks;
  - Salt from irrigation practices;
  - Acid drainage from mines;
  - Bacteria and nutrients from livestock, pet wastes, or faulty septic tanks; and/or
  - Atmospheric deposition or hydromodification (USEPA 2017).
- Groundwater resources: wells used for water quality monitoring, production, geotechnical observation, domestic uses, testing purposes, and irrigation.
- Waters of the US: waters as defined in 33 CFR 328. The boundaries of non-wetland waters of the US are delineated by their ordinary high-water mark.
- Wetlands as defined by the USACE: those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

  The USFWS National Wetland Inventory (NWI) database was used to identify locations of potential wetlands within the Build Corridor Alternatives. The NWI maps use the Cowardin System, which classifies the types of ecosystems related to water resources (Cowardin et al. 1979). Typical wetland classifications in the arid west include:
  - Freshwater Emergent Wetland: wetlands dominated by a 30 percent or greater areal coverage of emergent (extending out of the water) vegetation.
  - Freshwater Forested/Shrub Wetland: wetlands dominated by a 30 percent or greater areal coverage of trees or shrubs.
  - Freshwater Pond: wetlands less than 20 acres in a topographic depression or dammed river channel that lack trees, shrubs, or persistent emergent vegetation.

- Lake: wetlands greater than 20 acres in a topographic depression or dammed river channel that lack trees, shrubs, or persistent emergent vegetation.
- Riverine: wetlands contained within a channel, except for those dominated by trees, shrubs, or persistent emergent vegetation (Cowardin et al. 1979).

It should be noted that the NWI data have only been mapped by the USFWS at a desktop level and may not be representative of ground conditions. Formal wetland delineations using the three-part USACE methodology of identifying hydric soils, wetland hydrology, and hydrophytic vegetation would be required to accurately identify wetlands, which is beyond the scope of this Tier 1 analysis. For that reason, this report refers to the mapped NWI wetlands as "potential wetlands." Since NWI data may not reflect actual wetland conditions (especially where mapped along ephemeral washes), the NWI data were compared against aerial imagery in areas that had potential to affect the outcome of the analysis (e.g., at major river crossings) to verify the accuracy of the data to support decision-making.

Jurisdictional status for all wetlands and waters of the US in the Analysis Area has not been assigned at this Tier 1 level for following reasons:

- For many of the waters and wetlands in the Analysis Area, it is not possible to determine jurisdictional status without field delineations. Field delineations would be included as part of the Tier 2 environmental review process.
- The evolving nature of how jurisdiction under the CWA is interpreted by the courts means that, over the expected build-out period for Tier 2 projects, this status could change for many of the identified streams and wetlands.

Specific impacts on jurisdictional waters cannot be quantified until more detailed alignments are developed as part of the Tier 2 environmental phase.

- Floodplains: areas adjacent to a stream or river that are susceptible to flooding. Floodplains are designated by the size and frequency of the floods that occur within their area. FEMA defines the geographic area of floodplains according to varying levels of flood risk by designating special flood hazard areas (SFHA) on a Flood Insurance Rate Map (FIRM). SFHAs are those areas that are susceptible to being inundated by a flood event having a 1 percent chance (base flood or 100-year flood) of being equaled or exceeded each year, and are regulated by FEMA (FEMA 2007). A regulatory floodway is defined by FEMA as "…the channel of a watercourse and the adjacent land that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's FIRM or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area (FEMA 2007). The following list provides a description of flood zones in the Analysis Area.
  - A: SFHA inundated by the 100-year flood; base flood elevations are not determined.
  - AE: SFHA inundated by the 100-year flood; base flood elevations are determined.
  - AH: SFHA inundated by the 100-year flood; flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations are determined.

- AO: SFHA inundated by the 100-year flood; flood depths of 1 to 3 feet (usually sheet flow on the sloping terrain); average depths are determined. For areas of alluvial fan flooding, velocities also are determined.
- C: Area determined to be outside the 500-year floodplain.
- D: Area in which flood hazards are undetermined.
- X: Area of 500-year flood; area subject to the 100-year flood with average depths of less than 1 foot or with contributing drainage area less than 1 square mile; and areas protected by levees from the base flood (City of Scottsdale 2017; FEMA 2017).

E13.3 METHODOLOGY

Water resources were researched by desktop review of Geographic Information Systems data obtained from the US Geological Survey (USGS), FEMA, USFWS, and the ADWR. Information on registered groundwater wells was obtained from ADWR (ADWR 2017a). The locations and names of surface waterbodies (e.g., streams, rivers, lakes, and reservoirs) were identified using the USGS National Hydrography Dataset. Digital 100-year floodplain data were compiled from the FEMA website and FIRMs were reviewed (FEMA 2017). This study quantifies areas designated by FEMA as SFHA; however, Category X (e.g., 500-year floodplain) areas also were mapped for reference. The data collection and analysis for this technical report are consistent with EO 13690.

Each Corridor Option was overlaid on the Geographic Information Systems data to quantify the resource and to identify its location within the 2,000-foot-wide corridor. The potential for impacts was then qualitatively assessed by examining the location of the resources relative to the Corridor Option and potential for avoidance. Key factors that were assessed in this impact analysis included:

- Mapped quantity of water resources within each Corridor Option (number of groundwater wells, linear feet of streams, acreage of wetlands and floodplains) or within the Analysis Area (linear feet of impaired waterbodies)
- Configuration of water resources within the Analysis Area and Corridor Option, which may indicate how easy it would be to avoid sensitive waters (includes OAWs, AMAs, and SSAs), impaired waters, groundwater, waters of the US, wetlands, and floodplains (qualitatively assessed)
- Whether the Corridor Option is co-located in an existing transportation right-of-way (ROW), or would require construction within an undisturbed area (qualitatively assessed)

After assessing the above quantitative and qualitative factors, the level of impact for each Corridor Option by section was ranked as low/moderate/high in comparison to other Corridor Options within the same section (see Section E13.5). The rankings for the Corridor Options were then compiled for the overall Build Corridor Alternatives, with more “low” rankings of individual corridor segments corresponding to a relatively lower impact for the overall Build Corridor Alternative, and more “high” rankings of individual corridor segments corresponding to a relatively higher impact for the overall Build Corridor Alternative (see Section E13.6).

E13.4 AFFECTED ENVIRONMENT

As part of the basin and range physiography in the Analysis Area, ephemeral desert washes carry stormwater flows and can create intricate, braided drainage systems across the valleys between mountains, buttes, and other landforms. The overall Analysis Area traverses four AMAs that cover approximately 14,700 square miles and stretches continuously from the international border with Mexico at Nogales through central Arizona to the northern boundary of Maricopa County (ADWR 2008). One SSA is included in the Analysis Area and numerous impaired waters are present.

Groundwater is a major source of potable and irrigation water in the region. Groundwater is underground water found in pore spaces between grains of soil or rock or within fractured rock formations. Groundwater can originate from precipitation that infiltrates through soil and underlying unsaturated geologic materials until reaching the water table. Information on registered wells was provided by ADWR (ADWR 2017a). Waters of the US, including potential wetlands, are located throughout the Analysis Area. There are floodplains, floodways, and flood-prone areas associated with waters of the US.

The following sections discuss more specifically the existing conditions relating to water resources within the three sections of the Analysis Area (South, Central, and North).

E13.4.1 South Section

Key features relevant to water resources are shown on **Figure E13-2** (Sensitive Waters, Impaired Waters, and Groundwater – South Section), **Figure E13-3** (Potential Waters of the US, including Wetlands – South Section), and **Figure E13-4** (Floodplains – South Section) and include:

- Two AMAs, the Santa Cruz and Tucson
- A designated area of the Upper Santa Cruz and Avra Basin SSA (USEPA 2016)
- Recharge facilities, including the Central Avra Valley Storage and Recovery Project (CAVSARP) and the Southern Avra Valley Storage and Recovery Project (SAVSARP)
- One wastewater treatment plant (Tres Rios Water Reclamation Facility, located near I-10 and Ina Road in Tucson)
- Domestic water supply wells within the Analysis Area (ADWR 2017a)
- Santa Cruz River and its major tributaries
- Mapped wetlands and floodplains

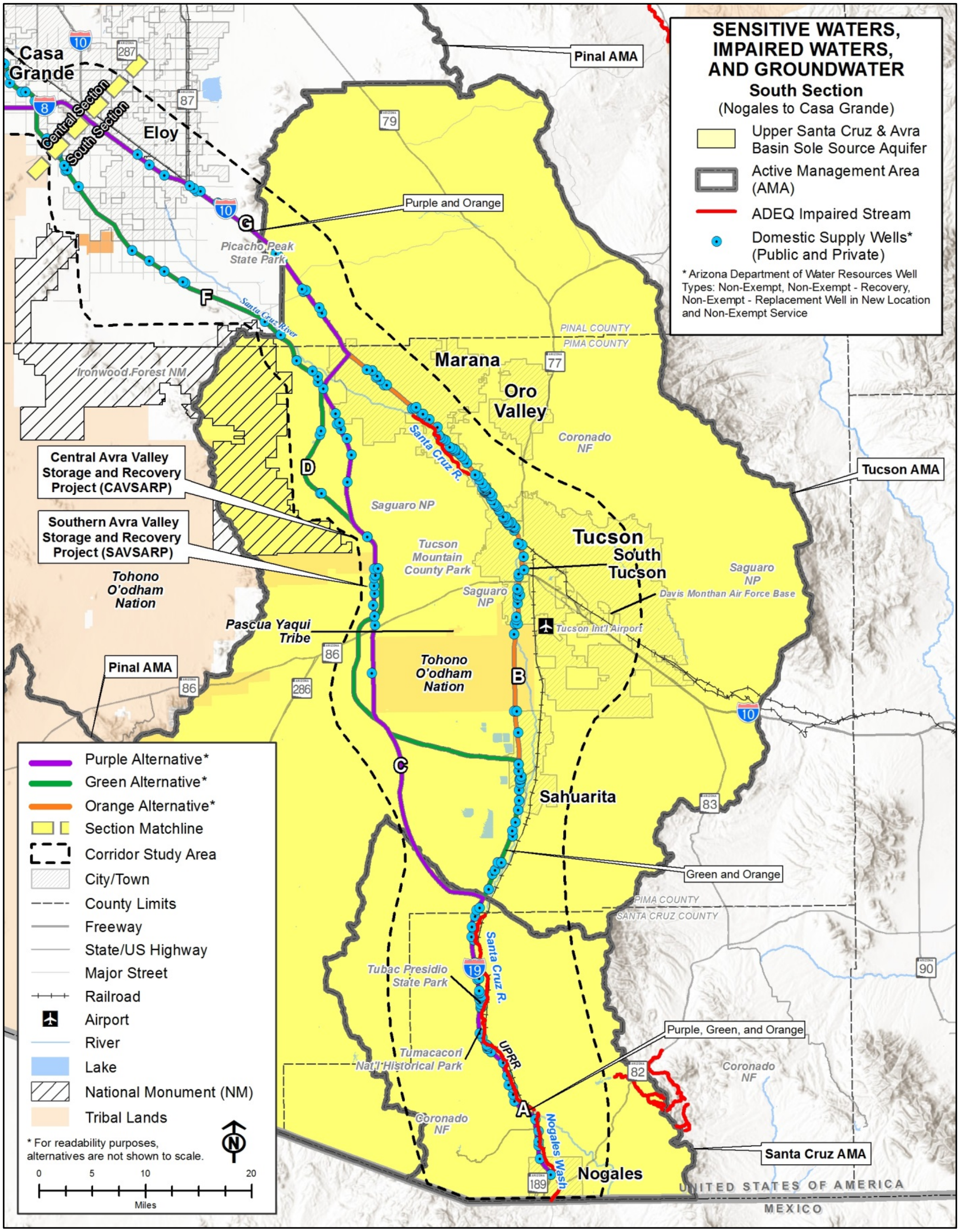

Figure E13-2 Sensitive Waters, Impaired Waters, and Groundwater – South Section

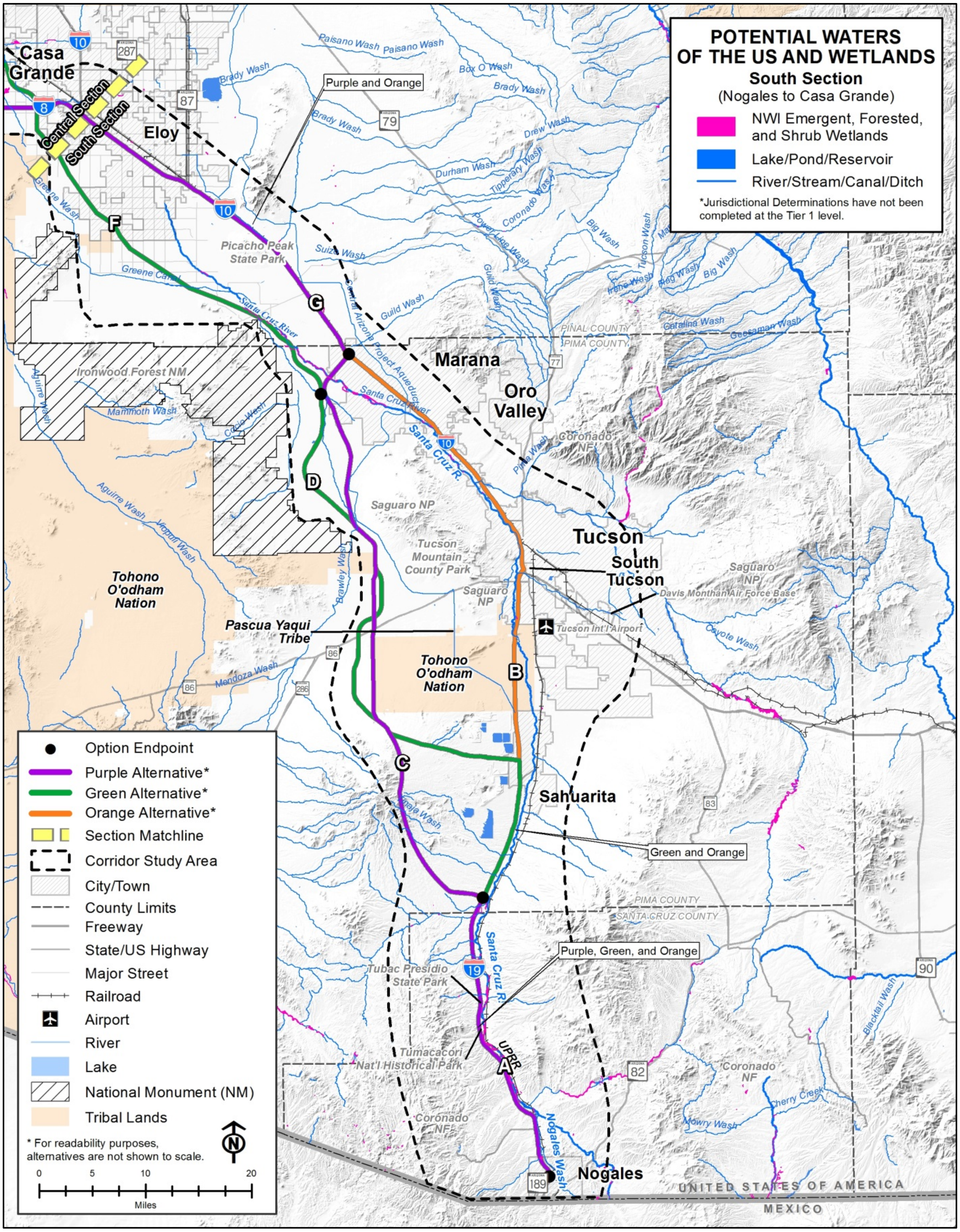

Figure E13-3 Potential Waters of the US and Wetlands – South Section

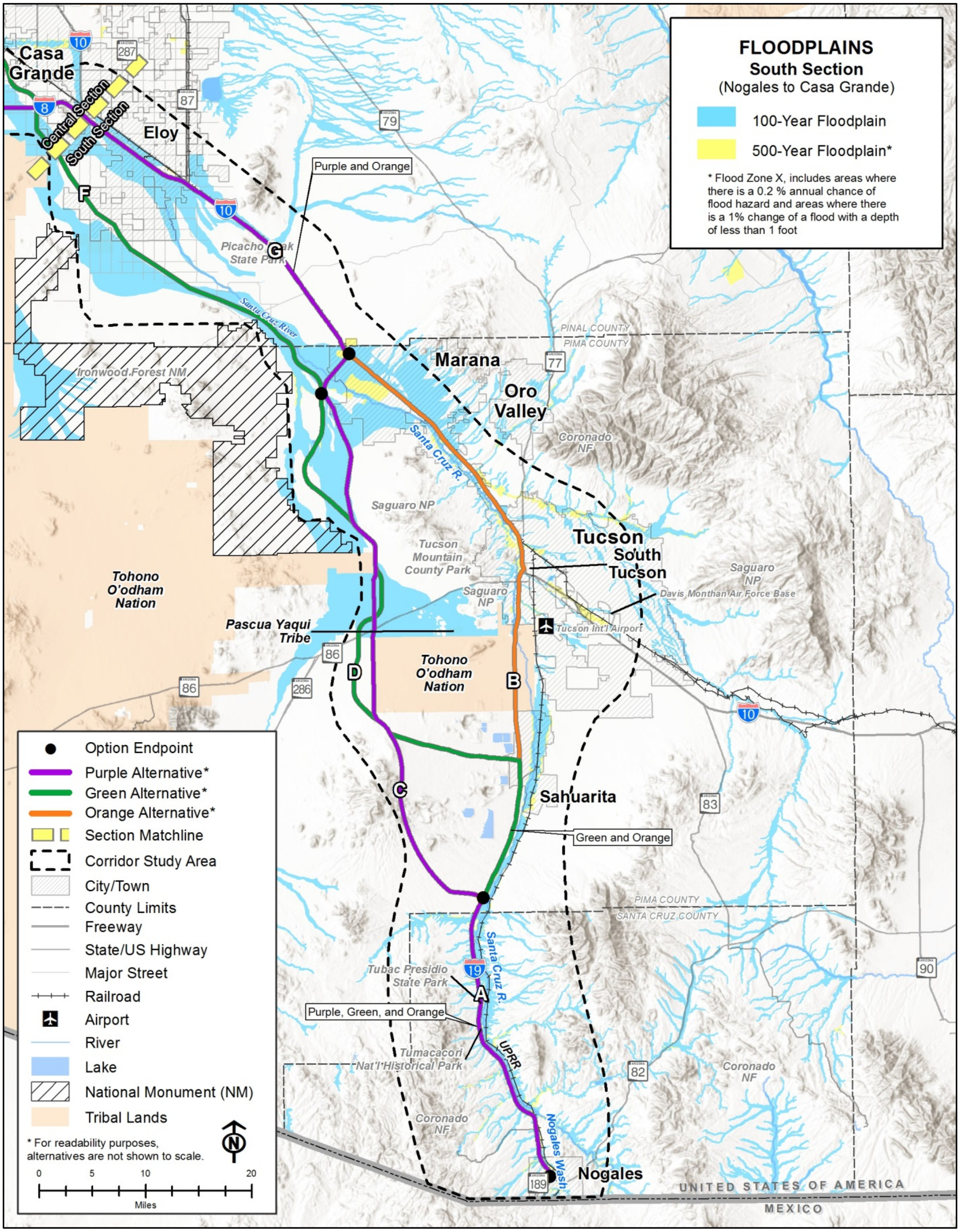

Figure E13-4 Floodplains – South Section

E13.4.1.1 Sensitive Water Resources (South Section)

A review of the OAWs listed by ADEQ indicates that no OAW would be crossed by the Build Corridor Alternatives in the South Section Analysis Area (ADEQ 2017a).

The South Section surface water resources are within the Santa Cruz and Tucson AMAs (**Figure E13-2**). The Santa Cruz AMA is approximately 716 square miles and its major drainage, the Santa Cruz River, flows from Mexico into the basin. The Tucson AMA is approximately 3,866 square miles, and the Santa Cruz River drains the Upper Santa Cruz Valley; it is the major drainage in the AMA (ADWR 2008).

The Upper Santa Cruz and Avra Valley SSA underlies approximately 4,591 square miles in southern Arizona (USEPA 2008). The Upper Santa Cruz and Avra Valley SSA is the only USEPA-designated SSA within the Analysis Area.

E13.4.1.2 Impaired Waters (South Section)

As regulated and monitored by ADEQ, impaired surface water segments within the South Section Analysis Area include the Santa Cruz River, Potrero Creek, and Nogales Wash (**Figure E13-2**;
Table E13-1 [Impaired Waters within the South Section Analysis Area by Corridor Option]).

Table E13-1 Impaired Waters within the South Section Analysis Area by Corridor Option

Impaired Water		Linear Feet of Impaired Waters by Corridor Option (1)(2)					
		A	B	C	D	F	G
Stream Name	**Impairment**						
Santa Cruz River	Ammonia, Cadmium (dissolved), chlorine, and *E. coli*	102,800	41,424	0	0	0	0
Potrero Creek	Chlorine, low dissolved oxygen, and *E. coli*	20,382	0	0	0	0	0
Nogales Wash	Copper, *E. coli* and total residual chlorine	13,316	0	0	0	0	0
Total Linear Feet Crossed		**136,498**	**41,424**	**0**	**0**	**0**	**0**

(1) Rounded to nearest foot.
(2) Includes impaired waters within 0.5 mile of Corridor Options.
SOURCE: ADEQ 2016.

As summarized in **Table E13-1**, only Options A and B have impaired waters located within 0.5 mile.

E13.4.1.3 Groundwater Resources (South Section)

The South Section of the Analysis Area includes the Santa Cruz, Tucson, and Pinal AMAs. The management goal for the Santa Cruz AMA is to maintain a safe-yield condition in the AMA and to prevent local water tables from experiencing long-term declines. Safe-yield is accomplished when no more groundwater is being withdrawn than is being annually replaced. The management goal for the Tucson AMA is to establish a safe-yield by 2025. The management goal of the Pinal AMA is to allow development of non-irrigation uses and to preserve existing agricultural economies in the AMA for as long as feasible, consistent with the necessity to preserve future water supplies for non-irrigation uses (ADWR 2016).

Recharge of aquifers in the Tucson AMA is supported by the CAVSARP and SAVSARP. Colorado River water is delivered to Tucson via the Central Arizona Project (CAP) canal, and that water is allowed to sink into the ground and recharge the aquifer in Avra Valley at CAVSARP and SAVSARP (City of Tucson 2017). The surface ponds for these recharge facilities are west of Tucson in Avra Valley (**Figure E13-2**).

Private, municipal, utility, and corporate-owned groundwater wells are located within the Analysis Area. The irrigation districts in the South Section use groundwater wells and have both surface (canals) and subsurface (pipes) conveyance infrastructure associated with their operations.

Groundwater in the Analysis Area is of acceptable quality for most uses. **Figure E13-2** shows the approximate location of public and private water supply wells within the 2,000-foot-wide Corridor Options, and **Table E13-2** (Groundwater Wells within South Section Corridor Options) quantifies the number of wells within each Corridor Option. Most of the groundwater resources meet federal and state drinking water standards, although contaminant levels exceed primary safe drinking water standards in a few areas (ADEQ 2002; USGS 2000). A review of water quality data from Pima County drinking water providers for the 1998-2000 sampling years indicates the most common regulated constituents detected were nitrate, fluoride, arsenic, and chromium. Although these constituents were detected in the drinking water supplies, none were seen at levels that exceeded the established drinking water maximum contaminant levels (Pima Association of Governments 2002).

Table E13-2 Groundwater Wells within South Section Corridor Options

	Number of Wells by Corridor Option					
	A	B	C	D	F	G
Number of Wells	41	133	25	31	38	18

SOURCE: ADWR 2017a.

E13.4.1.4 Potential Waters of the US (South Section)

Annual precipitation in the South Section ranges from 8 to 18 inches per year (ADEQ 2016). Runoff from precipitation events, which are almost entirely in the form of rainfall from infrequent winter storms and summer thunderstorms, is conveyed through desert washes and generally flows toward the Santa Cruz River. There are approximately 20 named ephemeral streams and canals within the Analysis Area that are tributaries to the Santa Cruz River. Aerial photography indicates numerous unnamed ephemeral washes also are found throughout the South Section. Most of the ephemeral watercourses in the area, including Rillito River, Cañada del Oro, and Julian Wash, are tributaries to the Santa Cruz River. Nogales Wash, a large tributary of the Santa Cruz River, originates about 5 miles south of the international border in Sonora, Mexico and then enters Arizona. Approximately 1 mile south of the border, Nogales Wash enters a concrete-covered channel floodway.

The Santa Cruz River extends from the City of Nogales at the border with Mexico northwest toward the City of Eloy and the Gila River. The Santa Cruz River flows south to north through the Analysis Area while the ephemeral tributary washes flow predominantly east to west. Only two reaches of the river experience year-round streamflow due to effluent from wastewater treatment plants in Nogales and Pima County (ADEQ 2016; Nakolan et al. 2015). The USACE has determined that the Santa Cruz River from the Roger Road Wastewater Treatment Plant to the Pima County/Pinal County border is a TNW (USACE 2008). The USGS report Water Quality in the Central Arizona Basins concludes that surface water in the area consists of effluent-dependent urban streams that are valuable water resources (USGS 2000).

Several irrigation canals, including the CAP canal, are within the Analysis Area. Additionally, the South Section Analysis Area includes manmade ponds used for livestock water, recharge, and tailings storage. These manmade water features that range in size from 0.25 acre to over 1,000 acres are shown on **Figure E13-3**. Many of these features may not be potential waters of the US and therefore not subject to USACE permitting; however, they are included on the figure for illustrative purposes as jurisdiction would need to be determined on a site-specific basis during Tier 2 studies (see Section E13.6.5.1). **Figure E13-3** also shows the potential waters of the US and NWI-mapped wetlands. Linear feet of potential waters of the US within the Corridor Options are quantified in **Table E13-3** (Potential Waters of the US within South Section Corridor Options).

Table E13-3 Potential Waters of the US within South Section Corridor Options

Stream or Canal Name	Linear Feet of Named Waterways by Corridor Option (1)					
	A	B	C	D	F	G
Brawley Wash	0	0	11,528	12,705	0	0
Casa Grande Canal	0	0	0	0	9,065	3,911
Central Arizona Project Aqueduct	0	3,902	3,073	0	0	0
Demetrie Wash	0	2,410	0	0	0	0
Diablo Wash	2,100	0	0	0	0	0
Escondido Wash	0	2,203	6,129	0	0	0
Greene Canal	0	0	0	0	5,052	0
Julien Wash	0	2,239	0	0	0	0
Las Chivas Wash	2,839	0	0	0	0	0
Los Robles Wash	0	0	4,014	2,344	10,878	0
Marjorie Wash	0	0	0	204	0	0
McClellan Wash	0	0	0	0	0	14,626

Table E13-3 Potential Waters of the US within South Section Corridor Options (Continued)

Stream or Canal Name	Linear Feet of Named Waterways by Corridor Option (1)					
	A	B	C	D	F	G
Old Junction Wash	2,717	0	0	0	0	0
Potrero Creek	5,206	0	0	0	0	0
Rillito River	0	3,789	0	0	0	0
Santa Cruz River	7,097	24,548	2,124	0	6,142	0
Santa Cruz Wash	0	0	0	0	4,184	3,217
Sopori Wash	2,403	0	0	0	0	0
Tinaja Wash	0	0	3,578	0	0	0
Tubac Creek	2,097	0	0	0	0	0
Total	**24,459**	**39,091**	**30,446**	**15,253**	**35,321**	**21,754**

(1) Rounded to the nearest linear foot of the water resource within the 2,000-foot-wide corridor.
SOURCES: Arizona State Land Department 1993; USGS 2007-2014.

E13.4.1.5 Wetlands (South Section)

Wetland resources that are present in the Analysis Area are associated with channels and floodplains of the Santa Cruz River, constructed wetlands at Sweetwater Wetlands Park, and ponding areas in or adjacent to ephemeral washes. Cowardin et al. (1979) wetland types within the Analysis Area are freshwater forested shrublands, emergent, ponds, lakes, and riverine. Riverine wetlands include the Santa Cruz River and major tributaries (USFWS 2017); these also may be considered waters of the US and the streams associated with these wetlands are quantified in Section E13.4.1.4. **Table E13-4** (Wetlands within South Section Corridor Options) shows the mapped wetland acreage by Corridor Option in the South Section. **Figure E13-3** shows the location of potential waters of the US and NWI-mapped emergent, forested, and shrub wetlands. NWI-mapped riverine wetlands, lakes, and ponds are not displayed on **Figure E13-3** due to the limitations of the map scale; however, many of the NWI-mapped riverine wetlands, lakes, and ponds are near the major waterways as mapped by ADWR (2017) and shown on **Figure E13-3**.

Table E13-4 Wetlands within South Section Corridor Options

Wetland Type[2]	Wetland Acreage by Corridor Option [1]					
	A	B	C	D	F	G
Freshwater Emergent Wetland	6	3	0	0	0	0
Freshwater Forested/Shrub Wetland	43	0	4	0	33	0
Freshwater Pond	20	30	10	30	8	34
Lake	0	5	0	0	0	0
Riverine	132	334	216	219	175	71
Total	**201**	**372**	**230**	**249**	**216**	**105**

(1) Acres rounded to the nearest acre.
(2) See Section E13.2 for a description of wetland type.
SOURCE: USFWS 2017.

E13.4.1.6 Floodplains (South Section)

Table E13-5 (Floodplains within South Section Corridor Options) quantifies the acreage of mapped 100-year floodplain within each Corridor Option in the South Section. Floodplains in the Analysis Area are associated with the Santa Cruz River and its tributaries as well as other ephemeral streams such as Arivaca Wash, Brawley Wash, Greene Wash, and Los Robles Wash. East of the Town of Marana, approximately 740 acres of Flood Zone X are protected by a levee (FEMA 2017). There also are regulatory floodways found along the Santa Cruz River and its major tributaries. **Figure E13-4** illustrates the mapped floodplains in the South Section.

In addition to floodplains adjacent to these areas, some areas are subject to sheet flooding. Sheet flooding occurs in areas with flat or low slopes and where there are few or no well-defined washes. Sheet flow also can occur in areas where the washes are not large enough to contain surface water flows during storm events. These areas are included within the areas mapped by FEMA as a SFHA.

Table E13-5 Floodplains within South Section Corridor Options

Flood Zone[2]	Floodplain Acreage by Corridor Option[1]					
	A	B	C	D	F	G
A	1,218	446	860	1,165	4,059	2,142
AE	900	508	1,010	444	1,567	693
AH	0	894	0	0	0	3
AO	116	785	3,735	2,318	0	18
Total	**2,234**	**2,633**	**5,605**	**3,927**	**5,626**	**2,856**

(1) Values are rounded to the nearest acre.
(2) Refer to Section E13.2 for flood zone definitions.
SOURCE: FEMA 2017.

E13.4.2 Central Section

Key features relevant to water resources in the Central Section Analysis Area are shown on **Figure E13-5** (Sensitive Waters, Impaired Waters, and Groundwater – Central Section), **Figure E13-6** (Potential Waters of the US and Wetlands – Central Section), and **Figure E13-7** (Floodplains – Central Section), and include:

- Two AMAs, the Pinal and Phoenix
- Domestic water supply wells (ADWR 2017a)
- Santa Cruz Wash, Gila River, and Hassayampa River, and their major tributaries
- Mapped wetlands and floodplains

E13.4.2.1 Sensitive Water Resources (Central Section)

A review of the OAWs listed by ADEQ indicates that no OAW would be crossed by the Build Corridor Alternatives in the Analysis Area (ADEQ 2017a). The Analysis Area water resources are within the Pinal and Phoenix AMAs. The Pinal AMA is 4,100 square miles, and its major drainage is the Gila River in the northern part of the AMA. The Phoenix AMA is 5,646 square miles, and the Gila and Salt Rivers are the major drainages in the AMA (ADWR 2008).

E13.4.2.2 Impaired Waters (Central Section)

Some reaches of the Hassayampa and Gila Rivers are impaired in the Analysis Area. The Hassayampa River is impaired due to *E. coli* and selenium. The Gila River is impaired due to selenium (ADEQ 2016). Impairments within the Study Area are primarily related to mining, agricultural runoff, municipal, and industrial discharges (ADEQ 2018). Locations of impaired waters are shown in **Figure E13-5** and are quantified in **Table E13-6** (Impaired Waters within the Central Section Analysis Area by Corridor Option).

Table E13-6 Impaired Waters within the Central Section Analysis Area by Corridor Option

Impaired Water		Linear Feet of Impaired Waters by Corridor Option [1][2]							
		H	I	K	L	M	N	Q2	R
Stream Name	**Impairment**								
Hassayampa River	*E. coli* and selenium	0	0	0	0	0	0	0	4,341
Gila River	Selenium	0	0	0	0	0	0	8,918	0
Total Linear Feet Crossed		**0**	**0**	**0**	**0**	**0**	**0**	**8,918**	**4,341**

(1) Rounded to nearest foot.
(2) Includes impaired waters within 0.5 mile of Corridor Options.
SOURCE: ADEQ 2016.

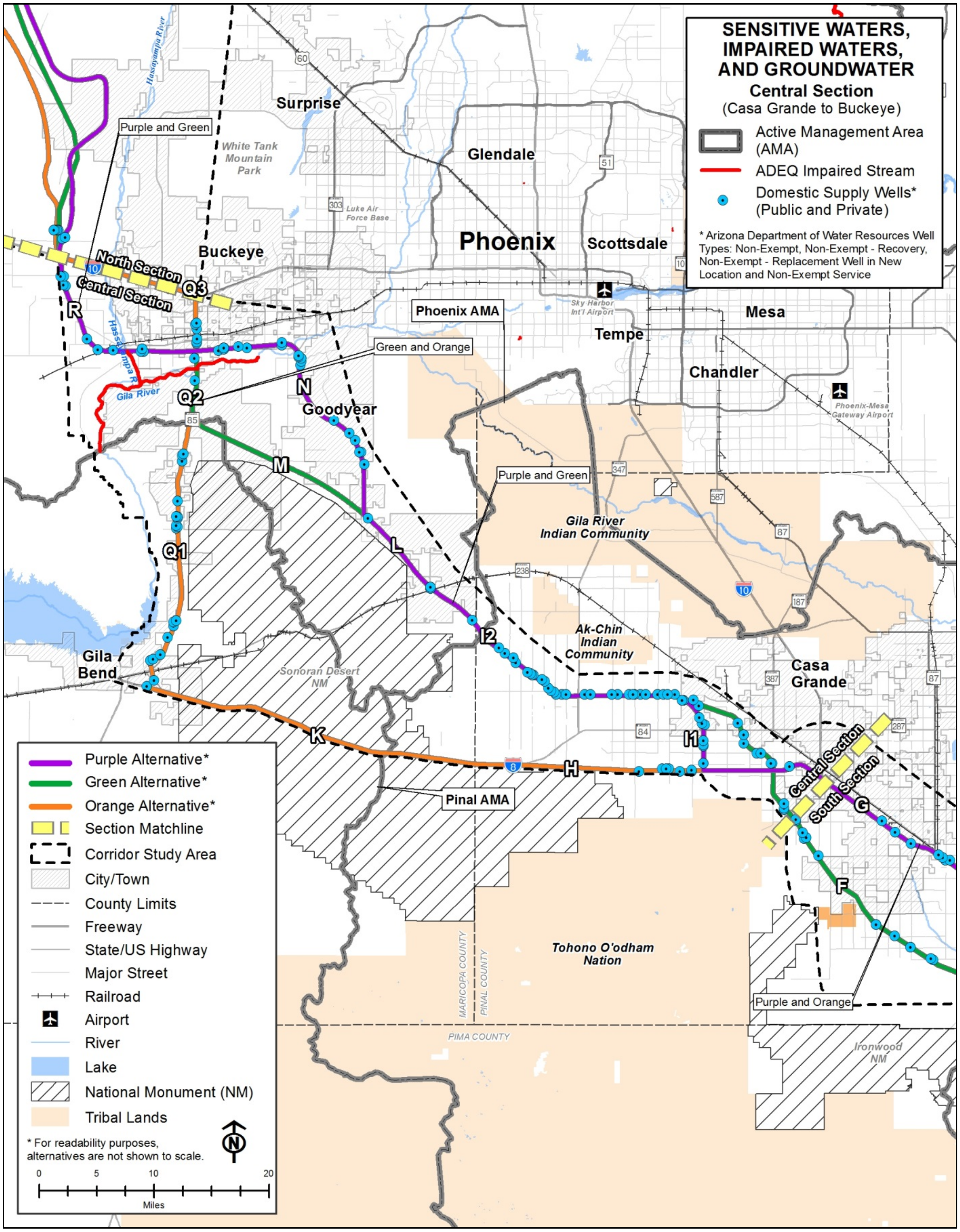

Figure E13-5 Sensitive Waters, Impaired Waters, and Groundwater – Central Section

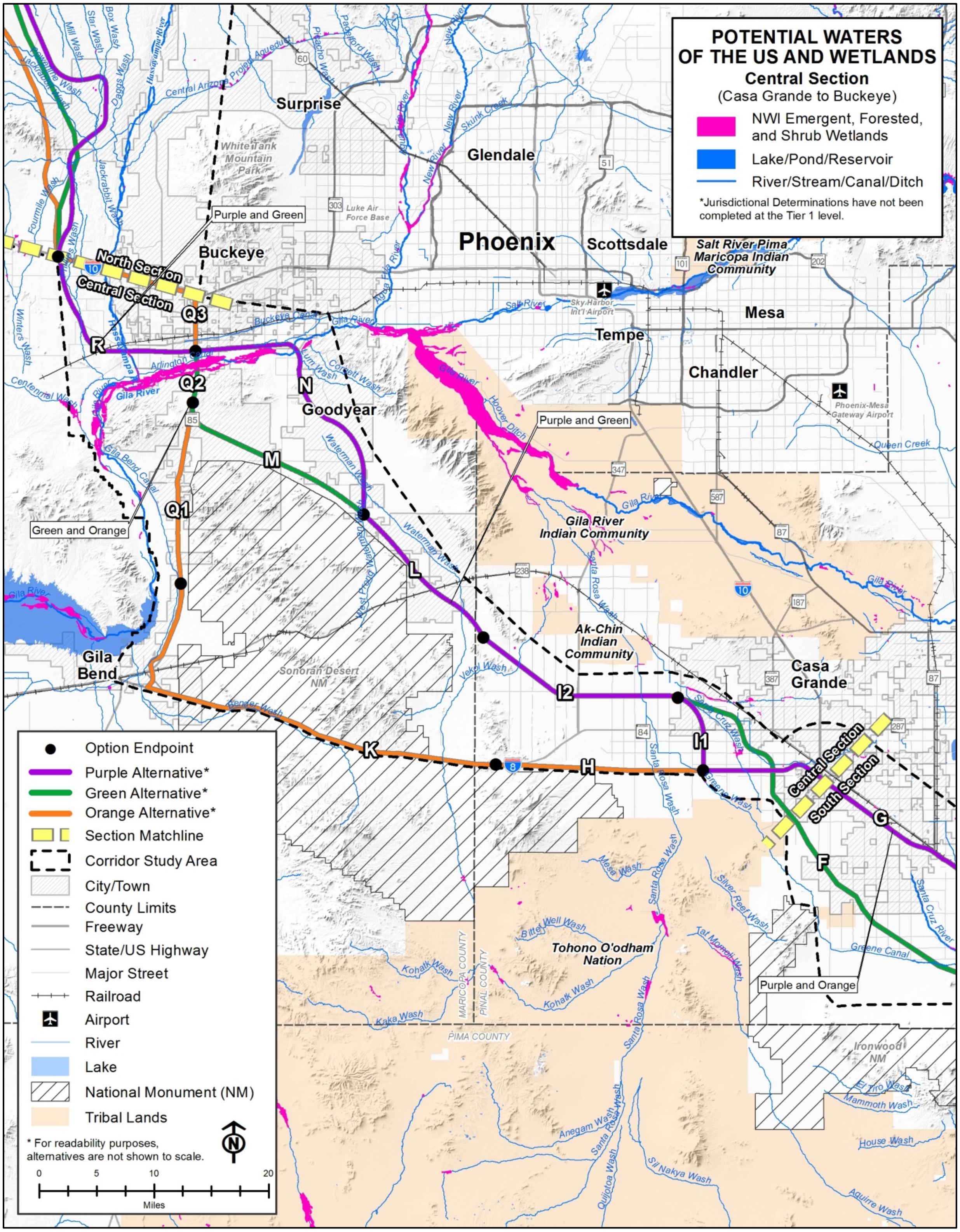

Figure E13-6 Potential Waters of the US and Wetlands – Central Section

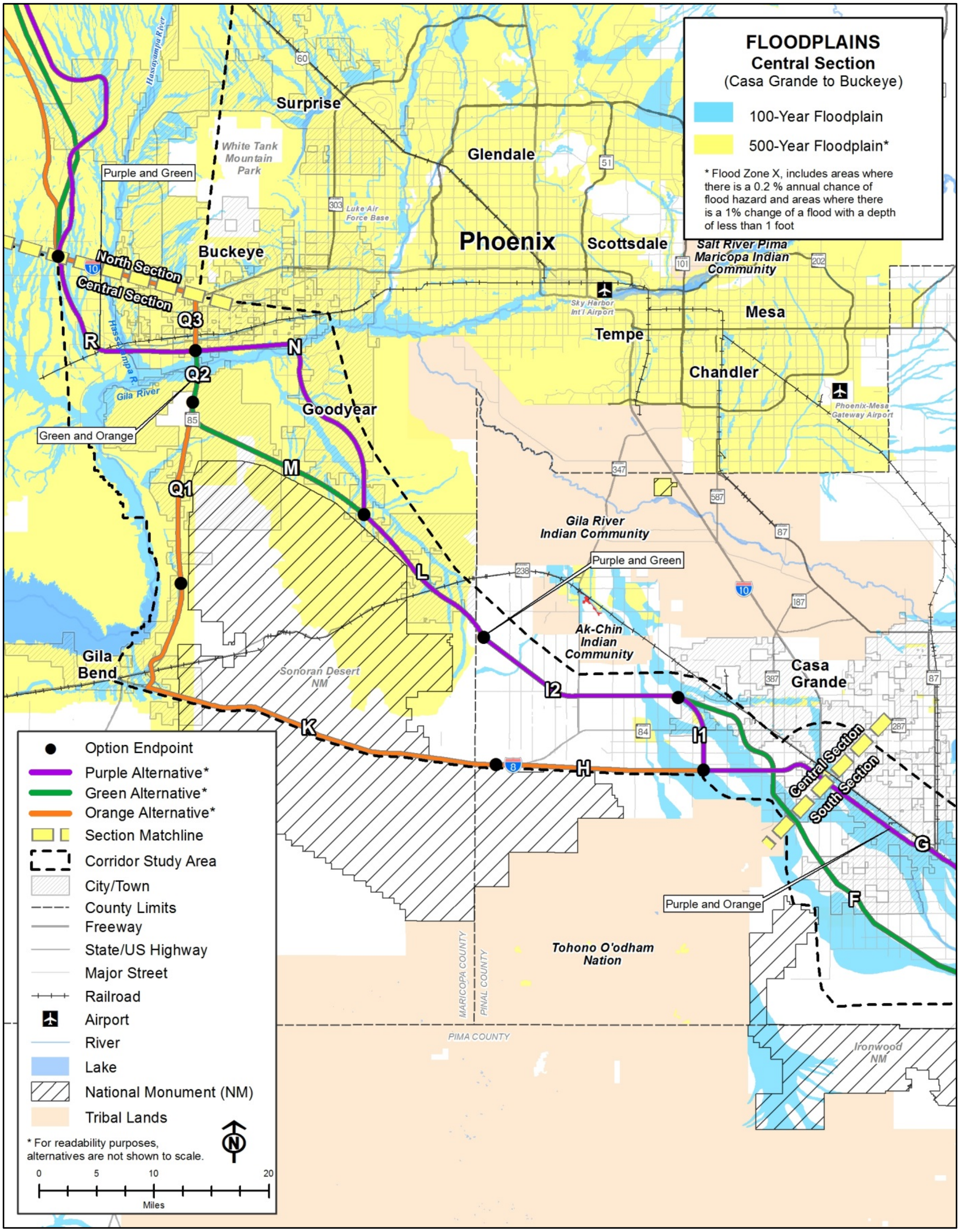

Figure E13-7 Floodplains – Central Section

E13.4.2.3 Groundwater Resources (Central Section)

The Analysis Area includes portions of the Pinal AMA and the Phoenix AMA. The Pinal AMA management goal is to preserve the agricultural economy for as long as is feasible while considering the need to preserve groundwater for future non-irrigation uses. The Phoenix AMA management goal is to achieve safe-yield by the year 2025 through the increased use of renewable water supplies and decreased groundwater withdrawals in conjunction with efficient water use.

Groundwater in the Pinal AMA Basin, as measured by ADEQ, is slightly alkaline, fresh, and hard-to-very hard as indicated by pH values and total dissolved solids. Of the 86 sites sampled for the Pinal AMA study, 13 percent met all SDWA primary and secondary water quality standards. In addition, ADWR aquifer water quality standards were exceeded at 70 percent of the 86 sites sampled. Sites sampled within the Pinal AMA exceeded the SDWA standards for the level of arsenic, fluoride, gross alpha, nitrate, and uranium (ADEQ 2007). **Table E13-7** (Groundwater Wells within Central Section Corridor Options) quantifies the wells by Corridor Option in the Central Section. **Figure E13-5** shows public and private water supply wells.

Table E13-7 Groundwater Wells within Central Section Corridor Options

	Number of Wells by Corridor Option										
	H	I1	I2	K	L	M	N	Q1	Q2	Q3	R
Number of Wells	7	11	37	10	9	0	36	13	2	8	2

SOURCE: ADWR 2017a.

E13.4.2.4 Potential Waters of the US (Central Section)

The Gila River flows during storm events from east to west, and most of the ephemeral washes that are tributaries to the Gila River flow predominantly north to south (ADWR 2017b). The Hassayampa River, a tributary of the Gila River, flows from north to south and flows into the Gila River approximately 5 miles west of State Route 85. Within the Lower Gila watershed, most of the Gila River is ephemeral and flows only in response to precipitation events or water releases from upstream dams. Flow in the lower portion of the Gila River would be intermittent if it were not controlled by dams, and most of the low flow in the river upstream of Gillespie Dam is sewage effluent and irrigation return flow.

In addition to the Gila and Hassayampa Rivers, there are approximately 16 named ephemeral streams and canals, including the CAP canal, and numerous other unnamed ephemeral washes throughout the Analysis Area. The named water locations are shown in **Figure E13-6** and the linear feet of these resources within the Corridor Options are quantified in **Table E13-8** (Potential Waters of the US within Central Section Corridor Options). The USACE has designated two reaches of the Gila River, totaling approximately 37 miles, as TNWs. These reaches are not located within the Corridor Options; however, it is reasonable to expect that other reaches of the Gila River also would be jurisdictional due to a direct connection to the Colorado River.

Table E13-8 Potential Waters of the US within Central Section Corridor Options

Named Waterway	Linear Feet of Named Waterways Crossed by Corridor Option [1]										
	H	I1	I2	K	L	M	N	Q1	Q2	Q3	R
Arlington Canal	0	0	0	0	0	0	0	0	2,075	0	0
Bender Wash	0	0	0	19,079	0	0	0	0	0	0	0
Buckeye Canal	0	0	0	0	0	0	0	0	0	2,065	0
Dickey Wash	0	0	0	0	0	0	0	0	0	2,739	0
Gila Bend Canal	0	0	0	5,101	0	0	0	0	0	0	0
Gila River	0	0	0	0	0	0	2,834	0	3,756	0	0
Greene Wash	3,322	0	0	0	0	0	0	0	0	0	0
Hassayampa River	0	0	0	0	0	0	0	0	0	2,128	2,205
Luke Wash	0	0	0	0	0	0	0	0	0	0	7,926
Lum Wash	0	0	0	0	0	0	6,894	0	0	0	0
Phillips Wash	0	0	0	0	0	0	0	0	0	2,181	0
Santa Rosa Wash	2,098	0	2,050	0	0	0	0	0	0	0	0
South Extension Canal	0	0	0	0	0	0	10,840	0	0	0	0
Vekol Wash	0	0	2,386	2,281	0	0	0	0	0	0	0
Waterman Wash	0	0	0	0	2,325	0	3,733	0	0	0	0
West Prong Waterman Wash	0	0	0	0	452	1,869	6,942	0	0	0	0
Total	**5,420**	**0**	**4,436**	**26,461**	**2,277**	**1,869**	**31,243**	**0**	**5,831**	**9,113**	**10,131**

(1) Rounded to the nearest linear foot of the water resource within the 2,000-foot-wide corridor.
SOURCES: Arizona State Land Department 1993; USGS 2007-2014.

E13.4.2.5 Wetlands (Central Section)

Cowardin et al (1979) wetland types within the Analysis Area include freshwater forested and shrublands, ponds, and palustrine wetlands. Riverine wetlands are mapped along the Gila River, Hassayampa River, and Santa Cruz Wash; these features also are potential waters of the US and are quantified in Section E13.4.2.4. In addition to natural wetlands, constructed wetlands adjacent to the I-11 Corridor Analysis Area include the 290-acre Tres Rios wetland located near the confluence of the Salt, Gila, and Agua Fria rivers west of Phoenix. **Table E13-9** (Wetlands within Central Section Corridor Options) summarizes the acres of potential wetlands within the 2,000-foot-wide Corridor Options. **Figure E13-6** (Potential Waters of the US and Wetlands Central Section) shows the location of potential waters of the US and NWI-mapped emergent, forested, and shrub wetlands. NWI-mapped riverine wetlands, lakes, and ponds are not displayed on **Figure E13-6** due to the limitations of the map scale; however, many of the NWI-mapped riverine wetlands, lakes, and ponds are near the major waterways as mapped by ADWR (2017) and shown on **Figure E13-6**.

Table E13-9 Wetlands within Central Section Corridor Options

Wetland Type (2)	Wetland Acreage by Corridor Option (1)										
	H	I1	I2	K	L	M	N	Q1	Q2	Q3	R
Freshwater Forested/Shrub Wetland	0	0	0	0	0	0	0	0	141	0	3
Freshwater Pond	6	1	23	12	0	0	6	1	0	0	0
Riverine	50	0	39	387	43	133	223	133	39	73	79
Total	**56**	**1**	**62**	**399**	**43**	**133**	**229**	**134**	**180**	**73**	**82**

(1) Acres rounded to the nearest acre.
(2) See Section E13.2 for a description of wetland type.
SOURCE: USFWS 2017.

E13.4.2.6 Floodplains (Central Section)

Table E13-10 (Floodplains within Central Section Corridor Options) summarizes the acres of 100-year floodplain within the 2,000-foot-wide Corridor Options. Floodplains in the Analysis Area are associated with the Santa Cruz, Gila, and Hassayampa rivers and their major tributaries, including Greene Wash, Santa Rosa Wash, Vekol Wash, Bender Wash, and Waterman Wash. Floodways are present along the channel of the Gila River and Waterman Wash. In addition to the floodways and floodplains adjacent to these areas, some areas are subject to sheet flooding. **Figure E13-7** illustrates the 100- and 500-year floodplains in the Central Section.

Table E13-10 Floodplains within Central Section Corridor Options

Flood Zone (2)	Floodplain Acreage by Corridor Option(1)										
	H	I1	I2	K	L	M	N	Q1	Q2	Q3	R
A	883	90	252	1	413	340	361	91	0	707	597
AE	0	438	0	100	0	20	1,005	155	479	99	274
AH	0	0	0	5	0	0	0	0	0	26	30
AO	0	228	0	60	0	0	0	3	0	0	0
Total	**883**	**6**	**252**	**166**	**413**	**360**	**1,366**	**249**	**479**	**832**	**901**

(1) Values are rounded to the nearest acre.
(2) Refer to Section E13.2 for flood zone definitions.
SOURCE: FEMA 2017.

E13.4.3 North Section

Key features relevant to surface and groundwater are shown on **Figure E13-8** (Sensitive Waters, Impaired Waters, and Groundwater – North Section), **Figure E13-9** (Potential Waters of the US and Wetlands – North Section), and **Figure E13-10** (Floodplains – North Section), and include:

- The Phoenix AMA
- Domestic water supply wells within the 2,000-foot-wide Corridor Options (ADWR 2017a)
- Hassayampa River and its major tributaries, and tributaries to the Gila River
- Mapped wetlands and floodplains

E13.4.3.1 Sensitive Water Resources (North Section)

No OAW would be crossed by the Build Corridor Alternatives within the North Section Analysis Area (ADEQ 2017a). North Section water resources are located within the 5,646-square-mile Phoenix AMA; the Gila and Salt rivers are the major drainages in the AMA (ADWR 2008). There are no SSAs in the Analysis Area.

E13.4.3.2 Impaired Waters (North Section)

There are no impaired waters within the North Section.

E13.4.3.3 Groundwater Resources (North Section)

Groundwater in the Phoenix AMA and the Upper Hassayampa River Basin is generally suitable for drinking water uses. While the data are limited for the Phoenix area, nine sites within the Upper Hassayampa River Basin have exceeded the primary maximum contaminant levels for arsenic, gross alpha, and nitrate. Groundwater in the basin typically has calcium or mixed-bicarbonate chemistry and is slightly-alkaline, fresh, and hard-to very-hard, based on pH levels, concentrations of total dissolved solids, and hardness concentrations.

Table E13-11 (Groundwater Wells within North Section Corridor Options) presents the number of groundwater wells by Corridor Option. Wells in Option X are used for public water supplies, groundwater monitoring, or geotechnical information. Wells in Option U contribute to public water supplies, water for domestic livestock, monitoring, or geotechnical information. Wells in Options S are groundwater replacement wells. **Figure E13-8** shows the locations of private water supply wells.

Table E13-11 Groundwater Wells within North Section Corridor Options

	Number of Wells by Corridor Option		
	X	U	S
Number of Wells	2	3	4

SOURCE: ADWR 2017a.

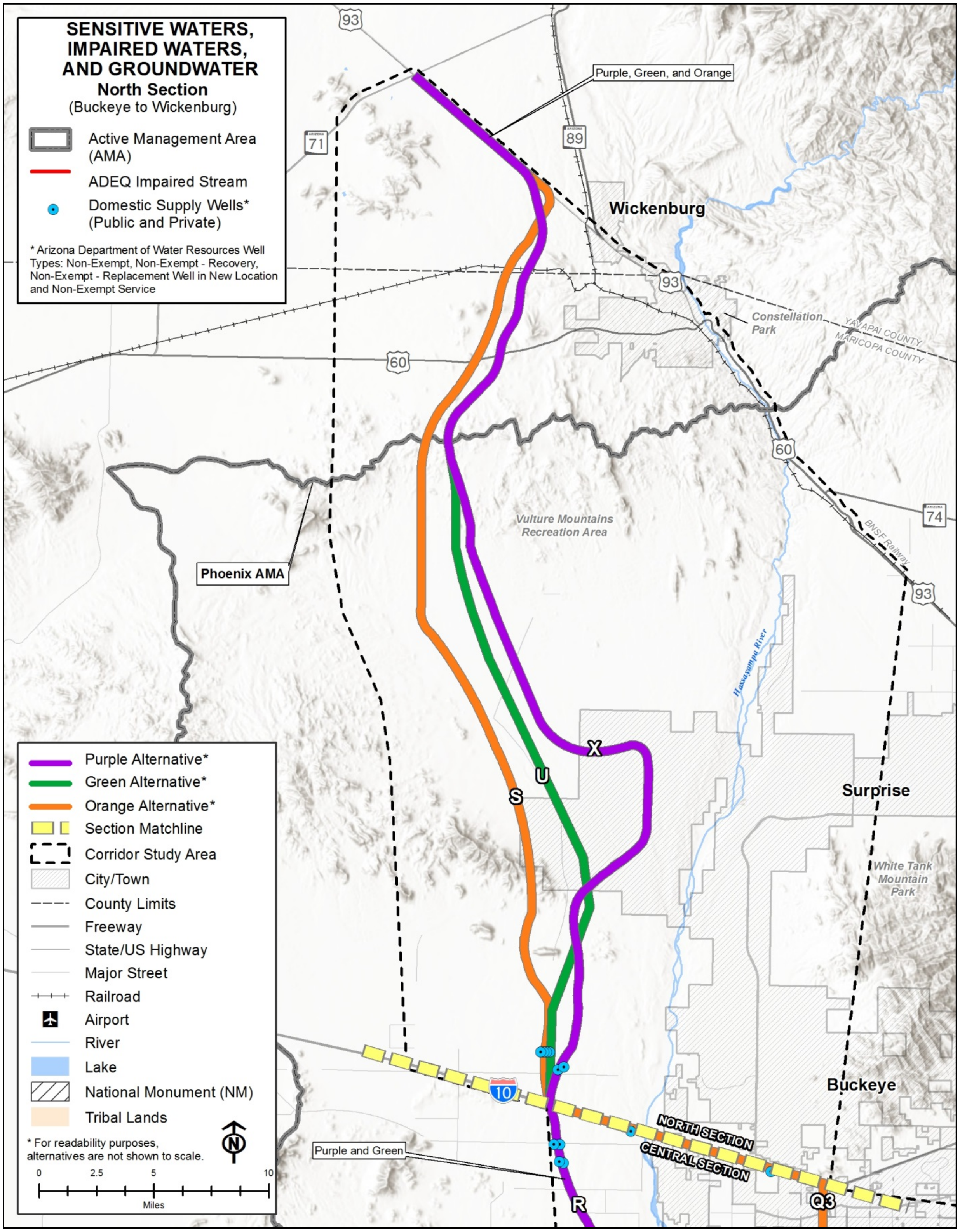

Figure E13-8 Sensitive Waters, Impaired Waters, and Groundwater – North Section

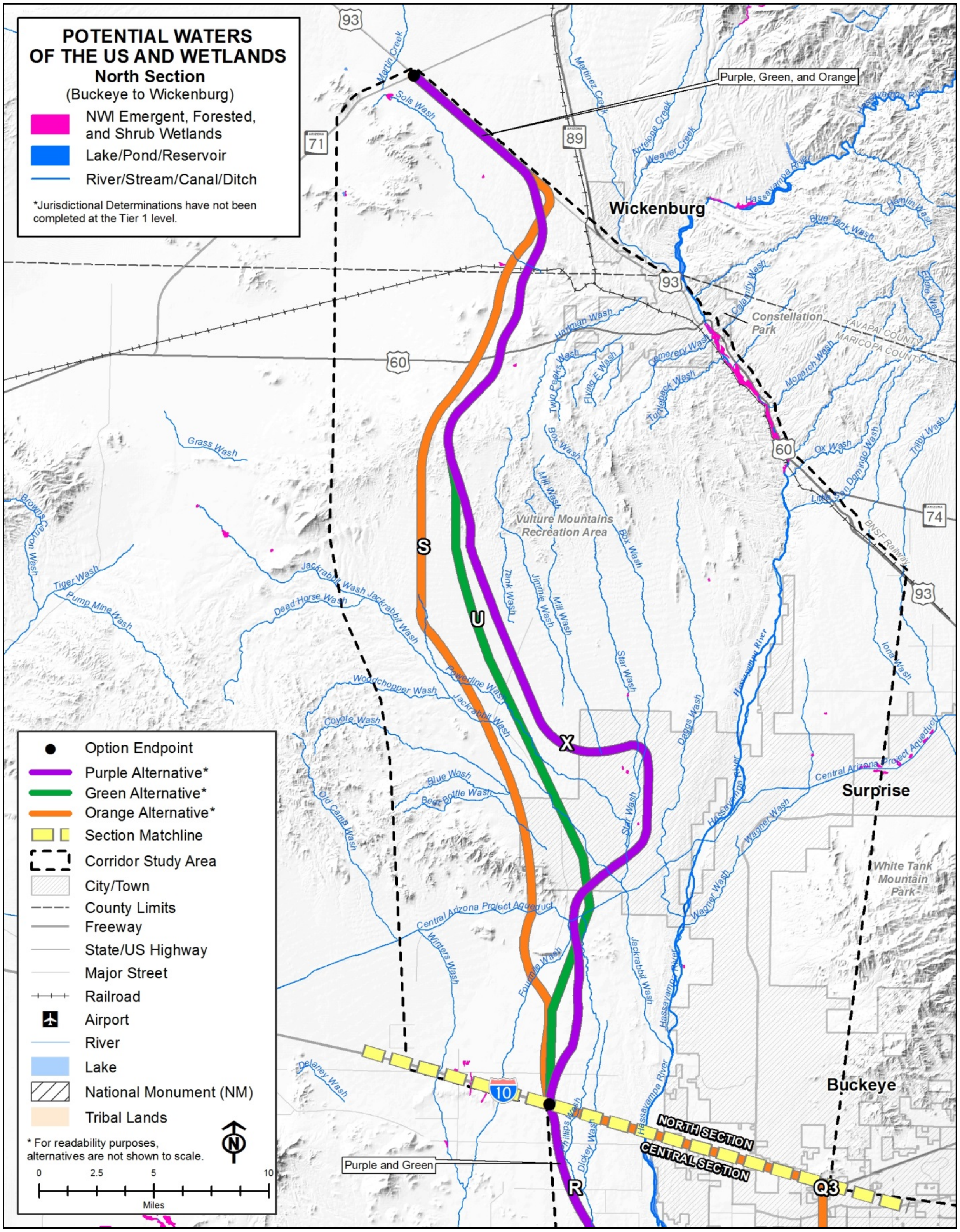

Figure E13-9 Potential Waters of the US and Wetlands – North Section

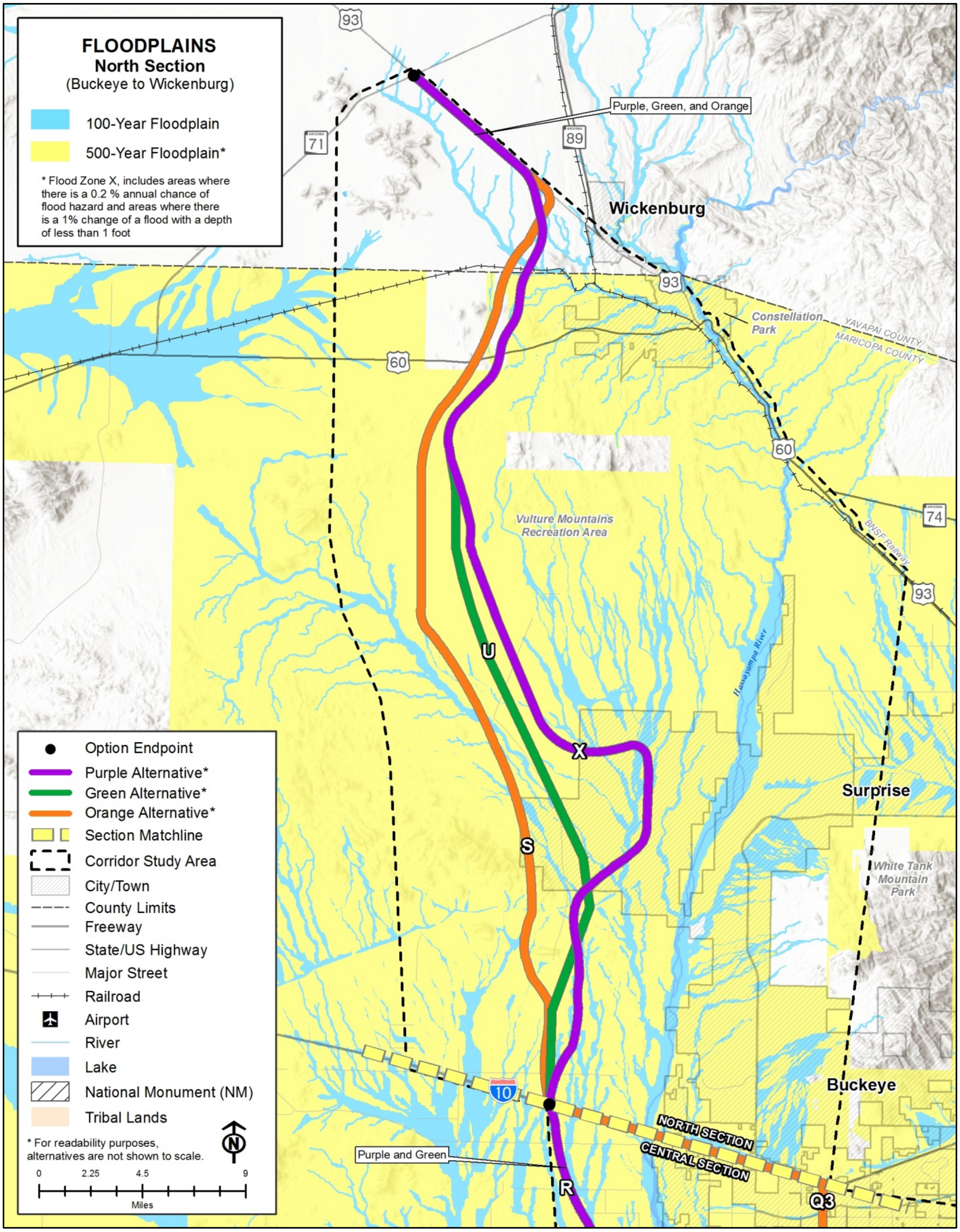

Figure E13-10 Floodplains – North Section

E13.4.3.4 Potential Waters of the US (North Section)

Water resources in the Analysis Area include an extensive network of perennial and ephemeral watercourses that flow into the lower Gila and Hassayampa Rivers. Within this area, most of the Salt and Lower Gila rivers are ephemeral and flow only in response to precipitation events (ADWR 2017b).

The Hassayampa River has surface flow during storm events and flows into the Gila River. The Hassayampa River is mostly intermittent but is perennial in its upper reaches and south of Wickenburg; some of its tributaries also have limited perennial stretches. Along most of its route, the Hassayampa River is a dry streambed, but water comes to the surface a few miles north of Wickenburg in Box Canyon and again downstream at the Hassayampa Preserve. South and downstream of Wickenburg, the river spreads out into a large riparian area. Tributaries to the Hassayampa River include Jackrabbit Wash, Powerline Wash, and Sols Wash. Tributaries to the Gila River include the Phillips Wash and the Fourmile Wash.

Aerial imagery indicates the presence of numerous other unnamed ephemeral washes throughout the North Section. In addition, the CAP canal flows east to west through the North Section. The Analysis Area contains the following ponds that range in size from 0.25 acre to about 2 acres:

- Owl Tank
- Divide Tank
- Black Hill Tank

These ponds, which are used for livestock watering, appear to be impoundments of ephemeral drainages, and may not be jurisdictional waters of the US. Specific permitting requirements, or lack thereof, would be determined during a Tier 2 analysis.

Figure E13-9 shows the potential waters of the US in the North Section, and **Table E13-12** (Potential Waters of the US within North Section Corridor Options) lists the linear feet of waters crossed in the North Section.

Table E13-12 Potential Waters of the US within North Section Corridor Options

Named Waterway	Linear Feet of Named Waterways Crossed by Corridor Option (1)		
	X	U	S
Beer Bottle Wash	0	0	3,217
Box Wash	2,904	3,116	0
Central Arizona Project Aqueduct	4,082	0	4,436
Fourmile Wash	686	0	2,367
Jackrabbit Wash	2,064	7,768	2,248
Mill Wash	1,547	0	0
Phillips Wash	86	5,221	0
Powerline Wash	0	15,435	11,289
Sols Wash	2,024	2,024	2,167
Star Wash	4,801	0	0
Total	**18,194**	**33,564**	**25,724**

(1) Rounded to the nearest linear foot.
SOURCES: Arizona State Land Department 1993; USGS 2007-2014.

E13.4.3.5 Wetlands (North Section)

Cowardin et al. (1979) wetland types within the Analysis Area include freshwater pond and riverine; other wetland types were not identified in the mapping for this portion of the Analysis Area. Tributaries to the Gila and Hassayampa rivers are mapped as riverine systems and also may be waters of the US, quantified in Section E13.4.3.4. **Table E13-13** (Wetlands within North Section Corridor Options) summarizes the acres of wetlands within the 2,000-foot-wide Corridor Options. **Figure E13-9** shows the location of potential waters of the US and NWI-mapped emergent, forested, and shrub wetlands. NWI-mapped riverine wetlands, lakes, and ponds are not displayed on **Figure E13-9** due to the limitations of the map scale; however, many of the NWI-mapped riverine wetlands, lakes, and ponds are near the major waterways as mapped by ADWR (2017) and shown on **Figure E13-9**.

Table E13-13 Wetlands within North Section Corridor Options

Wetland Type (2)	Wetland Acreage by Corridor Option (1)		
	X	U	S
Freshwater Pond	8	8	14
Riverine	118	117	128
Total	**126**	**125**	**142**

(1) Acres rounded to nearest acre.
(2) See Section E13.2 for a description of wetland type.
SOURCE: USFWS 2017.

E13.4.3.6 Floodplains (North Section)

Floodplains in the Analysis Area are predominantly associated with the Hassayampa River, its tributaries, and tributaries to the Gila River. The Hassayampa River is east of the Build Corridor Alternatives under evaluation in the North Section. Floodplains are associated with tributaries such as Powerline Wash, Sols Wash, and Jackrabbit Wash (which flow into the Hassayampa River), and Fourmile Wash and Phillips Wash (which flow into the Gila River). Floodways are present along the channels of the Hassayampa River, Jackrabbit Wash, and Star Wash. The estimated acreage of 100-year floodplain by Corridor Option in the North Section is shown in **Table E13-14** (Floodplains within North Section Corridor Options). **Figure E13-10** illustrates the 100- and 500-year floodplains in the North Section.

Table E13-14 Floodplains within North Section Corridor Options

Flood Zone (2)	Floodplain Acreage by Corridor Option (1)		
	X	U	S
A	740	367	868
AE	364	331	58
AH	47	36	5
Total	**1,151**	**734**	**931**

(1) Values are rounded to the nearest acre.
(2) Refer to Section E13.2 for flood zone definitions.
SOURCE: FEMA 2017.

E13.5 COMPARATIVE, QUALITATIVE ANALYSES OF CORRIDOR OPTIONS BY SECTION

E13.5.1 South Section

E13.5.1.1 Sensitive Water Resources (South Section)

The discussion of relative impacts to sensitive water resources in this section is based on the length of the Corridor Option, as well as the status of the corridor as new construction or co-located. Long, newly constructed corridors would be expected to have the greatest overall impacts to sensitive water resources, because they would result in the greatest amount of new impervious surface within the watershed, which could limit infiltration and increase runoff. Short, co-located corridors, on the other hand, would have a relatively small new area of impervious surface.

For the reasons outlined above, the new construction Corridor Options in the South Section (Options C, D, and F) would likely have the greatest impacts to sensitive water resources. Of the three co-located options in this section, Option B is the longest, for an overall moderate expected level of impact to sensitive water resources. Options A and G, which are co-located and relatively shorter, would have relatively lower impacts to sensitive water resources.

E13.5.1.2 Impaired Waters (South Section)

Option A would likely have the greatest impacts to impaired waters, given that it has the largest quantity of impaired waters located within 0.5 mile. Corridor Option B would have moderate impacts, whereas Options C, D, F, and G would have the lowest impacts as there are no mapped impaired waterways within 0.5 mile of these options.

E13.5.1.3 Groundwater Resources (South Section)

In general, Corridor Options that add more impervious surface would be expected to have higher impacts to groundwater due to increased runoff and reduced infiltration. Therefore, the new construction Corridor Options in the south section (Options C, D, and F) may have the greatest impacts to groundwater resources. Of the three co-located Corridor Options in this section, Option B is the longest and has the most wells within its corridor width, for a moderate level of impact to groundwater resources. Options A and C, which are co-located and have fewer wells identified within their corridor widths, would have relatively low impacts to groundwater resources.

E13.5.1.4 Potential Waters of the US (South Section)

In general, Corridor Options that parallel or cross major rivers multiple times would likely have the highest level of impacts to waters of the US. In these situations, it may be more difficult to avoid impacts than options that cross smaller tributaries (it is more feasible to span narrow tributaries rather than placing bridge abutments within the waterway). Therefore, the Corridor Options that may have the highest impacts to waters of the US are Options A and B (which parallel the Santa Cruz River) as well as Option F (which partially parallels the Santa Cruz River and has a new crossing of that resource). Moderate impacts are expected for Options C and D, which would have new crossings of smaller tributaries. Finally, Option G would have the lowest impacts to waters of the US. It is a co-located option with few major waterway crossings.

E13.5.1.5 Wetlands (South Section)

Options A, B, and F would likely have the highest impact to potential wetlands relative to the other Corridor Options. Although they are co-located, Options A and B parallel potential wetlands along the Santa Cruz River. Because the wetlands are parallel to the corridor and intersect it in numerous locations, it may be more difficult to avoid wetlands in Options A and B than in the other options. Similarly, Option F parallels potential wetlands along the Santa Cruz River and Los Robles Wash. Because Option F is not co-located, it would newly disturb those potential wetlands. Options C and D would likely have moderate impacts to wetlands. They have a few crossings of drainages with mapped riverine wetlands, but do not parallel a major riparian corridor for most of their length. Finally, Option G may have relatively low wetland impacts. It is entirely co-located, avoids major riparian corridors, and intersects the smallest acreage of mapped wetlands.

E13.5.1.6 Floodplains (South Section)

This analysis is based on floodplain acreage within each Corridor Option, the configuration of floodplains within the Corridor Option, and whether the Corridor Option is co-located. Options C, D, and F would likely have the highest potential to impact floodplains relative to the other

Corridor Options. None of these Corridor Options are co-located within an existing transportation ROW, and all three would unavoidably cross large mapped floodplains along the Santa Cruz River and its tributaries. Options A and B would have moderate potential to impact floodplains. These two co-located Corridor Options parallel the Santa Cruz River and partially overlap its floodplain, as well as those of tributaries. However, due to these options being co-located, the footprint of new disturbance in floodplains would likely be relatively small. Option G would have the lowest potential to impact floodplains. There is some mapped floodplain that overlaps the edges of the corridor, but not the entire corridor. Floodplain impacts may be avoidable for much of the corridor. It also is a co-located option, so if there are some floodplain impacts they would likely be minimal.

E13.5.1.7 Study Area Overview (South Section)

Table E13-15 (Comparative Water Resource Impacts in the South Section by Corridor Option) summarizes relative impacts to water resources for the South Section Corridor Options.

Table E13-15 Comparative Water Resource Impacts in the South Section by Corridor Option

Corridor Options	Relative Impact					
	A	B	C	D	F	G
Surface Water – Sensitive Resources	L	M	H	H	H	L
Surface Water – Impaired Waters	H	M	L	L	L	L
Groundwater	L	M	H	H	H	L
Potential Waters of the US	H	H	M	M	H	L
Wetlands	H	H	M	M	H	L
Floodplains	M	M	H	H	H	L

NOTE: L = Low Impact; M = Moderate Impact; H = High Impact.

E13.5.2 Central Section

E13.5.2.1 Sensitive Water Resources (Central Section)

In general, Corridor Options that add more impervious surface would be expected to have higher impacts to sensitive water resources due to increased runoff and reduced infiltration. Therefore, the new construction Corridor Options in the Central Section (Options L, M, N, and R) would likely have the greatest impacts to sensitive water resources. Of the seven co-located options in this section, Options K and Q1 are the longest and would therefore be expected to have moderate impacts to sensitive water resources. Options I1, I2, H, Q2, and Q3 are relatively short, co-located options and may, therefore, have the lowest impacts.

E13.5.2.2 Impaired Waters (Central Section)

Option R is located along a 4,340-foot reach of the Hassayampa River that is impaired due to *E. coli* and selenium. In addition, Option Q2 includes an 8,918-foot section of the Gila River that is impaired due to selenium. During construction, additional contributions of selenium could occur during stormwater runoff from disturbed soils. Option R would have moderate impacts and Option Q2 would have the highest impacts to impaired waters, based on length of impaired waters within 0.5 mile. As none of the other Corridor Options have impaired waters within 0.5 mile, these options would have relatively low impacts on impaired waters.

E13.5.2.3 Groundwater Resources (Central Section)

In general, Corridor Options that add more impervious surface would be expected to have higher impacts to groundwater resources due to increased runoff and reduced infiltration. Therefore, the new construction Corridor Options in the Central Section (Options L, M, N, and R) would likely have the greatest impacts to groundwater resources. Of the seven co-located options in this section, Options K and Q1 are the longest and would, therefore, have moderate impacts to groundwater resources. Options I1, I2, H, Q2, and Q3 are relatively short, co-located options and would, therefore, have the lowest impacts to groundwater resources.

E13.5.2.4 Potential Waters of the US (Central Section)

Corridor Options that parallel or cross major rivers multiple times would likely have the greatest impacts to waters of the US. In these situations, it may be more difficult to avoid impacts than options that cross smaller tributaries (it is more feasible to span narrow tributaries rather than placing bridge abutments within the waterway). Therefore, the Corridor Options that may have the highest impacts to waters of the US are Options N and R. Neither of these options are co-located, and they would have unavoidable new crossings of waters of the US. Option N crosses and partially parallels the Gila River. Option R crosses the Hassayampa River and crosses and partially parallels Luke Wash. Options K, Q2, and Q3 would have moderate potential impacts on waters of the US. These are co-located options that have some unavoidable crossings of major drainages, but do not parallel major rivers. Options H, I1, I2, L, M, and Q1 would have the lowest potential to impact waters of the US. These Corridor Options have fewer crossings of major streams and rivers compared with the other options.

E13.5.2.5 Wetlands (Central Section)

Options N and R would have the highest potential to impact wetlands relative to the other Corridor Options. Neither of these options are co-located, and they would have unavoidable new disturbance in potential wetlands. Option N would potentially impact wetlands along Waterman Wash and Lum Wash. In addition, it crosses and partially parallels mapped potential riverine wetlands along the Gila River. Option R would cross the Hassayampa River and potentially impact associated riverine wetlands, and it also would cross and partially parallel potential wetlands along Luke Wash. Options K, Q2, and Q3 would have moderate potential wetland impacts. These are co-located options that have some unavoidable crossings of major drainages with associated potential wetlands. However, they do not parallel major riverine wetland systems. Options H, I1, I2, L, M, and Q1 would have the lowest potential to impact wetlands. These Corridor Options either have relatively few mapped wetlands within the corridor or potential wetlands occur primarily on the edges of the corridor, so avoidance potential is high.

E13.5.2.6 Floodplains (Central Section)

Options N and R would likely have the highest potential to impact floodplains relative to the other Corridor Options. Neither of these two options are co-located, and they would have a relatively high amount of new disturbance within mapped floodplains. Options H, L, M, Q2, and Q3 would have moderate potential to impact floodplains. These options would unavoidably cross some areas of mapped floodplain, but they are either co-located (Options H, Q2, and Q3) or the floodplains they impact would be relatively small, discrete crossings of ephemeral or intermittent tributaries (Options L and M). Options I1, I2, K, and Q1 would have relatively low potential impacts on floodplains. These Corridor Options are either co-located or partially co-located and have relatively little mapped floodplain within their corridors.

E13.5.2.7 Study Area Overview (Central Section)

Table E13-16 (Comparative Water Resource Impacts in the Central Section by Corridor Option) summarizes the relative impacts to water resources associated with each of the Central Section Corridor Options.

Table E13-16 Comparative Water Resource Impacts in the Central Section by Corridor Option

Corridor Options	Relative Impact									
	H	I	K	L	M	N	Q1	Q2	Q3	R
Surface Water – Sensitive Resources	L	L	M	H	H	H	M	L	L	H
Surface Water – Impaired Waters	L	L	L	L	L	L	L	H	L	M
Groundwater	L	L	M	H	H	H	M	L	L	H
Potential Waters of US	L	L	M	L	L	H	L	M	M	H
Wetlands	L	L	M	L	L	H	L	M	M	H
Floodplains	M	L	L	M	M	H	L	M	M	H

NOTE: L = Low Impact; M = Moderate Impact; H = High Impact.

E13.5.3 North Section

E13.5.3.1 Sensitive Water Resources (North Section)

In general, Corridor Options that add more impervious surface would be expected to have higher impacts to sensitive water resources due to increased runoff and reduced infiltration. In the North Section, all three Corridor Options would be new corridors, with X being the longest and U being the shortest. Because Option X would add the most impervious surface, this option would have the relatively highest impacts on sensitive water resources. As the shortest route and the least amount of new impervious surface, Option U would have the relatively lowest impacts on sensitive water resources. Option S would have a moderate level of impacts relative to the other two options.

E13.5.3.2 Impaired Waters (North Section)

As there are no impaired waters identified in the North Section Analysis Area, no impacts are anticipated for any of the Corridor Options.

E13.5.3.3 Groundwater Resources (North Section)

In general, Corridor Options that add more impervious surface would be expected to have higher impacts to groundwater resources due to increased runoff and reduced infiltration. In the North Section, all three Corridor Options would be new corridors, with Option X being the longest and Option U being the shortest. Because Option X would add the most new impervious surface on the landscape, this option would have the relatively highest impacts on groundwater resources. As the shortest route and the least amount of new impervious surface, Option U would have the relatively lowest impacts on groundwater resources. Option S would have a moderate level of impact relative to the other two options.

E13.5.3.4 Potential Waters of the US (North Section)

In general, Corridor Options that parallel or cross major rivers multiple times would likely have the highest level of impacts to waters of the US. In these situations, it may be more difficult to avoid impacts than options that cross smaller tributaries (it is more feasible to span narrow tributaries rather than placing bridge abutments within the waterway). In the North Section, Corridor Option U crosses and nearly parallels several major washes, including Powerline Wash, Jackrabbit Wash, and Phillips Wash. It also has the highest overall stream length within its 2,000-foot-wide corridor. Therefore, Option U would likely have the highest potential impacts to waters of the US. Option S would unavoidably cross Jackrabbit and Powerline Wash, but it has less overall length of stream within its 2,000-foot-wide corridor compared to Option U. Therefore, Option S would have a moderate impact to waters of the US. Finally, Option X has the shortest stream length within its 2,000-foot-wide corridor, and compared with the other two options it bends to the east, where it has perpendicular, rather than parallel, crossings of major washes. This option may have the greatest potential to avoid waters of the US and therefore was rated as having the lowest impact.

E13.5.3.5 Wetlands (North Section)

As there are few mapped wetlands in the North Section, the relative impact for the different Corridor Options was based on the potential impact to mapped drainages. As the mapped drainages may have associated wetlands that are not included in the NWI data, the impacts to drainages were used to supplement the NWI wetland information for this section.

As described above, Option U crosses and nearly parallels several major washes, including Powerline Wash, Jackrabbit Wash, and Phillips Wash. It also has the highest overall stream length within its 2,000-foot-wide corridor. Therefore, Option U would likely have the highest potential impacts to wetlands. Option S would unavoidably cross Jackrabbit and Powerline Wash, but it has a shorter length of stream within its 2,000-foot-wide corridor compared to Option U. Therefore, Option S would have a moderate impact to potential wetlands. Finally, Option X has the shortest mapped stream length within its 2,000-foot-wide corridor, and compared with the other two options it bends to the east, where it makes perpendicular, rather than parallel, crossings of major washes. This option may have the greatest potential to avoid wetlands and therefore was rated as having the lowest impact.

E13.5.3.6 Floodplains (North Section)

Since all three Corridor Options in the North Section would be new corridors, this impact analysis was based on the acreage of mapped floodplain within the Corridor Options. Option X may have the highest potential to impact floodplains relative to the other options, as it crosses the greatest area of mapped floodplain. Option S would have a moderate potential to impact floodplains, while Option U would have the lowest potential.

E13.5.3.7 Study Area Overview (North Section)

Table E13-17 (Comparative Water Resource Impacts in the North Section by Corridor Option) summarizes the relative impacts to water resources associated with each of the North Section Corridor Options.

Table E13-17 Comparative Water Resource Impacts in the North Section by Corridor Option

Corridor Options	Relative Impact		
	S	U	X
Surface Water – Sensitive Resources	M	L	H
Surface Water – Impaired Waters	None – no affected resources	None – no affected resources	None – no affected resources
Groundwater	M	L	H
Potential Waters of the US	M	H	L
Potential Wetlands	M	H	L
Floodplains	M	L	H

NOTE: L = Low Impact; M = Moderate Impact; H = High Impact.

E13.6 ENVIRONMENTAL CONSEQUENCES OF THE BUILD CORRIDOR ALTERNATIVES AND NO BUILD ALTERNATIVE

The focus of this Draft Tier 1 analysis was to identify potential impacts common to all Build Corridor Alternatives, compared with the No Action Alternative, and to evaluate how the impacts vary among the alternatives. The end-to-end alternative analysis in this section builds upon the quantitative and qualitative comparison of the Corridor Options presented in Section E13.5. An alternative that has relatively greater potential impacts along each of its Corridor Options could be expected to have relatively greater impacts overall.

E13.6.1 Impacts Common to All Build Corridor Alternatives

E13.6.1.1 Sensitive Water Resources

All Build Corridor Alternatives could have short- and long-term impacts on water quality within sensitive water resources. Short-term impacts during the construction of a Build Corridor Alternative could include soil erosion from stormwater runoff. Due to vegetation removal during construction activities, stormwater runoff may be temporarily increased. Also, excavation and grading during construction could increase the risk of erosion and sedimentation of nearby waterbodies. Construction also could necessitate placement of temporary fills or diversions for access of personnel and equipment. These features could shift stormwater runoff patterns or temporarily constrict flow within stream channels, which could change rates of erosion and channelization.

Long-term impacts on water quality could occur due to fill material being placed in water resources, or changes in sediment deposition due to the construction of bridges and culverts or culvert extensions. Additional potential direct effects on water quality could include increased or decreased runoff and stormwater discharge caused by changes in the area of impervious surfaces, increased or decreased contribution of automotive-based nonpoint source contamination, and impacts on areas of groundwater discharge or infiltration.

Stream crossings and canal crossings create the potential for stormwater runoff that may cause pollutants to enter a waterway. For major streams, such as the Santa Cruz, Gila, and Hassayampa rivers, during periods of water flow, pollutants may impact water resources for several miles downstream of the crossings. Similarly, pollutants may move farther downstream in canals that carry water more frequently than ephemeral streams or washes. Crossings may constrict or block natural stream flows which could result in erosion. The location of stream crossings in relation to the watershed would provide an indication of how much of the waterways and watershed may be affected. Discharge of pollutants into the headwaters of a creek could affect the entire creek system, while discharge into the lower reaches could impact less of the system and may benefit from dilution effects of higher flows.

In locations where a Build Corridor Alternative is parallel to a stream or canal, its implementation would increase the area from which constituents could be conveyed by runoff. Construction of any Build Corridor Alternative would result in an increase in the overall area of impervious surface area within the associated watershed, which would result in increases in localized runoff compared to existing conditions or the No Build Alternative. Generally, runoff contains sediment or pollutants in quantities that could impact water quality. For example, runoff from paved surfaces would carry particulate matter from tire wear, oils, and greases from vehicles, and would be expected to include urban litter, such as paper and plastic materials.

E13.6.1.2 Impaired Waters

The Build Corridor Alternatives cross or parallel several impaired streams. Most impairments are listed for chlorides (salts), selenium, cadmium, ammonia, low dissolved oxygen, or *E.coli*. Impairments within the Study Area are primarily related to mining, agricultural runoff, municipal, and industrial discharges, with transportation a minor contributor (ADEQ 2018). Increases in runoff from construction (temporary), or new or widened highways could impact those streams. For example, if soils are high in selenium or chlorides (from salts), erosion of soils during or after construction could increase loading in the adjacent streams. Cadmium, a minor but common metal in highway storm runoff, is listed as a cause for impairment of a few streams. Nutrients in soils (nitrogen or phosphorous) or use of ammonia-based fertilizers may impact streams listed for ammonia or low dissolved oxygen. At rest stations, *E.coli* from poorly maintained septic systems, or more commonly from dog waste, can be high.

E13.6.1.3 Groundwater Resources

The potential for impacting (or contaminating) groundwater supply wells depends on well construction, proximity to potential sources, and geological conditions. Effects on wells may include physical damage to the well casing or wellhead, restriction in access to the wellhead, restricted use of the well, and/or administrative barriers to the well or use of the well. Operational impacts on existing wells may include restricted access to the well casing or wellhead, restricted use of the well, and safety issues associated with access to or use of the well.

Groundwater quantity and quality could be affected by construction activities. Increasing the impermeable ground surface could result in a decrease in groundwater recharge. Groundwater quality could be degraded by spills or inadvertent discharges during construction. Where groundwater from municipal, private, and individual wells is the principal source of potable water, road surface stormwater runoff from a new or widened roadway could impact drinking water in the area if it infiltrates the aquifers.

E13.6.1.4 Potential Waters of the US, including Wetlands

Impacts to potential waters of the US, including potential wetlands, would vary depending where the transportation facility and interchanges are sited within a Build Corridor Alternative. Potential waters of the US and wetlands could be directly affected during construction by cut slopes, fills (including structural fills such as bridge piers and culverts), diversions required to construct drainage slopes, or other transportation facilities. Short-term, temporary impacts could occur during construction activities such as clearing ground for staging areas, access routes, and diversions of surface flow. Although temporary, local diversions of surface water flows could alter local sediment deposits in waters of the US; sediment would be redistributed during storm events. Temporary construction impacts could include soil disturbance and pollutant loading of stormwater runoff. These impacts would cease after construction was completed and final stabilization had occurred.

Permanent impacts to potential waters of the US, including wetlands, could result from construction activities. Placement of fill material and structures within streams could permanently alter stream contours and result in the loss of wetlands. Impacts to potential waters of the US from the operation of transportation facilities, should a Build Corridor Alternative ultimately be selected and constructed, could include alteration of surface flow or localized sediment introduction due to maintenance activities.

E13.6.1.5 Floodplains

Floodplains within any of the Build Corridor Alternatives could be affected by an increase in impervious surface, constriction or blockage of surface water flow, and the placement of fill or structure within a waterway or floodplain. Placement of fill within a floodplain could increase base flood elevation and exacerbate flooding downstream.

E13.6.2 No Build Alternative

Under the No Build Alternative, a new I-11 transportation corridor would not be constructed. Vehicles would continue to utilize the existing transportation network in the I-11 Corridor Project Analysis Area. Sections of I-10 in Pinal County would be widened and intersections, such as Ina Road, would be improved in the South Section. Pavement preservation and other maintenance projects also would be implemented. These projects could have localized impacts on water resources, such as placement of fill within waters of the US, wetlands, and floodplains, and may increase impervious surfaces in some areas which could change the patterns of runoff and groundwater infiltration. Additionally, stormwater runoff would continue to affect water resources and their quality. Overall, effects of the No Build Alternative would likely be more localized and discrete compared to those of the Build Corridor Alternatives.

E13.6.3 Comparison of Build Corridor Alternatives

E13.6.3.1 Sensitive Water Resources

Overall, impacts on sensitive water resources are expected to be the lowest for the Orange Alternative and highest for the Green Alternative. The Orange Alternative has the most Corridor Options located within existing transportation ROW and would, therefore, have the lowest amount of new impervious surface. This would result in the lowest anticipated amount of new runoff compared with the other two Build Corridor Alternatives. However, the Orange Alternative would still have higher impacts than the No Build Alternative as it would add more impervious surface than the No Build option.

E13.6.3.2 Impaired Waters

Overall, the Purple Alternative is anticipated to have lower impacts to impaired waters than the other two Build Corridor Alternatives, while the Green Alternative is anticipated to have the highest impacts. Not only would the Green Alternative primarily be a new corridor, it has the highest quantity of impaired stream reaches in its Analysis Area. These include impaired reaches of the Santa Cruz, Hassayampa, and Gila rivers. The Orange Alternative, while it is largely co-located, has an impaired reach of the Gila River and an impaired reach of the Santa Cruz River in its Analysis Area. Compared with the other two Build Corridor alternatives, the Purple Alternative has the fewest impaired stream reaches within its Analysis Area. All of the

Build Corridor Alternatives are expected to have higher impacts on impaired waters than the No Build Alternative.

E13.6.3.3 Groundwater Resources

Overall, impacts on groundwater resources are expected to be lowest for the Orange Alternative and highest for the Green Alternative. The Orange Alternative has the most Corridor Options located within existing transportation ROW and would, therefore, have the lowest amount of new impervious surface. This would result in the lowest amount of new runoff compared with the other two Build Corridor Alternatives. However, the Orange Alternative would still have higher impacts than the No Build Alternative as it would add more impervious surface than the No Build option.

It should be noted that although the impacts to groundwater are anticipated to be lower under the Orange Alternative, this alternative has the potential to impact more wells that are used for public water supplies, water for domestic livestock, monitoring, and geotechnical information, relative to the other Build Corridor Alternatives.

E13.6.3.4 Potential Waters of the US, including Wetlands

Overall, the Purple Alternative would have the lowest impacts on potential waters of the US, including wetlands, while the Green Alternative would have the highest impacts. The Green Alternative would involve a substantial amount of new ground disturbance and new crossings of major rivers, including the Santa Cruz River and Hassayampa River. These new crossings also could impact nearby associated potential wetlands through the placement of fill material or runoff. The Orange Alternative, while it includes the greatest length of co-located corridor, also parallels and crosses the Santa Cruz River for a substantial distance in the South Section. Therefore, it may be difficult to site this corridor to fully avoid this major waterway and its associated wetlands.

The Purple Alternative includes both co-located and new Corridor Options. In the South Section, it routes to the west and avoids much of the Santa Cruz River, which would potentially be impacted in the Orange Alternative. In the Central Section, it includes new crossings of the Hassayampa and Gila Rivers; however, in the North Section it parallels and/or crosses fewer streams than the other two Build Corridor Alternatives. Therefore, the Purple Alternative impacts on potential waters of the US, including wetlands, are anticipated to be the lowest, followed by the Orange Alternative and the Green Alternative. All three Build Corridor Alternatives would have greater impacts on potential waters of the US than the No Build Alternative, as all three would result in more ground disturbance and new crossings of waterways.

E13.6.3.5 Floodplains

Overall, the Green Alternative would have the highest impacts on floodplains, followed by the Purple Alternative and the Orange Alternative. As a mostly new corridor, the Green Alternative would result in the greatest amount of new structural fill being placed within mapped floodplains, which would change flood elevations, constrict waterways, and potentially exacerbate downstream flooding. The Orange Alternative would result in the least amount of new fill within mapped floodplains, both because it is mostly co-located and also due to the configuration of floodplains in relation to the corridor. The Purple Alternative would be intermediate between these two. All of the Build Corridor Alternatives would have higher impacts on floodplains than the No Build Alternative.

E13.6.4 Environmental Consequences Summary

Table E13-18 (Water Resources Impact Summary Table) ranks the relative impacts to water resources for the three Build Corridor Alternatives as well as the No Build Alternative.

Table E13-18 Water Resources Impact Summary Table

Resource	Relative Impact			
	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
Surface Water – Sensitive Resources	N	M	H	L
Surface Water – Impaired Waters	N	L	H	M
Groundwater	N	M	H	L
Potential Waters of the US	N	L	H	M
Potential Wetlands	N	L	H	M
Floodplains	N	M	H	L

NOTE: N = Negligible Impact; L = Low Impact; M = Moderate Impact; H = High Impact.

A comparison of the potential impacts of each Build Corridor Alternative on the water resources in the Analysis Area indicates that overall, the Green Alternative would be the most impactful alternative based on the quantified data presented in Section E13.4 and the comparative, qualitative analysis in Sections E13.5 and E13.6. In general, this is because the Purple Alternative and Orange Alternative share more Corridor Options with existing transportation facilities, meaning that there would be fewer new water resources impacted. Conversely, the Green Alternative is primarily on a new corridor meaning that water resources impacted include a higher number of resources that were not previously affected by transportation facilities. For example, should the Orange Alternative be selected, bridges over waterways would likely need to be widened. However, should the Green Alternative be selected there would be new waterway crossings in areas that do not currently have a bridge.

E13.6.5 Potential Mitigation Strategies

Mitigation strategies for all alternatives include avoidance, minimization, and mitigation. Avoidance can be accomplished by shifting the footprint away from sensitive resources to the extent possible. For example, if a riverine wetland is located on one side of the 2,000-foot-wide corridor, shifting the Build Corridor towards the other side might avoid, or could at least minimize, impacts to the wetland. Similarly, a shift away from a high-hazard floodplain area could avoid or minimize impacts to the floodplain. Corridor shifts will depend on many other factors, including design standards and balancing impacts to other environmental resources.

Impact minimization could be accomplished through temporary Best Management Practices (BMPs) during construction, permanent BMPs after construction, and adherence to federal and state water quality requirements. AZPDES permits require that projects be designed to protect waters of the US. The Construction General Permit requires that erosion control BMPs be implemented and that a Stormwater Pollution Prevention Plan be prepared for construction activities exceeding 1.0 acre of ground disturbance. In addition to state and federal protections of water quality, Pima County, ADOT, City of Phoenix, and City of Tucson are Phase I MS4 permittees. Each MS4 permittee must develop and enforce a Stormwater Management Program to address stormwater discharge quality. Each program includes control measures (such as the permanent BMPs noted below) to minimize the discharge of pollutants in runoff.

Construction-phase BMPs include both structural and non-structural practices. Examples of structural practices include using perimeter BMPs around the work area to capture sediment; using a tracking pad so that equipment will not carry sediment onto roadway surfaces; slowing runoff to minimize erosion; and limiting the work area to avoid sensitive areas such as wetlands. BMPs to minimize wetland impacts also include placing protective material over wetlands before any temporary fill or equipment crossings occur, then removing all materials after work is completed to reestablish vegetation. Nonstructural BMPs include daily sweeping of adjacent roadways to pick up sediment that the tracking pads do not catch and stabilizing disturbed areas as soon as possible after work is completed.

Permanent BMPs are mainly structural. They are designed to slow stormwater runoff and retain pollutants. For example, check dams can slow water before it enters waterways or wetlands. Retention ponds hold water long enough to allow sediments to settle out. Sediments commonly carry other pollutants (such as metals), so removing them lowers impacts to water resources.

Long-term measures such as limiting use of fertilizers along highways or at rest stops also would lower potential impacts on water quality. Locating rest stops away from streams, and providing bags (and regulations) for picking up dog waste, would limit impacts for both *E. coli* and nutrients.

Where avoidance or minimization are not feasible, mitigation could be implemented. For example, if a groundwater well were impacted by interstate construction, well abandonment and compensation (for example, financial compensation, drilling a new well, or providing a municipal connection) might be required. For activities subject to Section 404 permitting, the USACE often requires a 3-to-1 or greater replacement of permanently impacted jurisdictional wetlands. Mitigation for flooding potential would be addressed where avoidance and minimization of floodplain areas are not feasible. Proposed encroachments in a 100-year floodplain area would require coordination with local floodplain administrators to discuss floodplain development permitting and potential mitigation measures. County flood control districts require a FUP in cases where a project encroaches into a jurisdictional floodplain. Approval of a FUP typically requires development of a hydraulic computer model to demonstrate that any structures, berms or other facility components located within the floodplain will not result in increased potential for flooding or erosion. The following county flood control districts would evaluate FUPs during a Tier 2 project assessment:

- Santa Cruz County Flood Control District;
- Pima County Regional Flood Control District;
- Pinal County Flood Control District;

- Flood Control District of Maricopa County; and
- Yavapai County Flood Control District

Mitigation measures for floodplain impacts would be required to comply with all levels of regulation.

E13.6.5.1 Future Tier 2 Analysis

The purpose of the I-11 Tier 1 Environmental Impact Statement is to assess impacts related to three Build Alternatives and the No Build alternative. Tier 2 NEPA reviews will require more detailed analysis of water resource and floodplain impacts within refined roadway alignments. Tier 2 NEPA analysis will include conceptual design which will be used to avoid, minimize, and mitigate impacts to water resources. It also will include field delineation of wetlands, determination of which waters of the US and wetlands are jurisdictional under the USACE definition, identification of Section 404 permitting requirements, coordination with the USEPA regarding SSA impacts, and focus on the relative values of different water resources including water quality, wetlands, and floodplains.

Potential avoidance and minimization of impacts on 100-year floodplains would be further evaluated in the Tier 2 NEPA studies. Any proposed encroachments in a 100-year floodplain area would require coordination with local floodplain administrators to discuss floodplain development permitting and potential mitigation measures. Tier 2 analysis will include assessment of impacts to high-hazard flood areas versus low-hazard (500-year-flood zone) areas. In addition, floodplain areas that have not been categorized will be assessed in more detail, for better comparisons.

The Tier 1 analysis has noted differences among the three Build Corridor Alternatives for co-location of major river crossings versus new crossings. Tier 2 analysis will further quantify those impacts. The Tier 1 analysis has listed several Phase I MS4 jurisdictions, each of which may have differing approaches to reducing impacts to the maximum extent practicable. Tier 2 analysis will assess which MS4 applies in which area, and whether any small operators (Phase II MS4s) are impacted by the Build Alternatives. All of the Build Corridor Alternatives cross the Upper Santa Cruz-Avra Basin SSA in the South Section of the Corridor Analysis Area. However, both Options C (Purple Alternative) and D (Green Alternative) are within 0.5 mile of the Upper Santa Cruz-Avra Basin recharge ponds.

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