US Army Corps
of Engineers
Los Angeles District

Little Colorado River at Winslow, Navajo County, Arizona

Flood Risk Management Feasibility Study

APPENDIX J

Clean Water Act 404(b)(1) Evaluation

October 2018

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LITTLE COLORADO RIVER AT WINSLOW DRAFT CLEAN WATER ACT SECTION 404(b)(1) EVALUATION

1.0 Clean Water Act Section 404(b)(1) Regulatory Background

Section 404 of the Clean Water Act (CWA) governs the discharge of dredged or fill material into waters of the U.S. (waters of the US). Although the U.S. Army Corps of Engineers (Corps) does not process and issue permits for its own activities, the Corps authorizes its own discharges of dredged or fill material by applying all applicable substantive legal requirements, including application of the Section 404(b)(1) Guidelines, 33 C.F.R. 336.1(a).

Under the Section 404(b)(1) Guidelines, an analysis of practicable alternatives is the primary tool used to determine whether a proposed discharge is prohibited. The Section 404(b)(1) Guidelines prohibit discharges of dredged or fill material into waters of the US if a practicable alternative to the proposed discharge exists that would have less adverse impacts on the aquatic ecosystem, including wetlands, as long as the alternative does not have other significant adverse environmental impacts (40 C.F.R. 230.10(a)). An alternative is considered practicable if it is available and capable of being implemented after considering cost, existing technology, and logistics in light of the overall project purpose (40 C.F.R. 230.10(a)(2)). The Section 404(b)(1) Guidelines follow a sequential approach to project planning that considers mitigation measures only after the project proponent shows no practicable alternatives are available to achieve the overall project purpose with less environmental impacts. Once it is determined that no practicable alternatives are available, the guidelines then require that appropriate and practicable steps be taken to minimize potential adverse effects on the aquatic ecosystem (40 C.F.R. 230.10(d)). Such steps may include actions controlling discharge location, material to be discharged, the fate of material after discharge or method of dispersion, and actions related to technology, plant and animal populations, or human use (40 C.F.R. 230.70-230.77).

Beyond the requirement for demonstrating that no practicable alternatives to the proposed discharge exist, the Section 404(b)(1) Guidelines also require the Corps to compile findings related to the environmental impacts of discharge of dredged or fill material. The Corps must make findings concerning the anticipated changes caused by the discharge to the physical and chemical substrate and to the biological and human use characteristics of the discharge site.

These guidelines also indicate that the level of effort associated with the preparation of the alternatives analysis be commensurate with the significance of the impact and/or discharge activity (40 C.F.R. 230.6(b)).

2.0 Basic and Overall Project Purpose

2.1 Basic Project Purpose

Where the activity associated with a discharge which is proposed for a special aquatic site (e.g., wetland, riffle pool, tidal marsh, etc.) does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not "water dependent"), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise. In addition, where a discharge is proposed for a special aquatic site, all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise. The basic project purpose comprises the fundamental, essential, or irreducible purpose of the proposed project. For purposes of this evaluation, the basic project purpose is flood risk minimization. Because there are no special aquatic sites within the project area, the rebuttable presumptions do not apply.

2.2 Overall Project Purpose

The overall project purpose serves as the basis for the Corps' section 404(b)(1) alternatives analysis and is determined by further defining the basic project purpose in a manner that more specifically describes the goals and accounts for logistical considerations for the project, and which allows a reasonable range of alternatives to be analyzed. It is critical that the overall project purpose be defined to provide for a meaningful evaluation of alternatives. It should not be so narrowly defined as to give undue deference to the preferred alternative, thereby unreasonably limiting the consideration of alternatives. Conversely, it should not be so broadly defined as to render the evaluation unreasonable and meaningless.

The overall purpose of the proposed action is to reduce risk of property damages and the life, safety, and health risks caused by flooding from the Little Colorado River (LCR) to the City of Winslow, surrounding community, and public and private infrastructure.

2.3 Study Area and Location

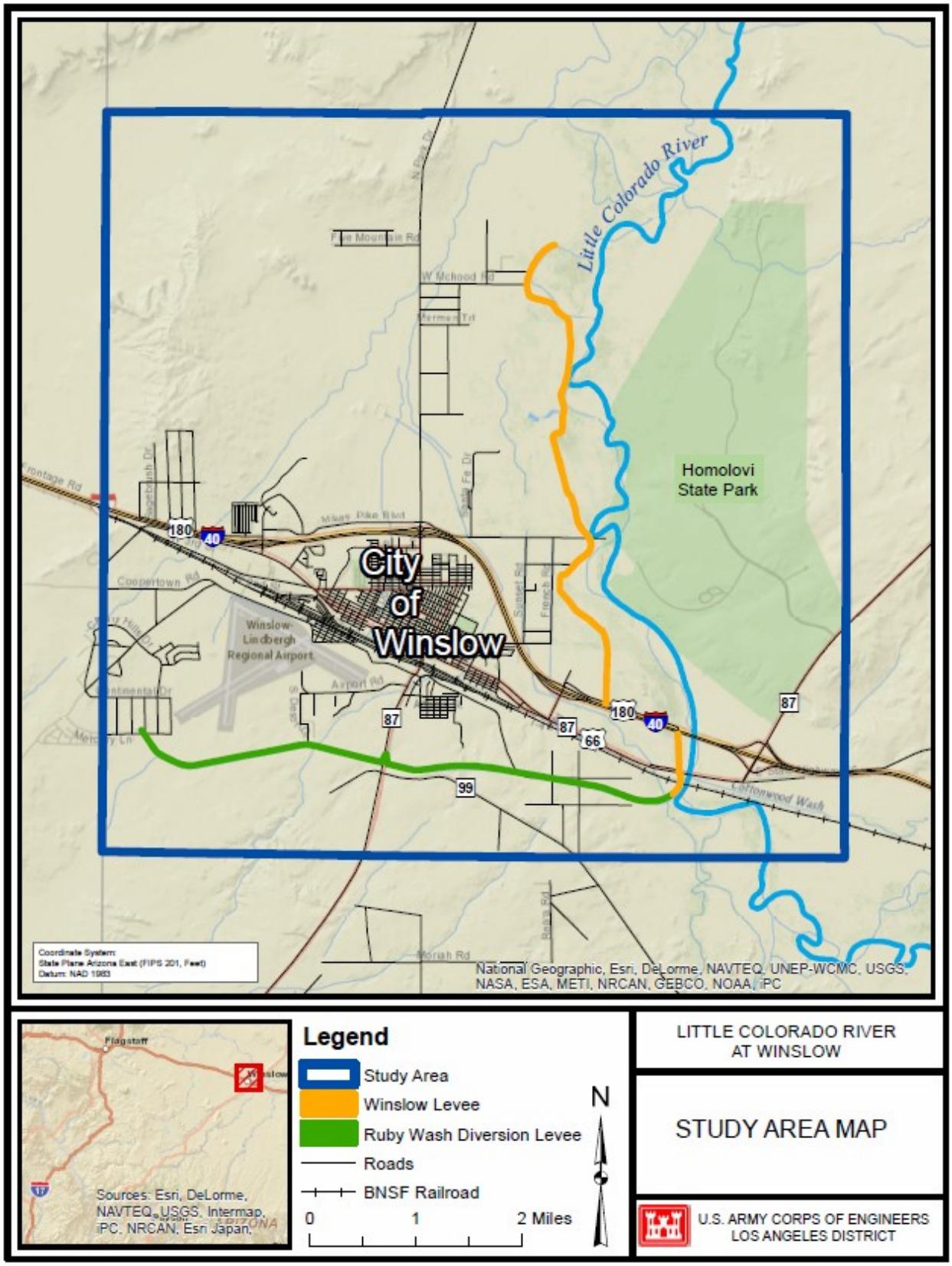
2.3.1 Study Area

The LCR at Winslow study area (Figure 1) is located in northeastern Arizona in the middle of the LCR Watershed, in and near the City of Winslow in western Navajo County. The study area includes the floodplain of the LCR from the Clear Creek confluence downstream (northwest) to the northern end of the existing Winslow Levee. The 49-square-mile study area encompasses the majority of the City of Winslow, including the Ruby Wash Diversion Levee and the Ruby Wash Levee. The tributaries of Ruby Wash, Clear Creek, Cottonwood Wash, Chevelon Creek, Jacks Canyon and Salt Creek join the LCR mainstem within the study area. Transportation infrastructure crossing the LCR consists of Interstate Highway 40, State Highway 87 (Historic Route 66), and the Burlington Northern Santa Fe (BNSF) Railroad.

The LCR watershed occupies most of the northeastern quarter of Arizona, and a small portion

of northwestern New Mexico [Arizona Department of Environmental (ADEQ), 2009]. The LCR originates in the White Mountains south of Springerville, Arizona. It flows in a north/ northwesterly direction in a well-defined canyon until reaching the City of Holbrook, Arizona. From there, the river continues westerly and flows another 30 miles on a broad, open floodplain before it reaches the City of Winslow. It then continues in a generally northwestern direction towards Grand Falls, before eventually joining the Colorado River in Grand Canyon National Park. The total drainage area of the LCR varies from 11,462 square miles at Holbrook, to 16,192 square miles at Winslow, to 21,068 square miles at Grand Falls. The drainage area increases to 30,800 square miles by the time the LCR joins the Colorado River in Grand Canyon National Park.

Figure 1: Study Area Map



2.3.2 Proposed Project Area

The proposed project area encompasses the portion of the study area in which structural or non-structural measures are proposed, along with any borrow, disposal, staging, stockpiling and access areas, for the array of alternatives carried forward for detailed consideration. The proposed project area includes parts of the LCR mainstem channel and the 1% annual chance of exceedance (100-year) floodplain, the Winslow Levee, the eastern end of the Ruby Wash Diversion Levee (RWDL), and the Ames Acres and Bushman Acres subdivisions. The proposed project area is shown in Figure 2.

2.3.3 Jurisdictional Determination of Waters of the US

Per the 2008 joint U.S. Environmental Protection Agency-Department of the Army guidance implementing the Supreme Court's decision in the consolidated cases *Rapanos v. United States* and *Carabell v. United States* which address the jurisdiction over waters of the US under the CWA, the agencies will assert, in pertinent part, jurisdiction over traditional navigable waters (TNWs) and relatively permanent non-navigable tributaries of TNWs where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months). A non-navigable tributary of a TNW is a non-navigable water body whose waters flow into a TNW either directly or indirectly by means of other tributaries. Relatively permanent waters do not include ephemeral tributaries which flow only in response to precipitation and intermittent streams which do not typically flow year-round or have continuous flow at least seasonally.

<u>Little Colorado River</u>

LCR is an approximately 340 mile-long non-navigable river from the headwaters in eastern Arizona to its confluence with the Colorado River, a TNW, near Grand Canyon. Its headwaters originate in the White Mountains along the northern and eastern slopes of Mount Baldy. Because LCR is a non-navigable waterbody and its water flows into the Colorado River directly, LCR is a non-navigable tributary of a TNW. The headwaters and lower reaches are perennial. The reach between the towns of St. Johns and Cameron, which includes the project reach through Winslow, is seasonal and conveys flows from winter-spring snow melts and the summer-fall monsoons. Outside of seasonal flows, average stream flows in the LCR are minimal, and sometimes the stream flows reduce to zero. Average flow rates during the winter–spring season (Nov 1 to May 31) is 28.9 cubic feet per second (cfs). Average flow rates during the summer–fall season (Jun 1 to Oct 31) is 13.1 cfs. The average base flow is 11.0 cfs. Thus, the reach of LCR through the proposed project area is relatively permanent. LCR is therefore a water of the US.

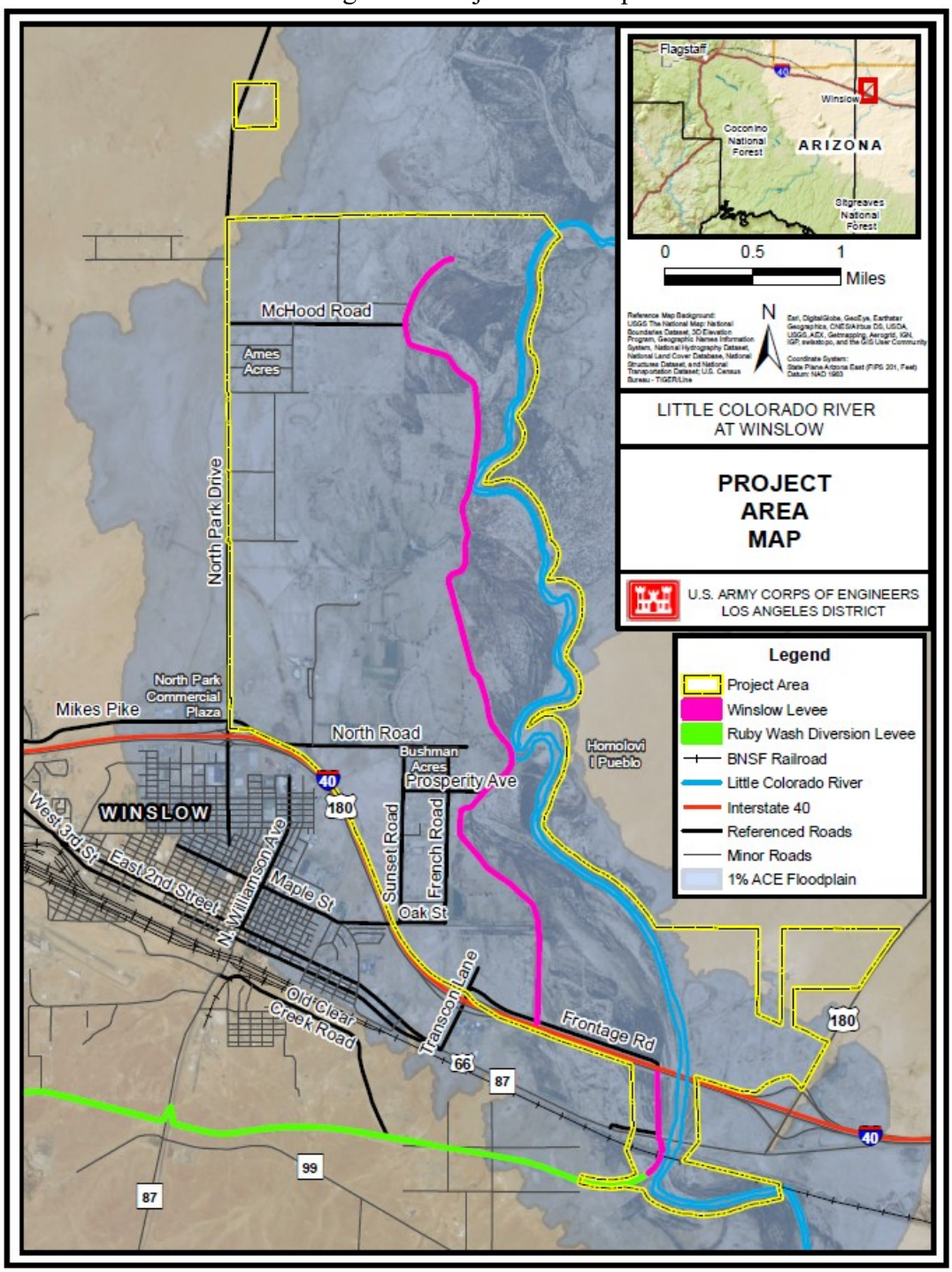
<u>Ruby Wash</u>

Planning-level jurisdictional evaluation was undertaken for Ruby Wash. Ruby Wash is a non-navigable drainage that is parallel to an east-west aligned levee south of Winslow. The RWDL was constructed in order to collect and divert ephemeral and seasonal flows from a number of small washes that would otherwise flow southward into Winslow. The levee redirects collected

flows eastward into the LCR. Its water flows into the Colorado River, a water of the US, indirectly via the LCR. Based on the above, Ruby Wash may be a water of the US.

In the absence of adjacent wetlands, jurisdictional limits in non-tidal waters of the US extend to the ordinary high water mark (OHWM). When adjacent wetlands are present, jurisdiction extends beyond the OHWM to the limit of the adjacent wetlands. No adjacent wetlands were identified in the proposed project area. OHWM within the LCR was primarily established by use of aerial photographs supplemented by observations from site visits. In general, the active channel and the active floodplain forms a distinct barren and sandy area devoid of vegetation. The OHWM for Ruby Wash, a potential waters of the US, was determined in a similar manner. The mapped areas are found in Attachment A of this appendix. In total, approximately 326.5 acres of potential waters of the US may be within the proposed project area.

Figure 2: Project Area Map



3.0 Alternatives Considered

3.1 Management Measures and Associated Discharges of Dredged and Fill Material

Alternatives were formulated from a combination of management measures. These management measures were screened and some eliminated from further consideration, for example due to the measure's inability to meet project objectives or its less productive outputs compared other more efficient measures. See Section 3.0 of the Integrated Feasibility Report/Environmental Impact Statement (IFR) for additional information. This section describes the management measures considered in the final array and qualitatively characterizes the anticipated discharges of dredged and fill material associated with each management measure.

3.1.1 Structural Measures

- **Conveyance Improvements at the Burlington Northern Santa Fe (BNSF) Railroad Bridge**
  This measure entails a mixture of elements to improve conveyance throughout and to stabilize an approximate 2,500 foot long reach of the LCR within the vicinity of the BNSF Railroad Bridge. Conveyance improvements include excavation to the current thalweg depth. Excavation depth would range from one to eight feet. Furthermore, salt cedar would be removed from upstream and downstream of the BNSF Railroad Bridge and Route 87 bridges. Salt cedar would be removed via mechanized equipment. Bulldozers would push the plants to create temporary stockpiles which would subsequently be loaded onto dump trucks for off-site disposal. Vibrations transmitted from the BNSF Railroad Bridge structure to the underlying substrate in conjunction with dynamics of water flow requires a robust bank stabilization structure that would minimize soil movement around the bridge piers while protecting the substrate from water erosion. Thus, the newly excavated channel would include an approximately 390 foot-wide low-flow channel with one-third of the soil cement banks within the OHWM of LCR, and overflow terraces with grouted riprap slope protection outside of the OHWM of LCR. The total width of the channel, terraces and armored embankments would be approximately 650 feet wide. Implementation of this measure would result in temporary discharges of dredged material within waters of the US associated with earthmoving activities within the LCR as well as permanent discharge of soil cement.

- **New Construction: Levee Parallel to I-40**
  Currently, the existing Winslow Levee joins the embankment of Interstate (I)-40. Thus, the I-40 embankment functions as a levee though it was not designed for this purpose. Under this measure, a new levee parallel to the I-40 would be constructed. The entirety of the new levee is located in the uplands outside of waters of the US. Thus, implementation of this measure would not result in discharges of dredged or fill material within waters of the US.

- **New Construction: Setback Levees**
  This measure entails construction of new setback levees behind the existing Winslow

Levee. The new levees would be setback further landward of selected segments of the existing levee. Segments of the existing levee riverward of the new levees would be kept in place during construction to provide protection from flows. Upon completion of construction, levee sections riverward of the newly constructed levees would be removed.

The New Setback Levees would be located entirely in the uplands, approximately 0.15 mile to 0.5 mile landward of waters of the US. Thus, construction would not result in discharges of dredged or fill material within waters of the US. Likewise, removal of segments of the existing levee riverward of the New Setback Levees would mostly result in no discharges of dredged or fill material within waters of the US because they are located in the uplands. With the exception of points where the LCR is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, only the removal of the existing levee near impingement points would result in discharges of dredged or fill material into waters of the US.

- **Reconstruction: East End Ruby Wash Diversion Levee**
  This measure entails a reconstruction of the east end of the Ruby Wash Diversion Levee. Ruby Wash, a braided channel system, is a direct tributary to the LCR. The Ruby Wash Diversion Levee is located in the uplands approximately 150 feet landward of the wash. Thus, reconstruction for the most part would not result in permanent discharges of fill material into waters of the US. However, in areas where the active channel is impinged against the levee, there would be temporary discharges of fill material into waters of the US associated with use of dewatering structures to isolate the work area from active flows. Dewatering structures would likely consist of earthen berms. These structures would be removed upon completion of construction.

- **Reconstruction: Winslow Levee**
  This measure entails a reconstruction of the existing Winslow Levee. The alignment and footprint of the existing structure would mostly be maintained. With the exception of points where the LCR is impinged against the structure, the existing levee is located in the uplands outside of waters of the US. Thus, reconstruction for the most part would not result in permanent discharges of fill material into waters of the US. Reconstruction at impingement points would result in temporary discharges of fill material in waters of the US associated with the use of dewatering structures to isolate the work area from active flows. Dewatering structures would likely consist of earthen berms or cofferdams.

  These structures would be removed upon completion of construction.

Subsequent to the release of the Draft IFR for public review and comment, additional design refinements were incorporated into the proposed project. These refinements are fully described in Chapter 3 of the IFR and include minor adjustments to construction quantities and materials, including limited use of launchable stone, and compression of the construction schedule.

Impacts to the aquatic environment from discharges of fill are independent of project scheduling.

Thus, the compressed construction timing would not impact the analysis below.

Regarding conveyance improvements at the BNSF Railroad Bridge, since waters of the US traverse through the middle of the conveyance-improvement area, while the refinements regarding construction quantities and materials impact only the periphery of the area, there would be no resulting change in impacts to waters of the U.S. as characterized throughout this analysis.

Regarding reconstruction of the levees, since the Winslow Levee and RWDL are for the most part located outside of waters of the US, discharges of fill would occur at primarily only at points where the LCR or Ruby Wash impinges against the levees. Therefore refinements related to construction quantities and materials are anticipated to result in insignificant changes compared to impacts described below. Regarding use of launchable stone, locations for placement of launchable stone would mostly be above the OHWM, resulting in no change to impacts to Waters of the US. However, some launchable stone could be placed at impingement points within Waters of the US. This placement would not result in a noticeable difference in acreage affected compared to the analysis below. In addition, because launchable stone is designed to move with erosion, material originally placed outside Waters of the US could move into Waters of the US as time passes. However, in the case where launchable stone is discharged into Waters of the US due to toe erosion, overall acreage affected is anticipated to be about 0.1 acre. This would not result in a change to the analysis presented herein. For these reasons, refinements related to construction quantities and materials, such as use of launchable stone along certain points of the levee toe, would not result in substantively different discharges of fill beyond those characterized below.

3.1.2 Non-Structural Measures

Non-structural measures include improvement of the existing flood warning system and elevation of residences. Implementation of any of these non-structural measures would not result in discharges of dredged or fill material into waters of the US.

3.2 Alternatives and Impacts to Waters of the US

The IFR evaluated an array of alternatives. Several alternatives were eliminated from further consideration for example because they were found to be infeasible, or due to possible high environmental impacts. Chapter 3 of the IFR provides complete descriptions of these alternatives as well as discussions of alternatives considered but not carried forward for further analysis.

Subsequent to the application of measures to screen alternatives, ten action alternatives (Alternatives 1.1, 3.1, 7, 8, 9, 10, 10.1, 10.2, 10.3, and 10.4) as well as the No Federal Action Alternative were further evaluated in the IFR, constituting a reasonable range of alternatives.

Under all alternatives, the non-federal sponsor would be responsible for operations and maintenance of the constructed project. The non-federal sponsor would maintain the levee per the operation, maintenance, repair, rehabilitation and replacement (OMRR&R) manual. Operations and maintenance activities near impingement points or the conveyance

improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. Most repairs would be like-for-like. Thus, discharges of fill material in most cases would not extend beyond the construction footprint. Operations and maintenance activities would also require periodic excavation of the channel through the conveyance improvements area.

Furthermore, emergency repairs may be required to stabilize weakened sections of the levee not repaired by this project during floods. Such repairs would be limited in scope and duration, and would likely entail the discharge of rocks and earthen fill into waters of the US. Levee repairs and improvements could require use of earthmoving equipment such as excavators, bulldozers, and loaders within the active channel.

3.2.1 Alternative 1.1

Under Alternative 1.1, the Winslow Levee and East End RWDL would be reconstructed; a new levee parallel to I-40 would be constructed and conveyance improvements at the BNSF Railroad Bridge would be implemented. Conveyance improvements include deepening and channelization of the LCR and removal of salt cedar upstream and downstream of the BNSF Railroad Bridge. The new and reconstructed levees would be designed at a scale that provides a 90 percent assurance of containing the 1% annual chance of exceedance (ACE) flood event.

<u>Levee Construction Features</u>
From upstream to downstream, the levee improvements would consist of the following: rebuild the easternmost 2000' of the RWDL to its abutment with the Winslow Levee, rebuild 3,052' of Winslow Levee from the RWDL north to I-40, construct 3,733' of new levee along the north side of and parallel to I-40, and rebuild 26,909' of Winslow Levee from I-40 to the north end of the proposed project near McHood Road. The total length of new and reconstructed levee would be 35,694'.

The typical levee section would consist of a trapezoidal compacted earth fill levee designed to provide a 90% assurance of containing the 1% ACE flood. Maximum levee height for Alternative 1.1 would be 16.3'. The levee would be faced with 3:1 (H:V) basaltic riprap, 3:1 grouted stone or 1:1 soil cement on the river side; scour protection installed to an average depth of 15' below grade on the river side; a 3:1 slope on the land side overlain with 4" of gravel mulch to prevent erosion; a 16' wide access road along the crest of the levee; a 10' wide, 6' deep trench drain having 3:1 side slopes at the toe of the levee on the land side; and a 15' wide gravel mulch maintenance road landward of the trench drain. The typical levee section footprint would be approximately 210' in width including the maintenance road and trench drain.

A temporary construction corridor would utilize the 15' wide maintenance road width, plus an additional 35', for a total width of 50'. An additional 25' for construction access would be needed on the river side of the levee. Adding the temporary 35' landside and 25' riverside construction zones increases the total construction corridor to a width of 270'. The total area of the project and temporary construction corridor would be approximately 222 acres.

Channel Construction Features

In addition to levee construction, Alternative 1.1 includes saltcedar removal and river channelization to increase conveyance of floodwater under the BNSF Railroad Bridge. Saltcedar would be removed from a ±96-acre area in the vicinity of the BNSF Railroad and State Route 87 bridges using landclearing equipment. Removed saltcedar would be disposed of on an upland location outside of the floodplain.

Following saltcedar removal, the river would be channelized for a length of ±2,500' at the BNSF Railroad Bridge by excavating a ±26-acre area to the current thalweg depth. Excavation depth would range from one to eight feet. The bottom of the newly excavated channel would remain earth-lined. Excavated material would either be recycled for levee construction, or disposed of on an upland area outside of waters of the US. The newly excavated channel would include a ±390' wide low flow channel with soil cement banks, and overflow terraces with riprap embankment armoring. The total width of the channel, terraces and armored embankments would be ±650'.

Dewatering and/or water diversion would be required for the work proposed in the LCR channel and on the river side of the levee. Existing floodplain soils would not support the weight of construction equipment or, in some areas, even a standard passenger vehicle. Wheeled or tracked transport across the LCR channel or adjacent floodplain would require soil enhancements (e.g., mixing soil with gravel, soil cement, clay, or silt as appropriate to better harden or bind the soil) in addition to dewatering to avoid equipment bog down. Any soil enhancements placed can be removed after the construction ends and the construction/access road alignment is restored.

Nonstructural Measures

Alternative 1.1 would include a flood warning system.

Material Required for Construction

Approximately 300,000 cubic yards (CY) of material would be excavated from the LCR floodplain at the BNSF Railroad Bridge. The Corps is assuming that 50% of the material excavated from the river for conveyance at the BNSF Railroad Bridge can be re-used for construction. As part of the channelization work, approximately 37,000 CY of soil cement and 26,000 CY of 36" riprap would be installed to create a low flow channel, terrace and armored side slopes; however, only 10,992 CY of soil cement would be discharged into waters of the US.

Table 1 below details discharges of dredged or fill material into waters of the US associated with Alternative 1.1.

Table 1: Alternative 1.1 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
Conveyance Improvements at BNSF Railroad Bridge	2,500 feet of river deepening & channelization	13.7		Earthen fill for dewatering structures	1.2	10,992	Soil cement	Temporary impacts = 13.7 acres for deepening and channelization & 7.1 acres for salt cedar removal in waters of the US. Permanent impacts = discharge of 10 foot x 2,500 foot long soil cement (0.6 acre) on each side of the channel = 1.2 acres Total volume of soil cement is 36,641 cy. A third of the total volume would be below plane of OHWM. Thus, 10,992 cy of fill would be discharged in waters of the US.
	96 acres of salt cedar removal including uplands	7.1		Earthen fill such as side cast from bulldozers				
New Construction: Levee Parallel to I-40	3,733feet	0			0			Outside of waters of the US
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45			0			Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structures.
Reconstruction: Winslow Levee	3,052 feet from RWDL to I-40; 26,909 from I-40 to McHood Road	0.6			0			Two 0.3 acre areas at two impingement points for temporary discharge of dewatering structures.
Total Impact Acreage		21.85			1.2			

3.2.2 Alternative 3.1

Under Alternative 3.1, the Winslow Levee and East End RWDL would be reconstructed; a new levee parallel to I-40 would be constructed; new setback levees would be constructed, and conveyance improvements at the BNSF Railroad Bridge would be implemented. Conveyance improvements include widening a segment of the LCR and removal of salt cedar from upstream and downstream of the BNSF Railroad Bridge and Route 87 bridges. The new and reconstructed levees would provide a 90% assurance of containing the 1% ACE flood.

Levee Construction Features

From upstream to downstream, the levee improvements would consist of the following: Rebuild the easternmost 2000' of the RWDL to its abutment with the Winslow Levee, rebuild 3,052' of Winslow Levee from the RWDL north to I-40, construct 3,733' of new levee along the north side of and parallel to I-40, set back 12,795' of the Winslow Levee, and rebuild 12,860' of Winslow Levee from I-40 to the north end of the proposed project near McHood Road. A 12,795' length of the levee would be set back from its current alignment to reduce the probability of levee impingement by the LCR. The total length of new and reconstructed levee would be 34,440'.

The typical levee section and construction corridor would be as described for Alternative 1.1, except that the maximum levee height would be 15.2'. The total area of the project and temporary construction corridor would be approximately 216 acres.

Channel Construction Features

Alternative 3.1 includes the same channelization features as described for Alternative 1.1. The material volumes and re-use assumptions for these features are identical.

Nonstructural Measures

Alternative 3.1 would include a flood warning system.

Table 2 below details discharges of dredged or fill material into waters of the US associated with Alternative 3.1.

Table 2: Alternative 3.1 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
Conveyance Improvements at BNSF Railroad Bridge	2,500 feet of river deepening & channelization	13.7		Earthen fill for dewatering structures	1.2	10,992	Soil cement	Temporary impacts = 13.7 acres for deepening and channelization & 7.1 acres for salt cedar removal in waters of the US. Permanent impacts = discharge of 10 foot x 2,500 foot long soil cement (0.6 acre) on each side of the channel = 1.2 acres Total volume of soil cement is 36,641 cy. A third of the total volume would be below plane of OHWM. Thus, 10,992 cy of fill would be discharged in waters of the US.
	96 acres of salt cedar removal including uplands	7.1		Earthen fill such as side cast from bulldozers				
New Construction: Set back levee	12,795 feet	0.46			0	0		Set back levee is outside waters of the US. Removal of existing levee riverside of new setback levee may require temporary discharge of dewatering structures. Dewatered area = 400'x50'(0.46 ac) within waters of the US
New Construction: Levee Parallel to I-40	3,733 feet	0			0	0		Outside of waters of the US
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45			0	0		Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structures.
Reconstruction: Winslow Levee	3,052 feet from RWDL to I-40; 12,860 from I-40 to McHood Road	0.6			0	0		Two 0.3 acre areas at two impingement points for temporary discharge of dewatering structures.
Total Impact Acreage		22.31			1.2			

3.2.3 Alternative 7

Under Alternative 7, non-structural measures such as flood warning system or floodproofing, i.e., elevation of residences, within the 100-year floodplain of the Winslow Levee would be implemented. The affected areas would be outside waters of the US. There would be no temporary or permanent impacts within the aquatic environment.

3.2.4 Alternative 8

Under Alternative 8, the Winslow Levee and RWDL would be reconstructed; a new levee parallel to I-40 would be constructed; new setback levees would be constructed, and conveyance improvements at the BNSF Railroad Bridge would be implemented. Conveyance improvements include widening a segment of the LCR and removal of salt cedar immediately upstream and downstream of the BNSF Railroad Bridge and Route 87 bridges. The new and reconstructed levees would provide a 90% assurance of containing the 1% ACE flood.

Levee Construction Features

From upstream to downstream, the levee improvements would consist of the following: Rebuild the easternmost 2000' of the RWDL to its abutment with the Winslow Levee, rebuild 3,052' of Winslow Levee from the RWDL north to I-40, construct 3,733' of new levee along the north side of and parallel to I-40, and rebuild 26,909' of Winslow Levee from I-40 to the north end of the proposed project near McHood Road. The reconstructed levee would include a 1,600' long levee setback across from Homolovi I Pueblo. A 2,000' section of the original Winslow Levee would be removed where it is replaced by the levee setback. The total length of new and reconstructed levee would be 35,694'.

The typical levee section and construction corridor would be as described for Alternative 1.1. The total area of the project and temporary construction corridor would be approximately 220 acres.

Channel Construction Features

Alternative 8 includes the same channelization features as described for Alternative 1.1.

Nonstructural Measures

Alternative 8 would include a flood warning system.

Material Required for Construction

Alternative 8 includes the same channelization features as described for Alternative 1.1. Thus, the material volumes and re-use assumptions are identical.

Table 3 below details discharges of dredged or fill material into waters of the US associated with Alternative 8.

Table 3: Alternative 8 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
Conveyance Improvements at BNSF Railroad Bridge	2,500 feet of river deepening & channelization	13.7		Earthen fill for dewatering structures	1.2	10,992	Soil cement	Temporary impacts = 13.7 acres for deepening and channelization & 7.1 acres for salt cedar removal in waters of the US. Permanent impacts = discharge of 10 foot x 2,500 foot long soil cement (0.6 acre) on each side of the channel = 1.2 acres Total volume of soil cement is 36,641 cy. A third of the total volume would be below plane of OHWM. Thus, 10,992 cy of fill would be discharged in waters of the US.
	96 acres of salt cedar removal including uplands	7.1		Earthen fill such as side cast from bulldozers				
New Construction: Set back levee	1,600 feet	0.46	0		0	0		Set back levee is outside waters of the US. Removal of existing levee riverside of new setback levee may require temporary discharge of dewatering structures. Dewatered area = 400'x50'(0.46 ac) within waters of the US
New Construction: Levee Parallel to I-40	3,733 feet	0	0		0	0		Outside of waters of the US
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45	0		0	0		Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structures.
Reconstruction: Winslow Levee	3,052 feet from RWDL to I-40; 26,909 from I-40 to McHood Road	0.6	0		0	0		Two 0.3 acre areas at two impingement points for temporary discharge of dewatering structures.
Total Impact Acreage		22.31			1.2			

3.2.5 Alternative 9

Under Alternative 9, Levee Increment 1, the east end of the RWDL would be rebuilt at its existing height, there would be no improvements to the Winslow Levee, no conveyance improvements, and use of nonstructural measures for residences north of I-40. This alternative would reduce the risk of flooding for events up to the 2.8% ACE (36-year) flood (LCR flows up to 44,780 cfs).

Levee Construction Features
Rebuild the easternmost 2000' of the RWDL to its abutment with the Winslow Levee. In areas where the active channel is impinged against the levee, there would be temporary discharges of fill material into waters of the US associated with the use of dewatering structures to isolate the work area from active flows.

The typical levee section and construction corridor width would be as described for Alternative 1.1, except that the maximum levee height would be 6.1'. Due to the small size of the project, the area of the project and temporary construction corridor would be approximately 12 acres in size.

Channel Construction Features
Conveyance under the BNSF Railroad Bridge is already sufficient to convey the 2.8% ACE flood. For this reason, Alternative 9 does not include channelization measures.

Nonstructural Measures
Nonstructural measures (such as floodproofing, i.e., elevation of residences, and a flood warning system) would be implemented as part of Alternative 9. Floodproofing of residential structures would be implemented in the area north of I-40 on a voluntary basis.

Table 4 below details discharges of dredged or fill material into waters of the US associated with Alternative 9.

Table 4: Alternative 9 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45	0		0	0		Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structures.
Total Impact Acreage		0.45	0		0	0		

3.2.6 Alternative 10

Alternative 10 proposes to rebuild the Winslow Levee from the RWDL downstream to a point 0.8 of a mile north of North Road, no improvements to the Winslow Levee downstream of the federal project, set back a short segment of the Winslow Levee across the LCR from the Homolovi I Pueblo, remove the original Winslow Levee in the setback area, rebuild the eastern end of the Ruby Wash Diversion Levee, construct a new levee parallel to I-40, and improve conveyance under the BNSF Railroad Bridge. New levee construction would be designed to provide a 90% assurance of containing the 1% ACE flood.

Nonstructural measures (such as floodproofing, i.e., elevation of residences, and a flood warning system) would be implemented as part of Alternative 10. Floodproofing of residential structures would be implemented in the area north of North Road, and east of North Park Drive, on a voluntary basis.

Levee Construction Features

From upstream to downstream, the levee improvements would consist of the following: Rebuild the easternmost 2000' of the RWDL to its abutment with the Winslow Levee, rebuild 3,052' of Winslow Levee from the Ruby Wash Diversion Levee north to I-40, construct 3,733' of new levee along the north side of and parallel to I-40, and rebuild 13,767' of Winslow Levee from I-40 to the north end of the proposed project, 0.8 of a mile north of North Road.

The reconstructed levee would include a 1,600' long levee setback across from Homolovi I. A 2,000' section of the original Winslow Levee would be removed where it is replaced by the levee setback. The total length of new and reconstructed levee would be approximately 22,570'.

The typical levee section and construction corridor width would be as described for Alternative 1.1, except that the maximum levee height would be 15.8'. Due to the shorter length of the project, the area of the project and temporary construction corridor would be reduced to approximately 139 acres, and there would only be one impingement point along LCR.

Channel Construction Features

Alternatives 10 includes the same channelization features as described for Alternative 1.1.

Nonstructural Measures

Alternative 10 includes a flood warning system and floodproofing measures for residences north of North Road and East of North Park Drive.

Material Required for Construction

Alternative 10 includes the same channelization features as described for Alternative 1.1. Thus, the material volumes and re-use assumptions are identical.

3.2.7 Alternative 10.1

Under Alternative 10.1, this alternative is the same as Alternative 10 except that it does not include floodproofing measures. This is the only difference from Alternative 10. Total acreage of temporary and permanent impacts to waters of the US would be identical to Alternative 10.

Table 5 below details discharges of dredged or fill material into waters of the US associated with Alternatives 10 and 10.1.

Table 5: Alternatives 10 & 10.1 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
Conveyance Improvements at BNSF Railroad Bridge	2,500 feet of river deepening & channelization	13.7		Earthen fill for dewatering structures	1.2	10,992	Soil cement	Temporary impacts = 13.7 acres for deepening and channelization & 7.1 acres for salt cedar removal in waters of the US. Permanent impacts = discharge of 10 foot x 2,500 foot long soil cement (0.6 acre) on each side of the channel = 1.2 acres Total volume of soil cement is 36,641 cy. A third of the total volume would be below plane of OHWM. Thus, 10,992 cy of fill would be discharged in waters of the US.
	96 acres of salt cedar removal including uplands	7.1		Earthen fill such as side cast from bulldozers				
New Construction: Set back levee	1,600 feet	0.46	0		0	0		Set back levee is outside waters of the US. Removal of existing levee riverside of new setback levee may require temporary discharge of dewatering structures. Dewatered area = 400'x50'(0.46 ac) within waters of the US
New Construction: Levee Parallel to I-40	3,733 feet	0	0		0	0		Outside of waters of the US
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45	0		0	0		Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structures.
Reconstruction: Winslow Levee	3,052 feet from RWDL to I-40; 13,767 feet from I-40 to vicinity of North Road	0.3	0		0	0		One 0.3 acre area at one impingement point for temporary discharge of dewatering structures.
Total Impact Acreage		22.01			1.2			

3.2.8 Alternative 10.2

This alternative involves rebuilding the Winslow Levee from the RWDL downstream to a point 0.8 of a mile north of North Road, no improvements to the Winslow Levee downstream of the federal project, set back a short segment of the Winslow Levee across the LCR from the Homolovi I Pueblo, removing the original Winslow Levee in the setback area, rebuilding the eastern end of the RWDL, and constructing a new levee parallel to I-40. New levee construction would be designed at a scale that provides a 90 percent assurance of containing the 4% ACE flood event.

Levee Construction Features
Levee construction features for Alternative 10.2 are identical to those for Alternative 10, except that the levee would be constructed at a height sufficient to contain the 4% ACE flood. The maximum levee height would be 13.3'.

Channel Construction Features
Conveyance under the BNSF Railroad Bridge is already sufficient to convey the 4% ACE flood. For this reason, Alternative 10.2 does not include channelization measures.

Nonstructural Measures
Alternative 10.2 would include a flood warning system.

Table 6 below details discharges of dredged or fill material into waters of the US associated with Alternative 10.2.

Table 6: Alternative 10.2 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
New Construction: Set back levee	1,600 feet	0.46	0		0	0		Set back levee is outside waters of the US. Removal of existing levee riverside of new setback levee may require temporary discharge of dewatering structures. Dewatered area = 400'x50'(0.46 ac) within waters of the US
New Construction: Levee Parallel to I-40	3,733 feet	0	0		0	0		Outside of waters of the US
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45	0		0	0		Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structures.
Reconstruction: Winslow Levee	3,052 feet from RWDL to I-40; 13,767 feet from I-40 to vicinity of North Road	0.3	0		0	0		One 0.3 acre area at one impingement point for temporary discharge of dewatering structures.
Total Impact Acreage		1.21			0			

3.2.9 Alternative 10.3

Under Alternative 10.3, the Winslow Levee would be rebuilt from the RWDL downstream to a point 0.8 of a mile north of North Road, no improvements to the Winslow Levee downstream of the federal project, set back a short segment of the Winslow Levee across the LCR from the Homolovi I Pueblo, remove the original Winslow Levee in the setback area, rebuild the eastern end of the RWDL, construct a new levee parallel to I-40, improve conveyance under the BNSF Railroad Bridge. New levee construction would be designed at a scale that provides a 90 percent assurance of containing the 2% ACE flood event. Alternative 10.3 does not include nonstructural measures other than implementation of a flood warning system.

Levee Construction Features
Levee construction features for Alternative 10.3 are identical to those for Alternative 10, except that the levee would be constructed at a height sufficient to contain the 2% ACE flood. The maximum levee height would be 14.5'.

Channel Construction Features
Alternative 10.3 includes the same channelization features as described for Alternative 1.1.

Nonstructural Measures
Alternative 10.3 would include a flood warning system.

Material Required for Construction
Alternative 10.3 includes the same channelization features as described for Alternative 1.1. Thus, the material volumes and re-use assumptions are identical.

Table 7 below details discharges of dredged or fill material into waters of the US associated with Alternative 10.3.

Table 7: Alternative 10.3 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
Conveyance Improvements at BNSF Railroad Bridge	2,500 feet of river deepening & channelization	13.7		Earthen fill for dewatering structures	1.2	10,992	Soil cement	Temporary impacts = 13.7 acres for deepening and channelization & 7.1 acres for salt cedar removal in waters of the US. Permanent impacts = discharge of 10 foot x 2,500 foot long soil cement (0.6 acre) on each side of the channel = 1.2 acres Total volume of soil cement is 36,641 cy. A third of the total volume would be below plane of OHWM. Thus, 10,992 cy of fill would be discharged in waters of the US.
	96 acres of salt cedar removal including uplands	7.1		Earthen fill such as side cast from bulldozers				
New Construction: Set back levee	1,600 feet	0.46	0		0	0		Set back levee is outside waters of the US. Removal of existing levee riverside of new setback levee may require temporary discharge of dewatering structures. Dewatered area = 400'x50'(0.46 ac) within waters of the US
New Construction: Levee Parallel to I-40	3,733 feet	0	0		0	0		Outside of waters of the US
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45	0		0	0		Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structures.
Reconstruction: Winslow Levee	3,052 feet from RWDL to I-40; 13,767 feet from I-40 to vicinity of North Road	0.3	0		0	0		One 0.3 acre area at one impingement point for temporary discharge of dewatering structures.
Total Impact Acreage		22.01			1.2			

3.2.10 Alternative 10.4

Under Alternative 10.4, the Winslow Levee would be rebuilt from the RWDL downstream to a point 0.8 of a mile north of North Road, no improvements to the Winslow Levee downstream of the federal project, set back a short segment of the Winslow Levee across the LCR from the Homolovi I Pueblo, remove the original Winslow Levee in the setback area, rebuild the eastern end of the RWDL, construct a new levee parallel to I-40, improve conveyance under the BNSF Railroad Bridge. New levee construction would be designed at a scale that provides a 90% assurance of containing the 0.5% ACE flood event. Alternative 10.4 does not include nonstructural measures other than implementation of a flood warning system.

Levee Construction Features

Levee construction features for Alternative 10.4 are identical to those for Alternative 10, except that the levee would be constructed at a height sufficient to contain the 0.5% ACE flood. The maximum levee height would be 17.1'.

Channel Construction Features

In addition to levee construction, Alternative 10.4 includes saltcedar removal and river channelization needed for conveyance of the 0.5% ACE flood under the BNSF Railroad Bridge. Saltcedar would be removed from a ±74-acre area in the vicinity of the BNSF Railroad and State Highway 87 bridges using landclearing equipment. Removed saltcedar would be disposed of on an upland location outside of the floodplain.

Following saltcedar removal, the river would be channelized for a length of ±6,000' at the BNSF Railroad Bridge by excavating a ±81-acre area to the current thalweg depth. Excavation depth would range from one to eight feet. The bottom of the newly excavated channel would remain earth-lined. Excavated material would either be recycled for levee construction, or disposed of on an upland area. The newly excavated channel would include a ±390' wide low flow channel with soil cement banks, and overflow terraces with riprap embankment armoring. The total width of the channel, terraces and armored embankments would be ±650'.

Dewatering and/or water diversion would be required for the work proposed in the LCR channel and on the river side of the levee. Existing floodplain soils would not support the weight of construction equipment or, in some areas, even a standard passenger vehicle. Wheeled or tracked transport across the LCR channel or adjacent floodplain would require soil enhancements in addition to dewatering to avoid equipment bog down. Any soil enhancements placed can be removed after the construction ends and the construction/access road alignment is restored.

Nonstructural Measures

Alternative 10.4 would include a flood warning system.

Material Required for Construction

Approximately 345,000 CY of material would be excavated from the LCR floodplain at the BNSF Railroad Bridge. As part of the channelization work, 42,000 CY of soil cement and 30,000 CY of 36" riprap would be installed to create a low flow channel, terrace and armored side slopes.

Table 8 below details discharges of dredged or fill material into waters of the US associated with Alternative 10.4.

Table 8: Alternative 10.4 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Management Measures	Extent of Construction	Temporary Discharges			Permanent Discharges			Comments
		Impacts to waters of the US (acres)	Volume (cy)	Material Type	Impacts to waters of the US (acres)	Volume (cy)	Material Type	
Conveyance Improvements at BNSF Railroad Bridge	6,000 feet of river deepening & channelization	32.9		Earthen fill for dewatering structures	2.9	14,000	Soil cement	Temporary impacts = 32.9 acres for deepening and channelization & 5.5 acres for salt cedar removal in waters of the US Permanent impacts = discharge of 10 foot x 6,000 foot long soil cement (0.6 acre) on each side of the channel = 2.9 acres Total volume of soil cement is 42,000 cy. A third of the total volume would be below plane of OHWM. Thus, 14,000 cy of fill would be discharged in waters of the US. Permanent impacts adjusted for an increase from 2,500 to 6,000 would be approximately 2.9 acres.
	74 acres of salt cedar removal including uplands	5.5		Earthen fill such as side cast from bulldozers				
New Construction: Set back levee	1,600 feet	0.46	0		0	0		Set back levee is outside waters of the US. Removal of existing levee riverside of new setback levee may require temporary discharge of dewatering structures. Dewatered area = 400'x50'(0.46 ac) within waters of the US
New Construction: Levee Parallel to I-40	3,733 feet	0	0		0	0		Outside of waters of the US
Reconstruction: East End Ruby Wash Diversion Levee	2,000 feet	0.45	0		0	0		Three 0.15 acre areas at three impingement points for temporary discharge of dewatering structu.
Reconstruction: Winslow Levee	3,052 feet from RWDL to I-40; 13,767 feet from I-40 to vicinity of North Road	0.3	0		0	0		One 0.3 acre area at one impingement point for temporary discharge of dewatering structures.
Total Impact Acreage		39.61			2.9			

3.2.11 Alternative 11

Under Alternative 11, No Federal Action Alternative, none of the proposed management measures would be implemented. There would be no impacts to waters of the US from management measures as none would occur.

The non-federal sponsor would continue operations and maintenance activities on the existing structures and implement emergency repairs as needed.

3.3 Impacts to Waters of the US

With the exception of Alternative 7 and Alternative 11, all alternatives would entail temporary discharges of fill material into waters of the US ranging from 0.45 to 39.61 acres. Action alternatives that incorporate the Conveyance Improvement management measure would result in permanent impacts to waters of the US ranging from 1.2 acres to 2.9 acres. In contrast Alternatives 7, 9, and 11 would result in no permanent impacts.

Table 9: Comparison of Impacts to Waters of the US

Alternatives	Temporary Impacts to waters of the US (Acres)	Permanent Impacts to waters of the US (Acres)
1.1	21.85	1.2
3.1	22.31	1.2
7 (Non Structural)	0	0
8	22.31	1.2
9 (Non Structural & Ruby Wash Reconstruction)	0.45	0
10	22.01	1.2
10.1 (Tentatively Selected Plan)	22.01	1.2
10.2	1.21	0
10.3	22.01	1.2
10.4	39.61	2.9
11 (No Federal Action)	0	0

3.4 Alternatives Analysis

3.4.1 Restrictions on Discharge

The 404(b)(1) Guidelines prohibit the discharge of dredged or fill material into waters of the U.S. if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. 40 C.F.R. 230.10(a). To be "practicable," an alternative must be "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." 40 C.F.R. 230.10(a)(2).

3.4.2 Overall Project Purpose

With the exception of the No Federal Action Alternative all alternatives meet the overall project purpose. The No Federal Action Alternative has been dropped from consideration in the

404(b)(1) evaluation since it does not meet the overall project purpose.

3.4.3 Practicability (Technology)

All action alternatives can be constructed with existing technology. All action alternatives would utilize conventional construction techniques and conventional construction equipment.

3.4.4 Practicability (Logistics)

In general, the non-federal sponsor is responsible for acquisition of lands, easements, and rights-of-way and performing relocations. Furthermore, the non-federal sponsor is fully capable of fulfilling its responsibility (Appendix H). Based on the above, all action alternatives are assumed to be practicable with respect to logistics.

3.4.5 Practicability (Cost)

Comparison of the focused array of alternatives (Alternatives 1.1, 3.1, 7, 8, 9, and 10) is shown in Chapter 3 of the IFR. In summary, Alternative 7 would cost the least due to its non-structural measures. In contrast, Alternative 3.1 would cost the most due to the extensive scope of construction including construction of setback levees. Comparison of the optimized plans (Alternatives 10.1, 10.2, 10.3, and 10.4) is also shown in Chapter 3. Alternative 10.2 would cost the least, and Alternative 10.4 would cost the most.

For reasons discussed in Chapter 3 of the IFR, Alternative 10.1 is the Recommended Plan (RP). Though not bound to do so, the U.S. Congress may select the RP for authorization and appropriation. Alternatively, the U.S. Congress may select another plan from the final array of alternatives for authorization and appropriation. Thus, all alternatives are considered practicable in terms of cost.

A counterpart to cost is the cost-benefit ratio. With the exception of Alternative 7, cost-benefit ratios for all action alternatives exceed unity. Alternative 7, with a cost-benefit ratio of 0.3, is not likely to be practicable for authorization and appropriation. Furthermore, the elevation of structures under Alternative 7 would not be independently justified under a separable analysis and would not be implementable under Corps policies.

Alternative 9 incorporates the elevation of structures equivalent to Alternative 7, and the rebuilding of RWDL. The elevation of structures would not be independently justified under a separable analysis and would not be implementable under Corps policies. The rebuilding of RWDL would address flood risk in only a small segment of the proposed project area. Further, both Alternative 7 and 9 would leave substantial annual residual damages, from the baseline of $10,230,000 reduced to only $9,964,000 and $8,324,000 (FY14 Price Levels), respectively. Therefore, under these alternatives, the area would remain highly susceptible to flood risk.

Likewise, Alternative 10.2 would have substantially higher residual risk than Alternative 10.1. This alternative would not reduce the flood risk in the vicinity of the BNSF bridge, as it would not increase conveyance capacity. If an event larger than 4% ACE occurred, then life safety,

property, and critical infrastructure would remain subject to existing flood risks. Alternative 10.2 has overall lower benefits and lower net benefits than 10.1.

3.4.6 Significant Environmental Impacts to Non-Aquatic Resources

As summarized in Table 5-0 of the IFR, Alternatives 3.1, 8, 10, 10.1, 10.2, 10.3, and 10,4 could result in significant impacts under NEPA to cultural resources. Alternative 3.1 would result in significant impacts to land use.

Table 10: Alternative 10.4 - Summary of Discharges of Dredged and Fill Materials into Waters of the US

Alternatives	Practicability Test			Significant Environmental Impacts to Non-Aquatic Resources?	Meets Overall Project Purpose?
	Cost	Logistics	Technology		
1.1	Yes	Yes	Yes	No	Yes
3.1	Yes	Yes	Yes	Yes	Yes
7	No	Yes	Yes	No	Yes
8	Yes	Yes	Yes	Yes	Yes
9	No	Yes	Yes	No	Yes
10	Yes	Yes	Yes	Yes	Yes
10.1	Yes	Yes	Yes	Yes	Yes
10.2	No	Yes	Yes	Yes	Yes
10.3	Yes	Yes	Yes	No	Yes
10.4	Yes	Yes	Yes	Yes	Yes
11	Yes	Yes	Yes	No	Yes

4.0 Environmental Effects

In accordance with the Section 404(b)(1) Guidelines, the potential short-term or long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment must be determined. With the exception of Alternatives 7 and 11, Alternatives 1.1, 3.1, 8, 9, 10, 10.1, 10.2, 10.3, and 10.4 would entail the discharge of fill material into waters of the US. The following discussion evaluates impacts of alternatives 1.1, 3.1, 8, 9, 10, 10.1, 10.2, 10.3, and 10.4 on environmental resources identified in Subpart C through Subpart F of the Section 404(b)(1) Guidelines.

4.1 Potential Direct and Secondary Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)

Substrate

Substrate within LCR and its tributaries is composed of soft strata of mudstone and sandstone covered by floodplain deposits. Floodplain deposits consist of silt clay loam and sand derived from volcanic and sedimentary rock and found on alluvial fans, floodplains, and drainage area in central and northern Arizona. Both types of soils are typically light reddish brown. See Section 4.1 of the IFR.

4.1.1 Construction

Alternative 1.1 would require the discharge of dewatering structures such as earthen berms or cofferdams at the Winslow Levee associated with construction near the two impingement points. Dewatering structures would also be required for reconstruction of the RWDL. The dewatering structures would be removed from waters of the US upon completion of construction.

Conveyance improvements would require excavation and earthmoving activities associated with the removal of sediment and salt cedar. Approximately 300,000 CY of material would be excavated from the floodplain at the BNSF Railroad Bridge, and salt cedar would be cleared from an approximately 96 acre area in the floodplain. These activities would result in redeposit of dredged material due to excavation and channelization as well as temporary stockpiling of native substrate or vegetation. All stockpiled material would be hauled to the uplands for disposal. There would be a loss of approximately 300,000 CY of native substrate from within waters of the US. However, due to the high sediment load within the water column from sources in the upper portion of the watershed, there would be no appreciable changes to sediment transport and deposition. Channelization of the river beneath the BNSF Railroad Bridge would require the discharge of approximately 10,992 CY of soil cement within waters of the US, permanently impacting approximately 1.2 acres of waters of the US. However, the total acreage of potential waters of the US in the project area is approximately 326.5 acres. Thus, permanent impacts would be limited to approximately 0.37% of the potential waters of the US within the project area. Furthermore, the structure would not impede sediment transport processes. Thus, there would be no appreciable loss of native substrate within the aquatic environment.

Alternative 3.1 and 8 would result in impacts similar to Alternative 1.1. Permanent impacts would remain unchanged from those characterized for Alternative 1.1.

Alternative 9 would require the discharge of dewatering structures such as earthen berms or cofferdams at the east end of the RWDL associated with construction near the three impingement points. The dewatering structures would be removed from waters of the US upon completion of construction. The segment of RWDL within the proposed project area is mostly outside of the lateral extent of the OHWM. Thus, fill material discharged into waters of the US would be minimal. Furthermore, since fill material used for reconstruction would mostly come from nearby borrow areas, fill material discharged into waters of the US would be native substrate. Other fill material such as launch stones for scour protection would likely be procured from a quarry at Indian Wells located 43 miles northeast of Winslow Levee. Last, since the reconstructed levee would remain similar to the existing levee, long-term changes in sediment transport processes are expected to remain unchanged.

Alternatives 10, 10.1 and 10.3 would result in impacts similar to Alternative 1.1. There would be a slight decrease in temporary impacts since reconstruction at Winslow Levee would avoid one impingement point. Permanent impacts would remain unchanged from those characterized for Alternative 1.1.

Alternative 10.2 would avoid reconstruction at one impingement point at Winslow Levee compared to Alternative 1.1. Furthermore, there would be no excavation, earthmoving activities associated with the removal of sediment and salt cedar or the discharge of fill through the conveyance improvement area. Thus, potential impacts to substrate would be substantially less compared to Alternative 1.1. Alternative 10.2 would require the discharge of dewatering structures such as earthen berms or cofferdams at the east end of the RWDL associated with construction near the three impingement points. The dewatering structures would be removed from waters of the US upon completion of construction. The segment of RWDL within the proposed project area is mostly outside of the lateral extent of the OHWM. Thus, fill material discharged into waters of the US would be minimal. Furthermore, since fill material used for reconstruction would come from nearby borrow areas, fill material discharged into waters of the US would be native substrate. Last, since the reconstructed levee would remain similar to the existing levee, long-term changes in sediment transport processes are expected to remain unchanged. Impacts would be approximately similar to Alternative 9.

Alternative 10.4 would avoid reconstruction at one impingement point at Winslow Levee compared to Alternative 1.1. Thus, 0.3 acre of temporary impacts associated with placement of dewatering structures would be avoided. Salt cedar would be cleared from an approximately 74 acre area in the floodplain. The conveyance improvement area would be more than doubled in length compared to Alternative 1.1 and more than tripled in size compared to Alternative 1.1. Thus, the amount of material to be excavated would increase from 300,000 CY to 345,000 CY. These activities would result in redeposit of dredged material due to excavation and channelization as well as temporary stockpiling of native substrate or vegetation. All stockpiled material would be hauled to the uplands for disposal. There would be a short-term permanent loss of approximately 345,000 CY of native substrate from the proposed project area. However, due to the high sediment load within the water column from sources in the upper portion of the watershed there would be no appreciable changes to sediment transport and deposition in the long-term. Likewise, the volume of soil cement discharged into waters of the US would increase from 10,992 CY to 14,000 CY, resulting in approximately 2.9 acres of permanent impacts within waters of the US. However, the total acreage of potential waters of the US in the project area is approximately 326.5 acres. Thus, permanent impacts would be limited to approximately 0.74% of the waters of the US within the proposed project area.

Secondary impacts would be limited to recurring deposition of sediment when native substrate from the conveyance improvement area at the BNSF Railroad Bridge are periodically excavated to restore the constructive channel to design depths and specifications. The scale and magnitude of these changes are small when compared to the larger forces both natural (i.e., geomorphology and hydrology) and anthropogenic (e.g., land use, cattle grazing etc.) that influence the sediment transport processes within the LCR. Thus, there would be no appreciably secondary impacts from the discharges of fill in waters of the US.

Operations: With the exception of points where the LCR and RWDL is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of dredged or fill material within waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of

fill material in the form of native substrate, cement, or rock. Most repairs would be like-for-like. Thus, discharges of fill material in most cases would not extend beyond the construction footprint. Operations and maintenance activities would also require periodic excavation of the channel through the conveyance improvements area. In some instances, use of dewatering structures may be required. There would be a permanent loss of approximately 300,000 cy or 345,000 cy of native substrate from waters of the US. However, due to the high sediment load within the water column from sources in the upper portion of the watershed there would be no appreciable changes to sediment transport and deposition. Furthermore, the structure would not impede sediment transport processes.

Secondary impacts would be limited to recurring deposition of sediment when native substrate from the conveyance improvement area at the BNSF Railroad Bridge are periodically excavated to restore the d channel to design depths and specifications. The scale and magnitude of these changes are small when compared to the larger forces both natural (i.e., geomorphology and hydrology) and anthropogenic (e.g., land use, cattle grazing etc.) that influence the sediment transport processes within the LCR. Thus, there would be no appreciable secondary impacts from the discharges of fill material into waters of the US.

4.1.2 Suspended particulates and turbidity

The reach of the LCR within the proposed project area is turbid due to excessive sediment from natural and anthropogenic sources from the upper watershed. In particular, historic and current grazing practices within the watershed has reduced the amount of vegetative cover, especially riparian, resulting in increased runoff, soil erosion, and bank destabilization. Loss of vegetation and increased surface runoff causes down cutting within tributaries, sedimentation downstream. Much like LCR, Ruby Wash traverses a watershed with reduced vegetation cover and unconsolidated soils. Furthermore, due to its steep gradient flows are expected to be high energy, erosive flows. Thus, active flows within Ruby Wash are expected to be turbid. Thus, the LCR meets all water quality standards with the exception of turbidity. Turbidity is the most common constituent that exceeds water quality standards in the Lower Colorado River Plateau Basin. See Section 4.3 of the IFR.

Construction: Alternative 1.1 would require the discharge of dewatering structures such as earthen berms or cofferdams at the Winslow Levee associated with construction near the two impingement points. Dewatering structures would also be required for reconstruction of the RWDL. Movement of vehicles across earthen substrate during the placement and removal of dewatering structures would temporarily elevate turbidity in the water column. When fully isolated from surrounding flows, work within the LCR and Ruby Wash would result in minimal or no increases in turbidity. The dewatering structures would be removed from waters of the US upon completion of construction.

Conveyance improvements would require excavation and earthmoving activities associated with the removal of sediment and salt cedar. Approximately 300,000 CY of material would be excavated from the floodplain at the BNSF Railroad Bridge, and salt cedar would be cleared from an approximately 96 acre area in the floodplain. Channelization of the river beneath the BNSF Railroad Bridge would require discharge of approximately 10,992 CY of soil cement within waters of the US.

Conveyance improvements would require limited earthmoving and stockpiling within waters of the US. Large bulldozers would scrape native substrate and salt cedar and form temporary stockpiles. Excavators and loaders would load the stockpiled material into trucks for upland disposal. The presence of mechanized equipment would loosen previously compacted soil. There would be a temporary increase in turbidity when active flows make contact with disturbed soils. Subsequent to construction, the areas would be reseeded with vegetation that would adequately stabilize soils and minimize resistance to flow conveyance. However, unvegetated sandbars are present within waters of the US throughout the proposed project area. Furthermore, the LCR and Ruby Wash are already turbid due to excessive sediment from natural and anthropogenic sources from the upper watershed. Thus, temporary increases in turbidity would not result in notable changes in turbidity.

Alternatives 3.1 and 8 would result in impacts similar to Alternative 1.1. Permanent impacts would remain unchanged from those characterized for Alternative 1.1.

Alternative 9 would require the discharge of dewatering structures such as earthen berms or cofferdams at the east end RWDL associated with construction near the three impingement points. Movement of vehicles across earthen substrate during the placement and removal of dewatering structures would temporarily elevate turbidity in the water column. When fully isolated from surrounding flows, work within Ruby Wash would result in minimal or no increases in turbidity. The dewatering structures would be removed from waters of the US upon completion of construction.

Alternatives 10, 10.1 and 10.3 would result in impacts similar to Alternative 1.1. There would be a slight decrease in temporary impacts since reconstruction at Winslow Levee would avoid one impingement point. Permanent impacts would remain unchanged from those characterized for Alternative 1.1.

Alternative 10.2 would avoid reconstruction at one impingement point at Winslow Levee compared to Alternative 1.1. Furthermore, there would be no excavation, earthmoving activities associated with the removal of sediment and salt cedar, or the discharge of fill through the conveyance improvement area. Thus, potential impacts to turbidity would be substantially less compared to Alternative 1.1. Alternative 10.2 would require the discharge of dewatering structures such as earthen berms or cofferdams at the east end of the RWDL associated with construction near the three impingement points. The dewatering structures would be removed from waters of the US upon completion of construction. The segment of RWDL within the proposed project area is mostly outside of the lateral extent of the OHWM. Thus, fill material discharged into waters of the US would be minimal. Furthermore, since fill material used for reconstruction would come from nearby borrow areas, fill material discharged into waters of the US would be native substrate. Last, since the reconstructed levee would remain similar to the existing levee, long-term changes in sediment transport processes are expected to remain unchanged. Impacts would be approximately similar to Alternative 9.

Alternative 10.4 would avoid reconstruction at one impingement point at Winslow Levee. The Conveyance improvement area would be more than doubled in length compared to Alternative

1.1. Thus, the potential for turbidity impacts would increase compared to Alternative 1.1. In general, the nature of impacts characterized for Alternative 1.1 would be the same for Alternative 10.4.

There would be de minimis secondary impacts from permanent fill material discharged within waters of US. Channel modifications within the conveyance improvement area would reduce flow velocities to approximately 6 to 7 ft/s. Reduced velocities would reduce channel erosion and increase sedimentation, potentially resulting in decreased turbidity and suspended particulates in the area within the vicinity of the BNSF Railroad Bridge. However, any changes in erosion and accretion would be minor in comparison to the high sediment load within the water column which results in substantial accretion of sediment throughout the LCR.

Operations: With the exception of points where the LCR and Ruby Wash is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material within waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. Most repairs would be like-for-like. Thus, discharges of fill material in most cases would not extend beyond the construction footprint.
Operations and maintenance activities would also require periodic excavation of the channel through the conveyance improvements area. In some instances, use of dewatering structures may be required. Excavation and dewatering activities would temporarily increase turbidity. However, the LCR is already turbid due to excessive sediment from natural and anthropogenic sources from the upper watershed. Thus, temporary increases in turbidity within excavation areas would not be notable, and would result in less than significant impacts.

Secondary impacts would be similar to those characterized for construction impacts.

4.1.3 Contaminants

In general, there is no development on the floodplain riverward of the Winslow Levee. There are no Superfund sites, cleanup sites, and landfills in the vicinity of the proposed project area. Potential sources of contaminants such as commercial and industrial operations are located landside of the levee and are sufficiently distant from proposed project area. For example, the closest underground storage tanks are located at a trucking plaza approximately 1/4 mile to the west of Winslow Levee. Ten remediated leaking underground storage tanks are located within one mile of Winslow Levee. There are some buried vehicles, some of which have been used as fill for the Winslow Levee are present in the floodplain. The extent to which these vehicles contain petroleum-based products such as oil and gas is uncertain. Any fluid leaks are expected to have been dispersed and diluted. See Section 4.16 of the IFR.

Construction: Alternative 1.1 would require the discharge of dewatering structures such as earthen berms or cofferdams at the Winslow Levee associated with construction near the two impingement points. Dewatering structures will also be required for reconstruction of the

RWDL. The dewatering structures would be removed from waters of the US upon completion of construction. Channelization of the river beneath the BNSF Railroad Bridge would require discharge of approximately 10,992 CY of soil cement within waters of the US. All fills would be chemically inert and would mostly be constructed from native substrate. Use of construction vehicles increases the potential for accidental release of fuels, solvents, or other petroleum-based contaminants. Furthermore, abandoned vehicles are present within LCR. Removal of abandoned vehicles from waters of the US also increases the potential for accidental release of minor amounts of fuels, solvents, or other petroleum-based contaminants.

Releases of such substances in any part of the construction footprint could drain to the LCR or Ruby Wash and thereby affect water quality. However, under any alternative requiring work within waters of the US, equipment best management practices (BMPs) would be implemented (see Section 5.16 of the IFR). Thus, accidental releases would be minimized. Lastly, there are no hazardous, toxic and radioactive waste (HTRW) sites within areas where work in waters of the US would occur. Thus, earth moving activities would not result in releases of contaminants from a HTRW site into the LCR or Ruby Wash.

Alternatives 3.1 and 8 would result in impacts similar to Alternative 1.1.

Alternative 9 would require the temporary discharge of dewatering structures such as earthen berms or cofferdams at the east end of the RWDL associated with construction near three impingement points. The dewatering structures would be removed from waters of the US upon completion of construction. All temporary fill would be chemically inert and would mostly be constructed from native substrate. Use of construction vehicles increases the potential for accidental release of fuels, solvents, or other petroleum-based contaminants. Releases of such substances in any part of the construction footprint could drain to the LCR or Ruby Wash and thereby affect water quality. However, under any alternative requiring work within waters of the US, equipment best management practices (BMPs) would be implemented (see Section 5.16 of the IFR). Thus, accidental releases would be minimized. Lastly, there are no hazardous, toxic and radioactive waste (HTRW) sites within areas where work in waters of the US would occur. Thus, earth moving activities would not result in releases of contaminants from a HTRW site into the LCR or Ruby Wash.

Alternatives 10, 10.1 and 10.3 would result in impacts similar to Alternative 1.1. There would be a slight decrease in temporary impacts since reconstruction at Winslow Levee would avoid one impingement point. Permanent impacts would remain unchanged from those characterized for Alternative 1.1.

Alternative 10.2 would avoid reconstruction at one impingement point at Winslow Levee compared to Alternative 1.1. Furthermore, there would be no excavation, earthmoving activities associated with the removal of sediment and salt cedar or the discharge of fill through the conveyance improvement area. Thus, potential impacts to contaminants would be substantially less compared to Alternative 1.1. Alternative 10.2 would require the discharge of dewatering structures such as earthen berms or cofferdams at the east end of the RWDL associated with construction near the three impingement points. The dewatering structures would be removed

from waters of the US upon completion of construction. All temporary fill would be chemically inert and would mostly be constructed from native substrate. Use of construction vehicles increases the potential for accidental release of fuels, solvents, or other petroleum-based contaminants. Releases of such substances in any part of the construction footprint could drain to the LCR or Ruby Wash and thereby affect water quality. However, under any alternative requiring work within waters of the US, equipment best management practices (BMPs) would be implemented (see Section 5.16 of the IFR). Thus, accidental releases would be minimized. Lastly, there are no hazardous, toxic and radioactive waste (HTRW) sites within areas where work in waters of the US would occur. Thus, earth moving activities would not result in releases of contaminants from a HTRW site into the LCR or Ruby Wash.

Alternative 10.4 would avoid reconstruction at one impingement point at Winslow Levee. The conveyance improvement area would be more than doubled in length on LCR compared to Alternative 1.1. Thus, the potential for accidental release of fuels, solvents, or other petroleum-based contaminants would be greater than Alternative 1.1. Potential for accidental releases in Ruby Wash would remain unchanged.

Secondary impacts could entail exposure of aquatic species to fuels, solvents, or other petroleum-based contaminants from earth moving equipment working within the active channel should accidental spills occur. Ingestion by species with limited mobility could result in mortality or transmittal of contaminants up the food chain. Potential impacts would be limited since exposure would be limited to instances where spills occur within the aquatic environment. Furthermore, the possibility of exposure to petroleum-based contaminants would be minimal since most construction would occur within dewatered areas and equipment BMPs would be implemented.

Operations: With the exception of points where the LCR is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material into waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. These fill materials are chemically inert and would not leach contaminants into the water column. Impacts would be less than significant.

Secondary impacts would be similar to those characterized for construction impacts.

4.1.4 Water Flow

Surface flow in all the washes of LCR at Winslow is intermittent. Winter-spring snow melts and the summer-fall monsoons are the primary source of seasonal flows. Outside of seasonal flows, average stream flows in the LCR are minimal, and sometimes the stream flows reduce to zero. Average flow rates during the winter–spring season (Nov 1 to May 31) is 28.9 cubic feet per second (cfs). Average flow rates during the summer–fall season (Jun 1 to Oct 31) is 13.1 cfs.

The average base flow is 11.0 cfs. Ruby Wash is an ephemeral water body. See Section 4.2 of the IFR.

Construction: Alternative 1.1 would require the discharge of dewatering structures such as earthen berms or cofferdams at the Winslow Levee associated with construction near the two impingement points. Dewatering structures would also be required for reconstruction of the RWDL. Structures would likely be discharged at the edge of active flows. However, the width of the low-flow channel ranges from 50 to 150 feet; width of the active channel ranges from 150 to 300 feet; and the width of the active floodplain ranges from 400 to 600 feet. Furthermore, discharge of dewatering structures would be limited to construction at the impingement points. The remaining portions of Winslow Levee and RWDL are outside of waters of the US. Thus, placement of dewatering structures would not result in notable increases in flow velocity and water surface elevations within the vicinity of the work area during construction. Furthermore, there would be no impoundment of flows. In addition, the reconstruction of Winslow Levee and RWDL would mostly be located outside waters of the US. Thus, there would be no permanent changes to the velocity, water surface elevation, or circulation within waters of the US.

At the BNSF Railroad Bridge conveyance improvement area, dewatering structures would be temporarily discharged in the middle of the LCR to allow for excavation and installation of soil cement embankments on one side while water is diverted to the opposite side. Dewatering structures would increase flow velocity and raise water surface elevation within the vicinity of the work area during construction.

However, in-water work would occur during low-flow conditions. Thus, changes would not be substantial and would be localized to the work area. In addition, conveyance improvements at the BNSF Railroad Bridge would entail deepening, widening and channelization of the LCR. The newly excavated channel would be lined with soil cement embankments riverward of the existing Winslow Levee. Channelization of the river beneath the BNSF Railroad Bridge would require the discharge of approximately 10,992 CY of soil cement within waters of the US.

The existing flow velocities at this reach are approximately 4 to 12 ft/s with the backwater effect (i.e., rise in water elevation due to pooling behind the constriction point) extending approximately 10,000 ft. upstream. Channel modifications would reduce velocities to approximately 6 to 7 ft/s and truncate the backwater effect to approximately 2,500 ft. upstream. Reduced velocities would reduce channel erosion and increase sedimentation. However, any changes in erosion and accretion would be minor in comparison to the high sediment load within the water column which results in substantial accretion of sediment throughout the LCR. Changes in circulation, velocity, water surface level would be attenuated and returned to baseline conditions within 1,000 feet downstream of the channelized reach.

Alternatives 3.1 and 8 would result in impacts similar to Alternative 1.1.

Alternative 9 would require the temporary discharge of dewatering structures such as earthen berms or cofferdams at the east end RWDL associated with construction near three

impingement points. Structures would likely be discharged at the edge of active flows. Thus, placement of dewatering structures would not result in notable increases in flow velocity and water surface elevations within the vicinity of the work area during construction. Furthermore, there would be no impoundment of flows. In addition, the reconstruction of RWDL would not result in permanent changes to the velocity, water surface elevation, or circulation at this reach. The dewatering structures would be removed from waters of the US upon completion of construction.

Alternatives 10, 10.1 and 10.3 would result in impacts similar to Alternative 1.1. There would be a slight decrease in temporary impacts since reconstruction at Winslow Levee would avoid one impingement point. Permanent impacts would remain unchanged from those characterized for Alternative 1.1.

Alternative 10.2 would avoid reconstruction at one impingement point at Winslow Levee compared to Alternative 1.1. Furthermore, there would be no excavation, earthmoving activities associated with the removal of sediment and salt cedar or the discharge of fill through the conveyance improvement area. Alternative 10.2 would require the temporary discharge of dewatering structures such as earthen berms or cofferdams at the east end RWDL associated with construction near three impingement points. Structures would likely be discharged at the edge of active flows. Thus, placement of dewatering structures would not result in notable increases in flow velocity and water surface elevations within the vicinity of the work area during construction. Furthermore, there would be no impoundment of flows. In addition, the reconstruction of RWDL would not result in permanent changes to the velocity, water surface elevation, or circulation at this reach. The dewatering structures would be removed from waters of the US upon completion of construction.

Alternative 10.4 would avoid reconstruction at one impingement point at Winslow Levee. The conveyance improvement area would be more than doubled in length compared to Alternative 1.1. Thus, the changes in flow characteristics characterized for Alternative 1.1 could be further pronounced. However, impacts would be localized to within a few thousand feet of the LCR.

Secondary impacts would entail minor changes in circulation, velocity, water surface level within the vicinity of the Conveyance Improvement Area as characterized under construction impacts. These changes would be attenuated and returned to baseline conditions within 1,000 feet downstream of the channelized reach. Flow characteristics; erosion and accretion processes; and sediment transport processes for the LCR within the proposed project area would remain unchanged.

Operations: With the exception of points where the LCR is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material into waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. However, most repairs would be like-for-like. Thus, discharges of fill material in most cases would not extend beyond the construction footprint. Operations and maintenance activities would also require periodic excavation of the channel

through the conveyance improvements area. Activities in waters of the US may require the discharge of dewatering structures for extensive repair and maintenance work. Structures would likely be discharged at the edge of active flows. Thus, placement of dewatering structures would not result in notable increases in flow velocity and water surface elevations within the vicinity of the work area during construction. The dewatering structures would be removed from waters of the US upon completion of construction. Overall, these activities would not result in substantial changes to velocity, surface elevation, and circulation patterns. Impacts would be less than significant.

Secondary impacts would be similar to those characterized for construction impacts.

4.1.5 Cumulative Impacts

Navajo County Flood Control District had historically constructed and maintained a levee to protect the city of Winslow. In 1978, a flood overtopped a 4 mile long levee. Navajo County constructed the current Winslow Levee between 1986 and 1989 using native substrate from the floodplain and adjacent areas. Most of the levee was constructed on the outer perimeter of the active floodplain, outside of waters of the US. The levee was repaired in 1994 after a flood overtopped the structure. Repairs included discharge of earthen fill from the floodplain and adjacent areas and addition of riprap to both sides of the damaged section of levee. On December 31, 2003, the levee experienced a piping failure. Further failure was avoided by discharging earthen fill on the riverside face of the levee. Permanent repairs were completed in 2005 as riprap was extended along both sides of the levee. The 5.3-mile-long RWDL was built by the Corps between 1968 and 1971. The purpose of this levee is to divert Ruby Wash flows away from downtown Winslow and eastward into the LCR mainstem. RWDL was likely repaired subsequent to construction. Repairs were likely like-for-like and resulted in de minims discharges of earthen fill within waters of the U.S. where the wash impinged against the levee.

The area within the vicinity of the project consists of undeveloped open space. There are no planned developments within the vicinity of the project in the foreseeable future. Thus, activities in the foreseeable future would consist of maintenance and flood damage repair for the construction project as well as existing railway and vehicular bridges. Most maintenance activities and repairs of the constructed project would not result in discharges of fill material within waters of the US or affect aquatic resources. Maintenance and repair activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. Most repairs would be like-for-like. Thus, discharges of fill material in most cases would not extend beyond the construction footprint. Operations and maintenance activities would also require periodic excavation of the channel through the conveyance improvements area. There would be no permanent loss of native substrate from the proposed project area since the high sediment load within the water column from sources in the upper portion of the watershed would replenish excavated sediment over time. Furthermore, the structure would not impede sediment transport processes. Since repairs would generally involve use of native substrate or rocks, the potential for introduction of contaminants into the water column are minimal.

4.2 Potential Direct and Secondary Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

Threatened and Endangered Species
Threatened or endangered listed species that historically may have been present within the proposed project area include Zuni Bluehead Sucker, Little Colorado River Spinedace, Southwestern Willow Flycatcher, Yellow-billed Cuckoo, Peebles Navajo Cactus, and Northern Mexican Gartersnake. None of these species has the potential to be present within the project area. No designated critical habitats are present in the proposed project area. See Section 4.5 of the IFR.

Construction: There would be no effect to any of the above-listed species from implementation of any of the alternatives.

Since saltcedar dominates the landscape, the possibility for presence of the species in the proposed project area is not anticipated for any of the alternatives.

There would be no secondary impacts.

Operations: With the exception of points where the LCR or Ruby Wash is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material within waters of the US or affect aquatic resources. Furthermore, Ruby Wash is ephemeral. Thus, most maintenance work in Ruby Wash would occur in the dry and would not affect aquatic resources.

Operations and maintenance activities near impingement points or the conveyance improvements in the LCR area may result in periodic discharges of fill in the form of native substrate, cement, or rock. However, most repairs would be like-for-like. Thus, discharges of fill material in most cases would not extend beyond the construction footprint. Operations and maintenance activities would also require periodic excavation and dewatering of the channel through the conveyance improvements area. There would be no effect to listed species, and BMPs described in Section 5.5 of the IFR would further reduce the potential for impacts.

There would be no secondary impacts.

4.2.1 Other Wildlife (Reptiles, Birds, and Mammals)

A variety of birds, and limited reptiles and mammals have the potential to be present within or within the vicinity of the aquatic ecosystem. Mammals include bats, mice, rats, beavers, ferrets, prairie dog, and fox. See Section 4.5 of the IFR.

Construction: Alternative 1.1 would require the discharge of dewatering structures such as earthen berms or cofferdams at the Winslow Levee associated with construction near the two impingement points, RWDL, and at the BNSF Railroad Bridge. In general, wildlife in the area are mobile. During construction, vibration, noise and presence of visual forms associated

with an active construction site would temporarily scatter wildlife from the construction area into vast open areas available within the proposed project area. Upon completion of construction, wildlife is expected to return. Thus, impacts to wildlife would be temporary and minor.

Approximately 7.1 acres of salt cedar would be removed from waters of the US, potential nesting habitat for migratory birds. Areas cleared of salt cedar during construction would be reseeded with vegetation that would adequately stabilize soils and minimize resistance to flow conveyance. These areas would remain available for wildlife use. Furthermore, the floodplain within the project area is densely populated with salt cedar. Approximately 1,900 acres of vegetation is present in and within the vicinity of the proposed project area. These areas would remain available for bird nesting and foraging. Thus, the permanent loss of 7.1 acres of salt cedar would result in minimal impacts to wildlife. To avoid impacts to migratory birds, work that would disturb or remove woody vegetation would not occur between April 15 and August 30 unless the affected area is first surveyed by a biologist and determined not to have nesting birds. Based on the above, impacts to wildlife would be less than significant.

Alternatives 3.1 and 8 would result in impacts similar to Alternative 1.1.

Alternative 9 entails implementation of nonstructural measures and reconstruction of RWDL. There would be no construction along Winslow Levee nor the conveyance improvement area. Furthermore, construction at RWDL would be smaller in scope relative to Winslow Levee. Thus, impacts to wildlife would be less than those characterized for Alternative 1.1.

Alternatives 10, 10.1, 10.2, 10.3 and 10.4 would result in impacts similar to Alternative 1.1.

Alternatives that implement new setback levees (3.1, 8, 10, 10.1, and 10.4) would increase the amount of floodplain available for establishment of riparian vegetation from 10.5 acres (Alternatives 8, 10, 10.1, and 10.4) to 158 acres (Alternative 3.1).

Secondary impacts from scattering of wildlife during construction may result in abandonment of burrows and nests. Foraging areas and territories may change as they are reestablished. However, there is sufficient open space available within the vicinity of the proposed project area for reestablishment of burrows, nests, and territories.

Operations: With the exception of points where the LCR and Ruby Wash is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material within waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. During construction, vibration, noise and presence of visual forms associated with an active construction site would temporarily scatter wildlife from the construction area into vast open areas available within the proposed project area. Upon completion of construction, wildlife is expected to return. Thus, impacts to wildlife would be temporary and minor.

Secondary impacts would be similar to those characterized for construction impacts.

4.2.2 Fish, Crustaceans, Mollusks and other Aquatic Organisms in the Food Web

Aquatic organisms that could be present within the aquatic environment of the proposed project area primarily consists of fish and amphibians. Though not federally-listed as threatened or endangered, the Flannelmouth Sucker, a federal species of special concern, was detected in the upper reaches of the proposed project area within the vicinity of the BNSF Railroad Bridge.

Presence of crustaceans and mollusks is also possible. See Section 4.5 of the IFR.

Construction: Alternative 1.1 would require the discharge of dewatering structures such as earthen berms or cofferdams at the Winslow Levee associated with construction near the two impingement points, RWDL, and the BNSF Railroad Bridge. In general, fish and amphibians are mobile. During construction, vibration, noise and presence of visual forms associated with an active construction site would temporarily scatter fish and amphibians from the construction area into others areas of the riverine environment. During dewatering activities, block nets would be used to minimize the potential for stranding fish in the dewatered area. Upon completion of construction, both fish and amphibians are expected to return. In-water construction work would temporarily elevate turbidity levels near the work area. However, given the turbid waters in the LCR, impacts to fish and other aquatic species would be minimal.

Mortality of aquatic organisms with limited mobility such crustaceans and mollusks within the construction footprint is likely. Individuals could be crushed or buried during construction. However, impacts would be temporary as affected areas are expected to recolonize upon completion of construction.

Alternatives 3.1, 8, 10, 10.1, 10.2 and 10.4 would result in impacts similar to those characterized for Alternative 1.1.

Alternative 9 would require the temporary discharge of dewatering structures such as earthen berms or cofferdams at the east end of the RWDL associated with construction near three impingement points. The dewatering structures would be removed from waters of the US upon completion of construction. Because Ruby Wash is ephemeral, the temporary discharges of fill material would result in minimal to no impacts to aquatic organisms.

Alternative 10.2 would avoid reconstruction at one impingement point at Winslow Levee compared to Alternative 1.1. Furthermore, there would be no excavation, earthmoving activities associated with the removal of sediment and salt cedar or the discharge of fill through the conveyance improvement area. Thus, potential impacts to aquatic species would be less than those characterized for Alternative 1.1. Alternative 10.2 would require the temporary discharge of dewatering structures such as earthen berms or cofferdams at the east end of the RWDL associated with construction near three impingement points. The dewatering structures would be removed from waters of the US upon completion of construction. Because Ruby Wash is ephemeral, the temporary discharges of fill material would result in minimal to no impacts to aquatic organisms.

Secondary impacts would entail minor changes in circulation, velocity, water surface level within the vicinity of the conveyance improvement area. Due to the wider and deeper channel through the BNSF Railroad Bridge there would be a slight decrease in velocity and surface water level. Furthermore, the interface between the water column and the soil cement structure may produce small eddys. However, these changes would not affect the aquatic species since eddys are present throughout surface flows due to natural irregularities within a natural river system. Because the changes would be localized, conditions associated with secondary impacts for aquatic species within the remainder of LCR proposed project area would remain unchanged.

Operations: With the exception of points where the LCR and Ruby Wash are impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material into waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. Operations and maintenance activities would also require periodic excavation of the channel as well as dewatering through the conveyance improvements area. Dewatering structures may be temporarily discharged into waters of US for in-water work. During dewatering activities, block nets would be used to minimize the potential for stranding fish in the dewatered area. Turbidity would be temporarily increased during installation and removal of dewatering structures. However, given the turbid waters in the LCR, impacts to fish would be minimal. Physical impacts to fish and amphibians during in-water work are unlikely. In general, sound and vibrations associated with heavy machinery would cause mobile species to temporarily abandon the work area. Mortality of aquatic organisms with limited mobility such crustaceans and mollusks within the construction footprint is likely. Individuals could be crushed or buried during construction. However, impacts will be temporary as affected areas are expected to recolonize upon completion of construction. There would be no significant effect to aquatic organisms as a result of operations and maintenance activities in waters of the US.

Secondary impacts would be similar to those characterized for construction impacts.

4.2.3 Vegetation

Saltcedar is the dominant species throughout most of the proposed project area. Other species present included greasewood (*Sacrobatus vermiculatus*), big sagebrush (*Artemisia tridentata*), coyote willow (*Salix exigua*), rabbitbrush (*Ericameria nauseosa*), four-wing saltbush (*Atriplex canescens*), New Mexico olive (*Forestiera neomexicana*), camelthorn (*Vachellia erioloba*), seepwillow (*Baccharis salicifolia*), sweet clover (*Melilotus officinalis*), winterfat (*Krascheninnikovia lanata*), tumble mustard (*Sisymbrium altissimum*), filaree (*Erodium botrys*), kochia (*Bassia scoparia*), and tumbleweed (*Salsola tragus*). Native species include coyote willow, New Mexico olive, and seepwillow. See Section 4.5 of the IFR.

Construction: Alternatives 1.1, 3.1, 8, 10, 10.1, and 10.3 would require removal of 7.1 acres of salt cedar, a non-native invasive plant, from waters of the US. The 7.1 acres of waters of US cleared of salt cedar during construction would be reseeded with vegetation that would

adequately stabilize soils and minimize resistance to flow conveyance. These areas would remain available for wildlife use. Thus, the permanent loss of 7.1 acres of a non-native, invasive plant would be less than significant.

Alternative 9 and 10.2 would not require removal of approximately 7.1 acres of salt cedar from the conveyance improvements area. There would be no decrease in the amount of existing vegetation or changes in vegetation composition within the proposed project area.

Alternative 10.4 would result in removal of approximately 5.5 acres of salt cedar from waters of the US. Thus, the geographic scope of impact would be slightly smaller compared to Alternative 1.1.

Secondary impacts associated with alternatives that remove and replace salt cedar with vegetation that would adequately stabilize soils and minimize resistance to flow conveyance may entail establishment of the replacement vegetation in downstream areas of LCR. Due to the dense growth of salt cedar, in the proposed project area and the ability of salt cedar to outcompete other types of vegetation, establishment of the replacement vegetation in downstream areas is not certain. Impacts are expected to be limited in scope. Alternative 9 would not result in secondary impacts.

Operations: The 7.1 acres of waters of US (5.5 acres for Alternative 10.4) reseeded with vegetation that would adequately stabilize soils and minimize resistance to flow conveyance would be maintained free of salt cedar. Thus, the permanent loss of this acreage of salt cedar would be less than significant.

Secondary impacts would be similar to those characterized for construction impacts.

4.2.4 Cumulative Impacts

Navajo County Flood Control District had historically constructed and maintained a levee to protect the city of Winslow. In 1978, a flood overtopped a 4 mile long levee. Navajo County constructed the current Winslow Levee between 1986 and 1989 using native substrate from the floodplain and adjacent areas. Most of the levee was constructed on the outer perimeter of the active floodplain, outside of waters of the US. The levee was repaired in 1994 after a flood overtopped the structure. Repairs included discharge of earthen fill from the floodplain and adjacent areas and addition of riprap to both sides of the damaged section of levee. On December 31, 2003, the levee experienced a piping failure. Further failure was avoided by discharging earthen fill on the riverside face of the levee. Permanent repairs were completed in 2005 as riprap was extended along both sides of the levee. The 5.3-mile-long RWDL was built by the Corps between 1968 and 1971. The purpose of this levee is to divert Ruby Wash flows away from downtown Winslow and eastward into the LCR mainstem. RWDL was likely repaired subsequent to construction. Repairs were likely like-for-like and resulted in de minims discharges of earthen fill within waters of the U.S. where the wash impinged against the levee.

The area within the vicinity of the project consists of undeveloped open space. There are no planned developments within the vicinity of the project in the foreseeable future. Thus, activities in the foreseeable future would consist of maintenance and flood damage repair for the

construction project as well as existing railway and vehicular bridges. Most maintenance activities and repairs of the constructed project would not result in discharges of fill within waters of the US or affect aquatic resources. Maintenance and repair activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. Most repairs would be like-for-like. Thus, discharges of fill material in most cases would not extend beyond the construction footprint. Operations and maintenance activities would also require periodic excavation of the channel through the conveyance improvements area.

During work in waters of the US, vibration, noise and presence of visual forms associated with an active construction site would temporarily scatter fish and amphibians from the construction area into others areas of the riverine environment. Upon completion of construction, both fish and amphibians are expected to return. In-water construction work would temporarily elevate turbidity levels near the work area. However, given the turbid waters in the LCR, impacts to fish and other aquatic species would be minimal. Mortality of aquatic organisms with limited mobility such crustaceans and mollusks within the construction footprint is likely. Individuals could be crushed or buried during construction. However, impacts will be temporary as affected areas are expected to recolonize upon completion of construction.

The 7.1 acres of waters of US (5.5 acres for Alternative 10.4) cleared of salt cedar during construction would be reseeded with vegetation that would adequately stabilize soils and minimize resistance to flow conveyance. These areas would remain available for wildlife use. Thus, the permanent loss of this acreage of a non-native, invasive plant would be less than significant.

4.3 Potential Direct and Secondary Impacts on Special Aquatic Sites (Subpart E) Sanctuaries and Refuges

There are no sanctuaries or refuges designated under state or federal laws within the proposed project area. Thus, both construction and operation of the proposed project would not directly or indirectly affect sanctuaries or refuges.

4.3.1 Wetlands

There are no wetlands in the proposed project area. Thus, both construction and operation of the proposed project would not directly impact wetlands. There would be no secondary impacts.

4.3.2 Mudflats

Mudflats are generally found in intertidal, estuarine or near-shore habitats, in deltas, or at river mouths. None of these conditions occur in the project area. Sediment deposits may occur on occasion in some parts of the LCR, but they do not function as mudflats, which are generally rich biologically and support benthic organisms that are supportive of fish and avian species. Thus, both construction and operation of the proposed project would not directly impact mudflats. There would be no secondary impacts.

4.3.3 Vegetated shallows

Vegetated shallows are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as sea grasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems. Vegetated shallows are not present in the proposed project area. Thus, both construction and operation of the proposed project would not directly impact vegetated shallows. There would be no secondary impacts.

4.3.4 Coral Reefs

Coral reefs consist of skeletal deposits, usually of calcareous or silicaceous materials, and occur in marine environments, which does not exist in the proposed project area. Thus, both construction and operation of the proposed project would not directly or indirectly affect coral reefs. Thus, both construction and operation of the proposed project would not directly impact vegetated shallows. There would be no secondary impacts.

4.3.5 Riffle and Pool

Streams are sometimes characterized by riffle and pool complexes. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Sand, silty loam, and clay are the primary substrates within the LCR and Ruby Wash. Rocks and cobbles are not sufficiently present to form permanent riffle and pool complexes. Thus, both construction and operation of the proposed project would not directly impact riffle and pool complexes. There would be no secondary impacts.

4.3.6 Cumulative Impacts

There are no special aquatic sites, sanctuaries or refuges within the aquatic environment. Thus, past construction activities, routine maintenance, and periodic flood damage repair work as well as continuation of these activities in the foreseeable future would not result in significant cumulative impacts.

4.4 Potential Direct and Secondary Effects on Human Use Characteristics (Subpart F)

4.4.1 Municipal and Private Water Supplies

The city of Winslow relies entirely on groundwater. Thus, the LCR and Ruby Wash are not direct sources for municipal or private water supplies. Furthermore, none of the alternatives would result in impoundment of water or changes to the availability of surface water. Thus, both construction and operation of the proposed project would not directly impact municipal and private water supplies. There would be no secondary impacts.

4.4.2 Recreation and Commercial Fisheries

The floodplain of the LCR riverward of the Winslow Levee is zoned as open space/recreational area. However, the proposed project area is sufficiently far from the populated center of Winslow such that sustained recreational use is unlikely. Furthermore, there are no recreational amenities such as parks, playgrounds, docks or piers near the LCR within the proposed project area. No recreational uses of the levee or flood plain were observed during field visits. There are no commercial fisheries in the LCR within the proposed project area. Thus, both construction and operation of the proposed project would not directly impact recreation and commercial fisheries. There would be no secondary impacts.

4.4.3 Water-related recreation

There are no recreational amenities conducive to water-related recreation such as docks, piers or boat launch ramp are near the LCR or Ruby Wash within the proposed project area. No water-related recreation such as fishing or boating were observed during field visits. Thus, both construction and operation of the proposed project would not directly impact water-related recreation. There would be no secondary impacts.

4.4.4 Aesthetics

Currently, the viewshed is composed of an open space with non-linear forms, heterogeneous textures and a natural color palette associated with a vegetated floodplain. The existing trapezoidal levee forms a distinct line with geometric forms as well as industrial colors and textures associated with an engineered structure.

Construction: Alternatives 1.1, 3.1, 8, 10, 10.1 and 10.3 would result in short-term adverse impacts during construction. The proposed measures under all action alternatives require large equipment to be present to perform the earthwork, remove the salt cedar, and to reconstruct the levees. Thus, there would be temporary impacts during construction. The extent and duration of temporary impacts is commensurate with the scope of the construction footprint. In the long term, these alternatives implementing levee reconstruction or construction of setback levees would not substantially alter the viewshed. Upon completion of construction, the viewshed would remain largely unchanged from that described above. Implementing conveyance improvements would result in removal of approximately 7.1 acres of salt cedar from waters of the US. Thus, a vegetated vista with non-linear forms, heterogeneous textures and a natural color palette associated with a vegetated floodplain would be transformed into a monochromatic, amorphous sandbar. However, the impacts would be temporary since the 7.1 acres of waters of US cleared of salt cedar during construction would be reseeded with vegetation that would adequately stabilize soils and minimize resistance to flow conveyance.

Construction under Alternative 9 would be limited to reconstruction of the RWDL. There would be temporary visual impacts during construction. However, the scope and duration of impacts would be substantially reduced when compared to other alternatives.

Alternative 10.2 would result in short-term adverse impacts during construction. However,

Alternative 10.2 would avoid reconstruction at one impingement point at Winslow Levee compared to Alternative 1.1. Furthermore, there would be no excavation, earthmoving activities associated with the removal of sediment and salt cedar or the discharge of fill through the conveyance improvement area. Thus, the geographic scope of impacts would be less than those characterized for Alternative 1.1.

Alternative 10.4 result in impacts similar to those characterized for Alternative 1.1. However, implementing conveyance improvements would result in removal of approximately 5.5 acres of salt cedar from waters of the US. Thus, a vegetated vista with non-linear forms, heterogeneous textures and a natural color palette associated with a vegetated floodplain would be transformed into a monochromatic, amorphous sandbar. However, the impacts would be temporary since the 5.5 acres of waters of US cleared of salt cedar during construction would be reseeded with vegetation that would adequately stabilize soils and minimize resistance to flow conveyance.

There would be no secondary impacts to aesthetics.

Operations: With the exception of points where the LCR is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material into waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material into waters of the US. Thus, there would be temporary impacts to aesthetics during construction. The extent and duration of temporary impacts is commensurate with the scope of the construction footprint. Since most activities would entail like-for-like repairs, impacts to aesthetics would not be substantially altered in the long term.

There would be no secondary impacts to aesthetics.

4.4.5 Parks, national and historical monuments, national seashores, wilderness areas, and research sites

With the exception of Homolovi State Park, there are no parks, national and historical monuments, national seashores, wilderness areas, and research sites within the vicinity of the project area. See Section 4.6 of the IFR.

Potential impacts to Homolovi State Park were evaluated in conjunction with hydraulic analyses which evaluated water surface elevations of each alternative compared under two baseline scenarios: (1) a baseline condition where the existing levees would not fail prior to overtopping and (2) a baseline condition where the existing levees could fail based on the probability of unsatisfactory performance due to levee slope failure, impingement, or piping failure prior to waters overtopping the levee. The non-levee failure baseline is expected to have higher water surface elevation compared to the levee failure baseline since, if the levees failed, water would breach the levee and enter the larger floodplain. Within Homolovi State Park, the Homolovi I Pueblo is partially in the 1% ACE floodplain under both baseline scenarios.

Construction: Alternatives 1.1 and 8 should not significantly alter the water surface profile at

Homolovi I or increase the flood frequency compared to the non-levee failure baseline.

Under the second baseline scenario, water would leave the system prior to reaching Homolovi I and therefore, the water surface elevation could be slightly higher at Homolovi I under these alternatives versus this baseline condition. However, the levee would need to simultaneously fail at four locations for this to be the case, which brings the likelihood that this second baseline condition would occur to a less than 5 percent chance in any given flood event. Therefore, it is not reasonably foreseeable that the alternatives would result in an adverse effect or a significant impact to Homolovi I. (See Section 4.6 of the IFR). During later planning and design phases, any potential impacts would be avoided or minimized to the extent possible.

Alternative 3.1 features the largest setback of all of the alternatives. Under the non-levee failure baseline, the 1% ACE flood would still inundate the Homolovi I Pueblo area. However, average water surface elevations in this area is expected to decrease by about 0.7 feet. Under the levee failure baseline scenario, Alternative 3.1 would result in a decrease in water surface elevation by approximately 1.5 feet, and a decrease of approximately 15 feet in the water surface profile.

Alternatives 7 and 9 would not alter the existing conditions at Homolovi I under either baseline scenario.

Impacts under Alternatives 10, 10.1, 10.2, 10.3 and 10.4 evaluated under the non-levee failure baseline scenario would be similar to those characterized under Alternatives 1.1 and 8, with the exception that no impacts would occur in the northern 2.5 miles of the Winslow Levee. Under the levee failure baseline scenario, water would leave the system prior to reaching Homolovi I and therefore, the water surface elevation could be up to 0.5 feet higher at Homolovi I under each of these alternatives, but given the reasons stated above, it is not reasonably foreseeable that the alternatives would result in an adverse effect or a significant impact to Homolovi I.

Additional modelling during the preliminary engineering and design phase would be undertaken at different flood events and different scenarios to ensure that flooding inundation and erosion impacts to Homolovi I are avoided or minimized to the extent possible.

Secondary impacts associated with either flooding or erosion could entail loosening of consolidated soils around structures at Homolovi I or expansion/contraction of earthen cultural resources associated with flood inundation and subsequent drying process.

Secondary impacts are not anticipated to result in significant impacts. Additional modelling during the preliminary engineering and design phase would be undertaken at different flood events and different scenarios to ensure that impacts to Homolovi I are avoided or minimized to the extent possible.

Operations: With the exception of points where the LCR is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material into waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material into waters

of the US. The extent and duration of temporary impacts is commensurate with the scope of the construction footprint. Since most activities would entail like-for-like repairs, impacts to Homolovi State Park would not be substantially different from those characterized for construction.

Secondary impacts are not anticipated to result in significant impacts. Additional modelling during the preliminary engineering and design phase would be undertaken at different flood events and different scenarios to ensure that impacts to Homolovi I are avoided or minimized to the extent possible.

4.5 Evaluation and Testing (Subpart G)

Construction: All alternatives would result in discharge of temporary fill. Alternatives 3.1, 8, 10, 10.1, 10.3 and 10.4 would result in discharge of permanent fill. Temporary fill would consist of dewatering structures within waters of the US. Dewatering structures would be removed upon completion of construction. Permanent discharges of fill material would entail discharges of soil cement. Both temporary and permanent fills would be chemically inert and would not leach contaminants into the water column. Per 40 C.F.R. 230.60(a), additional chemical, biological, and physical evaluation testing would not be required.

Operations: With the exception of points where the LCR and Ruby Wash is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most operations and maintenance activities would not result in discharges of fill material within waters of the US or affect aquatic resources. Operations and maintenance activities near impingement points or the conveyance improvements area may result in periodic discharges of fill material in the form of native substrate, cement, or rock. These fill material would be chemically inert and would not leach contaminants into the water column. Per 40 C.F.R. 230.60(a), additional chemical, biological, and physical evaluation testing would not be required.

5.0 Measures to Minimize Adverse Impacts (Subpart H)

- WQ 1: The construction contractor shall be required to obtain coverage under the National Pollution Discharge Elimination System (NPDES) construction general permit program, in compliance with the Clean Water Act Section 402, prior to construction. As part of this process the construction contractor shall be required to coordinate with the Arizona Department of Environmental Quality (ADEQ), and obtain and comply with the requirements of applicable permits including providing notifications/reports to the permitting agencies and to the Corps. Prior to initiating construction, the construction contractor shall prepare a Storm Water Pollution Prevention Plan (SWPPP), coordinate the SWPPP with the ADEQ for their concurrence, and implement the SWPPP, in accordance with the requirements of the NPDES construction general permit program.

- WQ 2: The SWPPP prepared by the construction contractor shall include an erosion control plan to control potential sedimentation and turbidity impacts. The erosion control plan shall include temporary measures such as sandbags and/or water bars and

may include long-term measures such as re-vegetating access roads and soils borrow areas.

- WQ 3: The construction contractor shall also prepare a pollution prevention plan (PPP) to reduce the potential for accidental release of fuels, pesticides, and other materials. The PPP shall include the designation of refueling locations, emergency response procedures, and definition or reporting requirements for any spill that occurs. Equipment for immediate cleanup shall be kept at the staging area for immediate use.

- WQ 4: Prior to construction, the Corps and/or the local sponsor shall prepare, obtain, and implement a project specific CWA 401 Water Quality Certification (WQC) from the ADEQ. A Clean Water Act (CWA) 401 Water Quality Certification letter of support for the proposed project was received on July 13, 2018. A CWA WQC was issued on August 6, 2018 (Appendix I – Environmental).

- WQ 5: Areas where surface or groundwater is encountered would be dewatered and pumped outside of the work limits, likely released back into the LCR downstream, thereby minimizing contact with construction activities. Applicable permits for dewatering and/or water releases would be obtained.

- VG 1: In the areas where saltcedar removal is proposed, follow-up treatment (e.g. mechanical and/or herbicide) is required on re-sprouting saltcedar. The approximately ±96-acre area of saltcedar within the floodplain and in vicinity of the BNSF Railroad and State Route 87 bridges would be reseeded and/or revegetated with native, historic vegetation previously found in the LCR Winslow project area.

- VG 2: For all considered disposal areas, material should be placed in areas that are upland and are not within riparian areas of the project area. All riparian areas, or where moist soil occurs, should be avoided when placing disposed material. In addition, any vegetated areas that are disturbed from disposal or borrow would need to be returned to pre-construction conditions revegetating with native, historic vegetation previously found in the LCR Winslow project area.

- VG 3: Any vegetated areas that are disturbed from disposal, borrow, staging, stockpiling, or access, or other construction related activities would be returned to pre-construction conditions revegetating with native, historic vegetation previously found in the LCR Winslow project area.

- VG 4: To reduce potential spread of the invasive saltcedar into borrow/disposal areas, borrow areas will segregate material to reduce the potential spread of saltcedar.

- WL 1 To avoid impacts to migratory birds, work that would disturb or remove woody vegetation would not occur between April 15 and August 30 unless the affected area is first surveyed by a biologist and determined not to have nesting birds.

- WL 2 During any construction and O&M activities during minimal flow periods (near impingement points, channel excavation/widening, etc.), BMPs would be incorporated to minimize negative impacts to the sensitive flannelmouth. BMPs may include, but are not limited to the following: silt curtains, wattles, coffer dams, and erosion protection screens. These BMPs would help to prevent fish access to the construction site and ensure protection of water quality. BMPs would be inspected daily to maintain the connection to the substrate and would be removed following construction.

- WL-3 After the completion of the widening of the conveyance channel, the channel bottom would be replaced with native material that is characteristic for the LCR. After the completion of the approximately ±26-acre area widening of the conveyance channel at the BNSF Railroad bridge, follow-up treatment (e.g. mechanical and /or herbicide) is required on re-sprouting saltcedar. No reseeding and/or revegetation with native plantings would be required in the conveyance channel, as recurring O&M work removing sediment in the conveyance channel would inhibit long-term establishment of natives.

- SP 1 As a precautionary measure, prior to the start of any construction or O&M activities, surveys for the Yellow-billed Cuckoo and southwestern willow flycatcher will be conducted. The following additional BMPs would be applied to avoid or minimize effects to species.
    - Follow-up treatments (e.g. mechanical and/or herbicide) of saltcedar would occur within saltcedar removal areas. This area would be reseeded and/or revegetated with native plantings.
    - During any construction or O&M activities during minimal flow periods (near impingement points, channel excavation/widening, etc.), BMPs would be incorporated to minimize negative impacts to the sensitive flannelmouth as well as other fish species. BMPs may include, but are not limited to the following: silt curtains, wattles, coffer dams, and erosion protection screens. These BMPs would help to prevent fish access to the construction site and insure protection of water quality. BMPs would be inspected daily to maintain the connection to the substrate and would be removed following construction.
    - After the completion of the widening of the conveyance channel, the channel bottom would be replaced with native material that is characteristic for the LCR.
    - In addition, any vegetated areas that are disturbed from disposal, borrow, staging, stockpiling, or access, or other construction related activities would be returned to pre-construction conditions.

6.0 Compensatory Mitigation for Losses of Aquatic Resources (Subpart J)

With the exception of points where the LCR and Ruby Wash impinge against the structures, the existing levees are located in the uplands outside of waters of the US. Thus, most construction as well as operations and maintenance activities under any of the action alternatives would not result in discharges of dredged or fill material within waters of the US or affect aquatic

resources. Alternatives that incorporate the conveyance improvement area as a management measure would result in permanent impacts to waters of the US due to the discharge of soil cement structures. Construction of Alternatives 1.1, 3.1, 8, 10, 10.1, and 10.3 would result in approximately 1.2 acres of permanent impacts to waters of the US. Alternative 10.4 would result in approximately 2.9 acres of impacts.. There are approximately 326.5 acres of potential waters of the US within the proposed project area. Thus, the permanent loss of 1.2 to 2.9 acres would represent approximately a 0.36% to 0.88% decrease in waters of the US, respectively. The sole aquatic function that would be affected as a result of the discharge is groundwater recharge. However, given the 0.36% to 0.88% decrease in waters of the US, loss of groundwater recharge functions would be de minimis. The discharge would not result in the loss of native riparian vegetation or wetlands since salt cedar, an invasive species, dominates the area. The discharge would be aligned parallel to existing structures such as the Winslow Levee, RWDL or the BNSF Railroad Bridge. There would be no temporary or permanent impoundment of waters. Thus, the discharge would not substantially alter existing fish and wildlife habitat. Due to the absence of commercial fisheries or aquaculture, the discharge would not affect aquaculture-based economies. Lastly, the discharge would not impound flows; redirect flows; or change circulation patterns. Thus, the discharge would not result in increased flood risks. Instead, the discharge in concert with the larger proposed action would serve to further reduce flood risks in the project area.

The removal of saltcedar which would occur as part of the project would provide a benefit to the aquatic environment, and offsets these permanent impacts. Based on the above, and with the implementation of avoidance and minimization measures, the proposed discharge would not result in loss of aquatic functions to a degree that would require compensatory mitigation.

7.0 Findings

Alternative 10.1 is the Recommended Plan. The discharge complies with the 404(b)(1) guidelines pursuant to 40 C.F.R. § 230.12. Our determination of compliance is based on the following findings:

(1) There are no available, practicable alternatives having less adverse impact on the aquatic ecosystem and without other significant adverse environmental consequences that do not involve discharge into Waters of the United States. Alternative 10.1 is the least environmentally damaging practicable alternative (LEDPA).

While Alternative 7 would have less impact to waters of the United States and avoid significant impacts to cultural resources, this alternative is not cost effective and is not supportable for implementation under Corps policies. Alternative 9 would also have less impact to waters of the United States and avoid significant impacts to cultural resources. However, in order to be supported for implementation, this alternative's components would have to be independently justified under Corps policies. This alternative is composed of two features, the elevation of structures equivalent to Alternative 7, and the rebuilding of RWDL. The elevation of structures would not be independently justified under a separable analysis and would not be implementable under Corps policies. The rebuilding of RWDL would address flood risk in only a small segment of the project area.

Further, both Alternatives 7 and 9 would leave substantial annual residual damages, from the baseline of $10,230,000 reduced to only $9,964,000 and $8,324,000 (FY14 Price Levels), respectively. Therefore, under these alternatives, the area would remain highly susceptible to flood risk.

Alternative 10.2, which provides for risk reduction to a 90% confidence level for the 4% ACE, would also have less impact to waters of the United States. However, this alternative would have substantially higher residual risk than Alternative 10.1. This alternative would not reduce the flood risk in the vicinity of the BNSF bridge, as it would not increase conveyance capacity. If an event larger than 4% ACE occurred, then life safety, property, and critical infrastructure would remain subject to existing flood risks. Alternative 10.2 has overall lower benefits and lower net benefits than 10.1. Thus, this plan is not considered the LEDPA due to the other adverse impacts identified.

Alternative 10.1 meets the overall project purpose and is practicable with respect to cost, technology, and logistics. It provides for risk reduction to a 90% confidence level for the 1% ACE. This alternative is determined to be the LEDPA.

(2) The discharge will not violate state water quality standards.

With the exception of points where the LCR or Ruby Wash is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most construction as well as operations and maintenance activities would not result in discharges of dredged or fill material within waters of the US or affect aquatic resources.

Construction areas within waters of the US would be dewatered and isolated from active flows to minimize water quality impacts. Adherence to the SWPPP, CWA Section 401 water quality certification requirements, and implementation of BMPs described in Section 5.1 would ensure compliance with state water quality standards. Both temporary and permanent fills used during construction and operation would be chemically inert and would not leach contaminants into the water column.

Initial excavation and periodic maintenance of the conveyance improvement area would temporarily increase turbidity. However, the LCR and Ruby Wash are already turbid due to excessive sediment from natural and anthropogenic sources from the upper watershed. Thus, temporary increases in turbidity would not result in notable changes in turbidity.

(3) The discharge will not violate toxic effluent standards.

With the exception of points where the LCR or Ruby Wash is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most construction as well as operations and maintenance activities would not result in discharges of dredged or fill material within waters of the US or affect aquatic resources.

Both temporary and permanent discharges of fill during construction and operation would not violate state water quality standards. Fill proposed to be discharged during construction as well as operation and maintenance would entail rocks, soil cement, and native soils. The fill material would be chemically inert and would not leach contaminants into the water column. All work areas would be isolated from active flows during construction and operation, and storm water runoff at construction and maintenance locations would be contained according to SWPPP conditions.

(4) The discharge will not jeopardize endangered or threatened species or their critical habitat.

With the exception of points where the LCR or Ruby Wash is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most construction as well as operations and maintenance activities would not result in discharges of dredged or fill material within waters of the US or affect aquatic resources.

There would be no effect to Zuni Bluehead Sucker, Little Colorado River Spinedace, Southwestern Willow Flycatcher, Yellow-billed Cuckoo, Peebles Navajo Cactus, or Northern Mexican Gartersnake from implementation of any of the alternatives, as none have the potential to be present. There is no critical habitat present in the proposed project area.

(5) The discharge will not violate standards set by the Department of Commerce to protect marine sanctuaries.

No sanctuaries as designated by the Marine Protection, Research and Sanctuaries Act of 1972 will be affected by the proposed project.

(6) The proposed discharge material will meet testing exclusion criteria.

Fill proposed to be discharged during construction as well as operation and maintenance would entail rocks, soil cement, and native soils. The rocks and soil cement material would be chemically inert and would not leach contaminants into the water column.

Initial excavation and periodic maintenance of the conveyance improvement area would disturb native soils. Upon contact with the water column, contaminants that could potentially be present within the soils could migrate into the water column. However, since the disturbed soils are native to site, work within waters of the US would not introduce additional contaminants not already present within the native substrate.

Evaluation of the information above indicates that the proposed discharge material meets testing exclusion criteria for the following reason(s):

( ) based on the above information, the material is not a carrier of contaminants.

(x) the levels of contaminants are substantially similar at the extraction and disposal sites and the discharge is not likely to result in degradation of the disposal site and pollutants will not be transported to less contaminated areas.

( ) acceptable constraints are available and will be implemented to reduce contamination to acceptable levels within the disposal site and prevent contaminants from being transported beyond the boundaries of the disposal site.

(7) The discharge will not contribute to significant degradation of Waters of the United States through adverse impacts to human health or welfare, through pollution of municipal water supplies, fish, shellfish, wildlife and special aquatic sites.

The LCR and Ruby Wash are not sources for municipal or private water supplies. Both waterways do not support recreational fisheries, commercial fisheries or shellfish operations. Special aquatic sites such as wetlands and vegetated shallows are not present within the proposed project area.

(8) The discharge will not contribute to significant degradation of Waters of the United States through adverse impacts to diversity, productivity, and stability of the aquatic ecosystem, such as the loss of fish or wildlife habitat, or loss of the capacity of wetland to assimilate nutrients, purify water or reduce wave energy.

With the exception of points where the LCR and RWDL is impinged against the structure, the existing levees are located in the uplands outside of waters of the US. Thus, most construction as well as operations and maintenance activities would not result in discharges of dredged or fill material within waters of the US or affect aquatic resources. Furthermore, the aquatic environment within the LCR riverine system lacks biologically productive aquatic features such as wetlands, vegetated shallows, and riffle and pool complexes.

(9) The discharge will not contribute to significant degradation of Waters of the United States through adverse impacts to recreational, aesthetic, and economic values.

The LCR and Ruby Wash are not sources for municipal or private water supplies. Both waterways do not support recreational fisheries, commercial fisheries, shellfish operations, or other economic elements.

(10) The discharge includes all appropriate and practicable measures (40 C.F.R. §§ 230.70-77) to minimize the potential harm to the aquatic ecosystem.

Appropriate and practicable measures identified in Section 5.1 above would be implemented.

On the Basis of the Guidelines, the Proposed Disposal Site(s) for the Discharge of Dredged or Fill Material is:

____ (1) Specified as complying with the requirements of these guidelines; or,

X (2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,

____ (3) Specified as failing to comply with the requirements of these guidelines. The required 404(r) statements are included in the Integrated Report.

8.0 References

Arizona Department of Environmental Quality (ADEQ). 2010. Impaired and Not Attaining Waters Lists - 303(d) list.

Arizona Department of Water Resources (ADWR). 2009. Arizona Water Atlas. Eastern Plateau Planning Area.

Arizona Department of Environmental Quality (ADEQ). 2002. Little Colorado River TMDL for Turbidity