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# Rio de Flag

## Environmental Impact Statement

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# Final

prepared 

U.S. Army Corps of Engineers  
Los Angeles District  
911 Wilshire Blvd.  
Los Angeles, CA 90017



prepared

KEA Environmental, Inc.  
350 S. Grand Ave., Ste. 3920-A  
Los Angeles, CA 90071



KEA ENVIRONMENTAL, INC.

SEPTEMBER 2000

**Final Environmental Impact Statement (EIS)**  
**Rio de Flag**  
**Coconino County, Arizona**

**Abstract:** This Final Environmental Impact Statement (EIS) addresses alternative means of providing flood protection in Flagstaff, Arizona. The Federal lead agency responsible for implementing the National Environmental Policy Act (NEPA) for this proposed action is the U.S. Army Corps of Engineers, Los Angeles District (USACOE). The initial Draft EIS was circulated for a 45-day public review period in compliance with NEPA from November 19, 1999 to January 4, 2000. The public comment period was later extended to March 31, 2000. In response to public comments and subsequent to a more detailed internal review of the project alternatives, the USACOE decided to revise the recommended plan and recirculate the Draft EIS for public comment. The public comment period for the revised Draft EIS started on June 30, 2000 and ended on August 14, 2000.

Five alternatives (including the No Action Alternative) have been carried forward for detailed environmental evaluation in this Final EIS. The first alternative (Alternative 6a) includes a detention basin along the Clay Avenue Wash and channel modifications along the Rio de Flag and Clay Avenue Wash alignments. Alternative 6a also includes flood control features at Thorpe Park (floodwalls, small embankments, road elevation) and bridge modifications upstream of Thorpe Park. The second alternative (Alternative 6b) includes the same project components as Alternative 6a with the exception of a two-block-long covered channel segment along the downtown reach of the Rio de Flag. The third alternative (Alternative 7) includes two additional detention basins (Cheshire Park and Thorpe Park) in conjunction with the bridge modifications, channel modifications, and Clay Avenue Wash detention basin described for Alternative 6b. The fourth alternative (Alternative D) would involve the construction of two large berms in the Continental Estates area to protect specific structures from flood flows, with no upstream flood control measures. The No Action Alternative involves no flood protection measures along the Rio de Flag or Clay Avenue Wash. Only one of these five alternatives will be selected for implementation.

Each alternative would result in environmental impacts. Mitigation measures and environmental commitments to reduce or avoid impacts have been identified. Consideration of the impacts versus the associated flood protection benefits resulted in the selection of Alternative 6b, the environmentally preferred alternative, as the USACOE's preferred alternative (also referred to as the "recommended plan").

Part I of this Final EIS includes the Final EIS text and Appendices. Part II includes the comment letters received on the revised Draft EIS and corresponding USACOE responses.

For Further Information Contact:      Tim Smith, Biological Sciences Environmental Manager  
U.S. Army Corps of Engineers  
Ecosystem Planning Section  
911 Wilshire Boulevard, 14<sup>th</sup> Floor  
Los Angeles, CA 90017

## **PART I**

# **FINAL EIS & APPENDICES**

The text of the public review Draft EIS has been revised and updated in response to public and agency comments. Although these changes are not extensive, it is important to identify which sections of the document have been revised. Accordingly, this Final EIS includes an annotated “R” in the margin of the text where the document has been substantially revised. Minor changes such as changing the word “Draft” to “Final” are not identified due to the extensive nature of these revisions. A sample “R” is provided in the margin of this paragraph. (For Electronic Format Revisions are in Blue Text)

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## **EXECUTIVE SUMMARY**

This document is a Final Environmental Impact Statement (EIS) addressing alternative means of providing flood protection in Flagstaff, Arizona. (The City of Flagstaff is located in southern Coconino County in north central Arizona, approximately 150 miles north of Phoenix.) The initial Draft EIS was circulated for a 45-day public review period in compliance with the National Environmental Policy Act (NEPA) from November 19, 1999 to January 4, 2000. This public comment period was later extended to January 18, 2000 and finally to March 31, 2000. In response to public comments and subsequent to a more detailed internal review of the project alternatives, the U.S. Army Corps of Engineers (USACOE) decided to revise the proposed action and alternatives and recirculate the Draft EIS.

### **BACKGROUND**

The Rio de Flag is an ephemeral stream and tributary of the San Francisco Wash, which feeds into the Little Colorado River. (An ephemeral stream is one that lacks a year-round baseflow, flowing only after rain or snow melt.) Sinclair Wash and Clay Avenue Wash, which are also ephemeral, are the major tributaries to the Rio de Flag within the study area. Flooding in the Rio de Flag is related to snow melt on the San Francisco Peaks in the spring and runoff from torrential summer storms.

Originating on the southwestern slopes of the San Francisco Mountains north of Flagstaff, the Rio de Flag flows over various types of terrain: the wide, flat valleys of the Fort Valley region; the steep, narrow canyons north of Flagstaff; and the wide, flat-bottomed canyons southeast of Flagstaff. The total drainage area of the Rio de Flag watershed is approximately 116 square miles, and the total drainage area above the Flagstaff city limits is roughly 50 square miles. The elevation of the drainage area as a whole ranges from approximately 12,356 feet to 6,800 feet (USACOE 1997).

Based on historical records, flooding within the City of Flagstaff may occur during any season of the year. Eighteen floods have been recorded along the Rio de Flag since 1888, and the last major floods (estimated 25-year events) in Flagstaff occurred in 1938 and 1993. Following the 1993 flood, the City of Flagstaff claims to FEMA amounted to just over \$200,000.

Significant development occurred within the Rio de Flag floodplains until adoption of Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps and associated development

restrictions in 1983. Years of unregulated development in the floodplain have left only a narrow and shallow low-flow channel throughout much of the downtown area.

Today residential, commercial, and industrial development is extensive along the floodplain of Rio de Flag through most of the city. A number of these structures are highly susceptible to flood-related damages in the event of a large storm. Under current conditions, structures valued at approximately \$385 million will continue to be subject to potential flood damage. Nearly half of the 100-year floodplain along the Rio de Flag is zoned as residential areas, whereas approximately one quarter is zoned as commercial. The historic downtown area and the south side of the city center are almost entirely within the floodplain of the Rio de Flag, the 100-year overflow zone of Clay Avenue Wash, or both, where flood depths range from 3 to 8 feet. The north campus of Northern Arizona University also lies within the 100-year floodplain. The railroad tracks which traverse east/west through the City of Flagstaff would also be affected by flooding, with portions of the tracks' embankment projected to be completely inundated during a 100-year event.

Development, especially in the historic downtown and south-side areas, has significantly affected the river channel in several ways:

- sections of the Rio de Flag and its tributaries were filled in, realigned, or both
- buildings were constructed adjacent to, or in some cases directly over, the channel
- roads crossings were built with culverts inadequately sized (too small) to carry storm flows.

Problems and opportunities related to the flooding of the Rio de Flag have been identified, defined, and assessed through public meetings, coordination with local and regional agencies, field reconnaissance, and interpretation of prior studies and reports.

## **PURPOSE AND NEED**

The purpose of the proposed action is to provide improved flood protection in Flagstaff. This increased level of flood protection would reduce public and private flood inundation damages to residential, commercial, industrial, and historic property, and to bridges and road crossings within the study area. Aside from its primary objective of providing increased flood protection, the proposed action would also reduce transportation-related damages and could provide a more natural

greenbelt/parkway setting through the use of native vegetation and grasses in selected reaches of the Rio de Flag channel. The proposed improvement in flood protection for the City of Flagstaff is needed for the reasons previously described under “Background.”

## **ALTERNATIVES**

A total of four alternatives were analyzed in the initial Rio de Flag Draft EIS (October 1999), including Alternatives 1, 5, D, and the No Action Alternative. Based on public comments and a detailed internal review of the project alternatives, Alternatives 1 and 5 were removed from consideration. As a result of the USACOE’s plan development process, three new flood protection alternatives were developed which are addressed in detail in this EIS. (In order to maintain consistency, these alternatives are designated with numbers or letters as they appear in other related USACOE reports.) Alternative D and the No Action Alternative were also carried forward from the initial Draft EIS analysis and are included in this document. The five alternatives analyzed in this revised EIS (Alternatives 6a, 6b, 7, D, and No Action) are summarized below and are described in detail in Section 2.0, Alternatives. Only one (or none) of these alternatives will be selected and implemented by the USACOE and the City of Flagstaff. As noted below, Alternative 6b is the USACOE’s preferred alternative.

### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

This alternative would involve: (1) bridge modifications upstream of Thorpe Park along the Rio de Flag; (2) flood protection structures and road modifications at Thorpe Park; (3) channel modifications along Clay Avenue Wash and the downtown portion of the Rio de Flag; and (4) a detention basin along the Clay Avenue Wash, just west of the city limits. These features are described below.

- **Bridge Modifications.** Three bridges would be modified along the Rio de Flag, including the Meade Lane, Anderson Road, and Beal Road bridges. Wingwalls would be constructed upstream of the Meade Lane bridge and the existing bridge would remain in place. The Anderson and Beal road bridges, however, would be demolished and replaced.
- **Thorpe Park Modifications.** A combination of berms and floodwalls would be constructed along the eastern side of the Rio de Flag through Thorpe Park. The walls would be constructed using reinforced concrete covered with basalt fieldstone as an esthetic treatment. The combined berm

and floodwall height would not exceed 5 feet. In order to minimize flooding of North Thorpe Road and adjacent properties, an approximately 350-foot section of the road would be rebuilt at a higher elevation. In addition, small embankments would be constructed on either side of the Rio de Flag just downstream of the existing weir. These embankments would be designed to direct floodwaters into the channel and would not result in upstream detention.

- **Rio de Flag Channel Modifications.** The Rio de Flag channel modifications would consist of two basic components: (1) expanding the existing channel from North Bonito Street downstream to just south of Route 66, and (2) creating a new channel starting south of Route 66, continuing roughly parallel to the railroad tracks through downtown (immediately south of the tracks), and joining a remnant portion of the historic Rio de Flag channel approximately 1,700 feet upstream of Butler Street. Under this alternative, the downtown reach would be an open channel configuration with buried riprap sideslopes and no covered channel segments (aside from the road and railroad crossings). Three homes would be acquired and removed along the western bank of the Rio de Flag near Cherry Avenue. This private property would be acquired by the City of Flagstaff as part of this project, pursuant to applicable Federal and state laws, including the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601).
- **Clay Avenue Wash Channel Modifications.** The Clay Avenue Wash channel modifications would generally entail either (1) expanding and lining the existing channel with concrete or riprap or (2) diverting the channel underground through developed areas.
- **Clay Avenue Wash Detention Basin.** The Clay Avenue Wash detention basin would be located to the west/southwest of downtown Flagstaff, just west of the city limits and north of Route 66. The proposed site encompasses mostly privately-owned property including undeveloped land and a rural residence and its associated agricultural buildings. This private property would be acquired by the City of Flagstaff pursuant to applicable Federal and state laws. The basin area also includes some state-owned land.

Grading and site work would consist of three relatively small embankments tied into high ground, with the site's natural topography serving to contain detained flood flows within the basin. Each of these embankments are described below; no other flood control measures (e.g., floodwalls) or grading would be required at the site. The capacity of the Clay Avenue Wash detention basin would be approximately 295 acre-feet (96 million gallons). When filled to capacity, water contained within the basin would cover approximately 71 acres. Water would be discharged from the basin over a period of up to 60 hours, depending on the amount of rainfall and snow melt. By

extending the period during which runoff and snow melt flow through the downstream channels, the amount of flow within the channels at any one time is reduced. This, in turn, lowers the potential for flooding adjacent to those channels.

- *Northeast Embankment.* The embankment constructed at the northeast edge of the detention basin would contain the outlet structure and spillway. The outlet structure would consist of a single 42-inch diameter corrugated metal pipe, with a capacity of approximately 165 cubic feet per second (cfs). In addition, a smaller “bleed off” pipe or irrigation gate valve would be installed at the channel invert to eliminate long-term ponding. The top of the embankment would be approximately 21 feet above ground level.
- *Northwest Embankment.* An embankment would be constructed just south of the Burlington Northern & Santa Fe (BNSF) railroad tracks along the northern boundary of the detention basin. This embankment would be approximately 1,225 feet in length and 50 feet in width. The top of the embankment would be no more than 10 feet above ground level.
- *Southeast Embankment.* This embankment would be adjacent to the Hidden Hollow Mobile Home park, and it would be specifically constructed to protect the mobile home park from flooding. This embankment would not contain an outlet structure or spillway, and it would be approximately 12 feet tall at its highest point. It would extend approximately 475 feet along the northern edge and 500 feet along the western edge of the mobile home park.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b is the USACOE’s preferred alternative (also known as the “Recommended Plan”). This alternative would provide 100-year flood protection in downtown Flagstaff and would also reduce flooding further downstream. The components of Alternative 6b are essentially the same as those described for Alternative 6a; however, this alternative includes a two-block-long covered channel segment along the downtown reach of the Rio de Flag. The covered channel would extend from Dale Street downstream to Birch Avenue. The underground channel would eliminate the need to acquire and demolish any homes along the downtown reach of the Rio de Flag.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The Clay Avenue detention basin and the Clay Avenue Wash and Rio de Flag channel modifications would be the same as for Alternative 6b. Alternative 7 also includes upstream detention basins along the Rio de Flag at Thorpe Park and Cheshire Park, respectively. These two basins are described below.

- **Cheshire Park Detention Basin.** The proposed Cheshire Park detention basin site is located in northern Flagstaff east of Fremont Boulevard and south of Highway 180. Under this alternative, Cheshire Park and several acres of ponderosa pine forest would be eliminated and replaced with a large basin. The Narrows dam, a small check dam southeast of the park, would be removed and replaced with a larger outlet structure. The basin would encompass approximately 5 acres of land, including approximately 0.5 acres of land currently owned by the Museum of Northern Arizona. Land acquisition would be undertaken pursuant to Federal and State laws.

The Cheshire Park detention basin would be an off-line basin. As such, a split-flow channel would be constructed along the west side of the proposed detention basin to convey normal flows along the Rio de Flag. A split-flow weir would divert flows in excess of 1,500 cfs over the weir and into the detention basin. The capacity of the basin would be 30 to 35 acre-feet (9.8 million to 11.4 million gallons) and the maximum water storage elevation would be approximately 7,084 feet above mean sea level. The basin would drain completely within 24 to 48 hours. The downstream face of the weir would be constructed of riprap. Following construction, the basin sideslopes would be revegetated pursuant to a native plant species revegetation plan currently being developed by the USACOE in consultation with the Arboretum at Flagstaff.

The upstream portion of the basin would have 10:1 sideslopes and the downstream portion would have 3:1 sideslopes. If feasible Cheshire Park would be reconstructed within the footprint of the proposed basin, and the park would be expanded to include passive recreational features throughout the basin. If it is not feasible to reconstruct Cheshire Park within the basin, a replacement park would be built elsewhere within the same neighborhood.

- **Thorpe Park Detention Basin.** The Thorpe Park detention basin would encompass approximately 23 acres of Thorpe Park in northwest Flagstaff. The total volume of the detention basin would be approximately 80 acre-feet (26 million gallons). A substantial portion of the park

would be excavated by approximately two feet, and a bypass channel would be constructed along the eastern boundary of the park. The basin would entail the following key components:

- *Basin Excavation.* Approximately 23 acres of Thorpe Park would be excavated by two feet in order to achieve the required storage capacity of the basin. All facilities affected by excavation activities would be replaced in a manner to minimize or avoid future flood damages. This includes the two Little League fields, three softball fields, concession stands, restrooms, a small parking lot just south of North Thorpe Road, and other park infrastructure (lighting standards, picnic tables, benches, plaques, etc.). Frances Short Pond would also be affected.
- *Bypass Channel.* A bypass channel would be constructed along the eastern side of the park near the current alignment of the Rio de Flag. The invert (channel bottom) would be excavated to 24 feet in width and the channel sideslopes would be constructed at a 3:1 slope. A combination berm and floodwall would also be constructed along the eastern side of the channel. Similar to Alternative 6a, the berm and floodwall would extend along the western property line of approximately 14 residences and the Flagstaff Junior High School. The combined height of the berm and floodwall would not exceed 5 feet, and the floodwall would be constructed using basalt fieldstone as an esthetic treatment. The bypass channel and floodwall would terminate at the proposed embankment (described below), and normal flows would continue through the embankment via an arch culvert.
- *North Thorpe Road Modification.* As with Alternatives 6a and 6b, an approximately 350-foot section of North Thorpe Road would be rebuilt at a higher elevation. The road would be closed for two weeks while pavement is removed, fill added, and the road repaved.
- *Embankment.* An embankment consisting of a berm, spillway, and outlet structure would be constructed immediately south (downstream) of the existing weir at Frances Short Pond. The historic weir would not be affected although it would no longer be used as an access road. At the outlet location, the embankment would have a height of approximately 12 feet, as measured from the base of the downstream side. Following construction, the embankment would be landscaped pursuant to a native species revegetation plan currently being developed by the USACOE in consultation with the Arboretum at Flagstaff.
- *Access Road Relocation.* The access road that currently leads to Flagstaff Junior High School would be relocated from its current alignment along the weir to a new alignment across the top of the embankment. Construction would require the closure of the road for approximately two

months. To avoid access-related impacts to the school, these construction activities would be undertaken during the summer.

- *Park Facility Replacement.* Over 350 trees (including nearly 280 ponderosa pines) and numerous park facilities would be removed under this alternative. All park facilities affected by construction activities would be replaced in their pre-construction condition. Structures (e.g. concession stand, restrooms) would be floodproofed in order to minimize or avoid damage during major flood events. Also, trees would be replanted in areas affected by project construction. Frances Short Pond would remain in its current location; however, excavation of the surrounding land by two feet would result in a wider pond and an increase in the amount of shallow water around the banks.

The embankment would define much of the detention basin's southern limits, and the berm and floodwalls would form the basin's eastern boundary. To the west and north, the spread of detained floodwaters would be contained within the excavated portion of the basin. At full capacity, the embankment and floodwalls would contain water within the excavated area at approximately 6,934 feet above mean sea level. The basin would be sized to completely drain within 48 to 60 hours for the 100-year event, 36 hours for the 50-year event, and less than 24 hours for other more frequent events.

#### **Alternative D: Localized Non-Structural Flood Proofing Alternative**

The Localized Non-Structural Flood Proofing Alternative would consist of two berms located in the vicinity of Continental Estates (a primarily residential community in eastern Flagstaff). These localized berms, described below, would protect specific structures from flood flows. Unlike the previously described alternatives, this alternative does not include the use of detention basins or channel modifications, and it would not provide any flood control protection for the areas upstream of Continental Estates (e.g., downtown Flagstaff). The berms would be constructed primarily on public land. If selected, this alternative would be modified in the final design phase in order to minimize or completely avoid private property acquisition.

- **North Berm.** The northernmost berm would be located southeast of the intersection of Country Club Drive and Interstate Highway 40 (I-40). The berm would extend approximately 3,530 feet along the east side of a residential area accessible via Cortland Boulevard. The berm would range in height from 14 to 23 feet, as measured from the base of the slopes, and the width would vary

from 72 to 98 feet along the base of the structure. Upon completion of construction, the berm would be landscaped in accordance with a native plant revegetation plan currently being developed by the USACOE in consultation with the Arboretum at Flagstaff. The north berm would completely avoid any grave sites at the Peaceful Valley Memorial Park (cemetery).

- **South Berm.** This berm would be located approximately 2,000 feet south of the north berm. The structure would be very similar in appearance and construction to the north berm; however, the dimensions would be slightly different. The south berm would range in height from 13 to 26 feet, and it would range between 72 and 114 feet wide at the base. Beginning at its westernmost end, the berm would be built near the western edge of several residential properties located on Fairview Drive and cross Country Club Drive just north of the residential area. To the east of Country Club Drive, the berm would parallel Oakmont Drive through the Continental Little League Fields and cross Oakmont Drive just east of Walnut Hills Drive. The berm would continue along the northeast side of several residences on Laurel Loop and Willow Loop, after which it would head east and tie into an existing hillside near Oakmont Drive. The total length of the south berm would be approximately 7,600 feet. As with the north berm, it would be vegetated with grasses, wild flowers, and shrubs.

### **No Action Alternative**

Under the No Action Alternative, no flood protection measures would be implemented along the Rio de Flag or Clay Avenue Wash in the Flagstaff area. In the absence of future flood control improvements, continued growth in the Rio de Flag watershed would be expected to exacerbate the current flooding problem.

### **IMPACT SUMMARY**

The potential environmental impacts of these five alternatives were evaluated in detail in this EIS (see Section 4.0). Table ES-1 provides a matrix comparison of the alternatives' respective impacts. Impacts have been categorized as one of the following:

- significant, unmitigable (impacts cannot be reduced below the level of significance)
- significant, mitigable (impacts would be reduced to less than significant levels)

- not significant
- beneficial.

In some cases, the No Action Alternative would have no impact on a given resource. Also, in some cases, one component of an alternative would have an adverse impact while another component of the alternative would provide beneficial effects. In these cases, both effects are noted. It should also be noted that the USACOE is seeking an exemption from Clean Water Act Section 401 certification for this project. Accordingly, a 404(r) evaluation has been prepared (see Appendix F).

**Table ES-1. Impact Summary Matrix**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Topography/ Geography</b>	<p>Short-term erosion impacts associated with construction of the various flood protection features (channel modifications, floodwalls, bridge modifications, detention basin, etc.) would be mitigated to less than significant levels. Other topography/ geography impacts would be less than significant.</p> <p><i>Significant, Mitigable</i></p>	<p>Impacts would be the same as those described for Alternative 6a. Short-term impacts from erosion would be reduced to less than significant levels.</p> <p><i>Significant, Mitigable</i></p>	<p>Impacts would be similar to those described for Alternatives 6a and 6b; however, this alternative would involve greater quantities of earthwork. Short-term impacts from erosion would be reduced to less than significant levels.</p> <p><i>Significant, Mitigable</i></p>	<p>Unlike Alternatives 6a, 6b, and 7, Alternative D would not entail construction in stream channels and would not have potentially significant erosion impacts. No significant topography/geography impacts would result, and no mitigation is required.</p> <p><i>Not Significant</i></p>	<p>Under the No Action Alternative, there would be no change to topography/geography resources.</p> <p><i>No Impact</i></p>
<b>Water Quality/ Hydrology</b>	<p>Alternative 6a would result in potentially significant water quality impacts from sedimentation or the accidental release of fuels or solvents during construction. Mitigation measures would be required to reduce impacts to a less than significant level.</p> <p><i>Significant, Mitigable</i></p>	<p>Impacts would be the same as those described for Alternative 6a. Short-term water quality impacts would be mitigated to less than significant levels.</p> <p><i>Significant, Mitigable</i></p>	<p>This alternative would alter the low flow hydrology of the Rio de Flag and the size and depth of Frances Short Pond. The effect of these changes on hydrology would be less than significant. As described for Alternatives 6a and 6b, Alternative 7 would result in potentially significant short-term water quality impacts.</p> <p><i>Significant, Mitigable</i></p>	<p>Berm construction could result in significant water quality impacts from the accidental release of fuels or solvents during construction.</p> <p><i>Significant, Mitigable</i></p>	<p>The No Action Alternative would not affect water resources.</p> <p><i>No Impact</i></p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Biological Resources</b>	<p>Alternative 6a would result in potentially significant impacts from the disturbance or removal of riparian/wetland vegetation and the potential introduction of nonnative weed species from imported fill material. These impacts would be mitigated to less than significant levels.</p> <p>No significant impacts to any federally listed threatened, endangered, or proposed threatened or endangered species would result from Alternative 6a.</p>	<p>Alternative 6b would result in the same biological resource impacts as Alternative 6a. In addition, this alternative would convert approximately 2 blocks of earthen channel to an underground concrete-lined arch. Mitigation measures are provided to reduce these impacts to a less than significant level.</p>	<p>Alternative 7 would result in the same biological resource impacts as Alternative 6b. In addition, Alternative 7 would result in potentially significant impacts to riparian/wetland vegetation at Cheshire Park and Thorpe Park (including impacts to Frances Short Pond). These impacts would be mitigated to less than significant levels.</p>	<p>No loss of sensitive habitat and no impacts to threatened or endangered species would occur under this alternative.</p>	<p>There would be no impacts to biological resources because there would be no construction activities that would affect those resources.</p>
	<i>Significant, Mitigable</i>	<i>Significant, Mitigable</i>	<i>Significant, Mitigable</i>	<i>Not Significant</i>	<i>No Impact</i>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<p><b>Cultural Resources</b></p>	<p>Three homes would be removed along the Rio de Flag under Alternative 6a. These homes are located in the Flagstaff Townsite Historic District but are not listed as contributing elements to the District. At the Clay Avenue Wash detention basin, three ranch buildings constructed in 1935, 1944, and 1954, respectively, are within the 100-year ponding limit. These would need to be evaluated for National Register of Historic Places (National Register) eligibility. If eligible, mitigation would be required. Six unevaluated historic archaeological sites in the 100-year ponding limit of this basin would not be significantly affected.</p> <p>Mitigation would be followed pursuant to a programmatic agreement being developed between the USACOE, the Arizona State Historic Preservation Officer, and the Advisory Council on Historic Preservation.</p>	<p>The three homes in the Flagstaff Townsite Historic District would not be removed under this alternative. Impacts to cultural resources would otherwise be the same as those described for Alternative 6a.</p>	<p>Two historic structures at the Thorpe Park detention basin site would need to be evaluated for National Register eligibility and moved from the embankment footprint.</p> <p>Alternative 7 would include the cultural resource impacts and mitigation listed for Alternative 6a. No additional cultural resource impacts are anticipated as a result of the Cheshire Park and Thorpe Park basins. Should archaeological resources be encountered during construction, they would be mitigated as described in the programmatic agreement being developed between the USACOE, the Arizona State Historic Preservation Officer, and the Advisory Council on Historic Preservation.</p>	<p>No cultural resources are anticipated within the area of disturbance for berm construction; accordingly, no impacts are anticipated. This assessment would be verified by a survey prior to construction.</p>	<p>The No Action Alternative would not directly impact cultural resources because it would not entail construction activities.</p> <p>Continued flooding could result in potentially significant effects to several potentially National Register-eligible structures in the City of Flagstaff. Mitigation for these impacts would normally be to protect the structures from flooding. However, implementing a flood control project would not be considered mitigation for the No Action Alternative; instead, the provision of flood protection is represented by project Alternatives 6a, 6b, and 7. Therefore, no mitigation measures are provided.</p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Land/Water Use</b>	<p>The flood protection features associated with Alternative 6a (channel modifications, floodwalls, detention basin, etc.) would not cause significant existing land use impacts and would not conflict with adopted land use plans or planning guidance.</p> <p>The impacts to residents of homes that would be purchased and demolished, including three houses along the Rio de Flag, a ranch house at the Clay Avenue Wash detention basin site, and 15 mobile homes at the Trailers Ho mobile home park (along Clay Avenue Wash) are addressed under Socioeconomics.</p>	<p>Three less homes would be affected under this alternative. Impacts to existing and planned land use would be essentially the same as those described for Alternative 6a.</p>	<p>In addition to the land uses impacted under Alternative 6b, Alternative 7 would affect existing recreational facilities at Cheshire Park and Thorpe Park. Cheshire Park would be replaced either on site or at a nearby location and Thorpe Park would remain in use following construction. The loss of park use during construction is addressed separately under Recreation, below. Because the parks would be replaced or returned to park use following construction, land use impacts would be less than significant.</p>	<p>The construction of berms along the edges of residential properties and a golf course would not result in significant land use impacts.</p>	<p>There would be no construction and no direct effects to existing or planned land uses. The potential beneficial effects of flood protection provided by the previous alternatives would not be realized under the No Action Alternative.</p>
	<i>Not Significant</i>	<i>Not Significant</i>	<i>Not Significant</i>	<i>Not Significant</i>	<i>No Impact</i>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Recreation</b>	<p>Alternative 6a would result in potentially significant short-term recreation impacts from temporary closures of trail sections within the Flagstaff Urban Trails System (FUTS). Mitigation measures are provided to reduce these impacts to less than significant levels.</p> <p><i>Significant, Mitigable</i></p> <p>The channel modifications would provide an extension of the FUTS system, including a north/south crossing under the railroad tracks.</p> <p><i>Beneficial</i></p>	<p>This alternative would result in temporary impacts to the FUTS, as described for Alternative 6a. Impacts would be mitigated to a less than significant level.</p> <p><i>Significant, Mitigable</i></p> <p>The channel modifications would provide an extension of the FUTS system, including a north/south crossing under the railroad tracks.</p> <p><i>Beneficial</i></p>	<p>Alternative 7 would result in significant unavoidable short- and long-term impacts to recreational users, including: the four-month closure of Cheshire Park, the twelve-month closure of Thorpe Park facilities, and the long-term loss of approximately 350 mature trees at Thorpe Park.</p> <p><i>Significant, Unmitigable</i></p> <p>Other impacts at Cheshire and Thorpe parks and along the FUTS would be mitigated to less than significant levels, including: temporary closures of trail sections within the FUTS, partial excavation of ballfields, impacts to Frances Short Pond, and impacts to recreational facilities from flooding.</p> <p><i>Significant, Mitigable</i></p>	<p>Construction of the southern berm would interfere with the use of the Continental Estates Little League Fields.</p> <p><i>Significant, Mitigable</i></p> <p>A portion of the southern berm would be constructed near a golf course, but this would not significantly affect the use of the course during or after construction. No other recreational impacts would occur.</p> <p><i>Not Significant</i></p>	<p>The No Action Alternative would not affect existing or planned recreational facilities.</p> <p><i>No Impact</i></p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Socioeconomics</b>	<p>Alternative 6a would involve the acquisition of 3 homes along the Rio de Flag downtown reach, a ranch house, and 15 mobile homes along the Clay Avenue Wash. The property owners would be compensated in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. While this ensures adequate financial compensation, including relocation expenses, it cannot substantially mitigate the loss of social ties, upheaval, and sense of loss that may be experienced by the individuals to be relocated. Therefore, while the economic effects of displacement would be reduced, the significant social impacts would be unmitigable.</p> <p><i>Significant, Unmitigable</i></p> <p>Construction would generate short-term beneficial economic impacts.</p> <p><i>Beneficial</i></p>	<p>Alternative 6b would involve the acquisition of a ranch house and 15 mobile homes along the Clay Avenue Wash. As described for Alternative 6a, the economic effects of displacement would be reduced, whereas the significant social impacts would be unmitigable.</p> <p><i>Significant, Unmitigable</i></p> <p>Construction would generate short-term beneficial economic impacts.</p> <p><i>Beneficial</i></p>	<p>Alternative 7 would involve the acquisition of a ranch house and 15 mobile homes along the Clay Avenue Wash. As described for Alternatives 6a and 6b, the economic effects of displacement would be reduced, whereas the significant social impacts would be unmitigable.</p> <p><i>Significant, Unmitigable</i></p> <p>Construction would generate short-term beneficial economic impacts.</p> <p><i>Beneficial</i></p>	<p>The construction of the berms would have a minor beneficial socioeconomic impact due to the creation of short-term construction jobs and the associated increase in personal income levels.</p> <p>Alternative D would not require the acquisition of private property (including residences).</p> <p><i>Beneficial</i></p>	<p>The No Action Alternative would not cause socioeconomic impacts; however, it would not prevent or minimize future flooding along the Rio de Flag. As a result, damages to residential, commercial, institutional, and industrial property would be expected in the future as a result of flooding.</p> <p><i>No Impact</i></p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Transportation</b>	<p>Alternative 6a would result in construction traffic from bridge modifications (10 truck trips per day for 5 days), Thorpe Park modifications (35 truck trips per day for 6 months), channel modifications (26 truck trips per hour for 6 months) and detention basin construction (46 truck trips per day for 3 weeks). The effect of this traffic on the local roadway network would be mitigated to a less than significant level.</p> <p>Channel modifications would also require 18 road closures during construction, each lasting up to one week. Sections of Mike's Pike would be closed over a period of six weeks. Other roads would be restricted to two lanes for short periods of time during construction. These short-term impacts would be mitigated to less than significant levels, primarily through the use of detours.</p>	<p>Although Alternative 6b would result in slightly fewer truck trips for the channel modifications component, traffic impacts would essentially be the same as Alternative 6a. Impacts would be mitigated to less than significant levels.</p>	<p>Construction-related traffic would result in potentially significant impacts on the local roadway network, including bridge modifications (10 truck trips per day for 5 days), Cheshire Park detention basin (26 truck trips per day for 4 months), Thorpe Park detention basin (73 truck trips per day for 8 weeks), Clay Avenue Wash detention basin (46 truck trips per day for 3 weeks), and channel modifications (26 truck trips per hour for 6 months). Mitigation measures would reduce these impacts to a less than significant level.</p> <p>Road closures (including an approximately two-month closure of the Flagstaff Junior High access road) would result in significant impacts. Mitigation measures are provided to reduce impacts from road closures to less than significant levels.</p>	<p>Alternative D would generate an average of 42 construction-related truck trips per hour for the duration of the six month construction period (12 per hour for the north berm and 30 per hour for the south berm). This traffic would utilize Country Club Rd., one of two primary access points to the Continental Estates area in eastern Flagstaff.</p> <p>The construction traffic would represent a significant impact due to the importance of Country Club Rd. for access to/from the Continental Estates area. This impact would be mitigated to less than significant levels by limiting construction traffic to non-peak hours (i.e., between morning and afternoon commutes).</p> <p>Temporary construction in the roadway at Country Club Dr. and Oakmont Dr. would be</p>	<p>The No Action Alternative would not generate traffic or close roads. During floods, roads in the downtown Flagstaff area and in low lying portions of Continental Estates may become impassable. Additionally, major floods could affect the Burlington, Northern &amp; Sante Fe railroad tracks that traverse Flagstaff.</p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Noise</b>	<p>In compliance with the City of Flagstaff Noise Ordinance, construction activity would not be conducted between the hours of 12:00 a.m. and 6:00 a.m. Monday through Friday or between 1:00 a.m. and 7:00 a.m. on Saturday or Sunday.</p> <p>Because channel modifications would occur in close proximity to sensitive receptors, including the Flagstaff City Library and City Hall, construction-related impacts would be significant. Non-blasting impacts would be mitigated to less than significant levels. If blasting is required in the channel sections adjacent to the library, noise impacts would not be mitigable; however, this is not anticipated.</p> <p><i>Significant, Mitigable (non-blasting)</i></p> <p><i>Significant, Unmitigable (blasting)</i></p>	<p>Noise impacts would be essentially the same as those described for Alternative 6a. Non-blasting noise impacts would be mitigated to less than significant levels. If required, noise impacts from blasting would be significant and unavoidable.</p> <p><i>Significant, Mitigable (non-blasting)</i></p> <p><i>Significant, Unmitigable (blasting)</i></p>	<p>Noise impacts would be similar to those described for Alternative 6a; however, this alternative would involve more intensive construction activities at Thorpe Park and construction of a detention basin at Cheshire Park. As with alternatives 6a and 6b, non-blasting noise impacts would be mitigated to less than significant levels. If required, noise impacts from blasting would be significant and unavoidable.</p> <p><i>Significant, Mitigable (non-blasting)</i></p> <p><i>Significant, Unmitigable (blasting)</i></p>	<p>Construction would comply with the Flagstaff Noise Ordinance.</p> <p>Noise levels at residences near the potential flood control berms are expected to be less than significant.</p> <p><i>Not Significant</i></p>	<p>The No Action Alternative would not generate noise.</p> <p><i>No Impact</i></p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Air Quality</b>	<p>Construction would generate pollutants through vehicle emissions. Additionally, grading and hauling soil would generate dust.</p> <p>These short-term emissions would not exceed state or Federal air quality standards. Voluntary mitigation has been identified to reduce the nuisance factor associated with dust generation.</p> <p><i>Not Significant</i></p>	<p>Air quality impacts would be the same as those described for Alternative 6a.</p> <p><i>Not Significant</i></p>	<p>Air quality impacts would be greater than those described for Alternatives 6a and 6b; however, short-term emissions would not exceed state or Federal air quality standards. Voluntary mitigation has been identified to reduce the nuisance factor associated with dust generation.</p> <p><i>Not Significant</i></p>	<p>Construction would generate pollutants through vehicle emissions. Additionally, grading and hauling soil would generate dust.</p> <p>These short-term emissions would not exceed state or Federal air quality standards. Voluntary mitigation has been identified to reduce the nuisance factor associated with dust generation.</p> <p><i>Not Significant</i></p>	<p>To No Action Alternative would not generate air pollutants.</p> <p><i>No Impact</i></p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Esthetics</b>	<p>This alternative would result in significant unavoidable esthetic impacts from the removal of mature trees lining the channel. Mitigation measures are provided to reduce these impacts, but not to a less than significant level. Such measures include 1:1 tree replacement during the post-construction and landscaping phase of the project.</p> <p><i>Significant, Unmitigable</i></p>	<p>The covered channel segment along the downtown reach of the Rio de Flag would incrementally increase the significant esthetic impacts of this alternative in comparison to Alternative 6a. As with Alternative 6a, mitigation measures are provided to reduce these impacts, but not to less than significant levels. Such measures include 1:1 tree replacement during the post-construction and landscaping phase of the project.</p> <p><i>Significant, Unmitigable</i></p>	<p>The significant unavoidable esthetic impacts described for Alternative 6b would occur under Alternative 7. This alternative would also result in significant unavoidable impacts at Thorpe Park and Cheshire Park from the removal of mature trees. Mitigation measures include 1:1 tree replacement during the post-construction and landscaping phase of the project.</p> <p><i>Significant, Unmitigable</i></p>	<p>The south berm would partially or completely obstruct views from numerous adjacent residences. This would constitute a significant, unmitigated esthetic impact.</p> <p><i>Significant, Unmitigable</i></p>	<p>The No Action Alternative would not result in any changes to the existing visual setting, and it would not result in esthetic impacts.</p> <p><i>No Impact</i></p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Hazardous and Toxic Materials</b>	<p>Several potential hazardous or toxic material sites are known to occur near the proposed channel modification alignments.</p> <p>For known or suspected hazardous materials sites, the USACOE has developed field screening procedures and preliminary response plans that would be finalized and implemented should any hazardous or toxic waste be identified during construction. These measures are anticipated to avoid significant hazardous and toxic materials impacts.</p> <p><i>Significant, Mitigable</i></p>	<p>Impacts would be the same as described for Alternative 6a. Mitigation measures are provided to reduce impacts related to hazardous and toxic materials to less than significant levels.</p> <p><i>Significant, Mitigable</i></p>	<p>No hazardous or toxic materials are anticipated at the Thorpe Park or Cheshire Park detention basin sites. As with Alternatives 6a and 6b, several potential hazardous or toxic material sites are known to occur near the proposed channel modification alignments. Mitigation measures are provided to reduce these impacts to less than significant levels.</p> <p><i>Significant, Mitigable</i></p>	<p>No hazardous or toxic materials are anticipated at either berm site. Should such materials be encountered, they would be handled pursuant to field screening procedures and preliminary response plans developed by the USACOE.</p> <p><i>Not Significant</i></p>	<p>This alternative would not require construction activity, and it would therefore not result in the potential to encounter hazardous or toxic materials.</p> <p><i>No Impact</i></p>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Safety</b>	<p>As discussed above, Alternative 6a would result in several temporary road closures. Impacts to emergency service provider access associated with these closures would be avoided through prior notification of the Flagstaff City Fire Department.</p> <p>The potential hazards associated with drainage channels, especially the covered concrete channels, would be mitigated through the use of an extensive public involvement program, warning signs, and fences or barricades in some locations.</p> <p>The on-going public information program would focus on teaching children the hazards of entering or playing in drainage channels.</p>	<p>Impacts regarding safety would be the same as described for Alternative 6a. Implementation of the Alternative 6a mitigation measures would reduce impacts to a less than significant level.</p>	<p>Alternative 7 would result in the same type of safety impacts as described for Alternatives 6a and 6b. Implementation of the Alternative 6a mitigation measures would reduce impacts to a less than significant level.</p>	<p>This alternative would not require road closures and would not otherwise generate significant safety hazards.</p>	<p>The No Action Alternative would not generate safety hazards; however, it would also not reduce any hazards associated with flooding.</p>
	<i>Significant, Mitigable</i>	<i>Significant, Mitigable</i>	<i>Significant, Mitigable</i>	<i>Not Significant</i>	<i>No Impact</i>

**Table ES-1. Impact Summary Matrix (continued)**

<b>Resource</b>	<b>Alternative 6a</b>	<b>Alternative 6b</b>	<b>Alternative 7</b>	<b>Alternative D</b>	<b>No Action Alternative</b>
<b>Cumulative Impacts</b>	Alternative 6a would not incrementally contribute to a significant cumulative impact.  <i>Not Significant</i>	Alternative 6b would not incrementally contribute to a significant cumulative impact.  <i>Not Significant</i>	Alternative 7 would not incrementally contribute to a significant cumulative impact.  <i>Not Significant</i>	Alternative D would not incrementally contribute to a significant cumulative impact.  <i>Not Significant</i>	The No Action Alternative would not incrementally contribute to a significant cumulative impact.  <i>No Impact</i>

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## **1.0 INTRODUCTION/PURPOSE AND NEED**

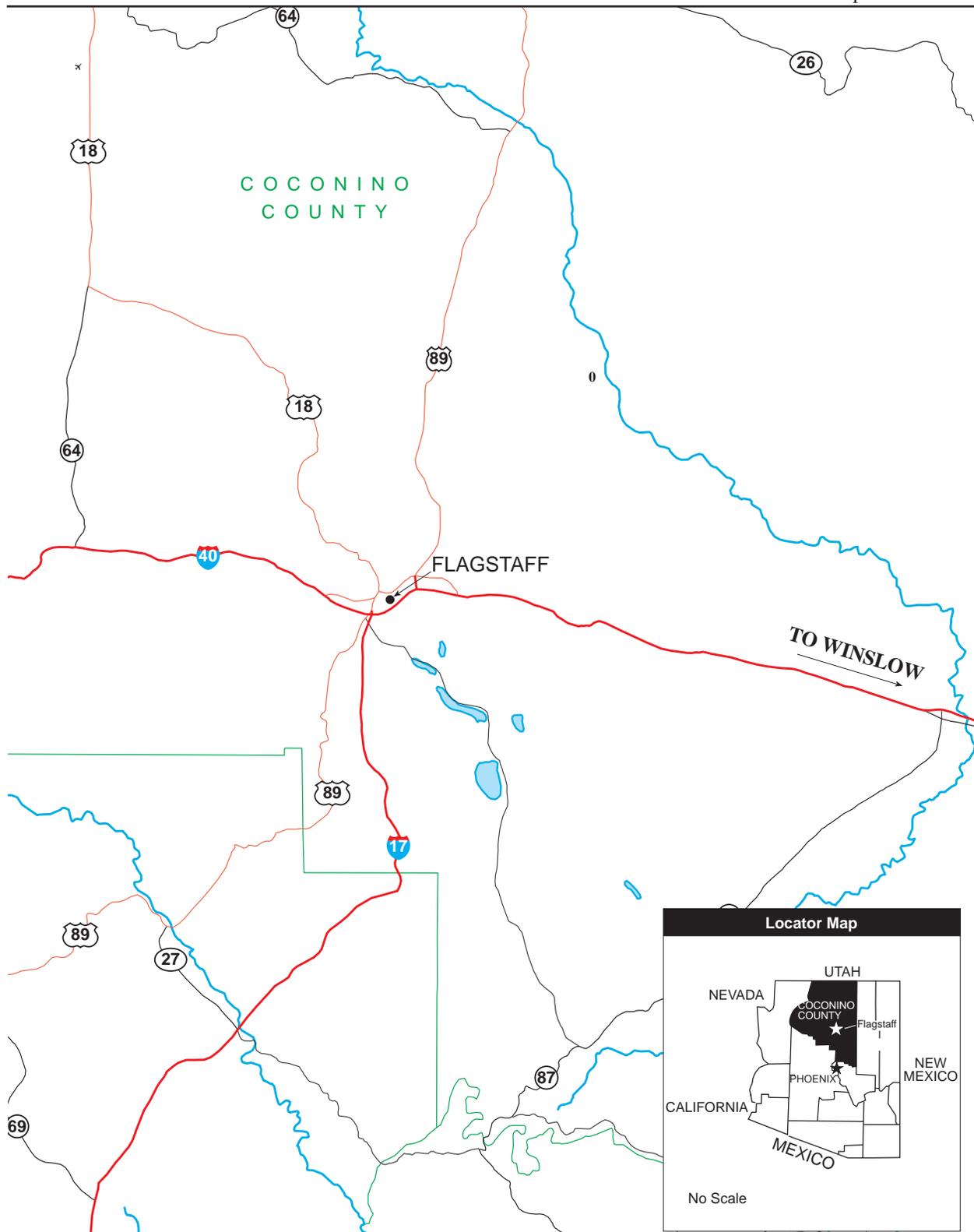
### **1.1 INTRODUCTION**

This document is a Final Environmental Impact Statement (EIS) addressing alternative means of providing flood protection in Flagstaff, Arizona. The initial Draft EIS was circulated for a 45-day public review period in compliance with the National Environmental Policy Act (NEPA) from November 19, 1999 to January 4, 2000. This public comment period was later extended to January 18, 2000 and finally to March 31, 2000. In response to public comments and subsequent to a more detailed internal review of the project alternatives, the U.S. Army Corps of Engineers (USACOE) decided to revise the recommended plan and recirculate the Draft EIS. The revised Draft EIS was circulated for public review from June 30, 2000 to August 14, 2000.

Comments received in response to the initial Draft EIS are included in Appendix A. These comments were considered during the preparation of the revised EIS and, based on these comments, changes and additional information were incorporated into the EIS as applicable. Written responses to the initial Draft EIS comments are not provided; however, written responses to comments received on the revised Draft EIS are included in Part II of this Final EIS.

This introductory chapter describes the project location, discusses the purpose and need of the proposed action, and briefly describes the study authority, agency use of the document, and related studies. Subsequent chapters describe project alternatives (Chapter 2), baseline conditions of the study area (Chapter 3), environmental consequences of the alternatives (Chapter 4), regulatory setting (Chapter 5), and the public participation process (Chapter 6).

The City of Flagstaff is located in southern Coconino County in north central Arizona (see Figure 1-1). The region has a population exceeding 60,000. The study area (see Figure 1-2) was defined through coordination between the USACOE and the City of Flagstaff, with input from the Flood Control District of Coconino County and the State of Arizona. The City of Flagstaff identified Rio de Flag and Clay Avenue Wash as the primary drainages contributing to flooding of major damage centers and problem areas. Located generally within the City of Flagstaff and Coconino County, Arizona, the study area for flood damages is approximately 15 square miles. It encompasses Rio de Flag upstream from the city limits to the Route 66 crossing just downstream of the Continental Estates housing development. Other “areas of potential effect”



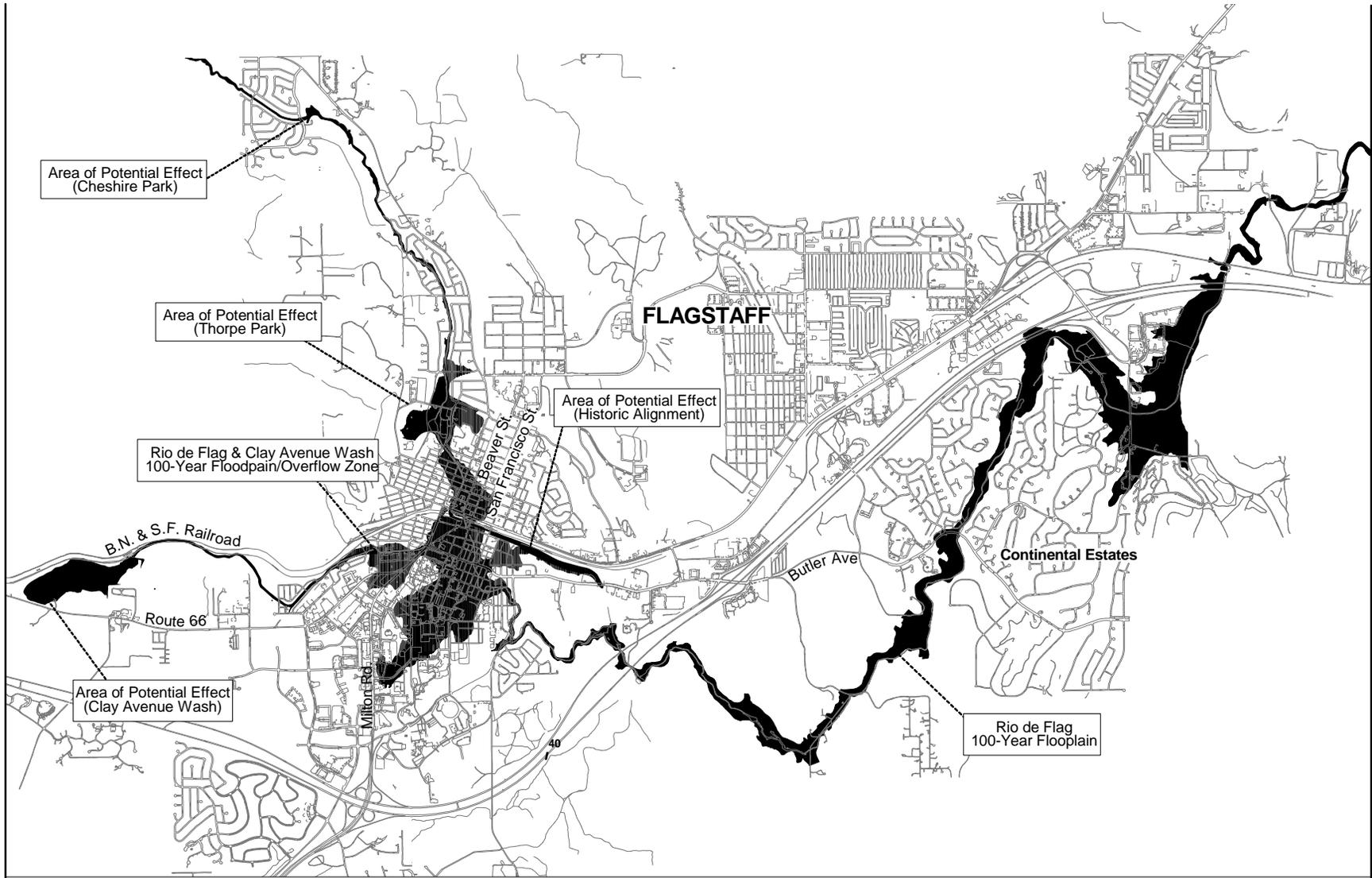
Source: Cartesia 1995



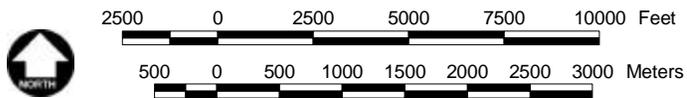
0 15 Miles

0 30,000 Meters

**Figure 1-1**  
**Regional Location Map**



Source: USACOE 1998 and USACOE 1999



**Figure 1-2**  
**Project Study Area**

included within the study area are three potential detention basin sites, portions of the Clay Avenue Wash, and the historic Rio de Flag alignment through downtown Flagstaff.

The Rio de Flag is an ephemeral stream and a tributary of the San Francisco Wash. (An ephemeral stream is one that lacks a year-round baseflow, flowing only after rain or snow melt.) Sinclair Wash and Clay Avenue Wash, which are also ephemeral, are the major tributaries to the Rio de Flag within the study area. Flooding in the Rio de Flag is related to snow melt on the San Francisco Peaks in the spring and runoff from torrential summer storms.

Based on historical records, flooding within the City of Flagstaff may occur during any season of the year. Floods have been recorded along the Rio de Flag in 1888, 1896, 1903, 1916, 1920, 1923, 1937, 1938, 1950, 1963, 1966, 1973, 1979, 1983, 1988, 1990, 1993, and 1995. The last major floods (estimated 25-year events) in Flagstaff occurred in 1938 (in terms of discharge) and in 1993 (in terms of volume). This corresponds to the height of the approximate 60-year interval between the peaks of wet cycles in northern Arizona. Since then, minor floods (estimated at less than 25-year events) have occurred. There is some evidence that Arizona has recently entered into another wet cycle (USACOE 1997). Structures valued at nearly \$385 million are currently at risk of flood damages in the event of a 100-year flood.

## **1.2 LOCATION**

The City of Flagstaff is located in southern Coconino County approximately 150 miles north of Phoenix (see Figure 1-1). Flagstaff is surrounded by the Coconino National Forest, an area that contains a large number of natural, scenic, and recreation attractions. Flagstaff is the Coconino County seat and serves as a center for employment, culture, and trading for northern Arizona.

Major transportation routes in the study area include Route 66 and Interstate Highway 40 (I-40). Both of these highways run generally east-west and parallel the Burlington Northern & Santa Fe (BNSF) Railroad (formerly known as the Atchison, Topeka, and Santa Fe Railroad) tracks. Throughout much of the study area, the Rio de Flag is paralleled by trails that are part of the Flagstaff Urban Trails System (FUTS).

The Rio de Flag is a tributary of the San Francisco Wash, which feeds into the Little Colorado River. Originating on the southwestern slopes of the San Francisco Mountains north of Flagstaff, the Rio de

Flag flows over various types of terrain: the wide, flat valleys of the Fort Valley region; the steep, narrow canyons north of Flagstaff; and the wide, flat-bottomed canyons southeast of Flagstaff. The total drainage area of the Rio de Flag watershed is approximately 116 square miles. The total drainage area above the Flagstaff city limits is roughly 50 square miles. The elevation of the drainage area as a whole ranges from approximately 12,356 feet to 6,800 feet (USACOE 1997).

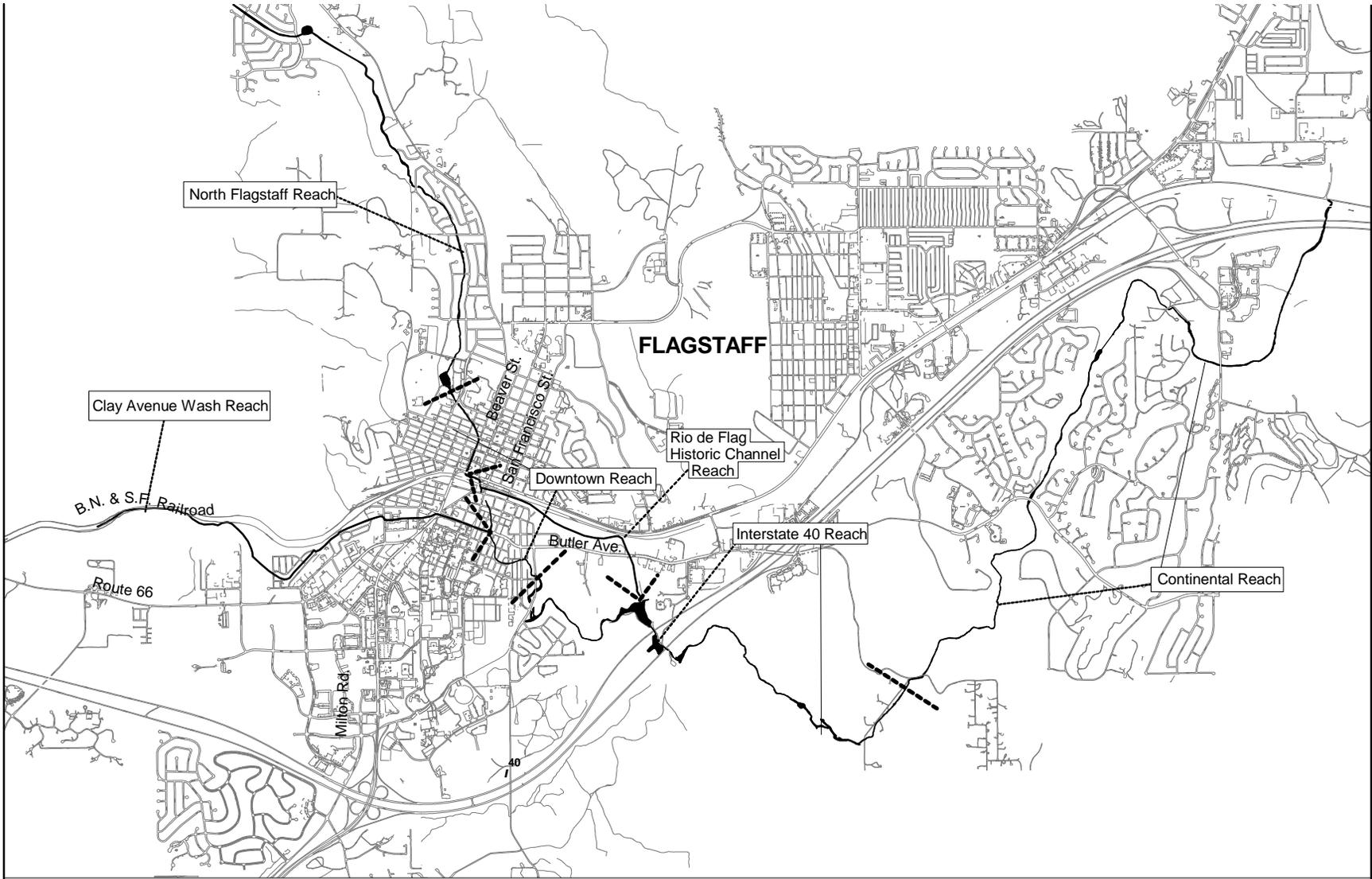
Sinclair Wash and Clay Avenue Wash originate southwest of Flagstaff on the slopes of Woody Mountain. Sinclair Wash flows northeast to its confluence with Rio de Flag just south of the O'leary Road/Lone Tree Road intersection. This study does not address baseline conditions or potential flood control for Sinclair Wash, although the contribution of Sinclair Wash flows into the Rio de Flag have been included in discharge calculations for the Rio de Flag downstream of its confluence with Sinclair Wash.

Clay Avenue Wash flows west from Observatory Mesa, joining the Rio de Flag (via an underground culvert) near the intersection of Butler and San Francisco Streets. Other smaller tributaries to Rio de Flag within the city limits are Penstock Avenue Wash, Peaceful Valley Wash, Country Club Wash, Fanning Drive Wash, Switzer Canyon Wash, Spruce Avenue Wash, West Street Wash, Bow and Arrow Wash, and Peak View Wash.

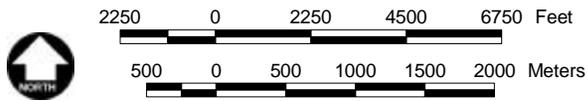
The study area has been divided into six distinct reaches in this EIS. These reaches represent an attempt to generally group together areas with similar environmental resources, land use, and/or floodplain characteristics for the purpose of NEPA analysis. As such, the reaches established for the environmental analysis do not necessarily correspond to those defined for the purpose of hydraulic analysis. Table 1-1 (on Page 1-8) compares the reaches identified for hydraulic and environmental purposes during the Rio de Flag Feasibility Study. The reaches used in this EIS are displayed on Figure 1-3 and described in the following sections.

### **North Flagstaff Reach**

The North Flagstaff Reach begins at the northern limit of the study area, just upstream of Thorpe Park, and extends southward to Dale Avenue. The Rio de Flag is shallow and narrow along this reach, flowing into Frances Short Pond at Thorpe Park (see Figure 1-4). Flooding in this area would cause inconvenience to local residents but little property damage.



Source: USACOE 1998



**Figure 1-3**  
**Study Area Reaches**



Facing downstream (south) in the Rio de Flag channel at Thorpe Park, just upstream of N. Thorpe Road.



Looking upstream (north) at Rio de Flag channel from bridge at Sitgreaves Street near intersection with Dale Avenue.

**Figure 1-4**  
**Photographs of North Flagstaff Reach**

**Table 1-1. Study Area Reaches**

	<b>Hydraulic Reach</b>	<b>Environmental Reach</b>
upstream	Rio de Flag Upper Reach	North Flagstaff Reach
		Downstream Reach
	Rio de Flag Historic Channel Reach	Rio de Flag Historic Channel Reach
downstream	Rio de Flag Lower Reach	I-40 Reach
		Continental Estates Reach
upstream	Clay Avenue Wash Upper Reach	Clay Avenue Wash Reach
downstream	Clay Avenue Wash Lower Reach	

**Downtown Reach**

The Downtown Reach extends from Dale Avenue to Elden Street west of Northern Arizona University. Significant flooding would occur during a 100-year event due to the limited size of the existing channel and road culverts. This area is extensively developed with existing buildings in the FEMA-defined 100-year floodplain. The channel is generally narrow, and vegetation consists of natural grass lining the bottom, and shrubs and trees on the vertical slopes of the banks (see Figure 1-5).

**Rio de Flag Historic Channel Reach**

Prior to the development of downtown Flagstaff and the railroads, the Rio de Flag followed a different alignment through the downtown area. While the existing Rio de Flag channel heads almost due south downstream from Cherry Street, the (pre-development) Rio de Flag channel headed in a southeasterly direction to what is now the intersection of Aspen and Sitgreaves streets. From there, the channel headed generally south towards the current intersection of Beaver Street and Phoenix Avenue. South of Phoenix Avenue, the channel curved and headed in a generally east/southeast direction south of the railroad tracks until entering a canyon that ultimately joined the Rio de Flag with Sinclair Wash (Jackson 1999). The historic and the existing Rio de Flag channel alignments currently rejoin near the I-40 wetlands.



Facing downstream (south) along the Rio de Flag near the intersection of Cherry Avenue and Kendrick Street.



Looking downstream along the Rio de Flag from the intersection of Birch Avenue and Kendrick Street.

**Figure 1-5**  
**Photographs of Downtown Reach**

Although the downtown portion of the Rio de Flag channel has been filled and developed, a remnant portion of this historic channel remains. This section of remnant channel is clearly visible where it crosses under Butler Avenue, approximately 1.1 miles east of the Lumber Street intersection with Butler Avenue. The remnant channel begins approximately 1,700 to 2,000 feet upstream (north and west) from where it crosses under Butler Avenue.

As used in this EIS, the term “Historic Rio de Flag Channel Reach” refers to an alignment approximating the historic channel location that

- extends east from Beaver Street, parallel to and south of the railroad tracks;
- connects with the remnant channel east of downtown Flagstaff, approximately 1,700 feet upstream of Butler Avenue; and
- follows the remnant channel downstream to the I-40 wetlands, where the remnant channel joins the existing Rio de Flag Channel (see Figure 1-3).

It is acknowledged that this is not the true historic alignment of the Rio de Flag—trying to reconstruct a channel along that alignment would require the destruction of numerous houses and buildings throughout downtown Flagstaff. The term “Historic Rio de Flag Channel Reach” is used because this reach follows the alignment necessary to connect to the historic channel and more closely approximates the historic channel of the Rio de Flag than does the current channel. Figure 1-6 shows the Historic Rio de Flag Channel Reach in two locations: (1) parallel to the railroad tracks in downtown Flagstaff, where a new channel would need to be excavated, and (2) immediately upstream from Butler Avenue, where the remnant channel still exists.

### **Clay Avenue Wash Reach**

The Clay Avenue Wash Reach encompasses the 100-year overflow zone for Clay Avenue Wash from just west of the city limits to the wash’s confluence with the Rio de Flag. At the western limits of the study area, Clay Avenue Wash flows through relatively undeveloped ponderosa pine forest and grassy montane meadows. The wash does not have a well-defined channel in this western area. Further east, where Clay Avenue Wash traverses residential communities, the wash varies from a well-defined channel approximately 10 feet in width to a much narrower and shallow grass-lined channel (see Figure 1-7). In some areas, flows have been diverted to city streets, or streets have been constructed directly in the historic channel alignment, or the channel has been diverted into an underground culvert.



Historic channel alignment is to the south (right) of the railroad tracks. Historic channel is buried south of the tracks.



Remnant Rio de Flag channel just north of Butler Avenue.

**Figure 1-6**  
**Photographs of Rio de Flag Historic Channel Reach**



Historic channel alignment is to the south (right) of the railroad tracks. Historic channel is buried south of the tracks.



Remnant Rio de Flag channel just north of Butler Avenue.

**Figure 1-6**  
**Photographs of Rio de Flag Historic Channel Reach**



Looking upstream (west) along the Clay Avenue Wash, just north of the Chateau Royale Mobile homes.



Looking upstream at the Clay Avenue Wash as it runs along the center of McCracken Drive.

**Figure 1-7**  
**Photographs of Clay Avenue Wash Reach**



Interstate-40 wetlands.



Facing downstream along the Rio de Flag in the Continental Estates, just west of Coburn Drive.

**Figure 1-8**  
**Photographs of Interstate-40 and Continental Estates Reaches**

The 100-year flood overflow zone along the Clay Avenue Wash Reach encompasses roughly 100 residences (primarily mobile homes/manufactured estates), as well as dozens of commercial buildings.

### **I-40 Reach**

The I-40 reach extends from Elden Street east and northeast to the Continental Estates. Flooding would be less significant here because the area is largely undeveloped. The channel deepens as it approaches the interstate where it flows through a wetlands area, known locally as the “I-40 wetlands.” The wetlands lie in a flat area surrounded by high, steep slopes, and they serve as a buffer for storm flows (see Figure 1-8, top photograph).

### **Continental Estates Reach**

The Continental Estates Reach is the easternmost of the five reaches in the study area. It begins in the middle of the southwestern boundary of Continental Estates and continues generally northeast through the subdivision, where it exits the study area through an approximately 42-inch-diameter corrugated metal pipe culvert under Route 66. The area around Continental Estates currently serves as a detention basin for the river. A portion of the normal river flow goes through a natural geologic drain (sinkhole). When the capacity of the sinkhole is reached, water flows through the surface course of the Rio de Flag, passing through a culvert under Route 66. This culvert conveys a flow of only 210 cubic feet per second (cfs). As a result of this flow restriction, the area immediately upstream of the culvert can fill with water up to 20 feet deep in a 100-year event. Development along the fringe of the floodplain in this area would be affected by infrequent flood events. The area is currently a designated floodway, and since 1983 the City has prohibited development within designated floodways (USACOE 1997). Figure 1-8 (bottom photograph) depicts the Rio de Flag immediately west of County Club Road in the Continental Estates Reach.

### **Detention Basins**

There are three potential detention basin sites in the study area. They are located (1) at Cheshire Park and the Narrows Dam, just upstream from the Museum of Northern Arizona and immediately east of Fremont Boulevard, (2) at Thorpe Park in the North Flagstaff Reach, and (3) just west of the Flagstaff City limits near Route 66, upstream from the Clay Avenue Wash Reach. Figures 1-9 and 1-10 provide photographs of the potential detention basin sites.



View of Cheshire Park facing north from southeast corner of park.



View of the Thorpe Park Little League Fields from N. Thorpe Road.

**Figure 1-9**  
**Photographs of Cheshire Park and Thorpe Park**



View of Frances Short Pond facing south towards the historic weir.



View from Route 66 facing east towards the proposed Clay Avenue Wash Detention Basin Area.

**Figure 1-10**  
**Photographs of Proposed Thorpe Park and**  
**Clay Avenue Wash Detention Basins**

### **1.3 PURPOSE OF AND NEED FOR THE PROPOSED ACTION**

Between the founding of Flagstaff around 1881 and the City's adoption of FEMA Flood Insurance Rate Maps in 1983, significant development has taken place within the floodplain of the Rio de Flag and its tributaries. Much of the building within the floodplain occurred in the 1920s and 1930s. Development, especially in the historic downtown and south-side areas, has significantly affected the river channel in several ways:

- sections of the Rio de Flag have been filled in, realigned, or both
- buildings have been constructed immediately adjacent to, or in some cases directly over, the channel
- road crossings have been built with culverts inadequately sized (too small) to carry storm flows.

Flood depths in the historic downtown area and in the south side of the city average over four feet and can reach nearly eight feet during a 100-year event. The city center contains large areas of residential development and numerous historic structures that are located within the 100-, 50-, and 25-year floodplains. Many of these structures are on the National Register of Historic Places (see Section 3.4, Cultural Resources).

Problems and opportunities related to the flooding of the Rio de Flag have been identified, defined, and assessed through public meetings (see Appendix B), coordination with local and regional agencies (see Appendix C), field reconnaissance, and interpretation of prior studies and reports. An initial screening of problems and opportunities included flooding and flood control, environmental restoration, recreation, and related land and water resources planning. The alternatives described in Section 2.2 have been designed to address these issues by increasing flood protection along various study area reaches (depending on the alternative).

#### **1.3.1 Need for Improved Flood Control Along the Rio de Flag and Clay Avenue Wash**

As described previously, significant development has occurred within the Rio de Flag floodplains until adoption of FEMA Flood Insurance Rate Maps and associated development restrictions in 1983. Years of unregulated development in the floodplain have left only a narrow and shallow low-flow channel throughout much of the downtown area. Today residential, commercial, and industrial development is extensive along the floodplain of Rio de Flag through most of the city. A number of

these structures are highly susceptible to flood-related damages in the event of a large storm. Under current conditions, structures valued at approximately \$385 million will continue to be subject to potential flood damage from a 100-year event. Nearly half of the 100-year floodplain along the Rio de Flag is zoned as residential areas, and approximately one quarter is zoned as commercial. The historic downtown area and the south side of the city center are almost entirely within the floodplain of the Rio de Flag, the 100-year overflow zone of Clay Avenue Wash, or both, where flood depths could range from three to eight feet. The north campus of Northern Arizona University also lies within the 100-year floodplain. Zoning classifications for lands within the 100-year floodplain of the Rio de Flag are shown in Table 1-2

**Table 1-2. Percentage of Each Zoning Classification Within the 100-year Floodplain for the Rio de Flag**

Zoning Classification	Acres	Percentage of 100-year Floodplain
Residential	401.3	48.7%
Commercial	202.5	24.6%
Public Land	192.0	23.3%
County Land	22.0	2.7%
Industrial	6.8	0.8%
Total	824.5	100%

Source: City of Flagstaff Planning Department 1998

The railroad tracks which traverse east/west through the City of Flagstaff would also be affected by flooding, with portions of the tracks' embankment projected to be completely inundated during a 100-year event. Major floods would cause the city and county to incur considerable costs for emergency response and repair operations. During the 1993 flood, which corresponded to approximately a 25-year event, the City of Flagstaff claims to FEMA amounted to just over \$200,000. Also, during a 25-year or greater event, most of the streets on the north and south sides of the tracks in the downtown area become impassable.

**1.3.2 Purpose of the Proposed Action**

The purpose of the proposed action is to provide improved flood protection in Flagstaff. This increased level of flood protection would reduce public and private flood inundation damages to residential, commercial, industrial, and historic property, to railroads, and to bridges and road crossings within the study area. Aside from its primary objective of providing increased flood protection, the proposed action would also reduce transportation-related damages and could provide a more natural

greenbelt/parkway setting through the use of native vegetation and grasses in selected reaches of the channel.

#### **1.4 STUDY AUTHORITY**

This study has been conducted under the authority given in House Resolution 2425, dated May 17, 1994.

#### **1.5 AGENCY USE OF DOCUMENT**

The USACOE has prepared this EIS to document the potential impacts associated with various alternative methods of improving flood control along the Rio de Flag and Clay Avenue Wash in Flagstaff, Arizona. This document has been circulated for public review and comment in accordance with the procedures of NEPA. The public, public agencies, and interested organizations were provided with a 45-day public review period to comment on the adequacy of the environmental analyses and mitigation, the range and merits of the project alternatives, and validity and accuracy of the data, assumptions, and methodologies included in the revised Draft EIS.

The USACOE has reviewed all comments received during the revised Draft EIS public review period and prepared responses to each substantive comment (refer to Part II of this Final EIS). These responses elaborate and clarify information in the revised draft document. In some cases, the revised Draft EIS text has been modified to address public or agency comments. Any text that has been substantially revised is identified in blue text on the page. This Final EIS will be released for a 30-day public review period, although comments received will not be given written responses.

As the lead Federal agency for the Rio de Flag Feasibility Study, the USACOE will issue a Record of Decision (ROD) after the EIS has been finalized and the 30-day public review period is completed. The ROD will indicate the alternative selected for implementation, summarize the reasons for that decision, and serve as notification that appropriate procedures and consultations have been executed. Once the ROD has been issued, the selected alternative can proceed to implementation (e.g., final engineering design, project construction, and operation). NEPA compliance requirements are further described in Section 5.1 of this document.

## 1.6 RELATED STUDIES

The following prior studies and reports contain reference information used in preparation of this report:

- U.S. Army Corps of Engineers, *Rio de Flag and Clay Avenue Wash Overflow Analysis and Summary Report*, November 25, 1998
- City of Flagstaff, *County Club Drive Flood Limits - February 19-21, 1993 Map*, 1996
- Federal Emergency Management Agency, *Flood Insurance Study*, September 1995
- City of Flagstaff, *Rio de Flag Alternative Flood Study*, September 1994
- URS Consultants, *Rio de Flag Alternative Flood Study*, July 13, 1991
- U.S. Geological Survey, *Flood Hydrology Near Flagstaff, Arizona*, June 1998
- Arizona Department of Water Resources, *Pre-Reconnaissance Flood Control Study of Rio de Flag Wash*, February 1998
- Arizona Department of Water Resources, *City of Flagstaff, Rio de Flag Project (Back-up Analysis)*, September 1998
- Arizona Department of Water Resources, *Water Resources of Southern Coconino County, Arizona*, 1986.
- Arizona Engineering Company, *Runoff in the City of Flagstaff: Drainage System for Various Return Period and Storm Duration*, February 1979
- National Oceanic and Atmospheric Administration, *Climate of Flagstaff, Arizona*, August 1974
- Water Resource Associates, Inc., *Flood Hydrology and Solutions to Flood Hazard Problems- Continental Country Club Project*, May 1974
- National Weather Service, *Precipitation, Frequency Atlas of Western U.S. Volume VIII, Arizona*, 1973
- U.S. Army Corps of Engineers, *Rio de Flag and Sinclair Wash*, April 1978
- U.S. Army Corps of Engineers, Los Angeles District, *Flood Plain Information, Rio de Flag and Sinclair Wash, Vicinity of Flagstaff, Coconino County, Arizona*, 1975
- U.S. Army Corps of Engineers, *Runoff from Snowmelt*, EM 1110-2-1406, January 1960

Supporting appendices are contained in several of the above documents, including technical reports on hydrology, hydraulics, geotechnical, economics, and environmental conditions.

## **2.0 ALTERNATIVES**

This section describes the plan formulation process (i.e., the process of developing potential flood control alternatives) for the Rio de Flag Feasibility Study. The discussion of the plan formulation process is followed by descriptions of the five alternatives evaluated in detail in this EIS and a summary of those alternatives initially considered but not carried forward for detailed environmental evaluation.

### **2.1 PLAN FORMULATION PROCESS**

A plan formulation process was used to develop, evaluate, and compare an array of candidate plans that have been considered for flood control improvements along the Rio de Flag. The general USACOE plan formulation process consists of the following major steps:

- Description and specification of flooding and water resource-related problems and opportunities in the study area.
- Identification of planning objectives and constraints within the study area.
- Formulation of preliminary alternative plans.
- Evaluation and comparison of alternative plans.
- Evaluation of Federal interest for a cost-shared flood control solution.

The Federal objective in water and related land resources project planning is to contribute to national economic development (NED) consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable Executive Orders, and other Federal planning requirements. Water and related land resources project plans are formulated to alleviate problems and take advantage of opportunities to contribute to this objective. Contributions to the NED are increases in the net value of the national output of goods and services, expressed in monetary units. In addition to the Federal objectives, specific planning objectives were identified for this project through coordination with local and regional agencies, the public involvement process, site assessment, and review of prior studies and reports.

Following the process described above, the formulation process for the Rio de Flag Feasibility study consisted of successive iterations of solutions to the defined flood problem developed within the limitations imposed by the project constraints. Solutions to the flooding problem were formulated to

meet the Federal and specific planning objectives of the study and address opportunities where possible. After each iteration, solutions were evaluated against the following feasibility criteria:

- **Technical Feasibility** - Solutions must be technically capable of performing the intended function, have the ability to address the problem, and conform the USACOE technical standards, regulations, and policies.
- **Environmental Feasibility** - Solutions must comply with all applicable environmental laws. (This environmental feasibility screening eliminated those measures that were clearly infeasible from an environmental standpoint; however, it was not used as a substitute for evaluating a full range of alternatives in this EIS.)
- **Economic Feasibility** - Solutions must be economically justifiable in that the economic benefits must exceed the economic costs, in accordance with all applicable regulations, policies, and procedures.
- **Public Acceptability** - Solutions must be publically acceptable as evidenced by a cost-sharing local sponsor and further documented through an open public involvement process that incorporates the public's input into the formulation of the solutions and the evaluation of solutions.

Initially, specific measures were developed to satisfy the four feasibility criteria. Measures are specific stand alone features, either structural or non-structural, to address the defined problem(s). There are numerous specific measures that can be utilized to provide flood protection depending upon site location, hydrology, environmental conditions and a host of other factors. In determining the set of measures to be evaluated for this study, specific consideration was given to public input and suggestions, USACOE experience with similar flooding situations, technical considerations based upon the specifics of the area and the problem, and environmental considerations for minimizing impacts.

Each measure was then evaluated in terms of the four feasibility criteria. All criteria had to be adequately met since any one criteria can serve as a screen to eliminate a measure from additional consideration. Following the evaluation of measures, those satisfying the feasibility criteria were carried forward for additional development and evaluation while those that fail were eliminated from further consideration. Those measures that passed the initial evaluation were then expanded upon or combined to form a preliminary set of alternatives. A total of nine preliminary alternatives was developed from the

set of feasible measures. This preliminary set of alternatives was then subjected to a more rigorous evaluation in terms of the feasibility criteria. In comparing the preliminary alternatives, the without project (No Action) condition served as the basis against which each alternative was evaluated.

Out of the nine preliminary alternatives, three were identified that best satisfied the four criteria. These three were then carried forward in the initial Draft EIS (October 1999) and, in addition to the No Action Alternative, they comprised the final array of alternatives for that document. The initial EIS was released for public and agency comment in compliance with the requirements of the National Environmental Policy Act, as amended, in November 1999. Prior to and concurrently with the release of the 1999 Draft EIS, an independent technical review of all aspects of the plan was conducted by the U.S. Army Corps of Engineers. Based upon public and agency review and independent technical review, it was determined that there was a need to re-evaluate the alternatives and either verify or change the selection of the recommended plan, as necessary. As a result of this re-evaluation, a revised final array of five alternatives was selected (Alternative 6a, 6b, 7, D and the No Action Alternative). Only one of these five alternatives will be selected for implementation. This final array of alternatives has been subjected to a high degree of evaluation, including detailed environmental analysis in this EIS, detailed cost estimation and design of project features, and specific real estate evaluations based upon project boundaries. The results of these evaluations form the basis for selecting the proposed action or recommended plan in the feasibility report. The recommended plan is described below in Section 2.2.2.

Flood protection measures that were not carried forward for analysis following the initial screening are described in Section 2.3.1. Alternatives developed from management measures that satisfied the feasibility criteria, but that were not selected for the final array of alternatives, are discussed in Section 2.3.2.

## **2.2 DESCRIPTION OF ALTERNATIVES**

This EIS evaluates five alternatives at an equal level of detail. Each alternative is a stand-alone alternative, and only one of the five will be selected for implementation. In order to maintain continuity with previous studies, these alternatives (except for the No Action Alternative) are designated with numbers or letters as they appear in other related USACOE reports. Each of the five is discussed briefly below, while sections 2.2.1 through 2.2.5 provide detailed descriptions of each alternative in

terms of modification to bridges, parks, roads, embankments, etc. The detailed descriptions focus on three areas: project components, construction requirements, and operations and maintenance.

- **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)** – Channel modifications would occur along Clay Avenue Wash and the downtown reach of the Rio de Flag. The downtown reach of the Rio de Flag would be an open channel configuration transitioning to a covered channel and greenbelt channel south of Route 66. Modifications at Thorpe Park would include a floodwall along the east side of the Rio de Flag, elevation of North Thorpe Road and construction of two small embankments. A detention basin would be constructed along Clay Avenue Wash immediately west of the Flagstaff city limits.
- **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)** – All of the components described for Alternative 6a would be constructed (detention basin along Clay Avenue Wash, bridge modifications, modifications at Thorpe Park, and channel modifications along the Rio de Flag and Clay Avenue Wash); however, the downtown reach of the Rio de Flag would include a covered channel segment extending for approximately two blocks between Dale and Birch Avenues (see Section 2.2.2). This is the USACOE’s “recommended plan” (which is also referred to as the preferred alternative).
- **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)** – Detention basins would be constructed at three locations: (1) along the Rio de Flag at Cheshire Park; (2) along the Rio de Flag at Thorpe Park; and (3) along Clay Avenue Wash immediately west of the Flagstaff city limits (see Section 2.2.3). Also, channel modifications would occur along Clay Avenue Wash and the downtown reach of the Rio de Flag as described under Alternative 6b (see Section 2.2.2).
- **Alternative D: Localized Non-Structural Flood Proofing Alternative** – Localized berms would be constructed around specific areas along the periphery of the Rio de Flag floodplain in the vicinity of Continental Estates (see Section 2.2.4).
- **No Action Alternative** – Under this alternative the existing channels and swales would remain in their current condition (see Section 2.2.5).

A summary comparison of the five alternatives is provided in Table 2-1. The recreational features associated with each alternative are described in detail in Appendix D of this EIS.

**Table 2-1. Comparison of Alternatives<sup>1</sup>**

Location Alternative	Rio de Flag <sup>2</sup>						Clay Avenue Wash <sup>3</sup>	
	Cheshire Park	Cheshire Park to Thorpe Park	Thorpe Park	Thorpe Park to Route 66	Route 66 to Butler Avenue	Continental Estates	West of City limits	Chateau Drive to Phoenix Ave.
Alternative 6a	No change	Wingwalls (Meade Ln.) Bridge replacement (Anderson Rd. and Beal Rd.)	Floodwalls (5' max) Elevate Thorpe Rd. Small Embankments	Soil and riprap channel	Riprap channel Covered channel Greenbelt channel Gabion structures	No change	Detention basin	Gabion structures Riprap channel Covered channel Concrete Channel
Alternative 6b	No change	Wingwalls (Meade Ln.) Bridge replacement (Anderson Rd. and Beal Rd.)	Floodwalls (5' max) Elevate Thorpe Rd. Small Embankments	Soil and riprap channel with 2 blocks of covered channel	Riprap channel Covered channel Greenbelt channel Gabion structures	No change	Detention basin	Gabion structures Riprap channel Covered channel Concrete Channel
Alternative 7	Detention basin	Wingwalls (Meade Ln.) Bridge replacement (Anderson Rd. and Beal Rd.)	Detention basin Floodwalls (5' max) Elevate Thorpe Rd. Large Embankment	Soil and riprap channel with 2 blocks of covered channel	Riprap channel Covered channel Greenbelt channel Gabion structures	No change	Detention basin	Gabion structures Riprap channel Covered channel Concrete Channel
Alternative D	No change	No change	No change	No change	No change	Bems	No change	No change
No Action	No change	No change	No change	No change	No change	No change	No change	No change

1 The five alternatives are described in detail in Sections 2.2.1 through 2.2.5. This summary table only describes the basic components of each alternative.

2 The portion of the Rio de Flag from Butler Ave. to the Continental Estates is not included in this table because none of the alternatives would affect this segment of the channel.

3 The portion of the Clay Ave. Wash between the western City limits and Chateau Dr. is not included in this table because none of the alternatives would affect this segment of the wash.

### **2.2.1 Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

Alternative 6a would provide 100-year flood protection along the Rio de Flag's downtown and historic channel alignment reaches and would also reduce flooding along the Clay Avenue Wash, I-40, and Continental reaches. The major components of this alternative are summarized in Table 2-1 and illustrated on Figure 2-1. The various flood control features from upstream to downstream for the Rio de Flag and Clay Avenue Wash channels are described below. Alternative 6a is not the preferred alternative.

#### **Project Components**

##### Rio de Flag

Flood control features along the Rio de Flag would consist of three basic components: (1) bridge modifications upstream of Thorpe Park; (2) flood control structures and road modifications in Thorpe Park; and (3) channel modifications downstream of Thorpe Park. These features are described below.

##### *Bridge Modifications*

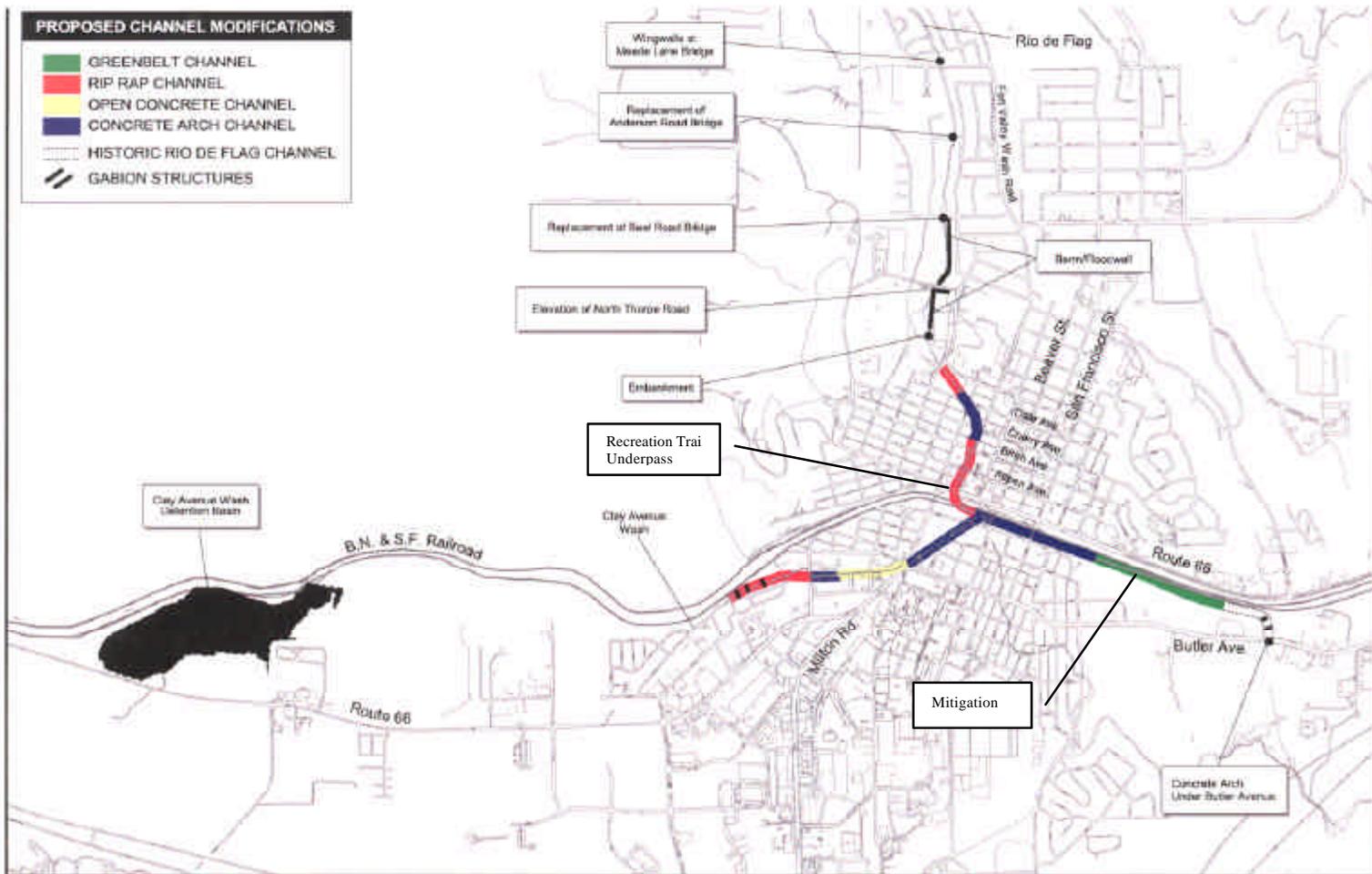
As discussed above, three bridges would be modified along the Rio de Flag, including the Meade Lane, Anderson Road, and Beal Road bridges. Wingwalls<sup>1</sup> would be constructed upstream of the Meade Lane bridge and the existing bridge would remain in place. The Anderson Road and Beal Road bridges, however, would be demolished and replaced. The Anderson and Beal bridge crossings would each be closed for approximately two to four weeks during construction. The bridges would not be closed simultaneously.

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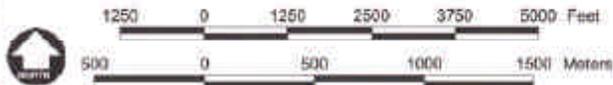
1 Wingwalls are angled concrete walls placed on both sides of a channel to direct the flow of water under or through a given structure. In this case, the wingwalls would be placed upstream of the Meade Lane bridge to direct flows under the bridge and protect the structural supports on either side.

**PROPOSED CHANNEL MODIFICATIONS**

- GREENBELT CHANNEL
- RIP RAP CHANNEL
- OPEN CONCRETE CHANNEL
- CONCRETE ARCH CHANNEL
- HISTORIC RIO DE FLAG CHANNEL
- GABION STRUCTURES



Source: USACOE 1986



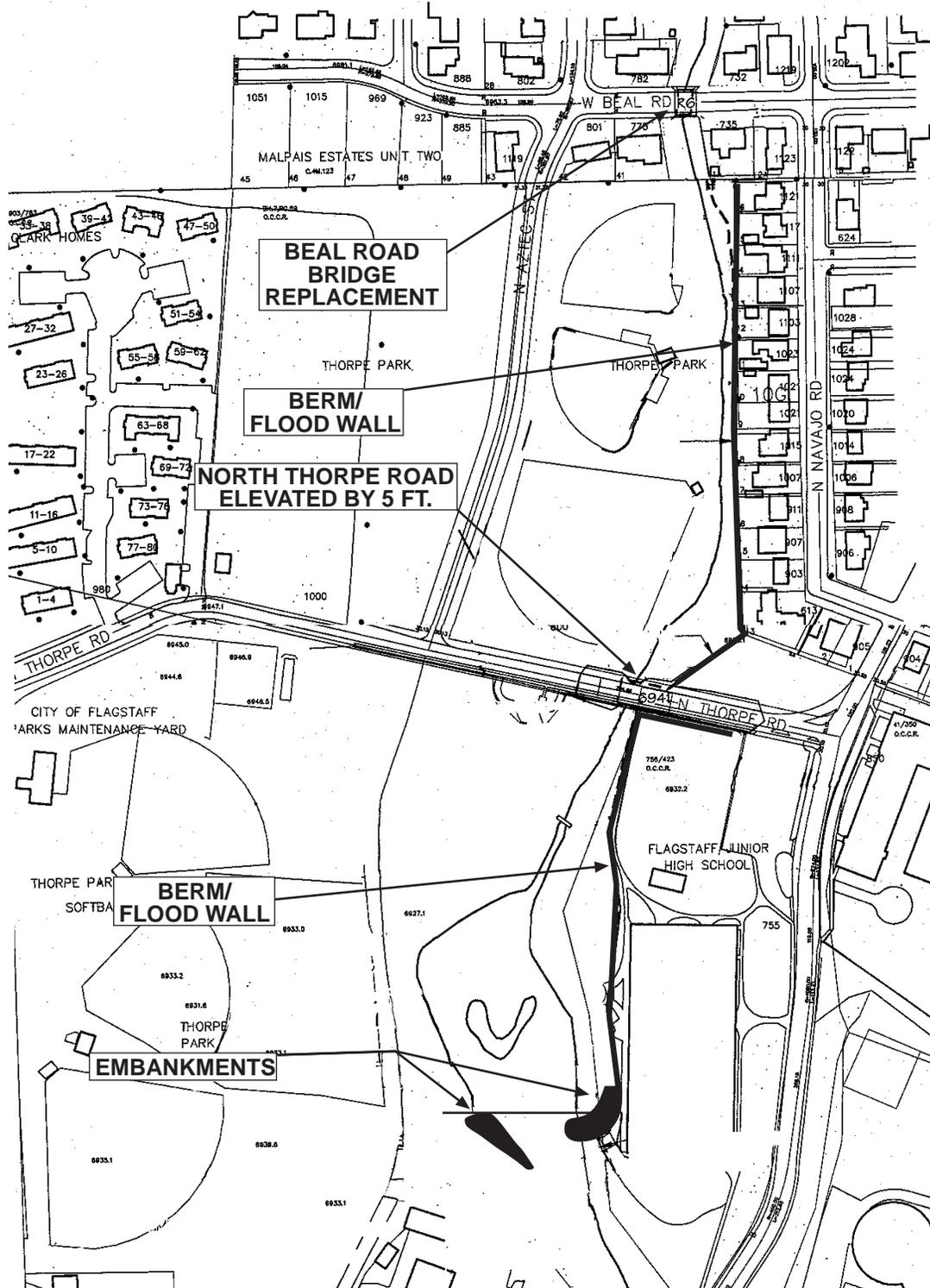
**Rio de Flag Project Features  
Plate 1 (Enclosure 1)**

### *Thorpe Park Modifications*

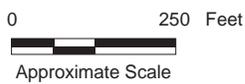
- *Floodwalls.* A combination of berms and floodwalls would be constructed along the eastern side of the Rio de Flag through Thorpe Park (see Figure 2-2). The top elevation of the walls would range between 6,936 and 6,942 feet above mean sea level and the combined height of the berms and walls would not exceed five feet. The walls would be constructed approximately three feet west of the property lines of Flagstaff Junior High School and 14 residential properties that front on North Navajo Drive. The floodwalls would be constructed using reinforced concrete covered with basalt fieldstone (malpais basalt) as an esthetic treatment. The stones would be placed on the outside of the walls to form a mosaic veneer, characteristic of other recent stonework in the city (including the Flagstaff public library). The floodwall footings would be designed to avoid existing groundwater wells in the area.
- *North Thorpe Road Modification.* In order to minimize flooding of North Thorpe Road and adjacent properties, an approximately 350-foot section of the road would be rebuilt at a higher elevation. This would require the use of retaining walls up to five feet in height along the side of the elevated road. This retaining wall would also incorporate a mosaic veneer of basalt fieldstone. North Thorpe Road would be closed for two weeks while pavement is removed, fill added, and the road repaved. This road closure would also occur during the summer to avoid access impacts to the nearby school. The existing culvert at the Rio de Flag crossing under Thorpe Road would be replaced.
- *Embankments.* Small embankments would be constructed on either side of the Rio de Flag just downstream of the existing weir. These embankments are designed to direct floodwaters into the channel and would not result in upstream detention. As shown in Figure 2-2, the eastern embankment would tie-in to the natural topography at an elevation of 6,939 feet above mean sea level. The western embankment would be located just south of the historic weir. The hard surfaces of each embankment would be constructed with an esthetic rock treatment similar to that described for the proposed floodwalls. The weir would remain in place and would not be affected by project construction.

### *Rio de Flag Channel Modifications*

Under Alternative 6a, channel modifications would occur along the Rio de Flag through the downtown reach from Bonito Road downstream to Butler Avenue (see Figure 2-1). These modifications are described below.



**Figure 2-2**  
**Alternative 6a Thorpe Park Modifications**



- A trapezoidal channel with a soft earthen bottom and 2:1 riprap lined slopes would be constructed through most of the downtown reach. (Slopes are described in terms of horizontal to vertical [H:V] ratios; accordingly, a 2:1 side slope will extend two feet horizontally from the channel bottom for every one foot of vertical rise.) This segment of riprap-lined channel would extend from Bonito Street downstream to Route 66. This segment would have a channel bottom width of approximately 24 feet and depth of approximately 7.9 feet. The riprap would be covered with soil, allowing the establishment of some vegetation. A trail would be constructed along the channel.
- Due to right-of-way requirements for this segment, three homes on the west side of the channel would be acquired and demolished, including: (1) one residence on the east side of Sitgreaves Street between Dale and Birch avenues; (2) one residence on the north side of Cherry Avenue between Sitgreaves and Kendrick streets; and (3) one residence on the south side of Cherry Avenue between Sitgreaves and Kendrick streets. The addresses of these homes are 314 Sitgreaves Street, 311 W. Cherry Street, and 314 W. Cherry Street. These private properties would be acquired by the City of Flagstaff, pursuant to applicable Federal and state laws, including the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601). (Refer to Section 5.17 for more information on relocation procedures and process.)
- At the Route 66 crossing, two underground culverts would be constructed: (1) a 24-foot by 9-foot concrete arch for drainage conveyance, and (2) a parallel 12-foot by 8-foot arch for bicycle/pedestrian access (which would be a continuation of the Flagstaff Urban Trail System [FUTS] trail). The portion of the project south of Route 66 would entail the construction of a new channel and adjacent recreational trail. The first segment of this new channel would curve into an east/southeast heading, forming an alignment parallel to and south of the railroad tracks. This channel segment would be similar to, but slightly larger than, the riprap-lined channel described above, with a depth of approximately 8.2 feet. The riprap-lined channel and recreation trail would extend from just south of Route 66 to a point approximately 170 feet west of South Beaver Street.
- At approximately 170 feet west of South Beaver Street, the Rio de Flag channel would be joined by an underground (covered) concrete channel conveying flows from Clay Avenue Wash. Both channels would converge and transition into an arch-shaped underground concrete channel that would run parallel to the railroad tracks through downtown. The underground channel would be approximately 28 feet wide at the base and approximately 12 feet tall at its center. This section of underground channel would extend east/southeast through downtown Flagstaff for approximately 1,900 feet. The existing downtown reach south of Route 66 would no longer carry storm flows and

other runoff from upstream portions of the Rio de Flag because that water would be directed into this new underground arch.

- At a point approximately 250 feet south/southeast of the North Elden Street/Route 66 interchange, the underground concrete channel would transition into an open greenbelt channel. The term “greenbelt” is used because this section of Rio de Flag would include several features favoring the establishment of vegetation in and along the channel, including a 56-foot-wide earthen channel bottom and shallow 4:1 earthen side slopes. The channel would not be lined with riprap or concrete. This segment would extend east and south from the underground channel, joining an existing remnant section of the historic Rio de Flag channel approximately 1,700 feet upstream of Butler Avenue.
- Gabion grade control structures<sup>1</sup> would be constructed approximately 150 feet and 400 feet upstream of Butler Avenue. These two structures would reduce the elevation of the channel by roughly 12.5 feet over a distance of approximately 250 feet. The channel flows would proceed under Butler Avenue through a 24-foot-wide and 8.5-foot-high concrete arch that would replace the existing culverts. Wingwalls would be constructed near the entrance of the concrete arch and a 50-foot-long riprap blanket would be constructed at the downstream end of the arch. Traffic on Butler Avenue would be disrupted during construction. Construction would occur in segments, allowing at least one lane of through traffic in each direction at all times.

In general, fences would not be erected along the riprap-lined channel segments. Where fences could be effectively integrated into existing development and would be needed (such as along residential properties), they would be provided. Vehicular barriers would be provided where a riprap channel is located along a street, and pedestrian barriers would be placed where warranted. Warning signs would be posted at major access points (such as gates) and periodic maintenance inspections and police patrols for vagrants/campers would be implemented along the modified channel.

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<sup>1</sup> A “gabion” is a wire basket or cage filled with stone and placed as, or as part of, a bank-protection structure. A “grade control structure” is a structure, such as a gabion, placed in a creek channel to provide a change in the channel grade with the intent of controlling channel erosion or lowering the elevation of the channel bottom.

## Clay Avenue Wash

### *Detention Basin*

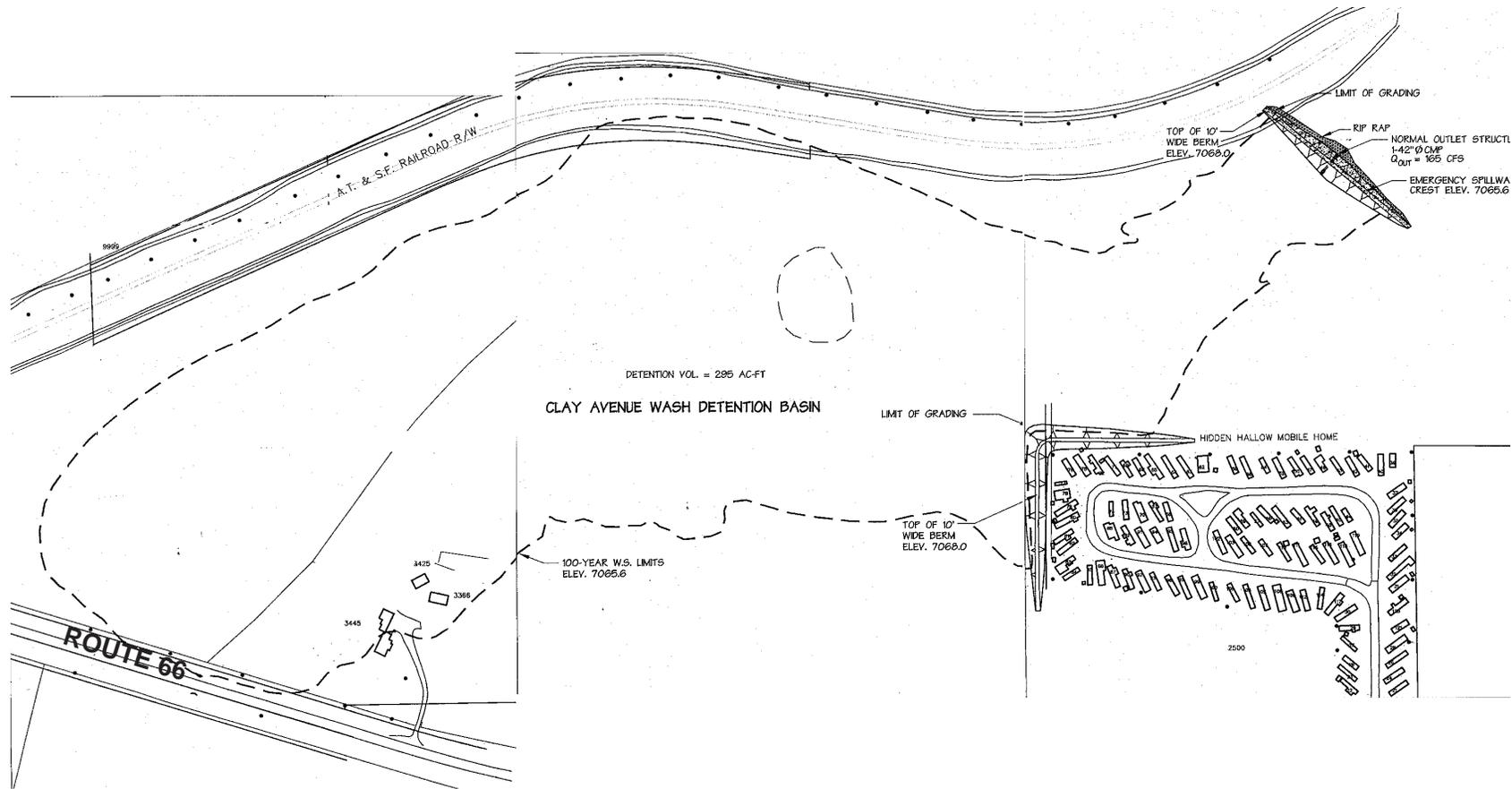
Detention basins provide flood protection by temporarily storing runoff and snow melt upstream from areas that are likely to flood during periods of high flow. The detained water, which may have otherwise exceeded the capacity of downstream channels and flooded surrounding areas, is released slowly from the detention basin.

Under Alternative 6a, an “on-line” detention basin would be constructed along the Clay Avenue Wash to the west/southwest of downtown Flagstaff, just west of the city limits and north of Route 66 (see Figure 2-3). Water would pass through the detention basin unrestricted during periods of relatively low flow. During periods of higher flow, however, the influx of water into the basin would exceed the discharge capacity of the basin’s outlet structures, and the detention basin would begin to fill. Only after the rate of water entering the basin drops below the capacity of the outlet structure would basin water level begin to drop. Water would be discharged from the Clay Avenue Wash detention basin over a period of up to 60 hours, depending on the amount of rainfall and snow melt. By extending the period during which runoff and snow melt flow through the downstream channel, the amount of flow within the channel at any one time is reduced. This, in turn, lowers the potential for flooding adjacent to the downstream Clay Avenue Wash and Rio de Flag channels.

During large flood events, the basins may reach capacity. If a detention basin reaches capacity and water continues to flow into the basin in excess of the basin’s outlet structure capacity, the basin ceases to provide flood protection to downstream areas. Figure 2-4 provides a schematic representation of “on-line” detention basin operations.

The proposed detention basin site encompasses mostly privately-owned property including undeveloped land and a rural residence and its associated agricultural buildings. This private property would be acquired by the City of Flagstaff pursuant to applicable Federal and state laws. The proposed detention basin site also includes some state-owned land.

Grading and site work would consist of three embankments tied into high ground, with the site’s natural topography serving to contain detained flood flows within the basin (see Figure 2-3). Each of these



Source: U.S. Army Corps of Engineers 1999

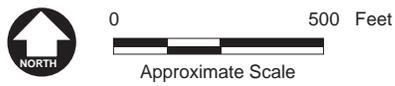
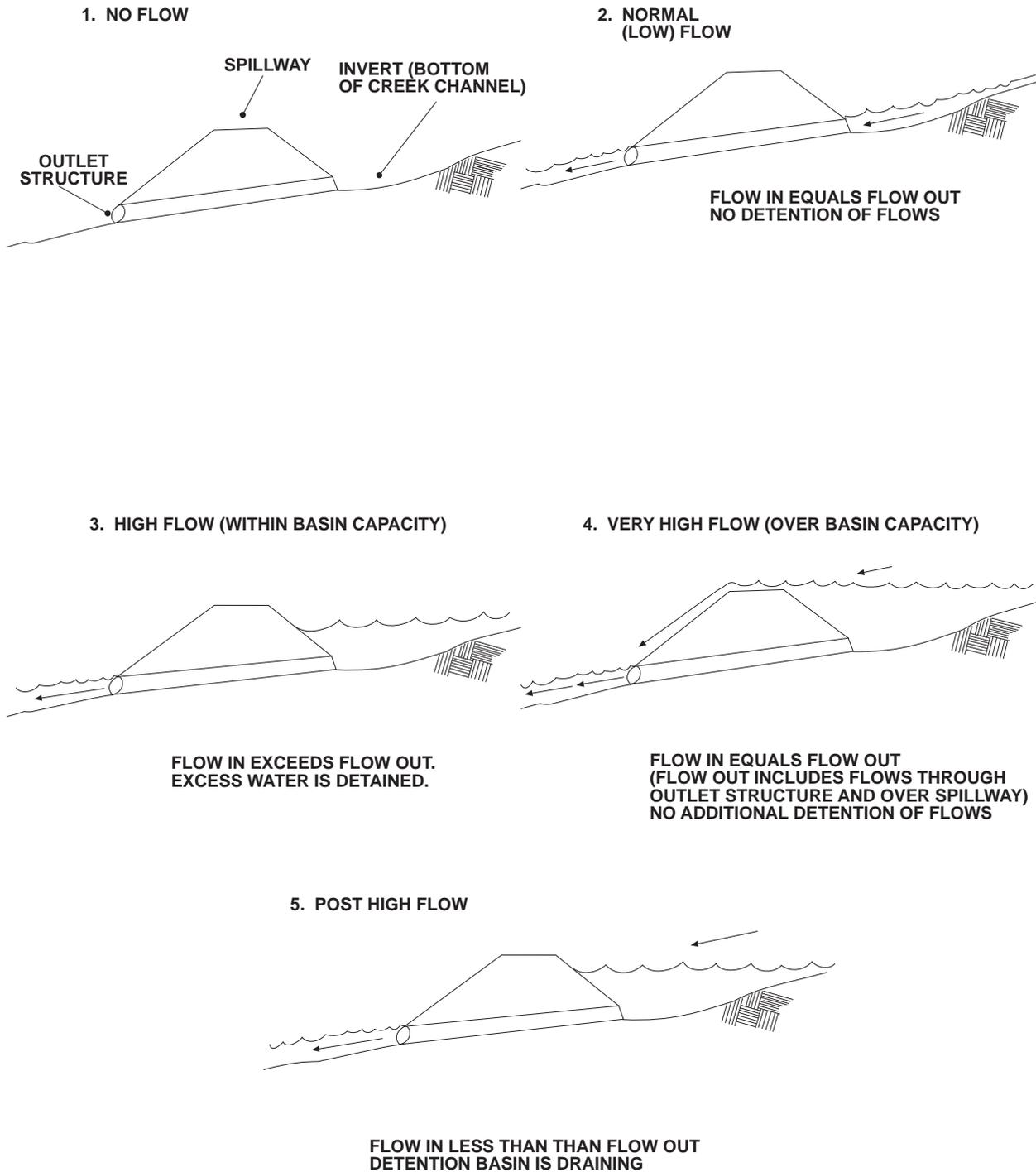


Figure 2-3  
 Clay Avenue Wash Detention Basin



(NOT TO SCALE)

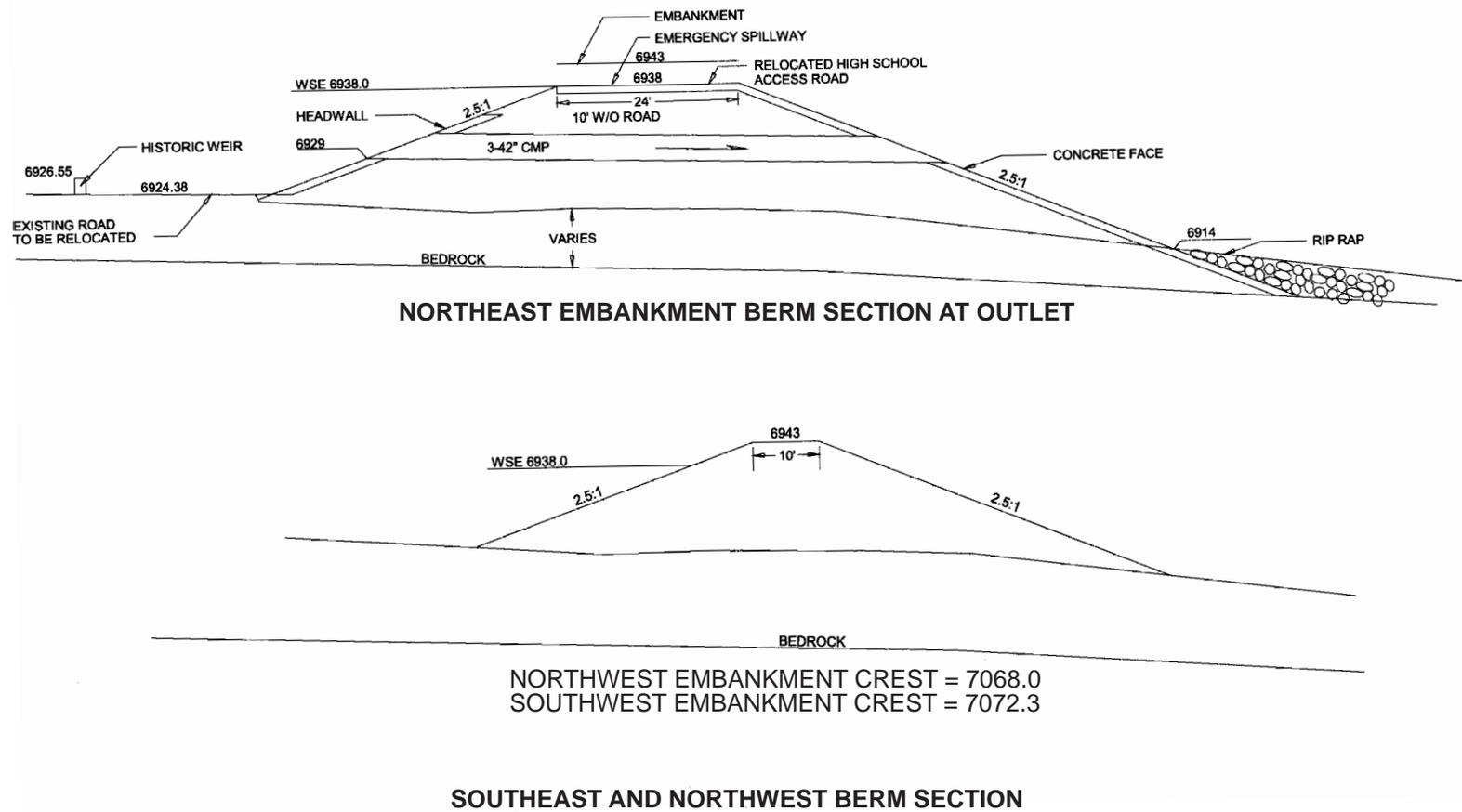
**Figure 2-4**  
**Schematic Diagram of On-Line Detention Basin Operation**

embankments are described below; no other flood control measures (e.g., floodwalls) or grading would be required at the site. The capacity of the Clay Avenue Wash detention basin would be approximately 295 acre-feet (96 million gallons). When filled to capacity, water contained within the basin would cover approximately 71 acres. The 100-year water surface elevation of the basin would be 7,065.6 feet above mean sea level. The basin would be sized to completely drain within 48 to 60 hours for the 100-year event, 36 hours for the 50-year event, and less than 24 hours for other more frequent events.

- *Northeast Embankment.* The embankment constructed at the northeast edge of the detention basin would contain the outlet structure and spillway. The outlet structure would consist of a single 42-inch-diameter corrugated metal pipe, with a capacity of approximately 165 cfs. In addition, a smaller “bleed off” pipe or irrigation gate valve would be installed at the channel invert to eliminate long-term ponding. The spillway and top of embankment would be at elevations of 7,065.6 and 7,072.3 feet above mean sea level, respectively. The top of the embankment would be approximately 21 feet above ground level. A cross section of the northeast embankment is shown at the top of Figure 2-5.
- *Northwest Embankment.* An embankment would be constructed just south of the Burlington Northern & Santa Fe (BNSF) railroad tracks along the northern boundary of the detention basin. This embankment would be approximately 1,225 feet in length and 50 feet in width. The top of the embankment would be no more than 10 feet above ground level. The elevation of the embankment would be at 7,068 feet above mean sea level. The embankment is shown on Figure 2-3.
- *Southeast Embankment.* This embankment would be adjacent to the Hidden Hollow Mobile Home park, and it would be specifically constructed to protect the mobile home park from flooding. This embankment would not contain an outlet structure or spillway, and it would be approximately 12 feet tall at its highest point (Figure 2-5). It would extend approximately 475 feet along the northern edge and 500 feet along the western edge of the mobile home park. The top elevation of the embankment would be 7,072.3 feet above mean sea level.

### *Channel Modifications*

The Clay Avenue Wash channel modifications would generally entail either (1) expanding and lining the existing channel with concrete or riprap or (2) diverting the channel underground through developed areas. The channel modifications are described below and illustrated on Figure 2-1.



**Figure 2-5**  
**Cross Section of Clay Avenue Wash**  
**Detention Basin Embankments**

- The Clay Avenue Wash channel modifications would start immediately north of the Chateau Royal mobile home park (also referred to as the Chateau Royal Apartments) in western Flagstaff. This segment of the channel would be modified into a trapezoidal channel with a soft earthen bottom and 2:1 riprap-lined side slopes. Three gabion grade control structures would be located in the first 500 feet of the riprap channel. This riprap-lined segment of the Clay Avenue Wash channel would extend east to Blackbird Roost.
- The eastern section of this channel segment would traverse the “Trailers Ho” mobile home park at 703 South Blackbird Roost, and it would require the relocation of up to 15 mobile homes from this park to an offsite location. The affected tenants and landlord of the Trailers Ho mobile home park would be compensated for this action in accordance with applicable Federal and state laws.
- From Blackbird Roost east to the edge of the parking lot at McCracken Place, Clay Avenue Wash would be diverted into an arch-shaped underground concrete channel. This segment of the wash currently follows a cul-de-sac and driveway which extend east from Blackbird Roost into an adjacent apartment building complex (see Figure 1-7 in Section 1.2, bottom photograph). The underground concrete channel would be approximately 24 feet wide at the base and approximately 5.5 feet tall at its center.
- The covered underground channel would open up into an un-covered concrete-lined box channel at the southern edge of the McCracken Place parking lot. This segment of box channel would be approximately 18 feet wide and 8.3 feet deep and safety fencing would be constructed along both sides of the channel. The open box concrete channel would extend east (downstream) to South Milton Road/Route 66.
- Downstream from South Milton Road/Route 66, Clay Avenue Wash would transition back to a covered, underground concrete channel. This underground channel would be similar to the one constructed east of Blackbird Roost (see above). The underground channel would generally follow the alignment of Mike’s Pike, terminating approximately 250 feet northeast of Mike’s Pike at a confluence with the Rio de Flag channel. This route would require construction within the intersection of Clay Avenue, South Milton Road/Route 66, and Mike’s Pike.

### **Construction Requirements**

Construction of the Alternative 6a project components would require approximately 6 to 12 months. Typical equipment to be used during the construction period would include loaders, scrapers, dozers,

trucks, blades, roller compactors, concrete mixers, water trucks, and backhoes. The specific construction requirements for each project component are described below.

## Rio de Flag

### *Bridge Replacement*

As described in Table 2-2, the Anderson Road and Beal Road bridges would be closed for approximately two to four weeks each during construction of the bridge modifications. These bridges would not be closed simultaneously, nor would construction overlap with the closure of North Thorpe Road described below. Approximately 460 cubic yards (46 truck loads) of concrete would be imported to the Anderson and Beal Road bridges and approximately 30 cubic yards (three truck loads) would be delivered to the Meade Lane bridge during construction. The Meade Lane bridge would not be closed during construction.

### *Thorpe Park Modifications*

Construction of the floodwall and embankments and elevation of North Thorpe Road would last approximately six months. Approximately 615 cubic yards of concrete and 615 cubic yards of stone would be imported to construct the floodwall and approximately 300 cubic yards of riprap and 500 cubic yards of fill material would be delivered for construction of the two embankments. This would generate approximately 35 truck trips per day for the first two months of the six-month construction period.

As shown on Table 2-2, North Thorpe Road would be closed for approximately two weeks in order to elevate the road bed. Construction staging would occur at disturbed open space areas in the park.

### *Rio de Flag Channel Modifications*

The Rio de Flag channel modifications would require 6 to 12 months to construct and would primarily involve open trench construction. The majority of the excavation would extend downward into sandstone or basalt bedrock. The sandstone is friable and weathered and is generally rippable with heavy equipment, whereas the basalt is hard and not always rippable. (“Friable” means soil or rock crumbles easily, and “rippable” means that rock can be broken by

**Table 2-2: Alternative 6a - Road Crossing Construction Requirements**

<b>Component/Road</b>	<b>Construction Effects</b>
<b><i>Bridge Modifications</i></b>	
Meade Lane	Road closure would not be required.
Anderson Road	Road closed at Rio de Flag bridge for approximately 2 to 4 weeks
Beal Road	Road closed at Rio de Flag bridge for approximately 2 to 4 weeks
<b><i>Thorpe Park Modifications</i></b>	
North Thorpe Road	Road closed for approximately 2 weeks
<b><i>Rio de Flag Channel Modifications</i></b>	
North Bonito Street	Road closed at Rio de Flag crossing for 5 to 7 days during construction
West Dale Avenue	Road closed at Rio de Flag crossing for 5 to 7 days during construction
West Cherry Avenue	Road closed at Rio de Flag crossing for 5 to 7 days during construction
West Birch Avenue	Road closed at Rio de Flag crossing for 5 to 7 days during construction
West Aspen Avenue	Road closed at Rio de Flag crossing for 5 to 7 days during construction
Route 66	Open during 2 week construction period (reduced lanes)
Main Railroad Tracks	Each track closed for up to 24 hours at Rio de Flag under-crossing (one track would always remain open)
Beaver Street	Closed for 7 days during construction. Converted to two-way street during 1 week closure of San Francisco Street
San Francisco Street	Closed for 7 days during construction. Converted to two-way street during 1 week closure of Beaver Street
Railroad Spurs	Closed for 5 to 7 days
Butler Avenue	Open during 2 week construction period (reduced lanes)
<b><i>Clay Avenue Wash Channel Modifications</i></b>	
West Chateau Drive	Road closed at Clay Avenue Wash crossing for 7 days during construction
South Blackbird Roost	Road closed for 7 days during construction of culvert
Blackbird Roost Court	Road closed for 7 days during construction of culvert
South Malpais Lane	Road closed at Clay Avenue Wash crossing for 7 days during construction
South Milton Road	Road closed at Clay Avenue Wash crossing for 7 days during construction
Milton Road/Clay Avenue/Butler Road/Route 66/Mike's Pike/Butler Avenue	This intersection (called the "5-points intersection") would remain open during construction, although some lanes would be closed to accommodate the open trench construction
Mike's Pike	The culvert would be constructed in sections, as to maintain access during the six-week construction process. Detours would be required and would change daily
Mike's Pike/Phoenix Avenue Intersection	Road closed for 7 days during construction of culvert

mechanical equipment.) In areas that are not sufficiently rippable, blasting may be required (especially in some of the deeper sections near the confluence of the Clay Avenue Wash and Rio de Flag).

Blasting activities would comply with all applicable construction and safety requirements, and the need for blasting would be minimized or eliminated during the project design phase.

At the Bonito Street and Dale, Cherry, Birch, and Aspen Avenue road crossings, construction of underground culverts would necessitate road closures of approximately five to seven days each. At the Route 66 crossing, the two culverts would be poured by halves to maintain through traffic (to a total closure time of five to seven days per half). At the Beaver Street and San Francisco Street crossings (one-way south and one-way north, respectively), construction would require about one week each, and construction at these two crossings would not be undertaken concurrently. In order to minimize impacts on traffic at Beaver and San Francisco Streets, each of these one-way roads would become a two-way road during construction at the other. Construction of the underground culvert at the railroad crossing (approximately 700 feet west of Beaver Street) would conform to the following method of construction: (1) remove track and excavate; (2) lower in prefabricated units by crane from flatbed train car on the adjacent (un-removed) track; and (3) re-cover and replace track. It is anticipated that this work could be accomplished within 24 hours per track. One of the two tracks at this crossing would always remain open. Construction of the covered arch at Butler Avenue would be undertaken in segments in order to maintain at least one lane of through traffic in each direction at all times.

The channel modifications would involve the import of approximately 8,907 cubic yards of concrete and 9,100 cubic yards of riprap. Roughly 176,252 cubic yards of soil and 89,409 cubic yards of rock would be excavated, some of which would be used for construction of the detention basin. Excess material would be delivered to disposal site(s) within six miles of the proposed channel modifications. Assuming that roughly 10 percent of the excavated material is re-used on site, the Rio de Flag channel modifications would generate approximately 20 truck trips per hour on the local roadway network (six month “worst-case” scenario).

### Clay Avenue Wash

#### *Clay Avenue Wash Detention Basin*

The Clay Avenue Wash detention basin would require approximately six months to complete and would be undertaken concurrently with the other project components. Approximately 14,947 cubic

yards of fill material would be imported to the site for construction of the embankments. In addition, approximately 770 cubic yards of riprap and 732 cubic yards of concrete would be delivered to the site during construction.

The grading phase for the Clay Avenue Wash detention basin would last approximately three weeks and would generate approximately 46 round-trip truck trips per day. Construction staging would take place primarily within the basin, and, if needed, adjacent to the existing subdivision construction staging area just downstream. The use of the privately owned land adjacent to the existing subdivision downstream from the detention basin site would be contingent upon reaching an agreement with the respective subdivision owner/developer.

#### *Clay Avenue Wash Channel Modifications*

The Clay Avenue Wash channel modifications would be completed within the overall 6- to 12-month schedule described for the Rio de Flag channel modifications. Construction would result in the temporary (approximately one week) closures of Chateau Drive, Blackbird Roost, and Malpais Lane, respectively. Only short segments of these roads would be closed during the construction of the underground culvert. Along Mike's Pike, trenching would occupy nearly the full width of the road. Construction would occur in a series of segments that progress along Mike's Pike, with approximately 350 feet of trench open at any given time. The arched underground channel would be constructed by pouring concrete into a form built with the trench and backfilling the trench as soon as the concrete sets. Approximately 50 feet of concrete channel would be poured per day with a seven day cycle of excavation, forming, pouring, curing, and backfill. The underground channel would be constructed in sections, as to maintain access during the 6-week construction process. Detours would be required and would change daily; however, access would be maintained to all businesses and residences during the construction period.

As with the Rio de Flag modifications, an open trench method of construction would be used along the majority of the Clay Avenue Wash Reach. The channel modifications would involve the import of approximately 2,700 cubic yards of concrete and 2,100 cubic yards of riprap. Roughly 50,100 cubic yards of soil and 17,200 cubic yards of rock would be excavated, some of which would be used for construction of the detention basin. Excess material would be delivered to disposal site(s) within six miles of the proposed channel modifications. Assuming that roughly 10 percent of the excavated material is re-used on site, the Clay Avenue Wash channel modifications would generate approximately

6 truck trips per hour on the local roadway network (based on a 6 month construction period, a longer construction period would reduce the number of daily trips).

As with the Rio de Flag channel modifications, blasting may be required in some areas where basalt is encountered. Steps will be taken to minimize or eliminate the need for blasting during the project design phase.

## **Operations and Maintenance**

Alternative 6a would require inspection, maintenance, and repair of the flood control structures. The scope of these activities would include the modified sections of the Rio de Flag and Clay Avenue Wash channels, the Thorpe Park floodwalls and embankments, and the Clay Avenue Wash detention basin. The City of Flagstaff would need to implement a long-term public information program regarding the hazards associated with drainages, especially the previously described covered concrete channels.

The Clay Avenue Wash detention basin would be designed and constructed to operate with minimal operational requirements. Based on its design, the basin would detain peak flows and then discharge them over a period of up to 60 hours. No human intervention (e.g., opening or closing valves and spillway gates) would be required to operate the detention basin; however, periodic inspection, maintenance, and repair would be conducted by the City of Flagstaff. The level of effort required to inspect, maintain, and repair the detention basin would not be extensive and would include tasks such as ensuring that the embankments do not erode following storms and removing debris and sediment buildup in the outlet structure. The traffic generated by these activities would be minimal, averaging a few trips per month.

### **2.2.2 Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b is the USACOE's preferred alternative (also known as the "recommended plan"). This alternative would provide 100-year flood protection along the Rio de Flag's downtown reach and would also reduce flooding along the Clay Avenue Wash, I-40, and Continental reaches. The preferred alternative includes all of the project components described for Alternative 6a (bridge modifications, floodwalls and embankment at Thorpe Park, elevation of North Thorpe Road, Clay Avenue Wash detention basin, and Clay Avenue Wash modifications); however, this alternative

includes a covered channel segment extending for approximately two blocks along the Rio de Flag between Dale Avenue and Birch Avenue (see Figure 2-6). Because all of the other project components are the same, only the description of the Rio de Flag modifications is provided below. Refer to Section 2.2.1 for a description of the shared project components listed above.

As described above, the channel modifications through downtown would be slightly different than Alternative 6a, in that the channel would be covered for a short segment instead of open. A 24-foot-wide by 9-foot-deep concrete arch would begin just upstream of Dale Avenue and continue for approximately two blocks to Birch Avenue. The channel would transition back to an open 2:1 slope riprap channel just south of Birch Avenue and continue downstream as described for Alternative 6a. A recreational trail would continue along the entire downtown reach, including the covered channel segment.

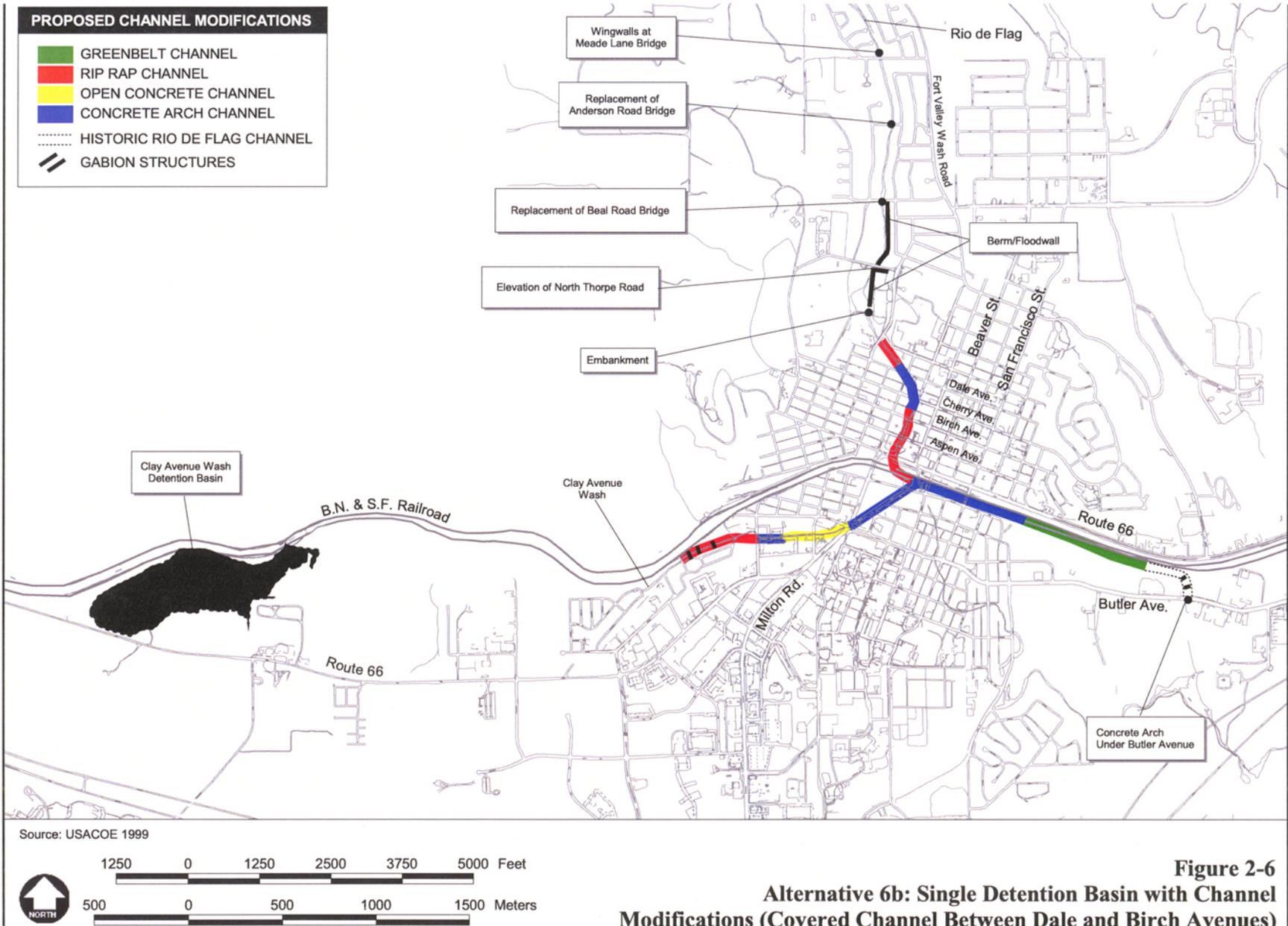
The Rio de Flag channel modifications between Bonito Street and Butler Avenue would require approximately 8,557 cubic yards of concrete and 8,190 cubic yards of riprap to be imported to the site. Approximately 175,041 cubic yards of soil and 86,210 cubic yards of rock would be excavated, 90 percent of which would be disposed of at sites within six miles of the point of origin. Similar to Alternative 6a, this alternative would generate approximately 20 truck-trips per hour under the 6-month “worst-case” scenario. The construction requirements for the other project components are described in Section 2.2.1.

### **2.2.3 Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

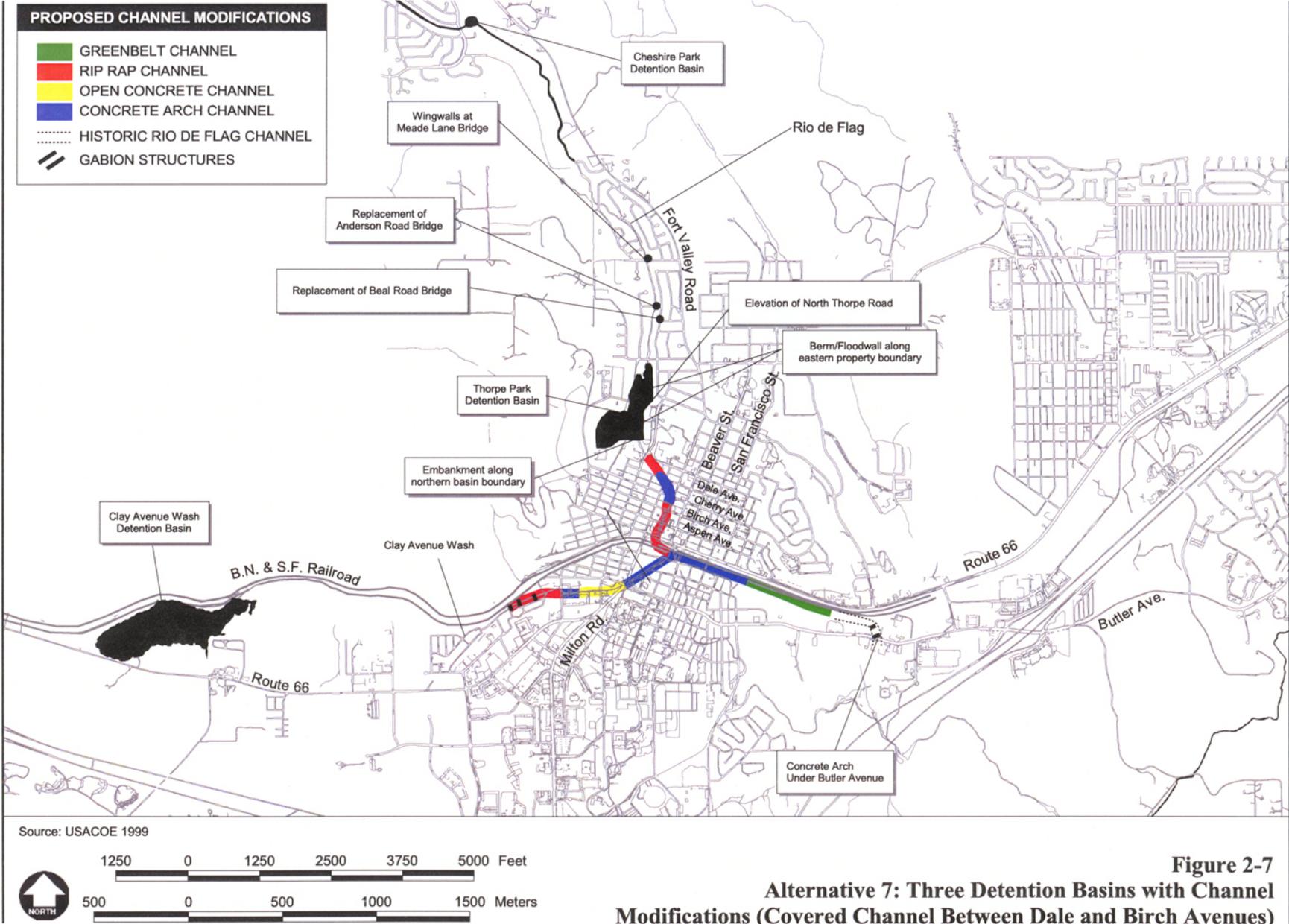
#### **Project Components**

This alternative would use detention basins and channel modifications along the Rio de Flag and Clay Avenue Wash to provide increased flood protection for the downstream reaches (see Figure 2-7). The detention basins along the Rio de Flag are described below; however, the remaining project components are the same as those described under Alternative 6b. The following previously described project components would be constructed under Alternative 7:

- Bridge modifications at Meade Lane and bridge replacement at Anderson Road and Beal Road (refer to Section 2.2.1);



**Figure 2-6**  
**Alternative 6b: Single Detention Basin with Channel**  
**Modifications (Covered Channel Between Dale and Birch Avenues)**



**Figure 2-7**  
**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

- Rio de Flag Channel modifications (refer to Section 2.2.2)<sup>1</sup>
- Clay Avenue Wash detention basin (refer to Section 2.2.1); and
- Clay Avenue Wash Channel Modifications (refer to Section 2.2.1).

The proposed Cheshire Park and Thorpe Park detention basins are depicted on Figure 2-7 and described below.

The Cheshire Park and Thorpe Park basin would be “off-line” detention basins. Accordingly, these basins would be located near, but not within, the Rio de Flag channel. For off-line basins, flows do not enter the basin until discharge rates in the main channel exceed a certain threshold. When this discharge rate is achieved, flows are diverted into an adjacent or off-line basin where they are stored and released over time. This stored water reduces the peak flow in the main channel and therefore reduces the potential for downstream flooding. The Cheshire Park and Thorpe Park detention basins are described below.

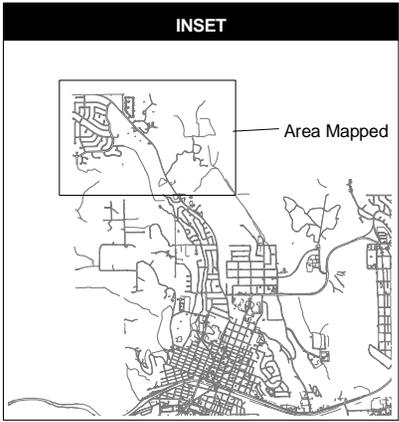
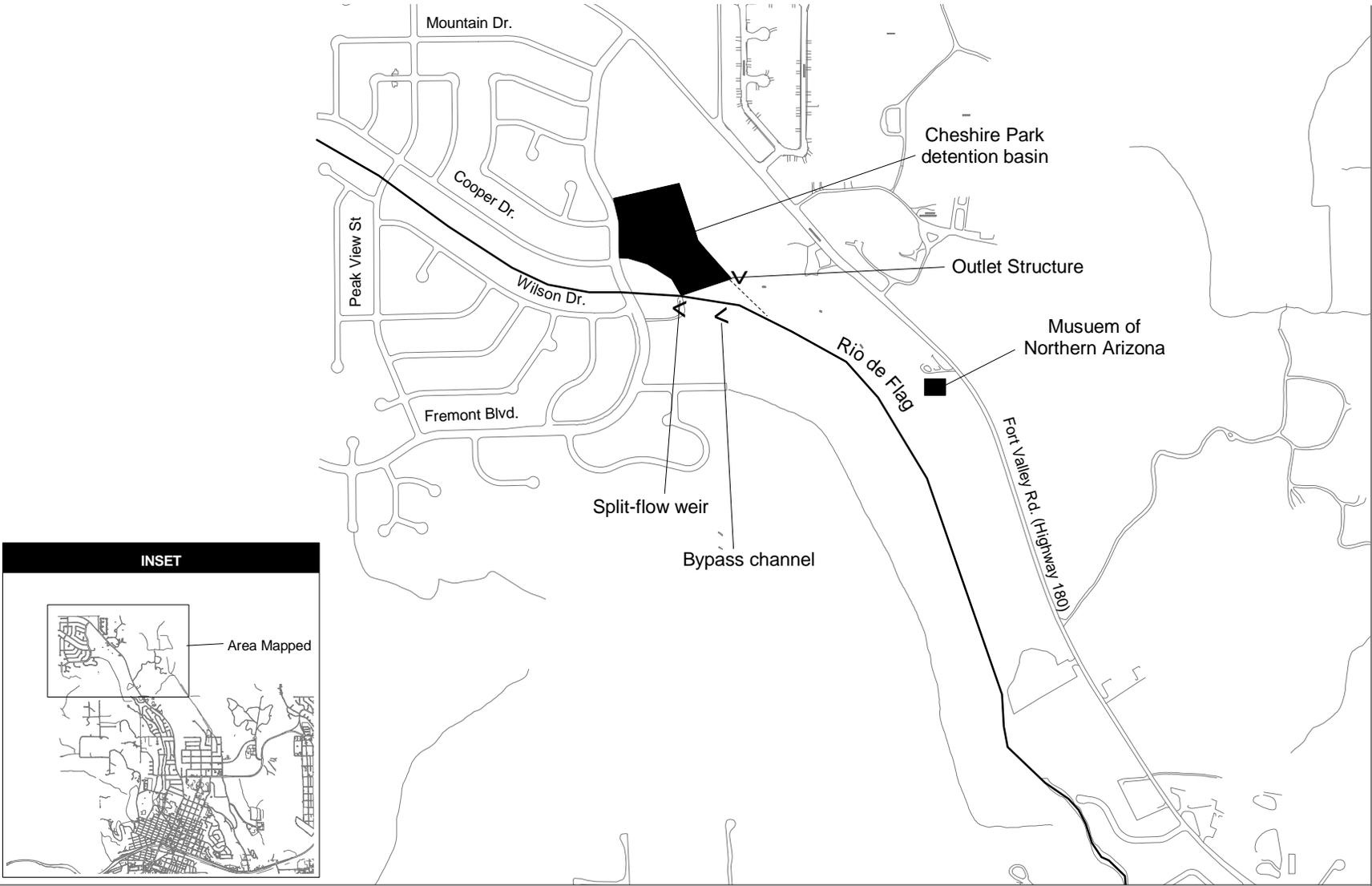
#### Cheshire Park Detention Basin

The proposed Cheshire Park detention basin site is located in northern Flagstaff east of Fremont Boulevard and south of Highway 180. Under this alternative, Cheshire Park and several acres of ponderosa pine forest would be replaced with a large basin as shown on Figure 2-8. The Narrows Dam, a small check dam southeast of the park, would be removed and replaced with a larger outlet structure. The basin would encompass approximately 5.0 acres of land, including approximately 0.5 acre of private land currently owned by the Museum of Northern Arizona. Land acquisition would be undertaken pursuant to Federal and state laws.

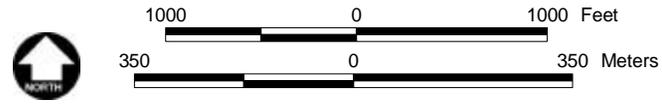
The Cheshire Park detention basin would be an off-line basin. As such, a split-flow channel would be constructed along the west side of the proposed detention basin to convey normal flows along the Rio de Flag. A split-flow weir (approximately 95 feet long and 2 feet tall) would divert flows in excess of 1,500 cfs over the weir and into the detention basin. The capacity of the basin would be 30 to 35 acre-

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1 In comparison to Alternative 6b, Alternative 7 would actually use a slightly smaller underground concrete arch through the two-block-long section of covered channel in the downtown Flagstaff Reach. This change would negligibly reduce the amount of rock excavation needed, and it would also nominally reduce the amount of concrete necessary to form the arch. These minor differences would not noticeably affect impacts associated with project construction or operation and are not further discussed.



Source: City of Flagstaff 1999



**Figure 2-8**  
**Cheshire Park Detention Basin**

feet (9.8 to 11.4 million gallons) and the maximum water storage elevation would be approximately 7,084 feet above mean sea level. The basin would drain completely within 24 to 48 hours.

The downstream face of the weir would be constructed of riprap. Following construction, the basin sideslopes would be revegetated pursuant to a native plant species revegetation plan developed by the USACOE in consultation with the Arboretum at Flagstaff (see Appendix J).

As shown on Figure 2-8, the upstream portion of the basin would have 10:1 sideslopes and the downstream portion would have 3:1 sideslopes. These contours might be altered into a series of terraces to allow Cheshire Park to be reconstructed within the footprint of the proposed basin. The reconstructed park would include replacements for all of the existing facilities, such as the tennis and basketball courts, picnic tables, and all play equipment. The park would also be expanded to include passive recreational features throughout the basin such as trails and picnic areas. If it is not feasible to replace the park within the detention basin, a new park would be constructed nearby within the same neighborhood.

#### Thorpe Park Detention Basin

The Thorpe Park detention basin would encompass approximately 23 acres of Thorpe Park in northwest Flagstaff (see Figure 2-9). The total volume of the detention basin would be approximately 80 acre-feet (2.6 million gallons). A substantial portion of the park would be excavated by approximately two feet, and a bypass channel would be constructed along the eastern boundary of the park. The basin would entail the following key components:

- *Basin Excavation.* Approximately 23 acres of Thorpe Park would be excavated by two feet in order to achieve the required storage capacity of the basin (see Figure 2-9). All facilities affected by excavation activities would be floodproofed prior to or during their on-site replacement so that they would not be damaged by occasional inundation of the detention basin. This includes the two Little League fields, three softball fields, concession stands, restrooms, Frances Short Pond, park monuments, a small parking lot just south of North Thorpe Road, and other park infrastructure (lighting standards, picnic tables, benches, plaques, etc.). The excavation activities would also result in the removal of approximately 190 trees, including approximately 130 mature ponderosa pines.
- *Bypass Channel.* A bypass channel would be constructed along the eastern side of the park near the current alignment of the Rio de Flag. The invert (channel bottom) would be



Source: City of Flagstaff

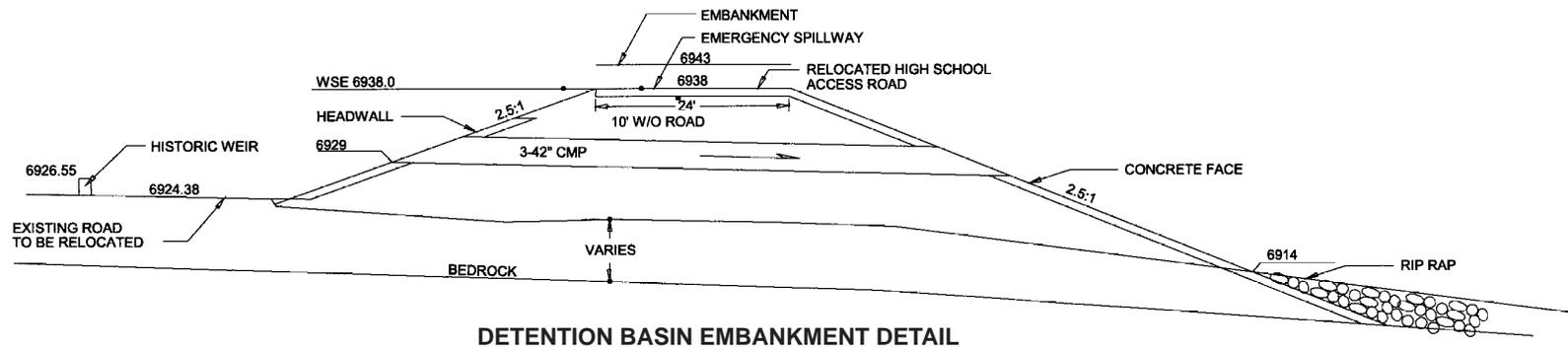
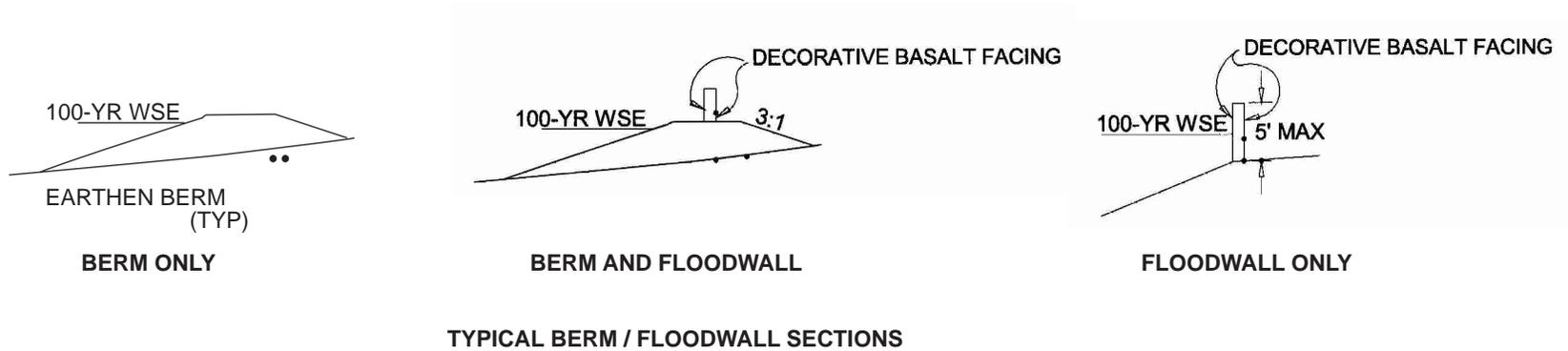


300 0 300 Feet

**Figure 2-9**  
**Thorpe Park Detention Basin**

excavated to 24 feet in width and the channel sideslopes would be constructed at a 3:1 slope. A berm/floodwall would also be constructed along the eastern side of the channel. Similar to Alternative 6a, the berm and floodwall would extend along the western property line of approximately 14 residences and the Flagstaff Junior High School. The combined height of the berm and floodwall would not exceed five feet, and it would be constructed using basalt fieldstone as an esthetic treatment. The bypass channel and floodwall would terminate at the proposed embankment (described below), and normal flows would continue through the embankment via an arch culvert. Excavation of the bypass channel would result in the removal of approximately 90 ponderosa pines and other vegetation, including mature riparian habitat.

- *North Thorpe Road Modification.* As with Alternatives 6a and 6b, an approximately 350-foot section of North Thorpe Road would be rebuilt at a higher elevation. The road would be closed for two weeks while pavement is removed, fill added, and the road repaved. This road closure would occur during the summer to avoid access impacts to the nearby school. The existing culvert at the Rio de Flag crossing under Thorpe Road would remain in place.
- *Embankment.* An embankment consisting of a berm, spillway, and outlet structure would be constructed immediately south (downstream) of the existing weir at Frances Short Pond (see Figure 2-9). At the outlet location, the embankment would have a height of approximately 29 feet, as measured from the base of the downstream side. The spillway at the top of the embankment would be at approximately 6,938 feet above mean sea level. The top height of the embankment would be 6,943 feet above mean sea level. Figure 2-10 shows a typical cross-section of the embankment  
  
The outlet structure would consist of one 48-inch-diameter corrugated metal pipe. A smaller “bleed off” pipe or irrigation gate valve would be installed at the channel invert to eliminate long-term ponding behind the detention basin. Approximately 80 trees would be removed in order to construct the embankment, including 65 ponderosa pines. Following construction, the embankment would be vegetated pursuant to a native species revegetation plan developed by the USACOE in consultation with the Arboretum at Flagstaff (see Appendix J).
- *Access Road Relocation.* The access road that currently leads to Flagstaff Junior High School would be relocated from its current alignment along the weir to a new alignment across the top of the embankment (see Figure 2-10). Construction would require the closure of the road for approximately two months. To avoid access-related impacts to the school, these construction activities would be undertaken during the summer.



**Figure 2-10**  
**Alternative 7 Cross Section of Thorpe Park**  
**Detention Basin Embankment and Floodwalls**

- *Park Facility Replacement.* All park facilities affected by construction activities would be replaced in their pre-construction condition. Structures (e.g. concession stand, restrooms, etc.) would be floodproofed in order to minimize or avoid damage during major flood events. Also, trees would be replanted at a 1:1 ratio in areas affected by project construction. Frances Short Pond would remain in its current location; however, excavation of the surrounding land by two feet would result in a shallower and wider pond.

The locations of these detention basin components are shown on Figure 2-9. The embankment would define much of the detention basin's southern limits, and the berm and floodwalls would form the basin's eastern boundary. To the west and north, the spread of detained floodwaters would be contained within the excavated portion of the basin. At full capacity, the embankment and floodwalls would contain water within the excavated area at approximately 6,938 feet above mean sea level. During these periods, however, most of the park would become unusable—three of the softball diamonds and two Little League fields would be completely flooded. The basin would be sized to completely drain within 48 to 60 hours for the 100-year event, 36 hours for the 50-year event, and less than 24 hours for other more frequent events.

Under Alternative 7, Frances Short Pond would not be hydrologically connected to the Rio de Flag, except during large flooding events; however, the water level of the pond would be maintained by pumping water into the system. The pond would be flushed and cleaned on a regular basis.

## **Construction Requirements**

### Cheshire Park Detention Basin

Construction of the Cheshire Park Detention Basin would affect approximately five acres of primarily undeveloped land in northern Flagstaff. Excavation of the basin would result in 21,780 cubic yards of excess soil and 26,806 cubic yards of excess rock. Approximately 7,260 cubic yards of fill material would be re-used on site; therefore, roughly 14,520 cubic yards of soil and 26,806 cubic yards of rock would be disposed of off site. This material would be delivered to disposal sites within six miles of the detention basin. Excavation of the basin would require approximately four months to complete and would generate approximately 26 truck-trips (round trip) per day. Construction staging would occur within the disturbed basin area.

### Thorpe Park Detention Basin

The Thorpe Park detention basin and bypass channel would require up to 9 months to construct (including one to two months for excavation, 0.5 to one month for site preparation and construction of the key wall, one to two months for fill, and three to four months for finish). It is projected that construction would result in the excavation of approximately 68,000 cubic yards of soil. The amount of soil that would be hauled off site would amount to approximately 58,000 cubic yards because roughly 10,000 cubic yards of excavated material would be utilized for construction of the embankment. Off-site disposal of fill material would occur at sites within six miles of Thorpe Park. Approximately 21,000 cubic yards of riprap, 1,215 cubic yards of concrete, and 615 cubic yards of stone would be imported to the site. The riprap and stone would be imported from local quarries (located within a four- to six-mile radius of the construction site).

The major excavation and grading activities would take place during the first eight weeks of construction. Based on a five-day workweek and the use of trucks with 20 cubic yards hauling capacity, it is projected that the grading phase would require approximately 73 round-trip truck trips per day (using 10 trucks) to remove the excess excavated material. Construction staging would take place primarily within the basin, and, if needed, at a city-owned inert material landfill approximately 3.5 miles from the site (on Woody Mountain Road). Construction staging would occur within the area of excavation. The recreation facilities affected by the project would be closed for approximately 12 months.

### **Operations and Maintenance**

As with the Clay Avenue Wash detention basin, these detention basins would be designed and constructed to operate with minimal operational requirements. Periodic inspection, maintenance, and repair would be conducted by the City of Flagstaff. The level of effort required to inspect, maintain, and repair the detention basins would not be extensive and would include tasks such as ensuring that the embankments do not erode following storms and removing debris and sediment buildup in the outlet structures. In the event that water detained at Thorpe Park adversely affects recreational facilities, the city would return the park to pre-flood conditions. This effort would likely be limited to sediment removal and clean up. The traffic generated by these activities would be minimal, averaging a few trips per month.

## **2.2.4 Alternative D: Localized Non-Structural Flood Proofing**

### **Project Components**

The Localized Non-Structural Flood Proofing Alternative would consist of two berms located in the vicinity of Continental Estates. The conceptual locations of the berms are shown in Figure 2-11 and described below. These localized berms would protect specific structures from flood flows. Unlike the previously described alternatives, this alternative does not include the use of detention basins or channel modifications, and it would not provide any flood control protection for the Downtown, Clay Avenue Wash, or I-40 reaches. Construction of the berms would occur primarily on publicly-owned land and would not require the relocation of any structures; however, some private property may be purchased. Acquisition of private property would be undertaken in accordance with all Federal and state laws.

#### North Berm

The northernmost berm would be located southeast of the intersection of Country Club Drive and I-40. The berm would extend approximately 3,530 feet along the east side of a residential area accessible via Cortland Boulevard. The berm would range in height from 14 to 23 feet, as measured from the base of the 2:1 slopes. The top elevation of the levee would be at 6,780 feet above mean sea level. Figure 2-11 shows the approximate location of the existing 6,780-foot contour—the area between this contour and the berm is the area that would be protected from flooding. The width would vary from 72 to 98 feet along the base of the structure. The north berm would completely avoid any grave sites at the Peaceful Valley Memorial Park (cemetery). As with the previous alternatives, the berm would be landscaped pursuant to the native plant species revegetation plan developed by the USACOE in consultation with the Arboretum at Flagstaff (see Appendix J).

#### South Berm

This berm would be located approximately 2,000 feet south of the north berm. The structure would be very similar in appearance and construction to north berm; however, the dimensions would be slightly different. The top elevation would remain at 6,780 feet. Because the base elevation of the berm would vary, the berm would range in height from 13 to 26 feet. The berm would also range between 72 and 114 feet wide at the base. Beginning at its westernmost end, the berm would traverse the western edge of several residences located on Fairview Drive and cross Country Club Drive just north of the



Source: City of Flagstaff 1998



1000 0 1000 2000 Feet

**Figure 2-11**  
**Berm Locations at Continental Estates**

residential area. To the east of Country Club Drive, the berm would parallel Oakmont Drive through the Continental Little League Fields and cross Oakmont Drive just east of Walnut Hills Drive. The berm would continue along the northeast side of several residences on Laurel Loop and Willow Loop after which it would head east and tie in to existing topographical features near Oakmont Drive. The total length of the south berm would be approximately 7,600 linear feet. Similar to the north berm, the area between the south berm and the existing 6,780-foot contour represents the area that would be protected from flood events by the berm. The south berm would also be landscaped pursuant to the native plant species revegetation plan developed by the USACOE and Flagstaff Arboretum (see Appendix J).

### **Construction Requirements**

Construction of the north and south berms would involve extensive excavation and fill over the course of the six-month construction period. The north berm would require approximately 47,120 cubic yards of excavation and approximately 144,780 cubic yards of fill. Assuming that all of the fill material is reused for construction of the berms, this would generate approximately 12 truck trips per hour (for six months) to import the balance of fill material. Construction of the south berm would result in roughly 107,090 cubic yards of excavated material, require approximately 358,080 cubic yards of fill, and generate an average of 30 truck trips per hour on the local roadway network. A combined total of approximately 42 truck trips per hour (on average) would therefore be required under this alternative for the duration of the six-month construction period.

### **Operations and Maintenance**

The operational requirements associated with Alternative D are similar to those described for the previous alternatives. Periodic inspection, maintenance, and repair would be conducted by the City of Flagstaff. The level of effort required to inspect, maintain, and repair the berms would not be extensive and would include tasks such as ensuring that the structures do not erode following major storms. The traffic generated by these activities would be minimal, averaging a few trips per month.

#### **2.2.5 No Action Alternative**

Under the No Action Alternative, no flood protection measures would be implemented along the Rio de Flag or Clay Avenue Wash in the Flagstaff area. The City of Flagstaff is experiencing steady growth

of around two percent annually, and this is forecasted to continue due to the availability of privately owned developable land and the desirability of the Flagstaff area as a place to live. This future growth, development, and population increase will result in a greater areal extent of impervious surfaces which, in turn, increases runoff during precipitation events. (Impervious surfaces are surfaces that prevent the infiltration of water—rooftops and paved areas such as streets and parking lots are examples of impervious surfaces.) In the absence of future flood control improvements, this continued growth in the Rio de Flag watershed would be expected to exacerbate the current flooding problem.

Under the No Action Alternative, the City of Flagstaff would continue to be subject to significant economic, social, and environmental damages from severe floods. Approximately 1,500 existing structures, worth about \$385 million, could be subject to about \$93 million worth of damage from a 100-year flood event. In addition to structural damage throughout a large portion of the city, historic resources would be affected, the Burlington Northern & Santa Fe railroad could be severely damaged or its operations significantly disrupted, and public infrastructure and services would remain at risk. Transportation problems would occur, with a large portion of the city and Continental Estates area inaccessible for several days. A significant portion of the campus of Northern Arizona University is within the floodplain, and during severe flood events could incur schedule disruptions (e.g. closings) and physical damage to facilities and historic buildings on campus. Numerous residential, commercial, and industrial properties in the area also would remain at risk.

## **2.3 MEASURES AND ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD FOR DETAILED ENVIRONMENTAL EVALUATION**

This section describes the flood control measures (2.3.1) and specific alternatives (2.3.2) that were considered by the USACOE but not carried forward for detailed environmental analysis in this Final EIS. The plan formulation process that led to these flood control solutions is described in Section 2.1.

### **2.3.1 Measures Not Carried Forward**

#### **Relocation of Existing Structures**

Relocation involves either (1) moving a structure out of the floodplain or (2) demolishing the structure and either building or finding a replacement in another location. In the downtown area, relocation was determined to be infeasible given that the floodplain encompasses nearly one-half of the town

(approximately 1,500 structures). In the Continental Estates area, relocation was similarly determined by the USACOE to be impracticable and economically unjustified based on property acquisition requirements.

### **Floodproofing for Individual Structures/Groups of Structures**

Implementation of non-structural measures such as floodproofing existing structures was evaluated. Floodproofing offers the opportunity to provide flood protection on an individual, structure-by-structure basis. Each structure or reasonable group of structures would either be surrounded by a floodwall or elevated in-place. Elevation of structures would be accomplished by raising them on piers, foundation walls, or fill material. Floodwalls or levees surrounding structures would consist of either a concrete or masonry wall, or soil material built-up and compacted around the structure. Walls surrounding structures would still require closures that would allow doors, windows, and driveways to be used while preventing water from entering the building. These closures typically would be manually operated based on flood forecasting and prediction that would alert the operator.

The Rio de Flag and Clay Avenue Wash floodplains contains approximately 1,487 structures including 1,241 residences and 246 business/commercial/public/industrial structures. The sheer density of the structures requires more costly means of floodproofing, such as concrete floodwalls immediately adjacent to the structures rather than soil levees or berms. To determine the costs associated with this alternative, the USACOE utilized conservative estimates for floodproofing, including approximately \$25,000 per residence and approximately \$40,000 for business/commercial/public structures, for a subtotal of approximately \$40,865,000. In addition, the cost of floodproofing at NAU is approximately \$25,000,000.

In the Continental Estates area, floodproofing of individual structures was also evaluated. The area is currently a designated floodway and development is required to be elevated above the 100-year water surface without causing a significant increase to that water surface. However, there are approximately 20 structures which were constructed within the current 100-year floodplain prior to FEMA designation, and there are approximately 100 structures located around the 100-year floodplain fringe which may suffer damage from a less frequent (i.e. 500-year) event. Most of these homes are higher than average value structures, generally between \$200,000 and \$3,000,000. Individual floodproofing would be costly. As with the downtown area, floodproofing in the Continental Estates area has been determined by the USACOE to be economically unjustified. (Note that floodproofing individual

structures is different than the use of berms to protect large groups of structures, as is described for Alternative D.)

Aside from the cost, a significant percentage of floodproofed homes and businesses would still suffer flood damages due to the potentially incomplete nature of the solution. The enclosures of the windows, doors, and driveways require human action in order to fully implement the solution, and this would have to occur in a relatively short amount of time. Based on the size of the floodplain within the city, it is infeasible to expect that a complete response to a flood threat would take place on the part of the property owners.

Due to the excessive costs and lack of practicality, individual floodproofing measures were not carried forward for detailed environmental analysis.

### **Flood Warning System**

A flood warning system could provide advance notice of high flood stage situations and enable people to move themselves, their vehicles, and some high value property out of the flood zone; however, this approach does little to nothing to protect structures (e.g., buildings). It was determined that a warning system by itself would not provide significant increases in warning times and this measure was not carried forward for detailed environmental analysis.

### **2.3.2 Alternatives Not Carried Forward**

As described in Section 2.1, the USACOE implemented a plan formulation process, through which nine preliminary alternatives were developed. These included five alternatives focused on the downtown Flagstaff area (Alternatives 1 through 5) and four alternatives that would provide flood protection in the Continental Estates area (Alternatives A through D). As a result of the screening process described in Section 2.1 and further engineering/design analysis, four project alternatives were carried forward for detailed environmental evaluation in this EIS. (A fifth alternative, No Action, is also evaluated in this EIS.) These alternatives include Alternatives 6a, 6b, 7 and Alternative D. The alternatives that were not carried forward for detailed analysis (1 through 5 and A through C) are summarized below.

### **Alternative 1 (Full Detention)**

This alternative would have involved the construction of detention basins at Thorpe Park and along the Clay Avenue Wash with no channel modifications. The basin at Clay Avenue Wash would have been identical to the basin described in Section 2.2.2. The basin at Thorpe Park would have utilized a large embankment to the south, floodwalls along the east side of the park and natural topography to the west and north to detain floodwaters. Engineering evaluations conducted subsequent to the release of the initial Draft EIS indicated that the level of flood protection provided by the Thorpe Park detention basin was not adequate along the downtown reach and that a detention basin-only alternative would not be feasible. Thus, although this alternative was carried forward for evaluation in the initial Draft EIS, this alternative was subsequently eliminated from further consideration.

### **Alternative 2 (Thorpe Park Detention Basin, Channelization on the Rio de Flag and Clay Avenue Wash)**

This alternative would have involved the construction of a detention basin and floodwalls at Thorpe Park (no basin would have been constructed along the Clay Avenue Wash). Alternative 2 would have also included the construction of channel modifications along the Rio de Flag and Clay Avenue Wash providing flood protection to the downtown area. The modifications to the Rio de Flag would have been similar to those described for Alternative 6a (see Section 2.2.3); however, under this alternative they would have begun further upstream at Birch Street. In addition, the new Rio de Flag channel would have had an earthen-bottom with a natural rock revetment through the majority of the reach. The Clay Avenue Wash modifications would have also started further upstream than those described for Alternative 6a and would have utilized open concrete channels in areas proposed for riprap under Alternative 6a. The Clay Avenue Wash modifications would have begun just upstream of the Railroad Springs development. The greenbelt channel along the Rio de Flag would have been included in this alternative.

This alternative would have reduced the overall discharge from Thorpe Park and would have increased channel capacity throughout the downtown area. The residual flooding from a 500-year flood event with a 100-year level of protection in place, for example, would have resulted in flooding that approximates the 25- to 50-year floodplain in the without-project condition. For the Continental Estates area, the reduced discharge from Thorpe Park would have been offset by the efficiency of the channelization such that the net effect would have been a minimal reduction in peak water surface

elevations. This alternative was marginally economically justified, but had high real estate and environmental consequences. Alternative 2 would have provided almost the same level of protection as Alternatives 6b; however, it would have been more costly to construct, and it would not have provided significant benefits to the Continental Estates area. Alternative 2 was therefore not carried forward for detailed environmental analysis.

### **Alternative 3 (Clay Avenue Wash Detention Basin, Channelization on Rio de Flag)**

Alternative 3 would have included a detention basin at Clay Avenue Wash and channel modifications similar to those described under Alternative 2. Thus, this alternative would have been similar to Alternative 2 in that it would have used a detention basin to reduce flow volumes and it would have increased channel capacity throughout the downtown area (providing a level of flood protection similar to Alternative 2). This alternative would have been economically justified, but it would have also had high real estate and environmental consequences. Alternative 3 would have provided the same level of protection as Alternatives 6b, but at higher costs and with fewer net benefits. In addition, Alternative 3 would not have provided significant benefits to the Continental Estates area. For these reasons, Alternative 3 was not carried forward for detailed environmental analysis.

### **Alternative 4 (Channel Modifications with No Detention)**

Alternative 4 would have included full channelization without detention basins. This would have included the construction of channel modifications along the Rio de Flag and Clay Avenue Wash to provide flood protection to the downtown area. The Rio de Flag and Clay Avenue Wash channel modifications would be the same as those described under Alternative 2.

Under this alternative, residual flooding in the downstream area would have been reduced compared to Alternatives 1, 2, and 3. Channelization, however, would have modified flood flow routing and timing such that the peak discharges entering the Continental Estates area would have increased. Without detention basins or some other means of significant attenuation, higher peak flows would have been conveyed to the Continental Estates area, and associated increases in water surface elevations would have occurred. An approximately one-foot increase in water surface elevation over and above the without-project condition in the Continental Lake area would have occurred with implementation of this alternative. Alternative 4 would have induced downstream damages and would not have been economically justified; therefore, it was eliminated from further evaluation.

### **Alternative 5 (Full Detention with Channel Modifications)**

Alternative 5 included the detention basins described for Alternative 1 and the channel modifications described for Alternative 2. Although this alternative was carried forward for evaluation in the initial Draft EIS, subsequent engineering and design evaluations indicated that this alternative was not feasible; therefore, it was eliminated from further consideration.

### **Alternative A (Excavation of Continental Lake)**

This alternative would have involved excavation within Continental Lake downstream of Country Club Drive, with the purpose of increasing storage capacity and reducing flood damages. There were two configurations of this alternative. The first configuration would have required the construction of a large stand-alone detention basin, which would have operated in the absence of any upstream flood control measures. The second configuration would have included a smaller detention basin to be used in conjunction with upstream flood protection alternatives.

In order to achieve adequate storage capacity in the Continental Estates area, a stand-alone detention basin would have required a substantial volume of excavation. Due to the high costs of the required excavation and the limited benefits available in the Continental Estates area, this alternative was determined to be unjustified. When considered with the upstream alternatives, a smaller detention basin would also not have provided sufficient incremental benefits to be justified. For these reasons, this alternative was not carried forward for detailed environmental analysis.

### **Alternative B (Improving Route 66/Railroad Undercrossing Outlet Structure)**

This alternative would have involved upgrading or improving the culverts which carry Rio de Flag flows under State Route 66 and the BNSF railroad tracks. The culverts would have been expanded from their current capacity of 90 cfs to a capacity of 210 cfs. (The projected inflow into the Continental Estates area during a 100-year event is approximately 4,200 cfs.) The culvert improvements could have been accomplished at relatively low cost. However, due to the duration of flooding in this area, the large volume of water detained upstream of the existing culverts, and the large areal extent of the ponded water, the hydraulic impact of increasing the outflow to 210 cfs would have been negligible. Peak water surface elevations would have been only minimally reduced; hence, the benefits of this alternative would have also been minimal. Increasing outflows above 210 cfs could have induced

property damages downstream because the FEMA-mapped 100-year flood plain for the Rio de Flag downstream of these culverts is based on a maximum culvert capacity of 210 cfs. Purchase of downstream property to avoid these damages was determined to be prohibitively costly. Based on the factors, Alternative B was not carried forward for detailed environmental analysis in this EIS.

### **Alternative C (Detention Basin Upstream of Continental Estates)**

This Alternative would have included the construction of a detention basin or series of localized detention basins immediately upstream of the Continental Estates area to reduce peak flows and flood damages. Alternative C would have also included the Thorpe Park and Clay Avenue Wash detention basins to reduce inflow into the Continental Estates area.

Alternatives 6a, 6b and 7, which are carried forward for analysis in this Final EIS, each include at least one detention basin and each would provide benefits to the Continental Estates area. The volume and capacity of additional smaller detention areas immediately upstream from Continental Estates would have been insufficient to provide significant benefits over and above the benefit provided by the large upstream detention basin(s). In addition, no feasible location was identified for an additional large detention facility near Continental Estates. For these reasons, Alternative C was eliminated from additional consideration.

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### 3.0 **BASELINE CONDITIONS**

This section describes the existing setting of those areas and environmental resources that could be affected by the alternatives described in Section 2.2.

#### 3.1 **TOPOGRAPHY/GEOGRAPHY**

##### 3.1.1 **Topography and Landform**

The Rio de Flag flows generally southeast from its headwaters on the western slopes of the San Francisco Peaks (peak elevation of 12,633 feet). It enters the City of Flagstaff from the north, following the course of a south-southeast-trending valley between two flat-topped, volcanic highlands: Observatory Mesa (7,500 feet) to the west and Switzer Mesa<sup>1</sup> (7,200 feet) to the east (see Figure 3-1). On the south side of the city, the stream channel arcs to the east, then northeast, widely skirting the base of Switzer Mesa and Mount Elden (9,300 feet). Within the study area, the valley of the Rio de Flag gently slopes from approximately 7,000 feet in the northwest to approximately 6,800 feet in the northeast. In the North Flagstaff and Downtown Reaches, where the direction of flow is generally north to south, the drainage is narrow and artificially channelized with steep sides. In portions of downtown Flagstaff, notably under Route 66 and the railroad tracks, the stream flows through concrete underground culverts.

Downstream of its confluence with Sinclair Wash, in the I-40 and Continental Reaches, the Rio de Flag flows east and northeast through natural, low, steep-sided hills that open up beyond the Continental residential area to become a wide valley bounded by low cinder hills. In this open portion of the study area, the ceiling of a cavity under the Rio de Flag floodplain has collapsed, creating a geologic drain for surface runoff.<sup>2</sup> After leaving the boundaries of the study area at I-40, the Rio de Flag continues to flow northeast through open valleys bounded by Mount Elden to the north and Wildcat Hill to the south.

Clay Avenue Wash, created by runoff from Observatory Mesa, runs westward (from 7,200 feet to 6,900 feet in elevation) through a narrow channel along the railroad tracks until it reaches Milton Road, where it partially submerges until it joins the Rio de Flag.

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<sup>1</sup> Switzer Mesa is also called "MacMillan Mesa."

<sup>2</sup> This geologic drain is known locally and appears on U.S. Geological Survey maps as the "Bottomless Pits."

### **3.1.2 Geologic Structure**

The course of the Rio de Flag channel in the study area is controlled by faults, except in the portion of the Downtown Reach south of the railroad tracks, where the course has been altered by human intervention. This fault control is most apparent in the I-40 and Continental Reaches, where the channel often changes direction. The channel at times follows the pervasive, northwest-trending joints and faults of the region, and at times the less pervasive northeast-trending joints and faults.

Rocks exposed in the study area are predominantly igneous of Quaternary age and much older sedimentary rocks—primarily limestone of Late Permian age (Kaibab Formation) and mudstone/sandstone of Triassic age (Moenkopi Formation). North of Route 66 and the railroad tracks, bedrock generally consists of basaltic or silicic lava flows intermixed with or covered by cinder deposits. South of the tracks, limestone of the Kaibab Formation is exposed along the north bank of the Rio de Flag channel. Virtually all rock types exposed at the surface in the study area contribute to rapid infiltration of surface water flow because of their porosity and fracture characteristics. Volcanic cinders, in particular, are highly permeable. The calcareous sedimentary rocks enhance infiltration only where they are fractured. The fractures, over time, can expand into extensive solution channels and cavities, which then absorb much of the surface runoff. However, this enhancement of infiltration of surface water is countered to some degree by the makeup of local soils.

### **3.1.3 Soils**

Surface soils in the Rio de Flag area vary with the underlying parent material. Local soil surveys indicate that thoroughly wetted permeabilities range from 2 to 10 inches per hour on the steep flanks of the San Francisco Peaks and Mount Elden, and from 0.8 to 2.4 inches per hour in the lower volcanic slopes and in alluvial valleys. West and southwest of Flagstaff, where some clay and silt is found in subsoil, the range is 0.2 to 0.8 inches per hour. A range of 0.3 to 0.8 inch per hour is characteristic for the region of exposed limestone south of I-40. Permeability of frozen ground during winter is near zero.

Soils at the Cheshire Park detention basin site consist primarily of alluvium (recent silts, sands, and gravels) that have been eroded and deposited at the site. From the Thorpe Park area to the crossing under Route 66 and the railroad tracks, the Rio de Flag is underlain mostly by Clover Springs loam with lesser amounts of Lynx loam. From the crossing to the geologic drain beyond the Continental residential area, the reaches where most flooding occurs, the Rio de Flag channel is underlain by Lynx

loam. At the geologic drain and under Big Fill Lake, Jacques clay loam is present (U.S. Soil Conservation Service 1975 and 1972). Soils on lands outside or adjacent to the Rio de Flag channel fall into several classifications. From the northern boundary of the study area to the crossing under Route 66 and the railroad tracks, soils on both sides the stream are of the Broliar Series. South of the crossing, three types of soils dominate: Tortugas Series soils, which develop on limestone bedrock; Daze Series soils, found on limestone and calcareous sandstone; and Broliar Series soils, which develop on basalt (U.S. Soil Conservation Service 1975).

#### **3.1.4 Deposited Sediments**

Sediment deposits along the Rio de Flag are primarily Quaternary alluvium typical of modern floodplains (Reynolds 1988). Sediments in the upper reaches are derived from volcanic rocks such as basalts and rhyolite. The sources are from the San Francisco Peaks, A-1 Mountain, and Mount Elden.

#### **3.1.5 Faulting and Seismicity**

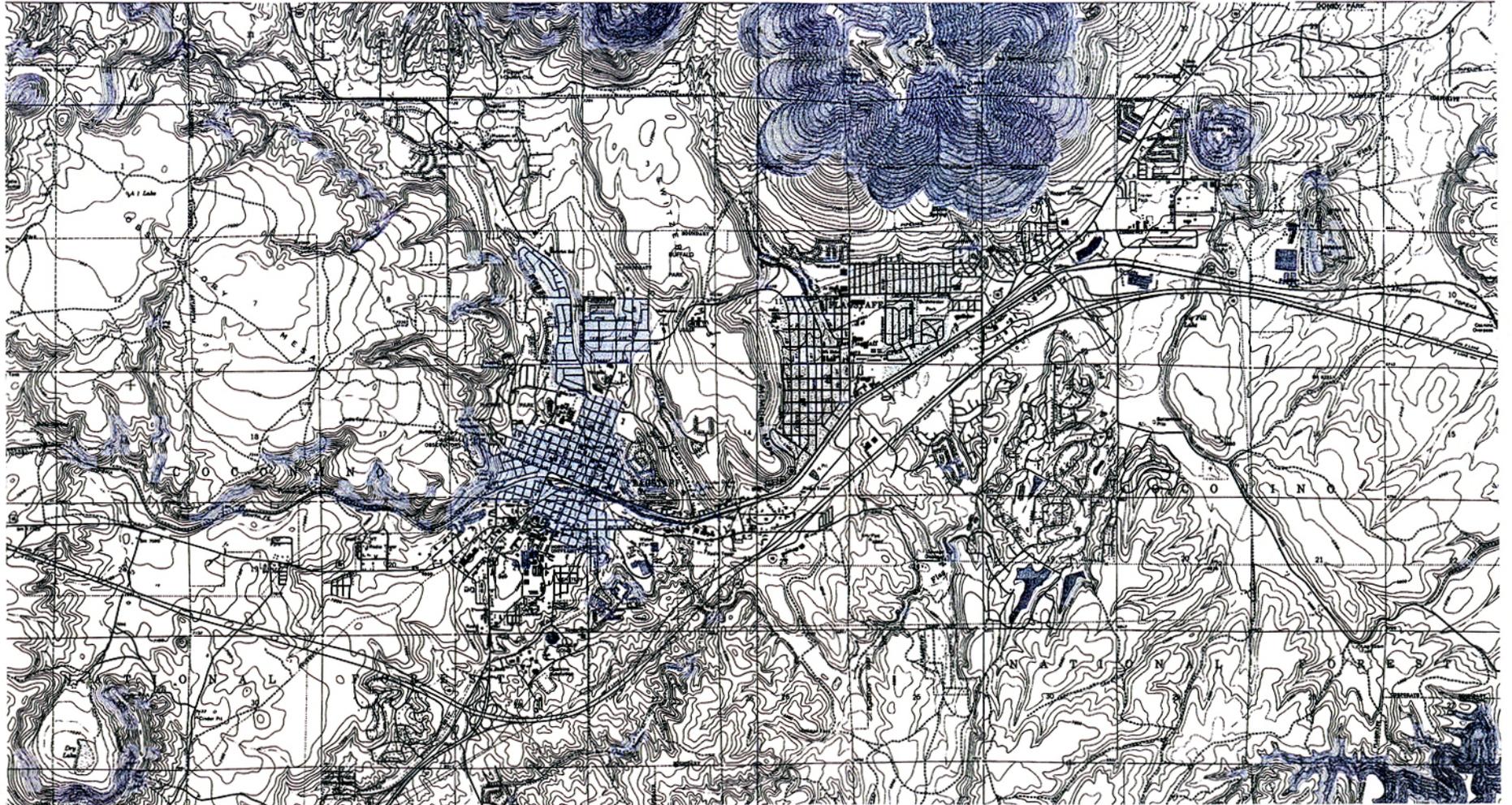
As described in Section 3.1.2, a number of small faults within the study area affect the course of the Rio de Flag. Despite the presence of these minor faults, the Rio de Flag does not intersect any known major fault zones within the immediate study area (i.e., areas where construction is being considered). Less extensive bedrock-hosted faults could be present in Kaibab Formation rocks in the study area, none of which are recognized as active. Outside of the immediate study area, the Rio de Flag flows near the active Lake Mary fault near its intersection with I-40.

Based on historic occurrences, the Flagstaff area is subject to small-to-moderate earthquakes, with some risk of larger, more damaging earthquakes. Four moderate sized earthquakes, centered from two to eight miles north of the city, were experienced between 1892 and 1959. These ground movements were related to the San Francisco volcanic field (located north of the city), which ranged in magnitude from 4.3 to 6.3 on the Richter scale. Past studies conclude that the Greater Flagstaff area could experience a maximum peak acceleration of approximately 1.5 g in response to seismic events, with a 2 to 10 percent probability of exceedance in 50 years (USACOE 1995 and USGS 1997). (One “g” equals the acceleration of the earth’s gravity.)

Recent investigations also indicate a maximum credible earthquake of a 6.9 Richter magnitude on the “Belmont Fault” over five miles west of downtown Flagstaff (Bausch and Brumbaugh 1997, Pearthree et al. 1996).

### **3.1.6 Minerals**

The project study area does not encompass known mineral resources of commercial value. The nearest historic mining locations are two stone quarries, one at the south end of Switzer Mesa about 0.1 mile north of the railroad lines and the other roughly 0.3 mile east of Switzer Canyon. These quarries are located approximately one mile east of the proposed greenbelt corridor.



Source: USGS Flagstaff East and Flagstaff West 7.5 Topographic Quadrangle Maps

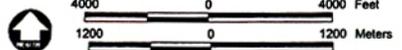


Figure 3-1  
Topography

## 3.2 WATER QUALITY/HYDROLOGY

### 3.2.1 Surface Water

#### Hydrology

The Rio de Flag and Clay Avenue Wash can each be classified as an ephemeral stream. Currently, no stream gauges are operating in the Rio de Flag basin, but between 1956 and 1960, and again between 1970 and 1982, the U.S. Geological Survey (USGS) maintained two gauges on the waterway. One gauge was upstream of much of the city development, and one was downstream at I-40, below the point where a former waste treatment facility (Plant Number One) discharged effluent into the channel. The peak discharges recorded at both gauges during those 18 years were extremely small, but they differed substantially. At the upstream gauge

- The greatest flow was 240 cfs
- Ten years had a peak discharge of 11 cfs or less
- Four years had zero discharge
- The median discharge was 10 cfs.

At the downstream gauge

- Maximum discharge was 1,421 cfs
- Five years had less than 100 cfs
- Two years (when flow was recorded at the upstream gauge) had zero discharge
- The median discharge was 134 cfs

Three localized permanent water resources exist along the Rio de Flag in the study area: (1) Cheshire pond, a small water source created by the Narrows dam at Cheshire Park detention basin site; (2) a duck pond (Frances Short Pond) at Thorpe Park; and (3) effluent from the Rio de Flag Water Reclamation Plant, which creates a wetland where the Rio de Flag crosses west-bound I-40 (“I-40 wetlands”). Effluent discharge from the Rio de Flag Water Reclamation Plant averages approximately 1.7 million gallons per day (pers. comm, W. Case, Plant Technician, May 1998).

## **Water Quality**

Water quality data for the study area is limited due to the small number of perennial surface water features, as described above. Water quality within Frances Short Pond reflects that, for much of the year, the pond is stagnant and accumulates waterfowl feces.

The surface waters downstream from the wastewater reclamation plant to San Francisco Wash are classified in the Arizona Administrative Code as “effluent dependent waters.” That is, without relatively continual discharges from the treatment plant, this segment of the Rio de Flag would be limited to ephemeral flows, similar to portions of the channel further upstream. The effluent discharges are treated to Arizona Department of Environmental Quality (ADEQ) irrigation water standards (City of Flagstaff 1990). The applicable standards for the surface waters below the discharge are contained in the Arizona Administrative Code Title 18, Chapter 11, Supp. 96-3, “Water Quality Standards.” Appendix B to this section of the Arizona Administrative Code, “List of Surface Waters and Designated Uses,” designates the beneficial uses for flows downstream from the wastewater reclamation plant as “Aquatic and Wildlife Habitat (effluent dependent water)” and “Partial Body Contact.”

The treated effluent contains relatively high nutrient levels (nitrates and phosphates), as evidenced by substantial algal growth present in the I-40 wetlands near the point of discharge. This is not unusual for treated effluent flows because it is difficult to remove nutrients from treated wastewater discharges. Furthermore, nutrients are generally a benefit to irrigation customers, as the presence of nutrients in the irrigation water reduces the need for fertilizer applications.

For ephemeral water bodies (such as those portions of the Rio de Flag and Clay Avenue Wash that do not have perennial flows), the Arizona Administrative Code states that “Aquatic and Wildlife (ephemeral)” and “Partial Body Contact” water quality standards shall apply (R18-11-105).

### **3.2.2 Groundwater**

Little groundwater quality data is available for the project study area. Accordingly, a discussion of groundwater quality is not provided in this subsection. Instead, the following baseline conditions description focuses on the locations, yields, and current uses of groundwater resources in and around Flagstaff.

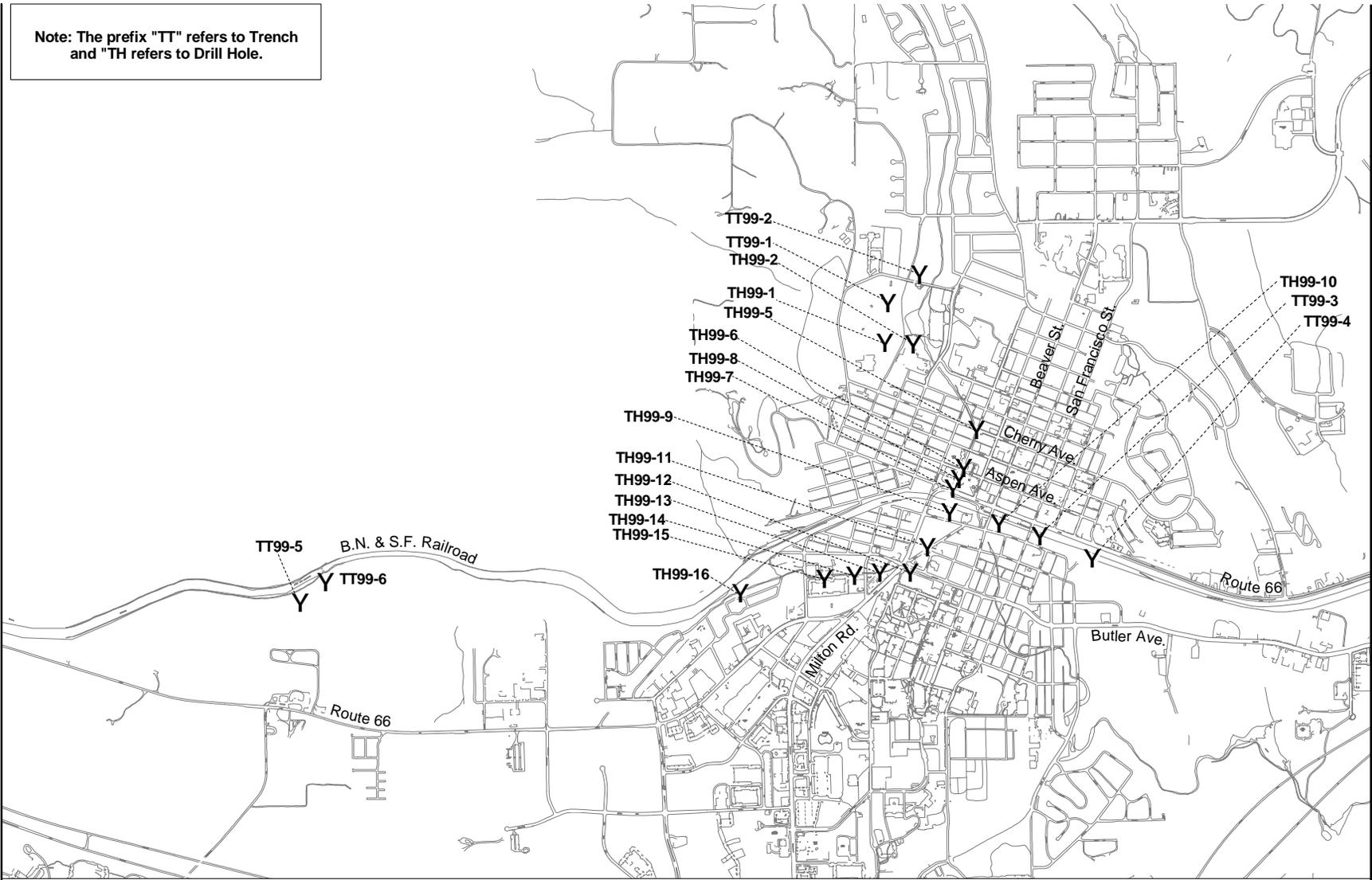
Depth to the main aquifer in the vicinity of Flagstaff (Coconino aquifer) ranges from as much as 2,500 feet in the north to 1,100 to 1,200 feet in the southwest (the city's Woody Mountain Wellfield), and as little as 300 feet in the Lake Mary area south of town (McGavok et al. 1986, McGavok 1968, and Brown and Caldwell 1978). The groundwater divide, located about eight miles southwest of Flagstaff is indicative of a major groundwater recharge zone. Beneath Flagstaff, groundwater flow from that divide moves northeast (McGavok *et al.* 1986). Water storage in the Coconino aquifer is high, but well yields are low due to the low permeability of the rocks that comprise the aquifer, except where they are significantly fractured (McGavok *et al.* 1986). Well yields are typically 200 to 800 gallons per minute in the Coconino aquifer (John Carollo Engineers and Harshbarger & Associates 1973).

Much more shallow and localized aquifers, called "perched aquifers," occur in the study area where lower permeability geologic materials impede the downward flow of water and prevent the water from reaching the main aquifer below. Local wells and springs that result from perched aquifers are ephemeral. In the Flagstaff area, perched aquifers can be encountered in alluvium where it overlies bedrock of low permeability, in volcanic rock, in the relatively unfractured Moenkopi Formation, and in chert and siltstone lenses in limestones of the Kaibab Formation (John Carollo Engineers and Harshbarger & Associates 1973).

The USACOE conducted 20 test borings (e.g., core samples) and trenches at the potential Thorpe Park and Clay Avenue detention basin sites and channel alignments in May and June, 1999. These test borings and trenches indicate that perched groundwater conditions are highly variable within the study area. Figure 3-2 shows the locations of the test excavations, and Table 3-1 indicates the depth to groundwater (if encountered). As shown on the table, three test locations within the potential footprint of the Thorpe Park detention basin site (TT99-1, TT99-2, and TH99-1) showed no indication of groundwater, with excavation depths ranging from 2 to 25 feet. Immediately downstream from the existing Frances Short Pond weir (site TH99-2), however, groundwater nearly saturated a zone at approximately 21 feet below the surface, near the bottom of a basalt layer.

Groundwater was not encountered at the potential Clay Avenue Wash detention basin site; however, the test excavations at this site were relatively shallow (less than 5.0 feet deep) because the boring equipment could not penetrate the basalt layer found approximately 4.5 to 4.75 feet below the surface.

Note: The prefix "TT" refers to Trench and "TH" refers to Drill Hole.



Source: USACOE 1999

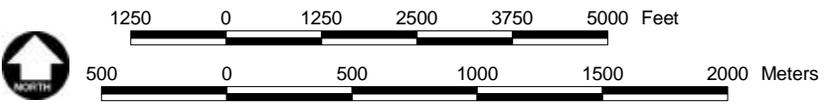


Figure 3-2  
Trench and Boring Excavation Sites

**Table 3-1. Depth to Groundwater at Test Excavation Locations**

Location/ Test Site <sup>1</sup>	Depth to Groundwater <sup>2</sup>	Location/ Test Site	Depth to Groundwater <sup>3</sup>
<b>Thorpe Park Detention Basin (TBD)</b>		<b>Clay Avenue Wash Detention Basin (CBD)</b>	
TT99-1	Not found (2 feet)	TT99-5	Not found (4.75 feet)
TT99-2	Not found (3.5 feet)	TT99-6	Not found (4.5 feet)
TH99-1	Not found (25 feet)	<b>Rio de Flag Channel (Rio)</b>	
TH99-2	21 feet <sup>3</sup>	TH99-5	11 feet
<b>Clay Avenue Wash Channel (CAW)</b>		TH99-6	Not found (4 feet)
TH99-16	Not found (9.5 feet)	TH99-7	Approx. 11 feet
TH99-15	Approx. 9.5 feet	TH99-8	18.5 feet
TH99-14	1.7 feet	TH99-9	8 feet
TH99-13	3.8 feet	TH99-10	Not found (20.3 feet)
TH99-12	Not found (15 feet)	TT99-3	Not found (10 feet)
TH99-11	10.75 feet	TT99-4	Not found (13.5 feet)

Source: USACOE 1999

<sup>1</sup> The prefix "TT" refers to test trench and "TH" refers to test (drill) hole.

<sup>2</sup> Where groundwater was not found, the depth of the test boring is provided in parentheses.

<sup>3</sup> Test boring was nearly saturated at the bottom of the basalt layer, which extended to approximately 21 feet below the surface.

Along the potential alignment for modifications and new channel creation for the Rio de Flag, eight test sites indicate that the depth to groundwater ranges from as little as 8 feet to more than 20 feet. Along the potential Clay Avenue Wash channel modifications alignment, groundwater was encountered as shallow as 1.7 feet (site TH99-14).

Wells in perched aquifers in volcanic rock about 10 miles west of Flagstaff intersected water at depths of 21 to 27 feet (McGavok 1968), and these wells may give an indication of recharge rates for perched water aquifers within the study area. Based on these wells, it appears that the recharge of perched zones is rapid, with topographic ridges and high permeability features such as volcanic cones as the main conduits of recharge. Flow within the perched aquifers is usually controlled by the topography (EBASCO Environmental 1990).

The geologic drain in the Continental Reach has acted as a sump for years with a large capacity to remove excess flow from the Rio de Flag (Bills 1995). It is generally agreed, although poorly documented, that any Rio de Flag surface flow entering the geologic drain eventually reaches Walnut Creek and Walnut Canyon National Monument via southward flow through fractures and possibly shallow, perched aquifers in the Kaibab Formation.

### 3.3 BIOLOGICAL RESOURCES

Biological resources of the project study area are described in terms of vegetation communities, wildlife and wildlife use, threatened and endangered plant and wildlife species, and functions of wetlands and “waters of the United States.”

#### 3.3.1 Vegetation Communities

Vegetation communities within the study area were mapped in August 1998 and April 2000 using 1:1,200-scale (1"=100') aerial photographs and described according to Brown (1994). Six vegetation types were identified in the study area: (1) Petran Montane Conifer Woodland, (2) Montane Meadow Grassland, (3) Ponderosa Pine Forest, (4) Wetland, (5) Mixed Riparian, (6) Disturbed/Urban. Elements of these communities are commonly intermixed throughout the study area. For example, cattail (*Typha* sp.), a common wetland species, occurs in portions of the heavily urbanized Downtown Flagstaff Reach of the Rio de Flag. These six vegetation types and their characteristics dominant plant species are summarized below. Dominant plant species were identified based on total canopy cover. Nonnative plants are marked with an asterisk (\*).

The distribution of these six communities within the project study area is depicted in Figure 3-3, and each community is described below:

- **Petran Montane Conifer Woodland** is dominated by ponderosa pine (*Pinus ponderosa*) with some Gambel oak (*Quercus gambelii*) and aspen (*Populus tremuloides*) intermixed in patches. The sparse understory vegetation is composed of wild rose (*Rosa* sp.) and a mix of bluegrass (*Poa* sp.), grama (*Bouteloua* sp.), and agropyron (*Agropyron* sp.). Prior to the settlement of Flagstaff and subsequent modifications to the Rio de Flag, it is likely that this was the dominant vegetation community in the lands adjacent to the study area. This vegetation community is present along the edges of the Rio de Flag floodplain and in small patches as found near Cheshire Park and just downstream from Thorpe Park.
- **Montane Meadow Grassland** is present at the site of the potential Cheshire Park and Clay Avenue Wash detention basins, and at the potential flood control berm sites in the Continental Estates area. Dominant grasses are bluegrass, grama, and agropyron. Other grasses include bentgrass (*Agrostis* sp.), smooth brome\* (*Bromus inermis*), and downy brome\* (*Bromus tectorum*). Perennials observed include primrose (*Oenothera* sp.), dogbane

- (*Apocynum* sp.), field bind-weed\* (*Convolvulus arvensis*), fleabane (*Erigeron* sp.), Cranesbill(*Geranium richardsonii*), toad-flax\* (*Linerria dalmatica*), and a few unidentified composites. Other perennials not observed during the site visits, but likely to occur, are lupine (*Lupinus* spp.), penstemon (*Penstemon* spp.), and goldenrod (*Solidago*). Within the poorly defined drainage channel at the Clay Avenue Wash site, the montane meadow vegetation exhibits mesic characteristics. (That is, this vegetation exhibits signs that it has adapted to an environment having a balanced supply of water, presumably from periodic flows within Clay Avenue Wash). While this mesic vegetation exhibits some characteristics of mixed riparian vegetation (described below), it does not include such riparian species as willows (*Salix* sp.) Additionally, this mesic vegetation would probably not qualify as wetlands pursuant to Section 404 of the Clean Water Act.
- **Ponderosa Pine Forest** is also present at the site of the potential Clay Avenue Wash detention basin. Forests dominated by ponderosa pine are abundant in the project vicinity and are a major forest type encompassing thousands of acres throughout western North America. Within the boundaries of the potential Clay Avenue Wash detention basin site, there appear to be few or no old-growth trees.
  - **Wetland** habitats along the Rio de Flag occupy large and small areas where there is permanent water from either an artificial discharge of water or artificial impoundments. Specifically, wetlands occur at the Narrows dam near Cheshire Park, Frances Short Pond in Thorpe Park, and adjacent to I-40 on both the north and south sides of the highway. Dominant emergent vegetation in this habitat type is composed of cattail and rushes (*Juncus* sp). Other common plants include horsetail (*Equisetum* sp.), sedges (*Carex* sp.), dock (*rumex*), and grasses such as bentgrass and bluegrass. There is open water bounded by the dense vegetation above. There is one island in Frances Short Pond that is nearly completely covered with rushes and cattail.
  - **Mixed Riparian** vegetation is highly variable and largely consists of scattered willows (*Salix* sp.), which are associated only with the Rio de Flag and not Clay Avenue Wash, mixed with plant species found in the surrounding uplands. Therefore, dominant plant species by cover vary in habitat type as the Rio de Flag passes through various upland communities. Plants are typically larger and found at higher densities. For example, in reaches where surrounding land use is mixed residential and commercial (e.g., the North Flagstaff Downtown and Clay Avenue Wash reaches), weedy plants and grasses such as white sweet clover\* (*Melilotus alba*), canary grass\* (*Phalaris canariensis*), and orchard grass\* (*Dactylis glomerata*) are typical. Trees may include willow,

poplar\* (*poplar* sp.), and aspen. The mixed riparian habitat near the Narrows dam is dominated by a dense stand of coyote willow (*salix exigua*). Arizona rose (*Rosa arizonica*) is also common in this upstream area.

- **Disturbed/Urban habitats** include areas associated with the following land uses: residential and commercial development, construction of sewer lines within the river channel and urban bike trails, agriculture livestock grazing, golf courses, recreational use of off-road vehicles, and modifications of the original channels. Trees in this habitat type include poplar\*, willow, and domestic fruit trees such as apple\*, cherry\*, and plum\*. Weedy plants are common and typically include sunflower, gum-weed (*Grindelia* sp.), ragweed (*Ambrosia* sp.), white sweet clover\*, toad-flax\* (*Linerria dalmatica*), and field bind weed\*. Other noxious weeds that are known to occur in disturbed/urban habitats in the Flagstaff area include yellow star thistle\* (*Centaurea solstitialis*), Russian knapweed\* (*Centaurea repens*), and poison hemlock\* (*Conium maculatum*). These species may occur in areas where fill material would be obtained. Grasses in disturbed/urban habitats include agropyron, bentgrass, orchard grass\*, and canary grass\*.

### 3.3.2 Wildlife and Wildlife Utilization

Wildlife habitat quality in the study area largely reflects the extent of human disturbances. From the upstream extent of the study area to the confluence of Sinclair Wash, wildlife habitat is limited by surrounding mixed residential and commercial developments (this includes the Thorpe Park and Cheshire Park/Narrows dam areas). While no mammals were observed (other than domestic cats and dogs) in this section, small to medium mammals likely to occur are coyote (*Canis latrans*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), skunks (*Mephitis* sp.), Nuttall's cottontail (*Sylvilagus nuttallii*), least chipmunk (*Eutamias minimus*), and Abert's squirrel (*Sciurus aberti*).

The portions of the study area with the highest potential for wildlife utilization are: (1) below the confluence of the Rio de Flag and Sinclair Wash, downstream to Herold Ranch Road and (2) the potential Clay Avenue Wash detention basin site. One reason for this is that there is less disturbance in the form of development up to the edge of the channel and less disturbance in the river channel/detention basin site. Also, the presence of perennial water from the Flagstaff wastewater treatment facility below the confluence of the Rio de Flag and Sinclair Wash may encourage wildlife use. Each of these areas is discussed separately, followed by discussions of the Narrows dam, Frances Short Pond, and the I-40 wetlands.

### **Below the Confluence of the Rio de Flag and Sinclair Wash**

Mammals observed or detected through sign (e.g., droppings) include elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), gray fox (*Urocyon cinereoargenteus*), squirrels (Sciuridae), whitetail prairie dog (*Cynomys gunnisoni*), skunks (*Mephitis* sp.), raccoon (*Procyon lotor*) and coyote (*Canis latrans*). While not directly observed, black bear (*Ursus americanus*) may occur occasionally. Birds observed in this section include lesser goldfinch (*Carduelis psaltria*), Stellar's jay (*Cyanocitta stellari*), mountain chickadee (*Parus gambeli*), common raven (*Corvus corax*), and lesser scaup (*Aythya affinis*). Other species observed were bullfrog, (*Rana catesbeiana*), short-horned lizard (*Phrynosoma douglassii*), and garter snake (*Thamnophis* sp.). Flathead minnow (*Pimephales promelas*) was the only fish species observed in the wetland; however, extensive sampling was not conducted.

From Herold Ranch Road to the downstream end of the study area, wildlife habitat quality progressively declines from excellent to poor. Discharges from the wastewater treatment facility infiltrate the soils and surface flow disappears. Additionally, disturbances from past agricultural activities, channelization, housing development, and construction of a golf course further reduce the overall quality of wildlife habitat. However, all of the species listed above may occur in this section, albeit more sporadically and at lower densities (with the exception of white-tailed prairie dog).

### **Potential Clay Avenue Wash Detention Basin Site**

Based on the presence of montane meadow grassland and ponderosa pine forest habitats at this site, a variety of bird and mammal species, including elk and deer would be expected to use this area.

### **Narrows Dam**

Wildlife use of the area surrounding the Narrows dam is expected to be low to moderate given the urbanized nature of the park and the surrounding area. Wildlife that occur in the area are expected to be typical of species found in the urban/Petran Montane Conifer Woodland interface. No mammals were observed during a site visit. However, mammals expected to occur on a sporadic to regular basis include coyote, raccoon, skunks, Nuttall's cottontail, least chipmunk, Abert's squirrel, mule deer, and gray fox. Birds observed in the study area include common raven, Stellar's jay, unidentified woodpecker (*Picoides* sp.), American robin (*Turdus migratorius*), mountain chickadee, pine sisken

(*Carduelis pinus*), lesser goldfinch, house sparrow (*Passer domesticus*), and European starling (*Sturnus vulgaris*). Numerous other bird species would also be expected to occur. Due to the continuing urbanization of the surrounding area, wildlife use by larger mammals is expected to decline in the long term.

### **Frances Short Pond**

During the site visit, Frances Short Pond appeared very turbid from recent stormwater runoff. Rushes and cattails lining the shore and forming a small island provide cover for nesting birds. Mallards (*Anas platyrhynchos*) and red-winged blackbirds (*Agelaius phoeniceus*) were observed. Wildlife utilization of the pond may be limited by its small size and urban setting. Aside from providing habitat for some waterfowl and other marsh-birds, the pond is unlikely to provide a significant refuge for wildlife. Three species of sport fish are stocked annually in the Frances Short Pond for a fishing derby held every spring for Flagstaff Middle School: catfish (*Ictalurus* sp.), bluegill (*Lepomis macrochirus*), and red ear sunfish (*Lepomis microlophus*) (pers. comm., M. Carlson, Flagstaff School District).

### **I-40 Wetlands**

At the I-40 wetlands, wildlife appears diverse and abundant. Deer, coyote sign, gray fox, and a variety of small mammals were observed in the vicinity of the ponds. In this portion of the study area, habitat for mammals appears excellent; there is a large quantity of forage, and adjacent woodlands provide cover. However, poor water quality (i.e., high nutrient levels) may affect the wildlife value of the I-40 wetlands habitat. A surface algae bloom observed during the site visit may indicate a eutrophication problem. This may limit the use of these wetlands by waterfowl. Only one lesser scaup (*Aythya affinis*) and one mallard were observed in the open water. Furthermore, given the algae bloom, the dissolved oxygen content may drop dramatically at night, limiting aquatic invertebrates and fish species.

### **3.3.3 Threatened and Endangered Species (Federally Listed Species)**

The U.S. Fish and Wildlife Service (USFWS) lists 16 threatened and endangered species for Coconino County (Table 3-2; see also correspondence from the USFWS dated February 5, 1999 and included in Appendix C of this EIS). Additionally, one proposed endangered species is also present in the county.

**Table 3-2. Listed and Proposed Species for Coconino County, Arizona**

Species Common Name (Scientific Name)	Status <sup>1</sup>	Known Distribution and Habitat Needs	Likelihood in Study Area
<b>Plants</b>			
Brady pincushion cactus ( <i>Pediocactus bradyi</i> )	LE	3,850 to 4,500 feet on benches and terraces in Navajo desert near Marble Gorge in Kaibab Formation limestone chips over Moenkopi shale and sandstone	Highly unlikely. Area is outside species' known range. Elevation is too high, plant community is not suitable, and site contains no suitable substrate.
Navajo sedge ( <i>Carex specuicola</i> )	LT	Silty soils at shady seeps and springs, seep springs on vertical cliffs	Highly unlikely. Area is outside species' known range.
San Francisco Peaks groundsel ( <i>Senecio Francescanus</i> )	LT	Alpine tundra above 10,900 feet on San Francisco Peaks.	Highly unlikely. Area is outside species' known range; no suitable habitat is present. Site is below known elevation range of species.
Sentry milk-vetch ( <i>Astragalus cremnophylax</i> var. <i>cremnophylax</i> )	LE	Pinyon-juniper-cliffrose on a white layer of Kaibab limestone in unshaded openings. Elevations > 4,000 feet.	Highly unlikely. Area is outside species known range.
Siler pincushion cactus ( <i>Pediocactus sileri</i> )	LT	2,800 to 5,400 feet in gypsiferous clay and sandy soils of Moenkopi formation in desert scrub transitional areas.	Highly unlikely. Area is outside species known range and no suitable habitat is present. Site is above known elevation range of species.
Welsh's milkweed ( <i>Asclepias welshii</i> )	LT	Open stabilized desert scrub dunes and lee side of active dunes; critical habitat is in Utah.	Highly unlikely. Area is outside species known range and no suitable habitat is present.
Parish alkali grass ( <i>Puccinellia parishii</i> )	PE	Moist saline soils at saline seeps and associated wetlands, 3,000 to 6,000 feet.	Highly unlikely. Site is above known range.
<b>Wildlife</b>			
Kanab ambersnail ( <i>Oxyloma haydeni kanabensis</i> )	LE	Travertine seeps and springs in Grand Canyon National Park at 2,900 feet.	Highly unlikely. Area is outside species known range and no suitable habitat is present.
Black-footed ferret ( <i>Mustela nigripes</i> )	LE	Grassland plains in prairie dog towns.	Highly unlikely. There are no known populations of black-footed ferrets in Arizona.

Species Common Name (Scientific Name)	Status <sup>1</sup>	Known Distribution and Habitat Needs	Likelihood in Study Area
Little Colorado spinedace ( <i>Lepidomeda vittata</i> )	LT	Moderate to small streams in pools and riffles with water flowing over gravel and silt. East Clear Creek, Chevelon Creek, and Nutrioso Creek.	Highly unlikely. Area outside of known range.
Humpback chub ( <i>Gila cypha</i> )	LE	Large, warm, turbid rivers, especially canyon areas with deep, fast water.	Highly unlikely. Habitats in area do not resemble those known to be used by the species.
Razorback sucker ( <i>Xyrauchen texanus</i> )	LE	Riverine and lacustrine areas, generally not in fast moving water, and may use backwaters.	Highly unlikely based on lack of suitable habitat.
American peregrine falcon ( <i>Falco peregrinus anatum</i> )	LE	Cliffs and steep terrain, usually near water or woodlands with abundant prey. 3,500 to 9,000 feet.	Possible but not likely. Area lacks nesting features.
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	LT	Large trees or cliffs near water with abundant prey (fish).	Highly unlikely. The majority of the area is too urbanized.
California condor ( <i>Gymnops californianus</i> )	LE	High desert canyon lands and plateaus.	Highly unlikely. In Arizona, The species is only known from the Vermillion Cliffs, approximately 100 miles north of Flagstaff.
Mexican spotted owl ( <i>Strix occidentalis lucida</i> )	LT	Canyons and dense forests above 4,100 feet.	Unlikely. Site is too urbanized..
Southwestern willow flycatcher ( <i>Empidonax traillii extimus</i> )	LE	Cottonwood/willow and tamarisk vegetation communities along rivers and streams	Highly unlikely. Site has no dense stands of cottonwood/willow or tamarisk.

<sup>1</sup>DEFINITIONS: LE=Listed Endangered, LT= Listed Threatened, PE= Proposed Endangered

Source: USFWS 1999

Of these 17 species, none is likely to occur within the study area. Thirteen of the 17 species are not expected to occur in the study area because their known ranges are located well outside of the study area and/or the study area does not contain habitats similar to those known to support these species: black-footed ferret (*Mustela nigripes*), California condor (*Gymnops californianus*), humpback chub (*Gila cypha*), Little Colorado spinedace (*lepidomeda vittata*), razorback sucker (*Xyrauchen*

*texanus*), Kanab ambersnail (*Oxyloma haydeni kanabensis*), Navajo sedge (*Carex specuicola*), Parish alkali grass (*Puccinellia parishii*), San Francisco Peaks groundsel (*Senecio Francescanus*), Sentry milk-vetch (*Astragalus cremnophylax cremnophylax*), Brady pincushion cactus (*Pediocactus bradyi*), Siler pincushion cactus (*Pediocactus sileri*), and Welsh's milkweed (*Asclepias welshii*). The four other federally listed species, bald eagle (*Haliaeetus leucocephalus vittata*), American peregrine falcon (*Falco peregrinus anatum*), Mexican spotted owl (*Strix occidentalis lucida*), and southwestern willow flycatcher (*Empidonax traillii extimus*) are not expected to occur for the reasons described below.

**Bald Eagle.** The bald eagle is currently listed as threatened; however, on July 6, 1999, the USFWS filed a proposed rule to delist the bald eagle. The final ruling is anticipated to be made in July 2000. Bald eagles occur throughout much of North America, with the greatest numbers found in Canada and Alaska. There are approximately 40 known bald eagle breeding areas in Arizona, primarily along the Salt and Verde Rivers in the central part of the state, although there are a few outlying pairs in other locations (Glinski 1998). None of these breeding areas or pairs are located within the study area.

The year-round population of bald eagles in Arizona is augmented in the winter by the arrival of several hundred eagles from outside the state, and wintering eagles are often seen at lakes southeast of Flagstaff (Grubb et al. 1989). Although bald eagles may traverse the study area, they are highly unlikely to use it for foraging or nesting. This assessment reflects the lack of suitable foraging habitat (primarily lakes and flowing rivers) and the proximity of urban uses to potential nesting sites (e.g, tall conifers) within the study area.

**American Peregrine Falcon** is listed as endangered by the USFWS. Probably the most important breeding habitat characteristic of this species is the presence of tall cliffs (typically over 150 feet but sometimes as low as 60 feet), which serve both as nesting and perching sites (Johnsgard 1990). Although nests sometimes occur some distance from water (Monson and Phillips 1981), a source of water is usually close to the nest site, probably in association with an adequate prey base of small to medium-sized birds. In Arizona, breeding activity was documented at 206 locations in 1995 (Garrison and Spencer 1996).

Peregrine falcons occasionally may visit the study area to forage; however, there are no known peregrine nest sites within the study area and no cliffs that are suitable for nesting. The closest known

territory is near Mount Elden (Ward and Siemens 1995) located less than five miles north of the eastern portion of the study area.

**Southwestern Willow Flycatcher** is listed as endangered by the USFWS. In Arizona, willow flycatchers arrive in May and begin to nest in late May (Phillips and Monson 1964) in riparian vegetation along streams, rivers, or other wetlands (Johnson et al. 1987). The following definition of survey habitat was provided by Arizona Partners in Flight (1996): "...suitable survey habitat for the southwestern willow flycatcher is characterized by patches of native riparian shrubs or trees including willow (*Salix* sp.), cottonwood (*Populus* sp.), box elder (*Acer negundo*), ash (*Fraxinus* sp.), or mixtures of these species; pure stands of tamarisk; or mixtures of native species and tamarisk characterized by high stem density or high foliage volume in the lowest stratum and/or mid-stratum. Tamarisk stands, particularly taller stands, may have a relatively open understory with a single stratum of foliage confined to the canopy. Patches may have either a single stratum and relatively low canopy (minimum canopy height of 12 feet) characteristic of an early- to mid-serial stage, or have several vegetation strata including a relatively tall canopy of cottonwood or willow (e.g. 50 feet). Riparian patches may be highly irregular in shape, but should have a minimum depth of 30 feet." The closest known breeding habitat is in the Verde Valley approximately 50 miles south of the study area (pers. comm., H. Yard).

It is unlikely that the southwestern willow flycatcher occurs within the study area. Habitat along the Rio de Flag does not resemble habitat known to be used by southwestern willow flycatcher for breeding. Willow patches are less than 30 feet across, trees are less than 12 feet high, and stem density is low. Furthermore, the cottonwood trees present are less than (40 feet) tall and are sparsely distributed, providing little or no canopy cover.

**Mexican Spotted Owl** is listed by the USFWS as threatened. Mexican spotted owls "primarily breed in old growth mixed conifer forest located on steep slopes, especially deep shady ravines" (AGFD 1992). Nest sites are usually in cavities in coniferous trees or on abandoned platform nests of other species and are occupied for several consecutive years. Other key habitat features include areas with lots of snags, downed logs, and dense canopy. This nocturnal owl is intolerant of moderately high temperatures and in summer tends to roost on north-facing slopes with a dense overhead canopy. The most common prey are woodrats; however, birds, rabbits, and insects are also taken. The nearest known Mexican spotted owl territory is located in Shultz Pass approximately 10 miles north of the study area.

It is unlikely that Mexican spotted owl occurs in the study area; there are no steep north-facing slope or cool shady ravines, and the canopy is generally low and open.

Although no longer a sensitive species, Arizona leather flower (*Clematis arizonica*) occurs in the study area. This species was formerly a USFWS candidate species until a recent floristic review of the genus *Clematis* revealed that there was no clear difference between *C. hirstussima* var. *arizonica* and *C. h.* var. *hirstussima*. Therefore, the USFWS removed Arizona leather flower from the list of candidate species because “it no longer meets the definition of ‘species’” (Federal Register, 9 January 1998 [Volume 63, Number 6]).

### **3.3.4 Wildlife Species of Concern in Arizona (WSCA)**

The southwestern willow flycatcher and mexican spotted owl are listed by the Arizona Game and Fish Department (AGFD) as WSCAs. Refer to the discussion above for specific information regarding these two species. In addition, the northern goshawk (*accipiter gentilis*) is also an AGFD-Listed WSCA with the potential to occur in the Flagstaff area.

**Northern Goshawk.** Recent attempts to have northern goshawk listed as a federally threatened species have been rejected by USFWS based on lack of evidence indicating a decline in numbers or significant loss of habitat. Typically, this species nests in mature stands of conifers in pine-oak and oak habitat (AGFD 1996). Threats to habitat includes timber harvesting, especially of large trees, and wildfire. Northern goshawk occurs locally in the pine-oak woodlands surrounding the study area (USACOE 1997).

It is likely that northern goshawk forage regularly in the study area; however, it is unlikely that this species breeds in the study area. The Rio de Flag does not pass through any notably large stands of conifers. However, northern goshawk may breed in undisturbed woodlands immediately adjacent to the study area in areas surrounded by Petran Montane Coniferous Forest.

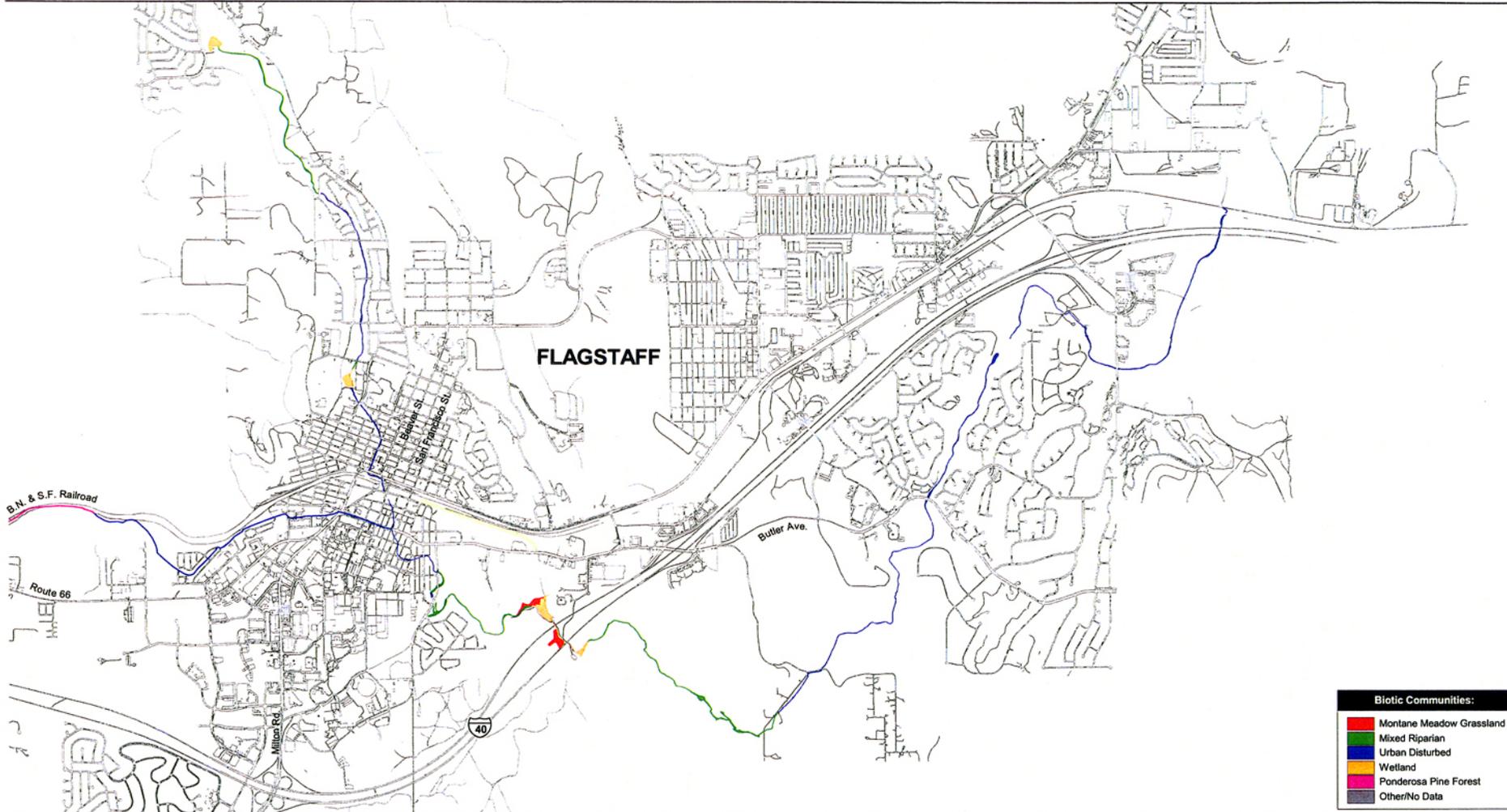
### **3.3.5 Functions of Wetlands and “Waters of the United States”**

Functions of wetlands and “waters of the United States” are defined as the normal or characteristic activities that take place in wetland ecosystems or simply the things that wetlands do. The variety of

functions extends from the simple, the reduction of nitrate to gaseous nitrogen, to the complex, the maintenance of ecological integrity. Functions of wetlands and “waters of the United States” that directly or indirectly benefit the public interest (as defined by 33 CFR, Section 320.4(b)(2)) include those:

- which serve significant natural biological functions, including food chain production, general habitat and nesting, spawning, rearing and resting sites for aquatic or land species;
- that are set aside for study of the aquatic environment or as sanctuaries or refuges;
- that the destruction or alteration of which, would detrimentally affect natural drainage characteristics, sedimentation patterns, flushing characteristics, or other environmental characteristics;
- which are significant in shielding other areas from wave action, erosion, or storm damage;
- which serve as valuable storage areas for storm and flood waters;
- which are ground water discharge areas that maintain baseflows important to aquatic resources and those which are prime natural recharge areas;
- which serve significant water purification functions; and
- which are unique in nature or scarce in quantity to the region or local area.

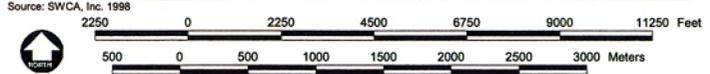
The Rio de Flag riparian system throughout the majority of the project area is repeatedly and heavily disturbed, and development has encroached into much of the floodplain area. Accordingly, the baseline conditions for wetlands along the Rio de Flag within the project area provide few, if any, of the functions noted above. The relative degree to which the current functioning of the wetlands along the creek would be affected by the proposed project alternatives however is discussed in Section 4.3 (Biological Resources).



**Biotic Communities:**

- Montane Meadow Grassland
- Mixed Riparian
- Urban Disturbed
- Wetland
- Ponderosa Pine Forest
- Other/No Data

Figure 3-3  
Biotic Communities



### 3.4 CULTURAL RESOURCES

“Cultural resource” is a term that refers to the imprint of human occupation left on the landscape. This imprint is manifested in the form of prehistoric and historic archeological sites, and historic buildings, structures, and objects. Archeological sites consist of artifacts, plant and faunal remains, trash deposits, and many types of features. Artifacts reflect anything that was manufactured or modified by human hands. Features can include structural remains, fire pits, and storage areas. Prehistoric archeological sites are loci of human activity occurring before European contact, which was first made in the southwest with the Spanish entrada in A.D. 1540. Prehistoric artifacts include: flaked stone tools such as projectile points, knives, scrapers, and chopping tools; ground stone implements like manos and metates; plain and decorated ceramics; and features or facilities that include subterranean and above ground architectural units, hearths, granaries and storage cists, and trash deposits known as middens.

Historic archeological sites reflect occupation after the advent of written records. Material remains on historic archeological sites include: refuse dumps, structure foundations, roads, privies, or any other physical evidence of historic occupation. Refuse consists of food waste, bottles, ceramic dinnerware, and cans. In a number of historic archeological situations privies are important because they often served as secondary trash deposits. There is usually a strong interplay between historic archeological sites and written records. The archeological data is frequently used to verify or supplement historic records. Historic structures include: commercial and residential buildings, industrial facilities, bridges, and roadways.

There are two principal methods of locating cultural resources. Before a project is started, a records and literature search is conducted at any number of repositories of archeological site records. The search may show that an archeological or historical survey had been conducted and some cultural resources were identified. That information may be enough to proceed with the significance evaluation stage of the project. If a conclusion was reached that (1) no previous survey had been done or (2) a previous survey was either out of date or inadequate, the project cultural resources expert, either a historian or archeologist, will carry out a survey to determine if any cultural resources are within the proposed study area boundaries.

After a cultural resource(s) has been identified during a survey, or record and literature search, the Federal agency overseeing the undertaking embarks on a process to determine whether the cultural resource is eligible for listing in the National Register of Historic Places (National Register). This

process is mandated by Section 106 of the National Historic Preservation Act. The Federal regulation that guides the process is 36 C.F.R. 800. For a cultural resource to be determined eligible for listing in the National Register, it must meet certain criteria. The resource has to be at least 50 years old or exhibit exceptional importance.

After meeting the age requirement cultural resources are evaluated according to four criteria; a, b, c, and d. The National Register criteria for evaluation as defined in 36 C.F.R. 60.4 are:

[T]he quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history.

After a cultural resource has been determined eligible for listing in the National Register it is accorded the same level of protection as any other property that is listed and becomes formally known as a “historic property,” regardless of age.

### **3.4.1 Area of Potential Effects**

The study area or area of potential effects (APE) for the proposed action is composed of the Rio de Flag floodplain within the City of Flagstaff, potential detention basin sites, potential new alignment for the Rio de Flag through downtown Flagstaff, and the potential berm sites located along the Rio de Flag floodplain periphery in the Continental Estates area.

### **3.4.2 Records and Literature Search**

A search of existing historic information was initiated by a visit with Dr. David Wilcox, Archaeologist at the Museum of Northern Arizona. A letter was sent to the State Historic Preservation Officer (SHPO) requesting information regarding historic resources within the APE for the proposed project. On

March 24, 1997, the SHPO provided list of the National Register listed properties and Historic Districts in Flagstaff. Telephone consultation was conducted with Ms. Susan Wilcox of the Arizona Historical Society, Northern Arizona Division. Ms. Wilcox also provided maps of the various historic districts and loaned the final report for the Southside/Oldtown Districts. Copies of the various Historic District inventory reports were obtained from the files of the City of Flagstaff Planning Division and the Flagstaff Public Library. The National Register of Historic Places Internet Web site (<http://www.cr.nps.gov/nr/nrhome.html>) was consulted to verify listings.

### **3.4.3 Flagstaff Prehistoric Chronology**

#### **Paleo-Indian and Archaic**

Cultural resources span a continuum of approximately 11,000 years in Arizona. The Paleo-Indian tradition is well documented primarily in southern Arizona. There are no known Paleo-Indian sites and barely any known Archaic sites near the Flagstaff area. In 1994, two sites were excavated that had either archaic or Basketmaker II components (Bradley and Neff 1994). Archaic projectile points have been found in isolated occurrences in the Flagstaff area and close to the Grand Canyon, but no sites have been excavated. As is often the case in southwestern archeology, there is little emphasis on the archaic. Consequently there is no developed archaic chronology for Flagstaff (Dave Wilcox, personal communication, 1997). There is an archaic presence in Verde Valley, however, that is not very well understood (Greenwald 1989). The Dry Creek phase described by Breternitz (1960) was roughly dated from 2000 B.C. to 1 A.D.

#### **Sinagua Culture**

The history of archeological research in the Flagstaff region is almost as interesting as the subjects of the research—the Sinagua. The levels of research in Flagstaff archeology have equated to intellectual trends in American archeology in general (Downum 1988). Research has primarily centered on the Sinagua culture as noted in the previous paragraph.

“Sinagua,” which is Spanish for “without water,” typifies the culture in regions near Flagstaff. The Sinagua were a ceramic-producing, agricultural culture. Their cultural sequence is broken down into two parts divided by the eruption of the Sunset Crater volcano (Downum 1988). The pre-eruptive

period encompasses three phases and lasted from about A.D. 500 until the first eruption in 1064. The post-eruptive period lasted until termination of the culture, about A.D. 1400.

The Sinagua culture is divided into two regions: the Northern Sinagua, located south and east of the San Francisco Peaks, and the Southern Sinagua, who were found in the Verde Valley (Pilles 1996). The Northern Sinagua are the aspect found in the Flagstaff/Sunset Crater area. Prior to 1939, the Pecos Classification was the basis for Sinagua chronology. A chronology for the Sinagua based on a long, comprehensive list of culture traits (Plog 1989) was developed by Harold S. Colton (Colton 1939). The phases for the Southern and Northern Sinagua have been modified and refined since 1939, most recently in 1988 (Pilles). Even though Colton based his chronological system on an extensive list of culture traits, the cornerstone of his argument was ceramics and architecture (Plog:1989:265).

Spatial definitions of the Sinagua after Colton have not been without their own set of problems. The Southwestern volume of the *Smithsonian Handbook of North American Indians* has two contradictory chapters placing the Sinagua in two different cultural provinces. Schroeder (1979) has the Flagstaff area as part of his Hakataya Tradition, while Plog (1979) shows Flagstaff well within the Western Anasazi province. To complicate the issue further, Reid (1989) shows the entire Sinagua culture in the northern periphery of the Mogollon region. There is still no general consensus on a definition of "Sinagua." Sinagua origins are still questionable. Pilles (1987) speculated that they came from the southeast and moved slowly to the San Francisco Peaks region.

The Sinagua are surrounded by the three main prehistoric southwestern cultures and are located a substantial distance from the core area of those cultures. Their geographic location, at the periphery of the Hohokam, Mogollon, and Anasazi culture areas, suggest that they may be composite group with shared traits from the three main cultures. In any case, they had a distinct culture which ran its course between A.D. 650 and 1400. Archaeological evidence indicates that, following abandonment of the region in 1400, the Sinagua may have moved to Homolovi area sites and become integrated with the ancestral Hopi (Pilles 1987), eventually migrating to the Hopi Mesas.

Development of an accurate system of dates has been somewhat problematic. The problems lies within the lack of ceramic design variability over long periods of time. Because there had been a lack of variability in Sinagua ceramic styles, Sinagua phase dates are usually obtained from intrusive ceramics (Pilles 1996). For example, in the Northern Sinagua locality, the Elden phase is characterized by early to middle Pueblo III (PIII) period Anasazi ceramics. Flagstaff and Walnut Black-on-white pottery

types dominate the PIII assemblages. Table 3-3 shows the chronological relationships between the Sinagua phases and their neighboring cultures, the Anasazi and the Hohokam. The phases and dates noted in Table 3-3 reflect the cultural sequence that is most commonly used. An alternative chronology was suggested by Plog (1989:276). Plog's chronology is focused on three periods of hiatus (A, B, and C) that he considered important enough to incorporate into a revised system; however, his chronology has not been routinely used (Carla Van West, personal communication, 1998). Pilles' table shows that the Sinagua are chronologically defined by phases. There is not a broad based system of culture development, as there is with the Hohokam, Anasazi, and Mogollon. Consequently, Pilles (1996) has published a sequence to place the phases in a developmental structure.

Pilles grouped the Cinder Park and Sunset Phases in the Early Sinagua category. The combined temporal placement of the two phases is A.D. 650 to A.D. 900. The Cinder Park Phase reflects the period that agriculturists settled in the Flagstaff and Verde Valley regions. Not many sites from this phase have been found in the Flagstaff area. Plog (1989) suggested that the Cinder Park Phase is of questionable value. However, at the time Plog wrote his chapter, there apparently was only a single Cinder Park date. The population increased slightly during the Sunset Phase between A.D. 700 and A.D. 900. Originally, this population increase was attributed to Hohokam migrations into the area. Although there was a Hohokam presence in the area, this view has been modified to place more emphasis on local growth. Sunset Phase settlements are usually located in the ponderosa pine-pinyon-juniper periphery north and northeast of Flagstaff. Sites are found primarily in the Cinder Hills vicinity, with other sites in or near Juniper Terrace, Deadman Wash, and Baker Ranch. The Cinder Hills sites are mostly covered with ash from the Sunset Crater eruption. Sites from this phase typically mirror Anasazi sites from the Winslow area. They consist of a central communal area surrounded by an arc of three or more pithouses.

The Middle Period Sinagua lasted from A.D. 900 to 1150. During this period the Sunset Crater volcano erupted between the A.D. 1064 and 1066. Northern Sinagua culture history in this temporal range includes the Rio de Flag, Angell-Winona, and Padre Phases. This 250-year period was typified by substantial population increase. The Northern Sinagua populations were centered around the fringe of the San Francisco Peaks. This phenomenon was possibly due to increased moisture levels during a period that was drier overall. The villages increased in size and seem to have developed a formalized socio/political structure. Usually a small site of three or more pit houses would be centered around a larger village. Researchers have hypothesized that the larger villages served a communal function. They

**Table 3-3. Sinagua Chronological Phases  
 Compared with Anasazi and Hohokam Phases**  
 Source: Pilles 1996

Date	Hohokam	Northern Sinagua	Southern Sinagua	Kayenta Anasazi (Kleijda Valley)	Date
1400	Civaco	Clear Creek	Tuzigoot	PUEBLO IV	1400
1300		Turkey Hill		TSEGI PHASE	1300
1200	Soho	Elden	Honank	PUEBLO III	1200
1100		Padre		LATE P1	1100
1000	Sarisa Sacaton	Angell-Winona Rio de Flag	Camp Verde	EARLY PII	1000
900					900
800	Santa Cruz	Sunset	Cloverleaf	PUEBLO	800
700		Cinder Park	Hackberry	BASKET MAKER III	700
600	Gila Butte				600
500					500
400	Snaketown		Squaw Peak	BASKET MAKER II	400
300					300
200	Sweetwater		?		200
100					100
AD BC	Listrelia		Dry Creek		AD BC

typically have a community room-pithouse or ballcourt. The presence of ballcourts implies influence from external sources and a propensity towards cultural evolution (Pilles 1987).

Architectural styles were also evolving. Masonry-lined construction became prevalent in pithouses, field houses, and surface rooms. Seasonal agricultural field houses were precursors of the later large pueblos. The houses in the Northern Sinagua region were large, circular, and sub-square pit houses with ramp entries. This was in contrast to the southern sites which were shallower pithouses that occasionally showed Hohokam traits. Sinagua agricultural practices were expanded to facilitate growing crops on a wide variety of soils types. Planting was done on alluvial parks and at the mouths of washes where they entered the alluvial parks. They also built terraces to act as check dams catching water and soil runoff at higher elevations. In addition to planting crops, the Sinagua also maintained a mixture of natural plants in their fields.

During the Elden phase, the Sinagua population reached its highest point. The Elden phase, named after Elden Pueblo, is contemporaneous with the neighboring Anasazi Pueblo III cultural stage. Both cultures floresced in the time period from A.D. 1150 until 1300. Northern Sinagua occupation during the Elden phase was focused in Flagstaff and Wupatki. In the Flagstaff area, the population moved down to lower elevations. Technology and socio/political organization peaked during the Elden Phase. Elden Pueblo near Flagstaff is one of the largest and most famous sites from this period (Pilles 1987). Interestingly, pithouse architecture persisted beyond A.D. 1100.

Complexities of Sinagua organizational systems are seen through site size, village layouts, unique artifact types, and varied mortuary practices. A settlement hierarchy shows different levels of organizational importance. There is a small number of important sites known as “chief” villages. Included in this category are Wupatki, Ridge ruin, and Juniper Terrace. Two sites that date from an earlier time period are Winona Villagea and Three Courts Pueblo. The unifying features of these sites are: all have ball courts, are located on historic trade routes, are on hilltops, and have an unusually large range of exotic artifacts and tradeware ceramics. Pilles (1987) speculated that these sites were centers for religious, political, and social leadership.

The Sinagua universe started a decline in the late thirteenth century that paralleled a changing environment. Climatic conditions became cooler and drier with precipitation cycles shifting to the winter and early spring. Population centers shifted to sites near springs. Areas of population concentration included : Mount Elden, Doney Park, Anderson Mesa, Wupatki, and Ridge Ruin. Signs

of possible hostilities are seen in the construction sites that may have been built to serve as a fort. These sites were built on hilltops and cinder cones, and other vantage points at the mouths of steep-walled canyons. Even with the absence of demonstrable proof of warfare, these sites are usually interpreted as places of refuge. An alternative interpretation has lately been proffered, that the hilltop sites were used as territorial markers.

The terminal period for the Sinagua was between A.D. 1300 and 1400. During this timeframe, the Sinagua tradition evolved into the Hopi culture. The last remnants of definable Sinagua culture are found at Wupatki, Anderson Mesa, Grapevine, and six large pueblos at Kinnikinick, the Pollock site, and Nuvakwewaqa. The most important of the remaining cultural centers were the three pueblos of Nuvakwewaqa in Chavez Pass.

The great pueblos were abandoned by 1400. Archaeological evidence shows direct links to the Hopi. The population from Anderson Mesa probably moved first to Homolovi on their way to the Hopi Mesas. There is a direct link between Nuvakwewaqa and the Hopi. Rockart images such Kokopelli, the Shalako Kachina, and Pöqangwhoa are recognized. Some of the same images are also found on pottery designs. Ruins at Wupatki, Nuvakwewaqa, and Elden Pueblo are known as being ancestral to the Hopi. The San Francisco Peaks are the home of the Kachinas and figure heavily in Hopi religious activities.

#### **3.4.4 Flagstaff History**

There is no known Spanish presence in the Flagstaff area. Apparently, there was no activity in the area between the cessation of the Sinagua tradition in A.D. 1400, and the early military expeditions of Captain Lorenzo Sitgreaves in 1851 and Lieutenant Amiel Weeks Whipple in 1853 (Downum 1988). The Superintendent of Indian Affairs for California, Edward F. Beale, was in the area in 1857. He was instructed by the War Department to build a wagon road that would link the Arkansas River with California. Then, in 1857, Lieutenant Joseph C. Ives was in the Flagstaff area while exploring the eastern tributaries of the Colorado River.

Flagstaff history really begins in the 1870s (Granger 1982). Edward Whipple settled near Flagstaff Spring in 1871, where he ran a saloon, and F. F. McMillen settled north of Flagstaff's present location, on Antelope Spring. A number of stories abound of how Flagstaff was named. Variations include Beale's men raising a flagstaff in 1859, another claims that emigrants raised it in May 1876 to

celebrate the centenary of the signing of the Declaration of Independence. Antelope Spring experienced a few name changes. In the early 1880s, it changed from Antelope Spring to Flagstaff Spring, finally becoming known as “Old Town Spring” or simply “Old Town” after the community burned down in 1884. Old Town and had quite a rowdy reputation. The town that replaced it a few hundred yards east of Old Town was named with some lack of creativity, “New Town.” Perhaps the name was to indicate that this new community would be more staid than its lawless predecessor (Ashworth1991). Flagstaff finally became the town’s official name when the post office was built at the new location in 1884.

For some time after Flagstaff was founded it remained a rough, unsophisticated town. Lawlessness pervaded the community and gambling and wide open saloons were prevalent. Part of Flagstaff’s problem was its attraction to some of the more disreputable citizens that had emigrated from Dodge City, Kansas. In spite of this raw frontier beginning, the ideals of hardworking, church-going folk in town prevailed so that Flagstaff became somewhat more genteel.

Critical to Flagstaff’s growth was the transcontinental railroad (Ashworth 1991). Much of the lumbering and mill work in town owes its existence to the railroad. The lumber mills served to provide the railroad with rail ties. Along with its mail delivery function, the train also brought newspapers from larger cities, such as Los Angeles and Kansas City. The Atlantic and Pacific Railroad did help bring civilization to Flagstaff by ferrying civilized easterners to town during promotional summer jaunts to the Pacific Coast.

Flagstaff was in a state of cultural flux in the late 1880s. Sanitation was basic, unpaved streets became quagmires in wet weather, and bicycles, the new fad, were being sold. Flagstaff’s first Catholic church was built in 1888 in Brannen’s Addition where it functioned until 1916. The Bank Hotel on Santa Fe Avenue touted its virtues as a top-of-the-line hotel, complete with an attached dining room where guests feasted on the finest foods available.

The 1890s brought important economic improvements to Flagstaff (Woodward Architectural Group 1993). In 1890, two banks were founded, the Arizona Bank and the Bank of Flagstaff. An electric plant was built, and the first telephone system was installed that same year. A hallmark of the early 1890s was the division of Yavapai County into two counties, which yielded the 47,000-square kilometer (18,000-square mile) Coconino County. The nascent Coconino County adopted Flagstaff for the county seat in 1891, and a total of 1,418 voters registered. Soon after, environmental and

economic problems beset Flagstaff. Two dry years caused a shortage of grass, which in turn precipitated a shortage of cattle feed. The feed shortage resulted in a 50 percent loss of the cattle herds. This event occurred during a nationwide economic crisis that began in 1893.

Flagstaff incorporated on May 26, 1894, by order of the Coconino County Board of Supervisors. The first town elections were held in May 1895. By the turn of the century, Flagstaff had a healthy economy and a population of almost 2,000 people. The mainstays of the economy were lumber, sheep, and freight transport.

The original community, Old Town, was dubbed Flagstaff Townsite after being known briefly as the School Addition. Emphasis in the Old Town District within the Flagstaff Townsite changed from commercial to residential between 1894 and 1935. The population consisted mostly of Hispanics who had immigrated from New Mexico. Hispanics and Basques moved into the area to work as contract sheep herders. Sheep ranching was an important industry in northern Arizona through the 1950s. The Hispanic population accounted for over 90 percent of the Flagstaff area sheep ranchers. Basque sheep herders rose from a minority of 25 percent to being the majority of sheep herders today.

Flagstaff had become a town of many ethnic and economically centered neighborhoods in the years following World War I. Upper middle class Anglos resided in the northern part of the Railroad Addition. Working class Anglo families lived on the west end of the original Flagstaff Townsite. New Mexican Hispanics lived on both sides of the railroad tracks in Old Town with Mexican immigrants living on the south side of the Railroad Addition. By 1920, a small but noticeable enclave of Basques lived in Flagstaff, near Benton Avenue and Humphreys Street. African-Americans moved in during the 1920s and 1930s, living in the southern part of Brannen's Addition down south Elden, O'Leary, and South Fontaine Streets.

### **3.4.5 Cultural Resources Within the Area of Potential Effects**

#### **Cheshire Park Detention Basin Site**

The western end of Cheshire Park has a set of tennis courts. The courts are surrounded with intentionally placed boulders which are native to the area. At the southeastern end of the APE the Narrows dam defines the terminus of the proposed detention basin. The dam is an approximately 50-foot-long by 15-foot-high semi-circular poured concrete check dam with an 18-inch diameter circular

centrally located outlet near its base. The design of the dam is purely functional and it is entirely devoid of ornamentation. At one time, two-inch galvanized pipes were placed in the top of the dam at regular intervals but these have been removed. The original function of the dam is highly speculative. No records or construction plans exist to explain who built it or why. A longtime neighbor, Mrs. Miriam Pederson, recalls it being built in the 1940s by Mr. Cheshire. Two potential scenarios exist for its purpose, but neither involve flood control. It was most likely built as an impoundment structure.

Much of the area north and west of the Narrows dam is undisturbed. A narrow foot trail runs diagonally through the property running northeast to the southwest. A utility pole has been recently placed in the ground near the trail. A small chert side scraper was found near the utility pole with a few pieces of chert debitage. There is no way to formally ascribe the debitage to prehistoric activity because (1) in the patch of vehicle tracks associated with installation of the pole, a (2) student flint knappers from the Harold S. Colton Research Center have apparently been leaving evidence of their activities throughout the area. The scraper was recorded as an isolated find. A small site, AZ:I:3112 (MNA) had been recorded by the Museum of Northern Arizona in 1977. However, the site was only a 10 feet by 10 feet cleared area where a cabin may have once stood. There was no physical evidence of anything structural. The Cheshire Park geological setting is comprised almost solely basalt bedrock. This largely precludes the potential for subsurface archeological deposits.

The Narrows dam does not appear to be eligible for listing in the National Register of Historic Places. The archeological materials from the area east of the dam are insufficient to make any meaningful statements, and are thus, considered to be ineligible as well.

### **Thorpe Park Detention Basin Site**

The proposed Thorpe Park detention basin site has been completely developed for recreation. Three artifacts (mano, biface frag, and groundstone axe) found in the area of the northernmost softball field suggest a prehistoric archeology site that may have been graded away during its construction.

Two small historic buildings are located on the western side of the access road/City Park Dam. One is a log cabin and the other is small building constructed from river cobbles. Boy Scouts moved the log cabin, built in 1895, to that location in 1978 from the Veit Ranch on the San Francisco Peaks. The cabin was moved in pieces for educational use by the Flagstaff Middle School. The cobble stone building was built by the city when City Park was completed in 1923. It is now used for storage of

maintenance equipment. These structures have not been evaluated for Section 106 (National Register) eligibility.

### **Clay Avenue Wash Detention Basin Site**

Seven cultural resource sites have been identified within the potential Clay Avenue Wash detention basin site. The first of these is the ranch house and two associated buildings (together considered one cultural resource “site”), which records indicate were built in 1935, 1944, and 1954 respectively.

At the point where the channel opens into the easternmost end of the potential detention basin site lies the former Atlantic and Pacific railroad alignment with abandoned railroad bridge abutments. The bridge, built in 1883 from the local Coconino Sandstone, was abandoned in 1937 when the Atchison, Topeka, and Santa Fe Railroad purchased the tracks and realigned them 165 feet north. Continuing west, there are two historic trash scatters composed primarily of cans, barrels, and miscellaneous rusted automobile parts. Between the two trash scatters is a historic trail remnant with a trail marker comprised of a rock pile. There are two additional historic resources on the private property portion of the detention basin. One is the obliterated remains of a small 1930-1940s-era cabin, and another is a small trash scatter.

A request for a determination of eligibility for the railroad bridge was submitted to the Arizona SHPO in a letter dated July 23, 1999. SHPO responded with a concurrence of our determination on September 15, 1999. None of the other resources have been evaluated for National Register eligibility and, with the possible exception of the ranch buildings, these sites are not expected to be eligible for the National Register.

### **Rio de Flag Channel**

No cultural resources have been identified during surveys of this portion of the project’s APE. However, two historic resources are within the southern extent of the Railroad Addition Historic District Extension are very close to the proposed alignment: the historic Flagstaff Lumber Company Warehouse at 23 South San Francisco Street and the Northern Motor Company building on the corner of San Francisco and Phoenix streets. (See “Historic Properties within the 100-Year Floodplain” regarding these properties.)

The reach of the Rio de Flag Channel between Thorpe and Cheshire Parks has not been surveyed. Information regarding the historical [potential of the wingwall at Meade Lane and the Anderson Road and Beal Road bridges are not known at this time. A cultural resources survey of these three locations may need to be completed.

### **Clay Avenue Wash Channel**

This portion of the project's APE was surveyed by the USACOE for cultural resources none were detected. There are, however, eight National Register listed properties are on the periphery of the Mikes Pike right-of-way. They are:

- C&M (Double circle) Garage
- E. T. McGonigle house/B&M auto camp
- Gavin/Hensing rental house
- Mary A. Gavin's rental houses at 31 through 35 South Mike's Pike
- an unnamed house at 17 S. Mikes Pike.

An additional building, the Flagstaff Steam Laundry is at the southwest corner of Mikes' Pike and Phoenix Ave at 210 W. Phoenix Ave. These historic buildings are all listed as contributors to the Southside/Oldtown Historic District. (See "Historic Properties within the 100-Year Floodplain" regarding these properties.)

### **Potential Berm Locations at Continental Estates**

These sites have not been surveyed; however, no cultural resources sites are expected to be intact at the potential berm sites because the area was recently developed.

### **Historic Properties within the 100-year Floodplain**

The largest concentration of cultural resources in the study area consists of the historic structures located within the floodplain. Historic building surveys have been going on since the early 1980s with over 1,000 buildings either listed on the National Register. There are approximately 350 buildings in the Southside/Old Town Historic District (SOHD) alone.

Currently there are five listed National Register Districts in Flagstaff. A sixth, the SOHD, is nearing submittal. As of February 1998, final changes were being made to the proposed District nomination forms (pers. comm., Susan Wilcox, 1998). Properties that are within the 100-year floodplain fall within the boundaries of the Railroad Addition, Flagstaff Townsite, SOHD, and Multiple Resource Area (MRA). The MRA was set up to include buildings that are individually listed on the National Register but lack the characteristics that would include them in a specific district.

#### Railroad Addition Historic District

The original Railroad Addition Historic District was listed on the National Register on January 18, 1983. Its boundaries have been extended twice since. On June 17, 1986, the southern boundary was extended from the railroad tracks south about 1.5 blocks. The western boundary is Beaver Street, and the eastern boundary is San Francisco Street. The southern boundary is a line that splits the block between Phoenix Avenue and Cottage Avenue. A final addition was made in September 1997 that incorporated the address at 122 East Route 66. The Railroad Addition is Flagstaff's central business district. Table 3-4 lists historic properties from this district that fall within the 100-year or 500-year floodplains of the Rio de Flag.

#### Flagstaff Townsite Historic District

The Flagstaff Townsite Historic District was listed on the National Register on April 30, 1986. This District was developed primarily in the years between 1888 and 1935. District boundaries are confined to Toltec Street on the west, Railroad Avenue (Santa Fe Street) on the south, Sitgreaves and Humphries on the east, and Cherry Street on the north. Table 3-5 lists historic properties from this District that fall within the 100-year or 500-year floodplains of the Rio de Flag.

#### Multiple Resource Area (MRA)

Six individually eligible properties in the MRA fall within the 100-year floodplain in the Rio de Flag study area. Some of them may have been reassigned into the Southside/Oldtown District (per. comm., Susan Wilcox, 1998). The National Register nomination forms for the Southside/Oldtown District were submitted for evaluation in March 1998 and confirmation of listing is not yet available. Table 3-6 lists these individually eligible MRA properties.

**Table 3-4. Historic Properties within the 100-year and 500-year  
Floodplains in the Railroad Addition Historic District**

<b>Street</b>	<b>Property Name</b>	<b>Address</b>	<b>District Relationship</b>
<b>San Francisco Street</b>	Babbit Office Building	6-10 N. San Francisco	Contributor
	Hawks Building	14 N. San Francisco	Contributor
	Herman Building	16-18 N. San Francisco	Contributor
<b>Santa Fe Avenue</b>	Santa Fe Passenger Depot	Railroad ROW	Contributor
	Santa Fe Freight Depot	Railroad ROW	Contributor
	Aubineau Building	2 E. Santa Fe	Contributor
	Navajo-Hopi Trading Company	10 E. Santa Fe	Contributor
	Vail Building	24 E. Santa Fe	Contributor
<b>Aspen Avenue</b>	Pollock block	5-11 E. Aspen	Contributor
	New Babbit Block August 24, 1999	15-17 E. Aspen	Contributor
	Babbit Bros. Store	12-24 E. Aspen	Contributor
<b>Leroux Street</b>	Dr. Raymond's Office	9 N. Leroux	Contributor
	Loy Building	15 N. Leroux	Contributor
	Longley Building	18-18 ½ N. Leroux	Contributor
	Telephone Exchange	19 N. Leroux	Contributor
	Mayflower Building	20 N. Leroux	Contributor
	Weatherford Hotel	21-23 N. Leroux	Contributor and individual listing

**Table 3-5. Historic Properties within the 100-year and 500-year  
Floodplains in the Flagstaff Townsite Historic District**

Street	Property Name	Address	District Relationship
<b>Humphries Street</b>	House	309 N. Humphries	Contributor
<b>Cherry Avenue</b>	House	205 W. Cherry	Contributor
	Multiple houses	207-211 W. Cherry	Contributor
	House	213 W. Cherry	Contributor
	House	216 W. Cherry	Contributor
	House	219 W. Cherry	Contributor
	House	223 W. Cherry	Contributor
	House	315 W. Cherry	Contributor
	W. A. Mayflower House Duplex	320 W. Cherry 402-406 W. Cherry	Contributor Contributor
<b>Birch Avenue</b>	House	220 W. Birch	Contributor
	House	310 W. Birch	Contributor
	Will Marlar House	314 W. Birch	Contributor
	House	324 W. birch	Contributor
<b>Kendrick Street</b>	W. H. Switzer House	305 N. Kendrick	Contributor
<b>Sitgreaves Street</b>	Duplex	214-216 N Sitgreaves	Contributor
	Duplex	215-219 N. Sitgreaves	Contributor
	Duplex	220-224 N. Sitgreaves	Contributor

**Table 3-6. Historic Properties within the 100-year and 500-year  
Floodplains in the Multiple Resource Area**

Street	Property Name	Address	District Relationship
<b>Mike's Pike</b>	C&M Garage	204 Mikes Pikes	Individual & contributor to the Southside District
<b>San Francisco Street</b>	Southside Market	217 S. San Francisco	Individual
<b>Leroux Avenue</b>	Hugh E. Campbell House	215 N. Leroux	Individual
<b>Cherry Street</b>	House	15 E. Cherry	Individual
<b>Beaver Street</b>	House	310 S. Beaver	Individual

### Southside/Oldtown Historic Districts

These two districts are distinct from each other but are usually lumped together because of their close proximity. The Southside District is directly south of the Railroad Addition. Historic properties on Phoenix Avenue, South San Francisco Street, and Beaver Street were formerly listed in the Railroad Addition but have been reassigned to the Southside District because of a better thematic fit. District boundaries are within Mike's Pike and Beaver Street on the west; Franklin Avenue, Ellery Avenue, and the Rio de Flag channel on the south; Elden Street and Lone Pine Road on the east; and Phoenix Avenue to the north. The Southside District is primarily residential in character (Woodward Architectural Group 1993) with commercial businesses on Phoenix Avenue.

Of prime interest is the ethnically diverse population that lived in Flagstaff from about 1900 to the 1940s. The Southside/Old Historic District is comprised of Flagstaff's largest historic Hispanic and African-American neighborhoods.

Table 3-7 lists historic properties from these two districts that fall within the 100-year or 500-year floodplains of the Rio de Flag.

**Table 3-7. Historic Properties within the 100-year and 500-year  
Floodplains in the Southside/Oldtown Historic District**

<b>Street</b>	<b>Property Name</b>	<b>Address</b>	<b>District Relationship</b>
<b>Phoenix Avenue</b>	Flagstaff Steam Laundry	210 W. Phoenix	Contributor
	Du Beau Hotel	19 W. Phoenix	Contributor
	Hicks Hotel	9 W. Phoenix	Contributor
	Hicks boarding House	7 W. Phoenix	Contributor
	Coconino	15-19 E. Phoenix	Contributor
	Downtowner Motel	Corner of Phoenix & San Francisco	Contributor
<b>San Francisco Street</b>	Downtowner Motel	19 S. San Francisco	Contributor
	Flagstaff Lumber	23 S. San Francisco	Contributor
	J. D. Halstead Lumber	23 S. San Francisco	Contributor
<b>Beaver Street</b>	Arizona Central Commercial Company	24 S. Beaver	Contributor
<b>Clay Avenue</b>	AL&T Co. Employee House	813 W. Clay	Contributor
	AL&T Co. Employee House	812 W. Clay	Contributor
<b>Mikes Pike</b>	Double Circle Garage	204 S. Mikes Pike	Contributor
	E.T. McGonigle House/ B&M Auto Camp	100 S. Mikes Pike	Contributor
	Gavin/Hensing Rental House	37 S. Mikes Pike	Contributor
	Mary A. Gavin Rental House	35 S. Mikes Pike	Contributor
	Mary A. Gavin Rental House	31-33 S. Mikes Pike	Contributor
	House	17 S. Mikes Pike	Contributor

## **3.5 LAND/WATER USE**

### **3.5.1 Jurisdictions**

With the exception of the potential Clay Avenue Wash detention basin site, the study area is located entirely within the city limits of Flagstaff, Arizona. The potential Clay Avenue Wash detention basin site extends to the west of the city limits onto unincorporated Coconino County land. This unincorporated land is located within the Metropolitan Planning Organization boundary of the City of Flagstaff and some of the site is owned by the State Trust for Public Lands.

### **3.5.2 Historical Overview**

Early development in Flagstaff (1880 to 1939) occurred along the Rio de Flag and adjoining floodplain. Flagstaff developed around the lumber mill, which supplied ties and other wood products for the Santa Fe Railroad (then the Atlantic and Pacific Railroad). The railroad depot became the hub for the development of Flagstaff, extending outward along the Rio de Flag. In contrast to the surrounding highlands, sedimentary deposits from the wash made the floodplain area relatively flat and, thus, more suitable for development. These conditions allowed settlers to establish stable building foundations and grow vegetable gardens and provided ample forage for livestock (Cline 1976).

Throughout the next two decades, development continued north and south of downtown along the Rio de Flag. More recent development (1960 to 1995) has occurred southwest and east of the downtown area, along Route 66 and I-40. To accommodate Flagstaff's growing population (see Section 3.7), the amount of developed land within the city's limits has nearly doubled in the past 20 years. In 1974, approximately 5.6 square miles in the city limits were developed. By 1995, approximately 10.9 square miles had been developed.

Surface runoff from the Rio de Flag has never been sufficient or reliable enough to be a substantial source of water for Flagstaff. In 1932, 26 shallow wells were drilled on the city-owned Clark Ranch (present-day Mountain View subdivision) producing about 70,000 gallons per day (Cline 1994). Shallow subsurface flow along the Rio de Flag provides only a minor localized water source.

Although unreliable as a source of potable water, surface flow from the Rio de Flag has been used for a number of other purposes. In 1924, the city built a rock and concrete dam on the Rio de Flag behind

the present-day Flagstaff Middle School to form City Park Lake (now known as “Frances Short Pond”). In 1950, aging sewer lines were replaced and extended an additional 0.5 mile down the Rio de Flag, where a water reclamation plant was built in 1956. The reclamation plant (also known as Plant Number One) was built 0.5 mile south of I-40, just west of Continental Estates. Within a decade, Plant Number One was becoming overburdened and there were increasing complaints regarding discharge of incompletely treated sewage into the Rio de Flag. A new treatment plant on the Rio de Flag at Wildcat Hill began operation in 1971 (Cline 1994).

### **3.5.3 Existing Land and Water Uses**

#### **Zoning**

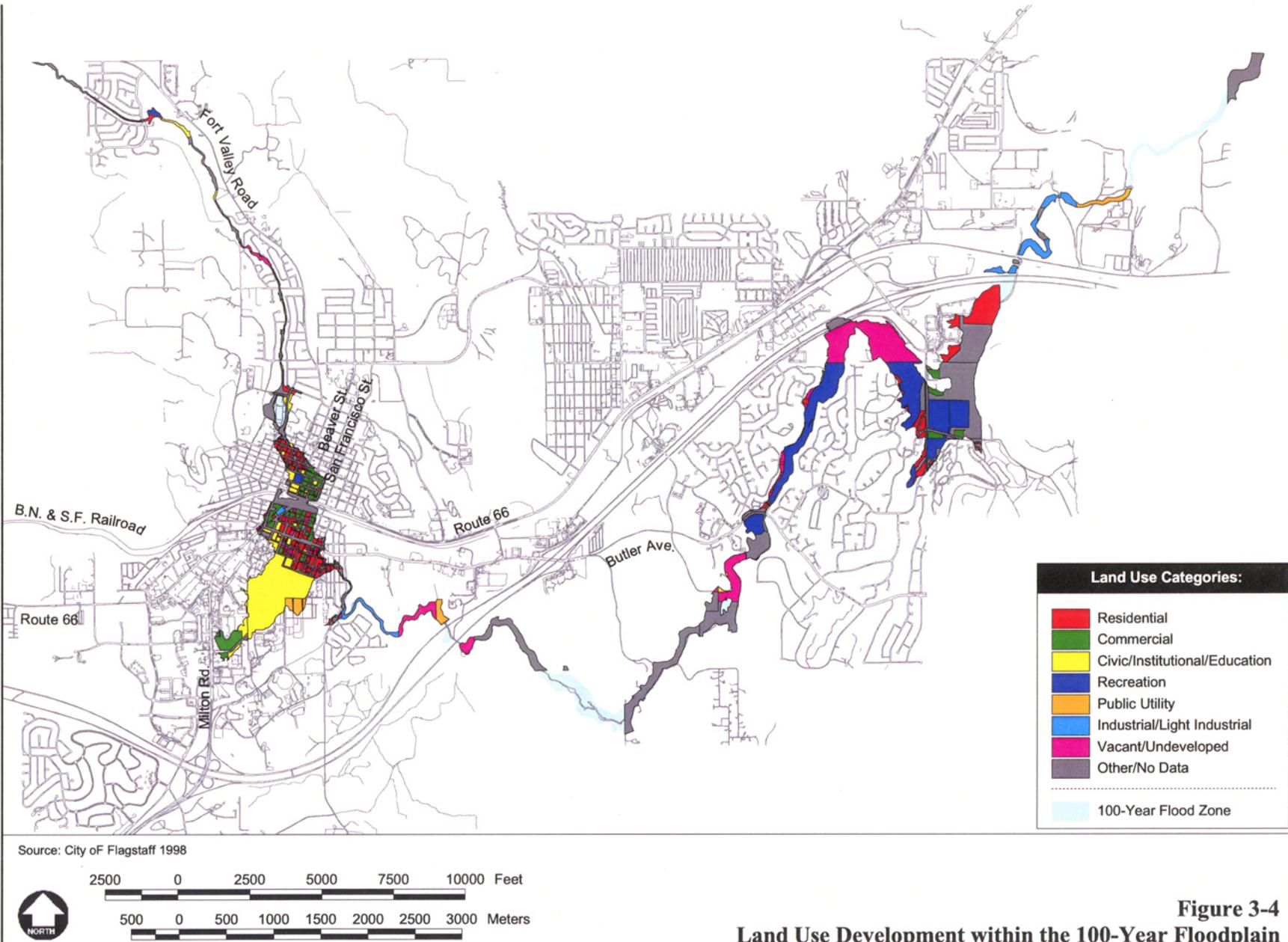
Nearly half of the 100-year floodplain along the Rio de Flag is zoned as residential areas. Areas zoned as commercial account for nearly a quarter of the 100-year floodplain. Less than one percent of the floodplain is zoned as industrial. The number of acres in each classification and the percentage of each classification as part of the total are shown in Table 1-1 in Section 1.3.1.

#### **Land Use**

The floodplain of the Rio de Flag is intensely developed through most of the city center (see Figure 3-4). Land use in the area consists of single-family and multiple-family dwellings, recreation areas, schools, light industry, railroad and utilities easements, and retail business structures. Some residential and business buildings in the city center are over 100 years old. Recreation facilities in the vicinity include parks, the Continental Country Club golf course, ball fields, picnic areas, a fishing pond, and bike/jogging trails. Table 3-8 shows the percentage of each land use within the 100-year Rio de Flag floodplain.

#### **Water Use**

The Rio de Flag and Clay Avenue Wash provide limited water use opportunities because they tend to carry flows through the study area only following storm events. The three perennial water sources within the study area are the pond at the Narrows dam near Cheshire Park, Frances Short Pond at Thorpe Park, and the I-40 wetlands.



**Figure 3-4**  
**Land Use Development within the 100-Year Floodplain**

**Table 3-8. Land Uses within the Rio de Flag 100-year floodplain**

<b>Land Use</b>	<b>Areal Extent (Acres)</b>	<b>Percentage of 100-year Floodplain</b>
Residential	87.4	10.4%
Commercial	42.3	5.0%
Civic/Institutional/Education	106.0	12.6%
Recreation	136.1	16.2%
Public Utility	17.9	2.1%
Industrial/Light Industrial	29.7	3.5%
Vacant/Undeveloped	107.8	12.8%
Other/No Data	313.9	37.3%
<b>Total</b>	<b>841.1</b>	<b>100.0%</b>

Source: Unpublished City of Flagstaff Geographical Information System (GIS) data

Based on its small size, there are few water used associated with the pond behind the Narrows dam neat Cheshire Park. Frances Short Pond provides limited recreational activities, such as fishing, and it is an important visual element of the park. The I-40 wetlands are designated for Partial Body Contact use, which can include activities such as boating (as opposed to Full Body Contact activities, such as swimming).

### **Land Use Regulations and Policies**

#### City of Flagstaff Resolution Number 1468 of 1987

This resolution is the City of Flagstaff *Growth Management Guide 2000* (City of Flagstaff 1987). The Growth Management Guide (GMG 2000) serves as the “general plan” for the City of Flagstaff and is intended to be a guide to the growth and development of the city. It is a public statement of the long range goals of the community, expressed by land use maps and statements of policy that describe how, when, why, and where to develop, rehabilitate or preserve the city. The GMG 2000 indicates where residential, commercial, and industrial development should occur and proposes general locations for community resources such as schools and parks. It also includes recommendations for transportation facilities, the extension of public utilities (sewer and water), and for phasing of development. The following excerpt is taken from the GMG 2000 and provide a concise overview of its general purpose:

The Guide is first, a physical plan. It is not a plan for economic development, or delivery of social services, although it may incorporate aspects of such concerns.

Secondly, the Guide is long range. It covers a period of 20 years or more and expresses current policies that will shape the future from the day of official adoption. However, the Guide does not preclude future decision making by prescribing the future in detail. The policies of the Guide say, in effect, “when the City is faced with a certain situation, it will probably act this way for these reasons.”

The policy approach has the advantage of stating a position in advance of a controversial proposal. The policies should be made to reflect changing conditions or unforeseen circumstances. Deviations from the Guide and its policies will require a rationale as convincing as the one in the Guide.

Thirdly, the Guide is comprehensive. It encompasses all geographical parts of the community and all functional elements which bear on physical development such as water and sewer facilities, parks, schools, fire stations, streets, and drainage.

The policies and land use designations of this Guide are intended to apply only within the area under the jurisdiction of the Guide, that is, within the corporate limits of the City of Flagstaff. In cases where the corporate limits are projected to expand, or growth in nearby County areas is anticipated, close coordination with the Coconino County’s general planning process will be necessary.

The GMG 2000 includes land use designations for the City of Flagstaff. The potential Cheshire Park and Thorpe Park detention basin sites are designated as “Park.” The potential Clay Avenue Wash detention basin site is outside the city limits, and is therefore not addressed in the GMG 2000.

The Rio de Flag channel is designated as “Open Space/Greenbelt” along its North Flagstaff, Interstate 40, and Continental reaches. For the Downtown Reach of the Rio de Flag, however, the channel does not have a specific land use designation. Rather, through this reach, the channel traverses areas designated for residential or commercial use. The potential new alignment for the Rio de Flag (i.e., the alignment that roughly approximates the location of the Rio de Flag’s historic channel) traverses land designated as “Commercial” and “Heavy Industrial.” Similar to the Downtown Reach of the Rio de Flag, the Clay Avenue Wash Reach traverses a series of commercial and residential land use designations.

The potential berm sites in the Continental Estates area are generally located near the boundaries between (A) areas designated as “Open Space/Greenbelt” (a category that includes undeveloped lands and the golf course) and (B) areas designated for residential or commercial uses.

#### City of Flagstaff Ordinance Number 1886 of 1995

This city ordinance amends the floodplain regulations set by Ordinance Number 1675 of 1990 by incorporating revised regulations for the National Flood Insurance Program and Arizona revised statutes<sup>3</sup>. The purpose of this ordinance is to “promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas” (City of Flagstaff Ordinance Number 1886). This ordinance supersedes any conflicting provisions.

#### City of Flagstaff Land Development Code of 1991

This document outlines regulations passed by the City of Flagstaff “to protect and promote the public health, safety, convenience, and general welfare of the citizens of the city; to provide for the orderly growth and development of the city; to classify, regulate, and segregate the uses of lands and buildings; to regulate the height and bulk of buildings, and to regulate the density of population” (City of Flagstaff Land Development Code of 1991).

#### Flagstaff 2020 Program

In 1996, the City of Flagstaff commenced a “community visioning project” designed to involve the city’s residents in a wide-ranging discussion about the future of the city. This 18-month strategic planning effort, entitled the “Flagstaff 2020 Program,” was guided and funded by a consortium of public- and private-sector groups, including the City of Flagstaff and Coconino County. Following a series of public meetings, surveys, focus groups, and other means of input, a final vision document was prepared and released in June 1997. The *Flagstaff 2020 Vision* identified the following seven “target areas” of concern, and provided goals and strategies for each:

- Managing growth
- Protecting the environment

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<sup>3</sup> In accordance with the Flood Disaster Protection Act of 1973 (PL 93-234), as amended, and the National Flood Insurance Act of 1968 (PL 90-448), as amended.

- Fostering human development
- Improving housing and livability
- Promoting health and safety
- Creating economic opportunity
- Strengthening and sustaining community

Action planning teams were established for each of the above target areas to guide and assist the community in achieving the strategic elements of the vision. Although the 2020 Plan is not official policy adopted by the city, it reflects the concerns and goals of the city and its residents and is designed to help shape the future of the city in the coming years.

#### Flagstaff Area Open Spaces and Greenways Plan

The Open Spaces and Greenways Plan began as part of the update of the City of Flagstaff's Growth Management Guide 2000. The GMG 2000 had identified many possible benefits that the City of Flagstaff and surrounding communities could realize from developing an Open Spaces and Greenways Plan. With these benefits in mind, the City of Flagstaff invited land management agencies and local citizens to take part in an open spaces and greenways committee to develop the Open Space Greenways Plan.

The goals and objectives of this plan were decided by the community and representatives of the land management agencies through a three-year planning process. The primary goal of the Open Spaces and Greenways Plan is to maintain Flagstaff's quality of life by finding ways to balance development with the retention of open spaces and natural areas. A key principal in the recommendations is that residents in the greater Flagstaff communities be able to reach open spaces in no more than 15 minutes from their neighborhoods. The plan identifies open space categories and landscape districts for the Greater Flagstaff area and provides general, as well as specific, recommendations to achieve the plan's goals.

In 1997, the agencies involved in preparing the plan signed a Memorandum of Understanding (MOU). Through the MOU, the agencies (including the City of Flagstaff and the County of Coconino) committed to using the Open Spaces and Greenways Plan in their future planning.

## **3.6 RECREATION**

### **3.6.1 Regional Recreational Opportunities and Facilities**

The natural environment surrounding Flagstaff draws both residents and tourists to the area. Approximately 384 square miles of the 525 square miles that comprise the Flagstaff area are managed by Coconino National Forest, which is one of the largest ponderosa pine forests in the world. These forests provide critical habitat for elk, deer, antelope, bear, and other wildlife. The San Francisco Peaks, including Mount Humphreys, are located north of the city. Walnut Canyon National Monument is located south of the city and is home to prehistoric archaeological cliff dwellings. Grand Canyon National Park (which attracts nearly five million visitors annually) and Glen Canyon National Recreational Area, located outside the limits of greater Flagstaff, are the region's two largest tourist attractions.

### **3.6.2 Local Recreational Opportunities and Facilities**

Due to its 7,000 foot elevation, Flagstaff experiences heavy snowfall during the winter and mild temperatures during the summer. This allows for a diversity of recreational uses including snow skiing in the winter and horseback riding, hiking, and other recreation in the summer. The City of Flagstaff operates and maintains 29 parks and 6 recreation centers, which include an ice rink, therapeutic recreation center, adult center, and general recreation centers (see Figure 3-5). A handful of parks, including the Tuthill County Park, are managed by the Coconino County Department of Parks and Recreation.

Recreational resources directly within the study area include Thorpe Park and segments of the Flagstaff Urban Trails System (FUTS).

#### **Parks**

##### **Cheshire Park**

Cheshire Park is adjacent to North Fremont Boulevard approximately 0.25 mile south of U.S. Highway 180. Cheshire Park is a community park primarily serving the residential neighborhoods to the north and east. Park facilities include a children's play area, a basketball court, two tennis courts, three picnic tables, two barbeque pits, portable toilets, several benches, and a grass play area. There is also a parking lot with six spaces.

### Thorpe Park

Thorpe Park is a large city park located approximately 0.5 mile northwest of downtown Flagstaff. The park is comprised of several areas, including the Thorpe Park Playground, Multi-Purpose Field, Softball Complex, and the Flagstaff Little League Complex. The park is open year-round and is the primary adult softball venue in the city. The facility is maintained by the City Department of Parks and Recreation.

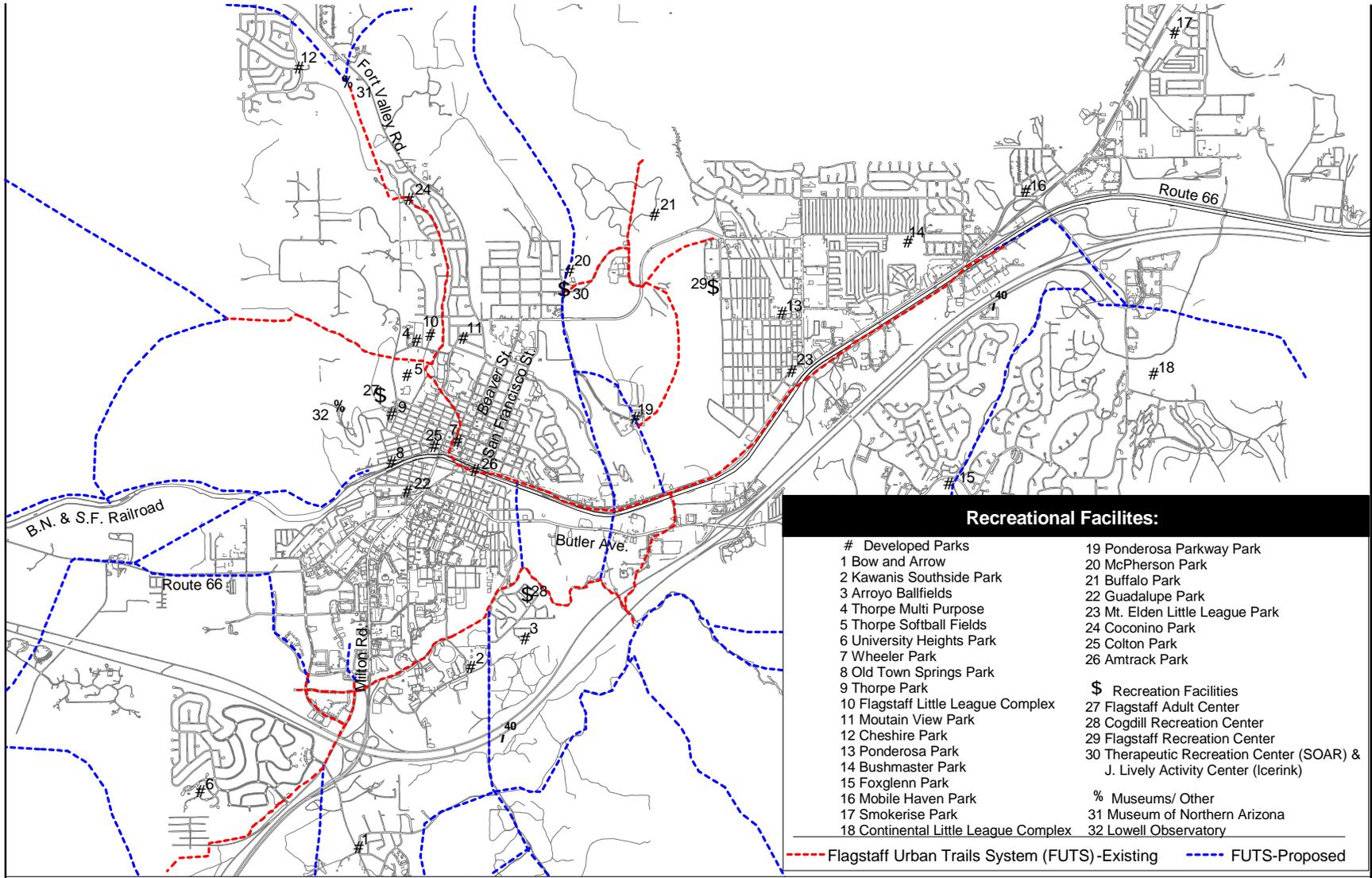
The Thorpe Park Playground is located at Santa Fe and Toltec Street and contains playground equipment, lighted tennis courts, a picnic ramada, individual picnic areas, horseshoe pits, a sand volleyball court, and an outdoor basketball court. The Thorpe Park Softball Complex is located north of Thorpe Road and has four adult softball fields, a concession stand, an announcer's booth, and an enclosed playground area. More than 2,500 adults play on softball teams during the summer softball season, most of which is played at the this facility (City of Flagstaff 1999). The organized softball seasons take place in April and July, and last for approximately eight weeks. In addition to regular season games, softball tournaments are held year-round at the park. Just north of the Softball Complex are two tennis courts and a handball court. The Flagstaff Little League Complex is located north of Thorpe Road and east of Aztec Street and includes one senior league field, one minor league field, one major league field, a concession stand, and three announcers' booths.

### Continental Estates Little League Field

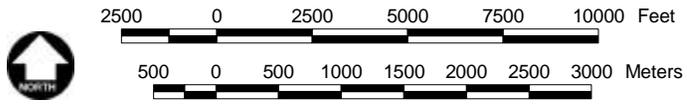
The Continental Estates Little League Field is located just north of Oakmont Drive in the Continental Estates area. The recreational complex supports one major league field, one minor league field, one T-ball field, a concession stand, and an announcer's booth.

### **Flagstaff Urban Trails System**

The City of Flagstaff has developed a number of trails throughout the city and has plans to develop several more. The Flagstaff Urban Trails System (FUTS) is a network of soft surface trails designed for recreation and nonmotorized transportation including, biking, hiking, jogging, cross-county skiing, and educational activities, as well as pedestrian and bike commuting. The trail system is approximately 50 percent complete with over 16 miles of existing trails. When complete, the 33-mile trail will link all parts of the city to the rural recreational trail system in the surrounding forest (City of Flagstaff 1999).



Source: City of Flagstaff 1996; Flagstaff Area Open Space and Greenways Plan, 1998.



**Figure 3-5  
 Recreational Resources**

The following is an excerpt from the Flagstaff Urban Trails System program description:

The Flagstaff Urban Trails System (FUTS) is being developed as a citywide interconnecting network of non-motorized transportation corridors and linear recreation areas. Various off-street trails are proposed to interconnect employment areas, activity centers, neighborhoods, schools and parks throughout the city. FUTS offers and provides for an alternative means of transportation, informal exercise and recreational opportunities. Anticipated uses of such a system include bicycling, hiking, jogging, cross-country skiing, educational activities, as well as pedestrian and bike commuting. FUTS promotes year-round full season opportunities for a diversity of uses.

Interconnection with the Arizona State Trail, Coconino National Forest trail system, and the Flagstaff Bikeways System creates an attractive regional recreational opportunity for visitors and residents alike. An extensive and easily accessible trail network will allow access to forest wilderness areas, canyons, cultural centers, national monuments, the Arboretum, the University, schools, residential and shopping areas, and downtown Flagstaff. The natural greenbelt setting in which the Flagstaff Urban Trails System is primarily located secures open space and greenbelt land use, promotes enjoying the environment, and provides a diverse exposure to various native wildlife and plant life. The benefits are economic, social and environmental.

The City already owns or has easements for a considerable amount of land required to place the framework of a trails system. Acquisition of additional right-of-way to secure these trail routes is an essential, continuing effort for the FUTS program. Utilization of major drainageways, utility easements, floodplains, scenic areas, high-slope areas, and developable land provides appropriate locations for the trails.

Figure 3-5 shows the locations of existing FUTS trails within Flagstaff.

## 3.7 SOCIOECONOMICS

### 3.7.1 Population and Demographics

The City of Flagstaff experienced a moderate population growth rate of 3.1 percent from 1970 to 1995. In that time, Flagstaff's population doubled from 26,117 to 52,701 (U.S. Census Bureau 1995). Although Flagstaff's rate of population growth is expected to decline, by 2050 the population is likely to have doubled again, approaching 113,684 (Arizona Department of Economic Security 1997).

#### Minority and Low-Income Populations

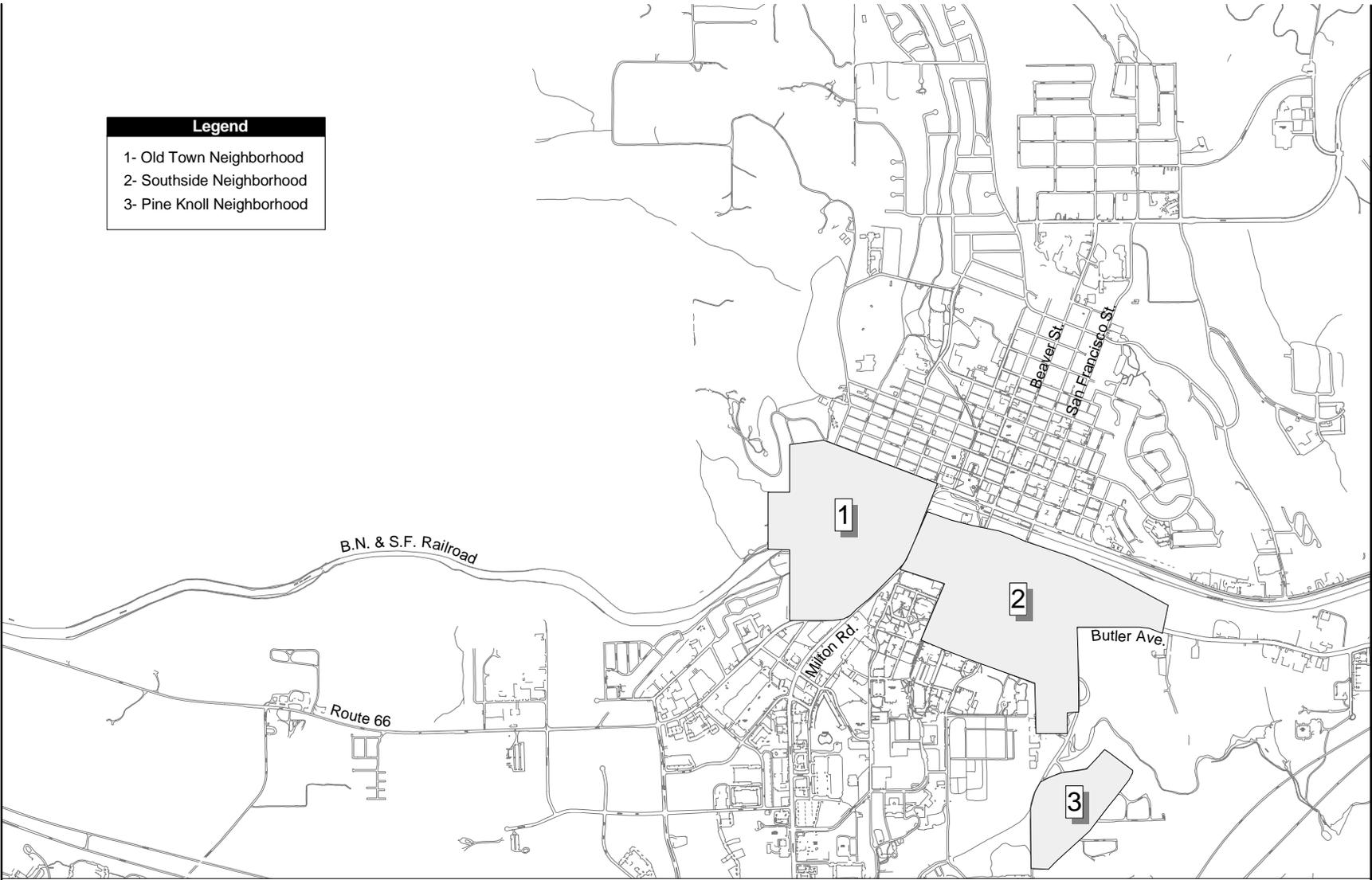
On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations" was published in the *Federal Register* (59 F.R. 7629). The Executive Order requires Federal agencies to identify and address disproportionately high human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

Three low-income neighborhoods have been identified within the study area: Southside, Old Town, and Pine Knoll (see Figure 3-6). As shown in Table 3-9, the majority of residents in these neighborhoods were in the low- or moderate-income categories as of 1990. Table 3-9 also identifies that in 1990, the median household income in these neighborhoods was considerably less than the median household income for Flagstaff as a whole. As of 1995, these three neighborhoods also had a higher proportion of minorities than Flagstaff as a whole (see Table 3-10).

**Table 3-9. Low-Income Concentrations in Southside, Old Town, and Pine Knoll Neighborhoods, 1990**

Neighborhood	Percent of Residents with Low or Moderate Incomes	Median Household Income
Southside	80.7 %	\$10,981
Old Town	65.6%	\$19,349
Pine Knoll	87.3%	\$15,296
Flagstaff as a whole	38.4%	\$28,382

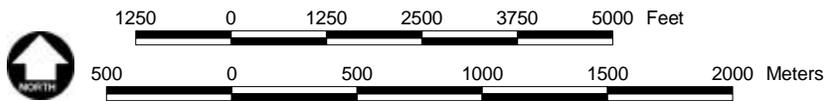
Source: The City of Flagstaff's Affordable Housing Plan 1996 based on data from the 1990 U.S. Census



**Legend**

- 1- Old Town Neighborhood
- 2- Southside Neighborhood
- 3- Pine Knoll Neighborhood

Source: City of Flagstaff 1996



**Figure 3-6**  
**Low- Income Neighborhoods**  
**in the Study Area**

**Table 3-10. Minority Concentrations in Southside, Old Town, and Pine Knoll Neighborhoods, 1995**

Race-Origin	Southside	Old Town	Pine Knoll	Flagstaff
White	72.2%	66.7%	52.5%	79.1%
African American	7.2%	4.7%	21.2%	2.0%
Native American	5.0%	12.7%	24.0%	8.9%
Asian	1.5%	2.7%	1.1%	1.7%
Other	14.0%	13.2%	1.2%	8.3%
<b>Total</b>	<b>99.9%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
Hispanic <sup>1</sup>	24.6%	22.6%	21.7%	15.4%

Source: The City of Flagstaff's Affordable Housing Plan 1996 based on data from the 1995 Special Census.

<sup>1</sup> In a separate question, these individuals who had already identified themselves as belonging to one of the aforementioned groups identified themselves as being of Hispanic origin.

### Property along the Rio de Flag Floodplain

In addition to having a large concentration of low-income people and minorities, Southside and Old Town have a large concentration of old and dilapidated housing stock. A field survey conducted in May 1994 indicated that an average of 24 percent of the housing structures in these areas showed visual signs of decline (City of Flagstaff 1996b). However, because these neighborhoods are located in the Rio de Flag floodplain, any renovations that equal or exceed 50 percent of a structure's market value must comply with FEMA, state, and local floodplain regulations. These regulations are often infeasible, limit use of the structure, and can be very costly, thereby restricting renovation in the low-income neighborhoods (pers. comm., J. Aronson, Flagstaff Historic Preservation Commission, 1998). Other concerns for property owners include costly flood insurance for structures in the floodplain and the fact that property in the floodplain is susceptible to damage during flooding. Under current conditions, a 100-year flood would cause significant damage throughout the floodplain.

### 3.7.2 Local Economy

The economy of Flagstaff is marked by low-income jobs, high cost of living, and relatively high unemployment. In 1990, the average per capita income in Flagstaff was \$11,517, which was approximately 14.4 percent lower than the state's average (U.S. Census Bureau 1990). Based on a 1997 third quarter survey by the American Chamber of Commerce Researchers Association, Flagstaff's cost of living was 12 percent higher than the national average.

In 1997, the labor force of Flagstaff was 29,991 people. The average unemployment rate in Flagstaff for 1997 was 6.6 percent—higher than the state average of 4.6 percent. The city has a service-and trade-dominated economy which accounted for nearly 50 percent and 30 percent, respectively, of the work force in 1990 (U.S. Census Bureau 1990). Tourism is Flagstaff's primary industry, due largely to the city's proximity to Grand Canyon National Park. Although tourism is a significant source of employment in the Flagstaff area, this sector tends to produce jobs at the lower end of the wage scale. Tourism is expected to continue as the major employer in the Flagstaff area as visitation to the region continues to increase (City of Flagstaff 1996a). Flagstaff is also a regional retail center for northern Arizona.

## **3.8 TRANSPORTATION**

### **3.8.1 Motorized Transportation**

Major transportation routes in the study area are Route 66 and I-40, both running generally east-west, parallel to the railroad. Automobile traffic on north-south routes is hindered by at-grade railroad crossings. As a result, Milton Road, the only north-south route without an at-grade crossing, is typically congested. There are no direct north-south routes through the city (City of Flagstaff 1997). Several solutions have been considered by the city to alleviate these traffic concerns, including the enhancement of the city's trail system, development of perimeter parking, and development of pedestrian over- and under-passes.

Traffic studies conducted in 1987 indicate that approximately 45 percent of the traffic on seven major city roads were passing through the community while 55 percent had origins or destinations in the area. Most of the through traffic (about 40 percent) was traveling east/west on I-40 (City of Flagstaff 1999).

### **3.8.2 Railroads**

The Burlington Northern & Santa Fe Railroad (formerly the Atchison Topeka & Santa Fe Railroad) traverses east/west through the city of Flagstaff, roughly parallel to Route 66. The double-track route bisects the city and passes just south of Route 66 in the downtown area. Currently, there are approximately 75 trains per day of up to 1.5 miles in length traversing the floodplain an average of once every 20 minutes. Several small spurs extend from the main line, some of which have been abandoned, others which service commercial and industrial uses near the city center.

### **3.8.3 Nonmotorized/Pedestrian Transportation**

The city currently has approximately 4.2 miles of separate bike paths and 15.4 miles of on-street centerline bike paths (City of Flagstaff 1999). With the exception of Route 66, none on the state highways include bikeways. Bicycle riding is permitted on all city sidewalks unless specifically posted otherwise.

## 3.9 NOISE

Noise is generally defined as unwanted or annoying sound, and it is typically associated with human activity that interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise and its appropriateness in the setting, and the individual. Therefore, the “A-weighted” noise scale, which weighs the frequencies to which humans are sensitive, is used for measurements. Noise levels using “A-weighted” measurements are sometimes written dB(A) or dBA. Figure 3-7 illustrates the ranges and responses from various sound levels and sound sources.

### 3.9.1 Existing Noise Sources

The loudest and most consistent noise within the study area comes from trains, which pass through town every 20 minutes (on average). Trains typically generate noise levels ranging from 80 to 85 dBA at 100 feet from the centerline to 85 to 90 dBA at 50 feet<sup>1</sup>. Other noise is generated from traffic along Route 66, I-40, and other city streets within the study area. Construction noise is also intermittently generated within the study area.

### 3.9.2 Sensitive Noise Receptors

Human noise-sensitive receptors are generally considered to be persons who occupy areas where noise is an important attribute of the environment. These areas often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, education facilities, and libraries. Refer to Section 3.5 for a discussion of land use patterns within the study area.

Noise-sensitive receptors may also include wildlife, including certain songbirds. Biological resources are addressed in Section 3.3.

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1 Railroad noise levels vary based on the type and length of train, cargo loads, railway alignment, train speed, and other factors. The range of noise levels provided above are based on a freight train traveling approximately 35 mph under normal straight-rail conditions.

Sound Source	Sound Level (dBA)*	Response
Civil defense siren (at 100 feet)	140	
Carrier deck jet operation	130	Painfully loud
Jet takeoff (at 200 feet)	120	Threshold of feeling and pain
Riveting machine (at 1 foot)	110	
Rock music concert	100	Very loud
Pile driver (at 50 feet)	90	
Ambulance siren (at 100 feet)	80	
Heavy truck (at 50 feet)	70	Moderately loud
Pneumatic drill (at 50 feet)	60	
Garbage disposal in home	50	
Freeway traffic (at 50 feet)	40	Quiet
Vacuum cleaner (at 10 feet)	30	
Air conditioning unit (at 20 feet)	20	
Speech in normal voice (at 15 feet)	10	
Residence-typical movement of people, no TV or radio	0	Threshold of hearing
Soft whisper (at 5 feet)		
Recording studio		

\* Typical A-weighted sound levels in decibels. "A" weighting approximates the frequency response of the human ear.

**Figure 3-7**  
**Weighted Sound Levels and Human Response**

### **3.9.3 Flagstaff Noise Ordinance**

The City of Flagstaff adopted *Ordinance No. 1511, Noise Control Regulations* in August 1987. Section 6-8-2 of the Ordinance defines restrictions related to nuisance noise, which states that between the hours of 12:00 A.M. and 6:00 A.M. on Monday through Friday or between one (1) A.M. and seven (7) A.M. on Saturday or Sunday:

...it shall be unlawful for any person, while outdoors or within a residential unit, to make or permit to be made any noise which is clearly audible within a residential unit other than that from which the noise may have originated.

Sections 6-8-3 and 6-8-4 of the Noise Ordinance describe the General Exceptions and Enforcement Procedures for the regulations outlined in Section 6-8-2. Specifically, Section 6-8-3(1) exempts noise created by public safety work from the prohibitions stated in the ordinance. Public safety work is defined by the city as “work immediately necessary to restore property to a safe condition, or work required to protect persons or property from potential danger or damage, including snowplowing or work by a public or private utility when restoring utility services” (City of Flagstaff 1987b).

## **3.10 AIR QUALITY**

### **3.10.1 Meteorology and Climate**

The semiarid climate of northern Arizona plays a significant role in the flow cycle of the Rio de Flag. Although the Rio de Flag is the major water course in the Flagstaff area, sustained flows in the channel are generally short-lived. Flooding in the Rio de Flag is related to snow melt on the San Francisco Peaks in the spring and runoff from torrential summer storms.

The average annual precipitation for the Rio de Flag drainage area ranges from about 20 inches in Flagstaff (elevation 6,879 feet) to about 35 inches in the San Francisco Peaks (elevation 8,000 to 12,633 feet), with a basin average of about 25 inches. The precipitation is distributed fairly evenly between summer and winter, with the summer precipitation ranging from 8 to 14 inches, and averaging about 10 inches. Most of the winter precipitation falls as snow (approximately 85 percent). While significant precipitation falls during the winter months, the wettest months of the year occur during the “summer monsoon” period during July and August, when thunderstorms are widespread across Arizona.

Annual temperature extremes in the Flagstaff area can range from zero to 90 degrees Fahrenheit (°F). The yearly average high and low temperatures are 61°F and 30°F, respectively. The prevailing winds are from the southwest with an average speed of 8 to 9 miles per hour.

### **3.10.2 Air Quality Setting**

Within the vicinity of Flagstaff there are several mandatory Class I areas as designated by the Clean Air Act Amendments of 1977. Class I areas have special national or regional value from a natural, scenic, recreational, or historic perspective. Mandatory Class I areas include national wilderness areas larger than 5,000 acres and national parks larger than 6,000 acres. Air quality in mandatory Class I areas must be maintained in its natural state. Mandatory Class I areas in the vicinity of Flagstaff include Grand Canyon National Park (approximately 80 miles northwest of Flagstaff), Sycamore Wilderness Area (approximately 30 miles southwest of Flagstaff), and Petrified Forest National Park (approximately 160 miles east of Flagstaff) (EPA 1990).

Flagstaff is located on the western border of Arizona's Airshed 3, which extends east to the New Mexico border between Springerville (181 miles east of Flagstaff) and Canyon de Chelly National Monument (U.S. Environmental Protection Agency 1990). Airshed 3 is a Class II area, which has much less stringent air quality standards than Class I areas (pers. comm., P. Lahm, U.S. Forest Service, 1998).

### 3.10.3 Existing Air Quality

Flagstaff is an attainment area, meaning that pollutant levels do not exceed National Ambient Air Quality Standards (NAAQS) defined by the Clean Air Act (40 CFR 50). Within the Flagstaff area, the ADEQ maintains two monitoring sites for particulate matter 10 microns or smaller in diameter (PM<sub>10</sub>) (ADEQ 1997). Particulate matter is usually created by forest fires (including prescribed burns), automobile exhaust, wood-burning stoves and fireplaces, and dust. The 1996 PM<sub>10</sub> concentrations at these two monitoring locations are listed in Table 3-11.

**Table 3-11. PM<sub>10</sub> Data for Flagstaff**

Site Location	Annual Average	NAAQS Annual	24-Hour Average Maximum	NAAQS 24 Hour Average
5701 E. Railroad St.	14 ug/m <sup>3</sup>	50 ug/m <sup>3</sup>	42 ug/m <sup>3</sup>	150 ug/m <sup>3</sup>
Thorpe Park	16 ug/m <sup>3</sup>	50 ug/m <sup>3</sup>	31 ug/m <sup>3</sup>	150 ug/m <sup>3</sup>
Flagstaff Junior High	15 ug/m <sup>3</sup>	N/A	32 ug/m <sup>3</sup>	N/A

Source: ADEQ 1997, 1999

Note: Sampling was conducted at the Railroad Street and Thorpe Park locations in 1996 and at the Flagstaff Junior High School in 1997.

### 3.10.4 Sensitive Receptors

Land uses that are considered sensitive receptors for general air pollution concerns include residences, schools, playgrounds, child care centers, and long-term health care facilities. Refer to Figure 3-4 in Section 3.5, Land and Water Use, regarding the distribution of land uses within the project study area.

### **3.11 ESTHETICS**

This section describes the visual character of the Rio de Flag study area, including its general appearance and typical views. The description is followed by a discussion of viewers that may be sensitive to visual change in the study area. (See also Figures 1-4 through 1-9, which contain photographs of the study area.)

#### **3.11.1 Visual Character**

The visual character of the project study area reflects the varied nature of its components, which include the Rio de Flag and Clay Avenue Wash channels, residential and commercial neighborhoods in downtown Flagstaff, Thorpe Park, and the undeveloped potential Clay Avenue Wash detention basin site.

##### **Rio de Flag Channel**

In the upstream portions of the North Flagstaff Reach, the channel retains a natural appearance, although residential and other development encroach to the channel edges, particularly on the east. Further downstream in the North Flagstaff and Downtown Flagstaff reaches, the channel appears in a more degraded state (e.g., debris in the channel, little native vegetation, culverts under roads, and sporadic placement of bank stabilization/erosion control features). Along one portion of these reaches, near City Hall, the channel has been modified into a grassy swale.

The I-40 Reach reflects a more natural appearing channel, with native vegetation and less development. Parts of this reach pass through a meadow which, although privately owned, has not been developed. A FUTS trail parallels the Rio de Flag through much of this reach. In the Continental Reach, the channel once again loses its natural appearance, and reflects urban modifications—sections of this reach are lined with riprap, close to residential development, lacking native vegetation, and/or converted to grassy swales within a golf course setting.

##### **Clay Avenue Wash Channel**

At the upstream end of the channel (i.e., the site of the potential detention basin), Clay Avenue Wash lacks a well defined channel. The visual character of this area is dominated by the surrounding

ponderosa pine forest. Further downstream (east), the wash enters residentially and commercially developed areas. In these developed areas, the channel has been modified in some locations to provide some flood control, whereas in other locations it is routed onto city streets. Ultimately, it disappears into a culvert at the western edge of Milton Road. Overall, the channel has a relatively low esthetic value through much of this reach.

### **Downtown Flagstaff**

Much of downtown Flagstaff is within the study area because it is encompassed by the Rio de Flag 100-year floodplain, the Clay Avenue Wash 100-year overflow zone, or both. Downtown Flagstaff includes a number of attractive buildings, many of which are historic (see Section 3.4, Cultural Resources). Downtown Flagstaff also provides a number of vistas to the highly scenic surrounding landscape. The overall attractiveness of this area contributes to Flagstaff's status as a tourist destination.

### **Thorpe Park**

Thorpe Park is dominated visually by Frances Short Pond and the ballfields. The ballfields are well maintained, and surrounding urban uses are visible in this area (e.g., a high-school, maintenance facilities, and residences). Accordingly, the overall character of the park is more urban than natural; however, the park does serve as a visual transition between the more developed neighborhoods of downtown Flagstaff and the undeveloped National Forest lands to the west.

### **Cheshire Park Detention Basin Site**

Cheshire Park's dominant visual feature is the park itself, including the grass field, the children's play equipment, and game courts. The line of trees behind the park and mountains in the background add to the visual effect of the park. Based on the site's topography and the screening effect of the trees, the Narrows dam and associated pond are not prominent visual features. Rather, views to the dam are generally limited to immediately adjacent residences and to park visitors who leave the developed park area.

### **Potential Clay Avenue Wash Detention Basin Site**

The potential detention basin site has three prominent visual features: (1) ponderosa pine forest, (2) grassy meadows, and (3) a farmhouse with associated outbuildings. Much of this site is enclosed with barbed wire fencing. The detention basin site, which can be easily viewed from Route 66, is relatively attractive; however, it is not generally distinguishable from other agricultural areas or other stands of ponderosa pine forest.

### **Potential Berm Locations at Continental Estates**

The potential berm sites are generally located between undeveloped or golf course areas and residential or commercial land uses. As with much of the Continental Estates area, the berms are located in areas where evidence of human activity is apparent, but where there is still a high scenic value resulting from natural features (e.g., pine covered hills, large areas of undeveloped land) or grassy golf course fairways.

### **3.11.2 Policies and Development Standards**

#### **Scenic Views**

The value which the local community places on their natural environment is reflected in the following excerpt from the *Flagstaff 2020 Program*,

Nature is precious to people who live here and they devote considerable energy and attention to enjoying, protecting and enhancing it. Local citizens consider the spectacular scenery and landforms surrounding them to be irreplaceable gifts that must be preserved for future generations.

#### **Open Spaces and Greenways**

The Greater Flagstaff Open Spaces and Greenways Coalition oversees the implementation of the region's Open Spaces and Greenways Plan, which designate open spaces and greenways for permanent protection. One of the plan's goals is to link neighborhoods, commercial centers, and open spaces in a pedestrian/bicycle circulation system. Location of access points to this system will allow most residents to reach them in about a 15-minute walk. The Rio de Flag is considered as potentially

being one of these greenways, providing a nearly continuous public corridor through the community where natural vegetation has been restored (City of Flagstaff 1997).

One of the policies stated in the Flagstaff Growth Management Guide 2000 requires the city to “develop plans and programs which carefully manage development on hillsides, ridge lines, and drainage courses in order to reduce adverse impacts and to protect the scenic quality, vegetation, and wildlife values of those areas” (City of Flagstaff 1987a). To achieve this, the Growth Management Guide encourages a “non-structural approach” to flood control which seeks to incorporate such features into the city’s Open Space/Greenbelt System.

### **Development Standards and Design**

The community is establishing strong development standards designed to direct growth skillfully and ensure the community's continued livability.

A Growth Management Alliance (GMA) is being formed to establish a simplified uniform development code for the city and county for lands within the Regional Urban Growth Boundary (RUGB). Within the RUGB, developers will pay development impact fees. These fees will help cover the cost of basic services needed for new developments, including roads and utilities. New residential developments will set aside land and/or funds for future neighborhood amenities, including schools and parks. New developments also will provide walkways, bicycle paths, transit stops, and space for other nearby amenities.

The Flagstaff Area Regional Planning Group is an informal group of city, county, and metro planning organizations who coordinate planning efforts in the Flagstaff area. The city has design and development standards to help protect views of the natural environment, including lighting standards to preserve views of the night sky. “Intimacy” in design will be encouraged to promote interaction between people, neighborhoods, and the community. Design that revives historic American neighborhood qualities—front porches, sidewalks, and street trees—are also encouraged (City of Flagstaff 1997).

### **Environmental Urban Design**

To shape development and redevelopment in a way that preserves community integrity, character, and livability, citizens wish to promote good urban design and growth management. Clustered residential development, generally concentrated in or near the city core, with greenways and strategically located community focal points, is one of the city's goals (City of Flagstaff 1997).

## 3.12 HAZARDOUS AND TOXIC MATERIALS

Hazardous materials and wastes include substances that pose a potential hazard to human health or the environment. A number of properties may cause a substance to be hazardous, including toxicity, ignitability, corrosivity, or reactivity. Hazardous materials can be released into the environment by either point or nonpoint sources. Point sources release contaminants from a specific site. Nonpoint sources release contaminants in a diffused fashion; for example, as runoff from urban or agricultural areas into a river.

### 3.12.1 Database Search

A comprehensive database<sup>1</sup> search of all potential sources of point source contamination within a two-mile radius of the intersection of Beaver Street and Butler Avenue was conducted for this project (Environmental Data Resources, Inc. 1997). From this search it was determined that, within 500 feet of the existing channel of the Rio de Flag, the only potential sources of hazardous waste contamination include six underground storage tanks (USTs)<sup>2</sup>.

### 3.12.2 Field Investigations

In addition to the database search, field investigations have been undertaken by the USACOE to determine the extent of potential hazardous waste contamination within the study area. Based on the preliminary laboratory analysis, there are five areas where contamination has been or is expected to be encountered.

- **Greyhound Bus Station UST.** The Greyhound Bus Station is located at 399 S. Malpais Lane, immediately south of the Clay Avenue Wash channel. Between 1974 and 1994, two 10,000-gallon diesel USTs were located on-site. Both tanks were removed in April 1994, at which time slight amounts of hydrocarbon contamination were detected in the soil above the tanks. Based on laboratory analysis of the excavated tank pit material, it was concluded that hydrocarbons released

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<sup>1</sup> This database search complies with the guidelines suggested by the American Society of Testing Materials (ASTM).

<sup>2</sup> Note that there may be potential point sources of hazardous waste contamination within 500 feet of the Rio de Flag that occur outside the radius of this search. For example, in the Continental area.

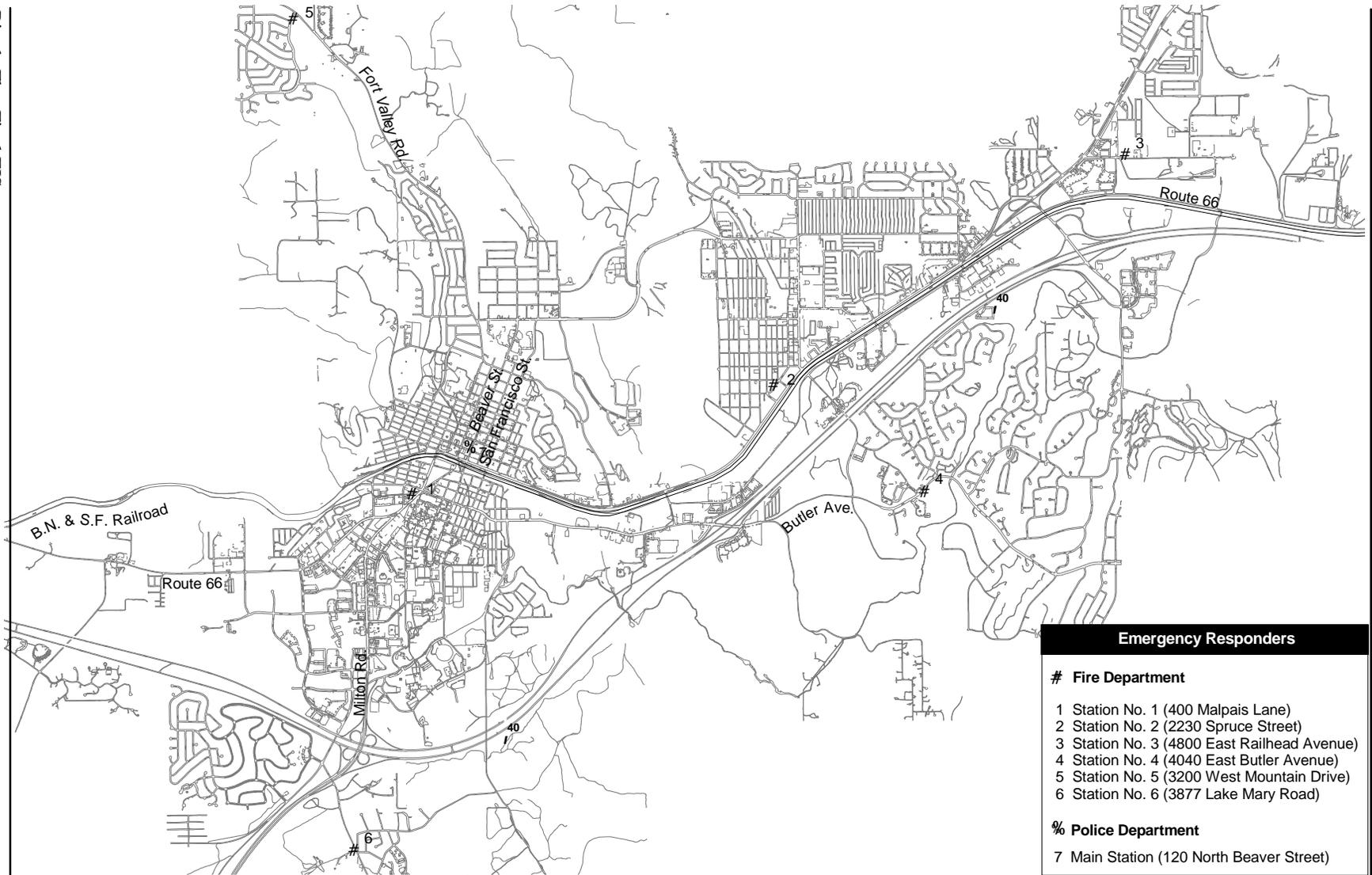
into the tank pit were likely from fuel overspills during the life of the tank. The levels of contamination were considerably below the residential and non-residential Arizona soil remediation levels (SRLs). Further USACOE sampling (1999) identified some hydrocarbon contamination in the underlying groundwater.

- **City Fire Station UST.** City Fire Station No. 1 is located approximately 8 feet north of the Clay Avenue Wash Channel. A 3,000 gallon diesel UST was located on-site from 1980 to 1996 when it was removed. As with the Greyhound UST, post-removal soil analysis revealed levels much lower than the Arizona SRLs. Supplemental investigations conducted by the USACOE identified hydrocarbon contamination in the groundwater at the site.
- **Mobile Station (Mike's Pike).** Reports of contamination under the Mobile Station at Mike's Pike were investigated by the USACOE in 1999, and it was determined that hydrocarbon contamination was present underneath Mike's Pike in the proposed underground channel alignment.
- **City Hall.** Based on previous reports of oily film found in a utility installation ditch, the USACOE conducted soil sampling near the Flagstaff City Hall. The results of this sampling indicated that some soil-borne contaminations were present near the Rio de Flag channel adjacent to the City Hall. The origin of this contamination is unknown; however, it is possible that it may be creosote from contaminated trash in the fill along the re-graded wash invert.
- **Five Points Intersection.** Soil gas vapors have been reported under the Five-Points intersection (Milton Road/Route 66/Clay Avenue/Butler Avenue/Mike's Pike). Although investigations conducted by the USACOE in 1999 were inconclusive, hydrocarbon contamination in the soil and possibly in perched groundwater is expected under the intersection.

### **3.13 SAFETY**

The safety risks associated with the existing study area are typical of almost any urban environment, such as the risks of pedestrian or vehicular accidents. The Rio de Flag and Clay Avenue Wash channels are relatively shallow through most of the study area and they do not pose a significant risk to the public. Rather than describe all potential safety risks within an urban environment such as Flagstaff, the safety baseline condition is described in terms of emergency service providers (e.g., fire stations) that could be affected by project construction.

The City of Flagstaff Fire Department consists of over 75 firefighters working out of six stations in Flagstaff (see Figure 3-8). The Fire Department, which provides fire protection, emergency medical service, hazardous materials response, wildland fire protection, and rescue operations for the City of Flagstaff, also serves other parts of Coconino County through service contracts. In addition to emergency scene operations, the City of Flagstaff Fire Department conducts Emergency Management Planning, Wildland Urban Interface involving wildland fire safety and forest health, construction plans review, and on-site code and standard compliance through fire and life safety inspections.



Source: City of Flagstaff, 1999.



**Figure 3-8**  
**Emergency Responders**

## **4.0 ENVIRONMENTAL CONSEQUENCES**

This section addresses the environmental consequences of Alternatives 6a, 6b, 7, D, and the No Action Alternative. Environmental consequences are addressed in terms of the 13 environmental resource and issue areas described in Chapter 3. For each resource or issue area, this section states the significance criteria used in the impact evaluation, describes the environmental consequences that would be expected to occur under each alternative, and discusses mitigation measures if those impacts would exceed the stated significance thresholds. Environmental Justice (as defined by Executive Order 12898) is addressed in Section 4.7, Socioeconomics. Cumulative impacts are addressed in Section 4.14 and other mandatory NEPA sections are discussed in Sections 4.15 and 4.16. Environmental commitments for the Recommended Plan (Alternative 6b) are summarized in Section 4.17.

### **4.1 TOPOGRAPHY/GEOGRAPHY**

#### **4.1.1 Significance Criteria**

This analysis addresses the potential for an alternative to result in topographic alteration due to grading, excavation, and/or disposal of material. Significant impacts on topography/geology would result from:

- adverse effects on unique geologic features
- disturbance of a geologic feature of unusual scientific value for study or interpretation
- rendering known mineral resources inaccessible
- triggering or accelerating geologic processes such as landsliding or erosion
- substantial alteration of topography.

#### **4.1.2 Impact Assessment**

##### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

###### Topography

###### *Bridge Modifications*

Bridge modifications would occur at Meade Drive, Anderson Road, and Beal Road. The bridges on Anderson Road and Beal Road would be completely replaced, and modifications to the bridge on Mead Drive would involve the installation of wing walls which direct flood flows. These modifications would not substantially alter topography, and there would be no significant impact.

###### *Thorpe Park Modifications*

South of Beal Road along Thorpe Park, 2,000 linear feet of berms and floodwalls would be constructed at a combined maximum height of five feet. Just downstream from the southern floodwall, two small embankments would be used to direct stream flows. In addition to the floodwalls and embankments, Thorpe Road would be elevated five feet to be above the floodwall and avoid the normal channel flows. These modifications would not have a significant impact to the existing topography.

###### *Channel Modifications*

The construction of the modified Rio de Flag and Clay Avenue Wash alignments would not significantly alter the local topography. The majority of the channel alignments would remain the same, although in many areas the modified channel would be slightly wider and deeper than the existing channel. In some locations, the channels would transition to covered channels which would have little demonstrable effects on the local topography. The only location where channel modifications would not follow the existing alignment is where the Rio de Flag crosses the railroad tracks and the new channel would follow on approximation of the Rio de Flag's historic alignment. This new channel would not significantly alter the existing topography, as it would join into an existing remnant of the historic channel

north of Butler Avenue. Based on these factors, impacts on topography from the channel modifications would be less than significant.

#### *Clay Avenue Wash Detention Basin*

The Clay Avenue Wash detention basin would require the construction of three berms to detain flood waters during peak flows along the Clay Avenue Wash. As shown on Figure 2-3, the berms would be located at (1) the northwest corner of the Hidden Hollow Mobile Home area, (2) immediately south of the BNSF railroad embankment, and (3) approximately 700 feet north of the northeast corner of the mobile home park. The berm located adjacent to the mobile homes would be a maximum of 12 feet tall with a crest elevation of 7,072.3 feet above mean sea level. The northwest berm would have a crest elevation of 7,068 feet above mean sea level and would stand up to 10 feet in height. The northeast berm, which would include the outlet structure, would be no taller than 21 feet. The spillway and crest elevations of the northeast berm would be 7,065.6 and 7,072.3 feet above mean sea level, respectively. The berms would “tie-in” to the natural topography.

The topographical alterations required to construct the detention basin would be limited to the erection of the berms described above, neither of which would be considered a substantial alteration of topography.

#### Faulting/Seismicity

Based on historic occurrences, the Flagstaff area is subject to small-to-moderate earthquakes, with some risk of larger, more damaging earthquakes. The Clay Avenue detention basin would be designed and constructed according to applicable seismic safety standards. Given the site-specific geotechnical design parameters that would be incorporated into the proposed embankments, the detention basin would not cause (or incur) significant impacts with regard to faulting or seismicity.

#### Landsliding/Erosion

Construction of the proposed Clay Avenue detention basin embankments could result in impacts relating to localized erosion and soil stability. These potential impacts, however, would be reduced to below the level of significance through the implementation of specific design guidelines and construction

specifications. The proposed detention basin embankments would be designed and constructed so that they would not trigger or accelerate geologic processes such as erosion.

Short-term erosion impacts would be reduced below the level of significance through the incorporation of the mitigation measures described in Section 4.2.3 (Water Resources Mitigation).

#### Unique Geologic Features

The earth resources in the basin area are not uncommon in the regional geologic setting. In the study area, there are no unique geologic features or geologic features of unusual scientific value for study or interpretation; therefore, no adverse effects would occur to such resources.

#### Mineral Resources

As described in Section 3.1.6, there are no known mineral resources of commercial value in the study area. Accordingly, the implementation of Alternative 6a would not prohibit or permanently restrict access to significant mineral resources.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

This alternative includes all of the components described for Alternative 6a; however, Alternative 6b includes a two-block-long covered channel segment extending from Dale Avenue downstream to Birch Avenue. The environmental effects of the bridge modifications and the Clay Avenue Wash channel modifications and detention basin would be the same as described for Alternative 6a. As described for that alternative, no significant impacts would occur with respect to topography/geography as a result of these project components.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The Clay Avenue detention basin and the Clay Avenue Wash and Rio de Flag channel modifications would be the same as for Alternative 6b. Alternative 7 also includes upstream detention basins along

the Rio de Flag at Thorpe Park and Cheshire Park, respectively. The topography/geography impacts associated with the Thorpe Park and Cheshire Park detention basins are discussed below.

### Topography

#### *Thorpe Park*

Construction of the Thorpe Park Detention basin would require approximately 10,000 cubic yards of imported fill material to erect the proposed embankment. The embankment would be located just south of the existing weir at Francis Short Pond and would stand roughly 29 feet in height (as viewed from the foot of the downstream slope). The base of the headwall would remain at the existing ground surface elevation of 6,924 feet above mean sea level, whereas the top elevation of the embankment (crest elevation) would be at 6,943 feet. The embankment would “tie in” to the hillside immediately west of the Flagstaff Junior High School and extend west towards the softball complex. The raised structure would angle toward the southwest for approximately 600 feet where it would terminate near the northeast corner of the Arizona Armory National Guard property (see Figure 2-9). The minor changes in surface contours would not be considered a substantial alteration of topography. No prominent topographic features (i.e., hilltops, ridges, canyons, rock outcrops) would be destroyed, permanently covered, or adversely modified.

#### *Cheshire Park*

The Cheshire Park detention basin would be constructed between Fremont Boulevard and the existing dam. Under this alternative the dam would be removed and a larger detention basin would be excavated. A bypass channel and outlet structure would also be constructed as part of this detention basin. Construction of the detention basin at the park would require the clearing of approximately five acres of land and the excavation of 21,780 cubic yards of soil. This would not cause a substantial change to any prominent topographical features of the area, and it would not be considered a significant topography impact.

### Faulting/Seismicity

As described in Alternative 6a, the Flagstaff area is more susceptible to small-to-moderate earthquakes rather than large damaging ones. The detention basins associated with the two parks would be

designed and constructed according to seismic safety standards; accordingly, the detention basins would not cause (or incur) a significant impact due to seismic activity.

#### Landsliding/Erosion

The detention basins at Thorpe and Cheshire Parks could result in localized soil and slope stability; however, through specific design and construction guidelines these potential impacts would be reduced to less than significant levels.

#### Unique Geologic Features

There are no known unique geologic features or geologic features of unusual scientific value for study or interpretation at the Cheshire Park or Thorpe Park detention basin sites. Therefore, impacts to unique geologic features would not occur under this alternative.

#### Mineral Resources

As described in Alternative 6a, there are no known mineral resources of commercial value in the study area. Therefore, construction of the Thorpe Park and Cheshire Park detention basins would not have a significant impact on the mineral resources in the area.

### **Alternative D: Localized Non-Structural Flood Proofing**

As described for Alternative 7, the design of the proposed berms and embankments are based on site-specific geologic investigations undertaken by the USACOE. The design parameters derived from this information reduce impacts regarding faulting, seismicity, landsliding and erosion below the level of significance. In addition, there are no known unique geologic features, geologic feature of unusual scientific value for study or interpretation, or significant mineral resources located within the footprints of the two proposed berms. Impacts on topography/geography would be less than significant under this alternative.

### **No Action Alternative**

The No Action Alternative would not generate impacts with respect to topography/geography.

### **4.1.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

Potentially significant impacts from erosion would be mitigated to less than significant levels as described in Section 4.2, Water Quality/Hydrology. No other significant impacts to topography/geography would result from Alternative 6a; therefore, no additional mitigation measures are provided.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Potentially significant impacts from erosion would be mitigated to less than significant levels as described in Section 4.2. No other significant impacts to topography/geography would result from Alternative 6b; therefore, no additional mitigation measures are provided.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Potentially significant impacts from erosion would be mitigated to less than significant levels as described in Section 4.2. No other significant impacts to topography/geography would result from Alternative 7; therefore, no additional mitigation measures are provided.

#### **Alternative D: Localized Non-Structural Flood Proofing**

No significant impacts on topography/geography would result from Alternative D; therefore, no mitigation measures are provided.

#### **No Action Alternative**

No impacts to topography/geography would result from the No Action Alternative; therefore, no mitigation measures are provided.

## **4.2 WATER QUALITY/HYDROLOGY**

### **4.2.1 Significance Criteria**

This evaluation describes impacts to surface water and groundwater. Impacts are considered significant if an alternative would cause an exceedance of a water quality standard or the water quality objectives contained in the appropriate state water quality control plan. As described in Section 3.2, the applicable state water quality standards for the study area are contained in the Arizona Administrative Code, Title 18, Chapter 11, “Water Quality Standards.”

### **4.2.2 Impact Assessment**

For any of the project alternatives, the greatest potential for water quality impacts involves turbidity and sedimentation associated with construction and restoration activities. There is also a potential for water quality impacts caused by accidental spills of fuels or solvents during construction. The potential for operation-related water quality impacts (i.e., impacts associated with the inspection, maintenance, and repair of the respective flood control facilities or the temporary detention of water in basins) is nominal and is not further addressed in this section.

These flood control alternatives would generally occur in ephemeral portions of the Rio de Flag and Clay Avenue Wash. As stated in Section 3.2, “Aquatic and Wildlife (ephemeral)” and “Partial Body Contact” water quality standards apply to ephemeral water bodies (Ariz. Admin. Code §R18-11-105). Based on these designated uses, the applicable surface water standards for turbidity are a maximum of 50 nephelometric turbidity units<sup>1</sup> (NTU). Fuel or solvent discharges into surface waters are prohibited by the “Narrative Water Quality Standards” contained in the Arizona Administrative Code (§R18-11-108).

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1 Turbidity is measured by determining how much light is scattered (refracted) by particles suspended within a water column. The instrument commonly used to measure turbidity is called a nephelometer. A light detector is setup to the side of a (source) light beam; more light reaches the detector if there are numerous small particles refracting the source beam than if there are few. The units of turbidity from a calibrated nephelometer are called nephelometric turbidity units (NTU).

**Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

This alternative would entail construction in the Rio de Flag and Clay Avenue Wash channels. At Thorpe Park, construction that could affect the Rio de Flag would include the proposed floodwalls along the eastern bank of the channel, elevation of North Thorpe Road, and construction of two small embankments.

Construction activity has the potential to cause soil erosion and thereby sedimentation and turbidity. Removal of existing vegetation along the eastern bank of the Rio de Flag during construction of the berm and floodwall would increase the erodibility of soils through removal of soil-stabilizing root mass and new exposure of unprotected soils to rainfall and stream flows. In the event that heavy rainfall were to occur while this situation existed, significant erosion-related turbidity and sedimentation impacts would occur. Flagstaff experiences an annual average of 19.8 inches of precipitation, with monthly averages higher than 1 inch for all months except May and June. Accordingly, it is probable that there will be some rain events during detention basin construction. After this riparian vegetation has been restored (see Biological Resources, Mitigation, Section 4.3.3), the potential for erosion-related turbidity impacts would be less than significant.

High stream flows in the Rio de Flag or Clay Avenue Wash could result in erosion and sedimentation impacts during construction of the embankments at Thorpe Park and the downstream channel modifications. Water quality impacts could also occur following construction but prior to establishment of vegetative cover. Once the vegetation has a chance to establish on the embankments and channel sideslopes, the potential for erosion-related turbidity impacts would be less than significant. Mitigation measures are provided to reduce short-term impacts from erosion and sedimentation to less than significant levels.

Fuel and solvent spills or leaks from construction equipment could enter the Rio de Flag or Clay Avenue Wash either directly, in the case of large spills, or indirectly through storm water runoff, resulting in a significant impact to water quality. A fuel or solvent spill could also affect groundwater quality, depending on the volume of the spill.

These potentially significant construction-related impacts would be mitigated to less than significant levels through the measures described in Section 4.2.3.

### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

This alternative includes all of the project components described for Alternative 6a, with the exception that it includes a covered channel segment for approximately two blocks along the downtown reach of Rio de Flag. Impacts would essentially be the same as those described for Alternative 6a, given that the two-block-long covered channel segment would not noticeably alter hydrology or water quality along this reach. Accordingly, potentially significant water quality impacts during construction would be mitigated to less than significant levels.

### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The Clay Avenue detention basin, and the Clay Avenue Wash and Rio de Flag channel modifications for Alternative 7 would be the same as Alternative 6b. Along with these modifications, two additional detention basins would be constructed along Rio de Flag at Cheshire and Thorpe Parks. The hydrology and water quality impacts associated with these two components are described below.

#### Hydrology

The addition of the Cheshire Park and Thorpe Park detention basins would alter hydrologic conditions along the Rio de Flag. Currently, normal flows along the upstream portion of the Rio de Flag (north of Cheshire Park) are detained at the Narrows dam and released through a small outlet structure. (In large events, this on-line detention basin becomes full and flows overtop the checkdam.) Flows continue along the Rio de Flag into Thorpe Park where water enters the Frances Short Pond. When the capacity of the pond pass is exceeded, water flows over the historic weir and into the downtown reach of the Rio de Flag channel.

Under Alternative 7, the Narrows dam would be replaced with an off-line detention basin. A bypass channel would be constructed to the west of the detention basin to convey normal flows. When flows exceed approximately 1,500 cubic feet per second (cfs), water would begin to fill the detention basin through a split-flow weir. When the capacity of the basin is exceeded, water would flow through the basin's outlet structure into the Rio de Flag and join the flows from the bypass channel. Further south, normal flows would traverse the eastern boundary of Thorpe Park through a bypass channel and would

not enter the Frances Short Pond. The Thorpe Park bypass channel would pass to the east of the pond and through an embankment south of the historic weir. Because water would no longer be collected at the Frances Short Pond, the downtown reach of the Rio de Flag would experience more frequent flows. This change in low-flow hydrology would more closely resemble natural conditions; therefore, impacts on hydrology would not be significant.

During major flood events, the two detention basins would fill, thus reducing peak discharge along the Rio de Flag. This alteration of hydrologic conditions would not be significant, because the basins would hold water for no more than 60 hours.

### Water Quality

The Thorpe Park and Cheshire Park detention basins and bypass channels would result in construction-related water quality impacts. Significant erosional impacts would occur if heavy rainfall were to take place during the excavation in or adjacent to the channel. Because there would be an increase in the amount of construction in and around the channel, there would also be a corresponding increase in the potential for construction equipment to spill fuel or solvents. These potential impacts would be mitigated to less than significant levels through the measures described in 4.2.3.

As discussed above, Frances Short Pond would be cut-off from the Rio de Flag. By lowering the surrounding ground level by two feet and maintaining the original water surface elevation of the pond, water would be spread out over a greater area. Accordingly, the area of shallow water would be greatly increased. This would likely result in an increase in wetland vegetation growth along the outer banks and an increase in temperature of the pond. In order to maintain the water level of the pond and adequate water quality, water would be pumped into the system. The pond would be flushed on an annual or semi-annual basis and trash would be removed. Assuming that (1) the water that is pumped into the pond is free of contaminants and (2) the pond is flushed and cleaned on a regular basis, impacts to water quality would be less than significant.

### **Alternative D: Localized Non-Structural Flood Proofing**

Alternative D would entail the construction of berms along the periphery of the floodplain. Because the berms would not be adjacent to the Rio de Flag, the potential for sediment entering the channel as a result of berm erosion is relatively low. Additionally, the berms would be vegetated subsequent to

construction. Based on these factors, erosion and turbidity impacts to surface waters would be less than significant. Fuel or solvent spills, which could be carried into the channel by runoff or infiltrate into groundwater, could result in a significant water quality impact.

### **No Action Alternative**

Under the No Action Alternative, there would be no construction and therefore no potential for construction-related water quality impacts.

### **4.2.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

The following measures would reduce potential water quality impacts to a less than significant level:

- Construction in and along the Rio de Flag and Clay Avenue Wash will cease if and while substantial rain events are predicted or are occurring in the project vicinity. Exposed bare ground will be covered with seed-free loose straw or erosion control matting prior to these events to protect the soil from erosion while construction activities have ceased.
- Bare ground on the construction site will be covered with seed-free loose straw or erosion control matting during the post-construction period prior to establishment of vegetative cover or during periods of prolonged inactivity once the soil surface has been disturbed and bare ground exposed.
- Embankments will be planted with native vegetation as specified in the native species revegetation plan developed by the USACOE and the Flagstaff Arboretum (see Appendix J).
- The Rio de Flag and Clay Avenue Wash channels upstream of construction activity will be dammed temporarily to prevent water from entering the reach under construction should a storm occur. A diversion pipe will be installed in the dam to convey any water around the construction area for discharge downstream of the construction activity.

- Equipment will be in proper working condition and inspected for leaks and drips on a daily basis prior to commencement of work. The USACOE and/or the City of Flagstaff will develop and implement a spill prevention and remediation plan and workers will be instructed as to its requirements. Construction supervisors and workers will be instructed to be alert for indications of equipment-related contamination such as stains and odors. Construction supervisors and workers will be instructed to respond immediately with appropriate actions as detailed in the spill prevention and remediation plan if indications of equipment-related contamination are noted. Construction equipment will only be operated within dewatered areas of the creek.
- Fuels, solvents, and lubricants will be stored in a bermed area so that potential spills and/or leaks will be contained. Soil contamination resulting from spills and/or leaks will be remediated as required by state and/or Federal law. Storage areas will be constructed so that containers will not be subjected to damage by construction equipment.

As mitigated, water quality impacts would be less than significant.

**Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Mitigation for this alternative would be identical to the measures identified for Alternative 6a. As mitigated, impacts would be less than significant.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Mitigation for this alternative would be identical to the measures identified for Alternative 6a. As mitigated, impacts would be less than significant.

**Alternative D: Localized Non-Structural Flood Proofing**

The Localized Non-Structural Flood Proofing Alternative would not result in significant erosion and turbidity impacts; however, significant impacts could result if a fuel or solvent spill occurs during construction. These potential impacts would be mitigated to less than significant levels through the last

two measures identified for Alternative 6a. These are the measures addressing (1) a spill contingency plan and (2) the storage of hazardous materials at the construction site.

**No Action Alternative**

Under the No Action Alternative there would be no water quality impacts and no need for mitigation.

## 4.3 BIOLOGICAL RESOURCES

Impacts to biological resources are described in terms of impacts to vegetation communities, wildlife and wildlife use, threatened and endangered species, and functions of wetlands and “waters of the United States” as described in Section 3.3.

### 4.3.1 Significance Criteria

The impacts of each alternative are discussed in terms of both short- and long-term impacts to biological resources of the study area. Impacts are considered significant if:

- the population of a threatened, endangered, or candidate species is directly affected or if its habitat is lost or disturbed
- there is a net loss in the habitat value of a sensitive biological habitat or area of special biological significance
- the movement or migration of fish or wildlife is impeded
- there is a substantial loss in the population or habitat of any native fish, wildlife or vegetation (substantial loss defined as any change in a population which is detectable over natural variability for a period of five years or longer).

### 4.3.2 Impact Assessment

No significant impacts to any federally listed threatened, endangered, or proposed threatened or endangered species are expected to occur under any of the alternatives. Furthermore, no significant impacts to the movements or migrations of fish or wildlife, and no significant loss in the population or habitat of any native fish, wildlife, or vegetation is anticipated under any of the alternatives.

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

It is highly unlikely that there would be impacts to threatened, endangered, or proposed threatened or endangered species or their habitats under this alternative because no such species are known to occur in or near Clay Avenue Wash and the downtown reach of the Rio de Flag. Furthermore, the vegetation communities along these reaches do not resemble those known to be used for breeding by any

threatened and endangered species. Impacts to vegetation are described below in terms of the project components.

#### Bridge Modifications

The bridge modifications at Anderson Road, Beal Road, and Meade Lane would occur in areas of urban/disturbed habitat where the Rio de Flag channel does not contain wetland or other sensitive vegetation communities. Accordingly, the biological resource impacts associated with these [bridge modifications would not be significant. The bridge modifications would not impact any “waters of the Unites States.”](#)

#### Thorpe Park

Vegetation would be physically removed or crushed beneath construction equipment during the installation of the floodwalls, the elevation of Thorpe Road, and the construction of the two embankments at Thorpe Park. Floodwall construction upstream (north) of Thorpe Road and the elevation of Thorpe Road would affect the Rio de Flag channel, resulting in a temporary impact to approximately 0.3 acre of mixed riparian vegetation. Construction of the floodwall downstream (south) of Thorpe Road and construction of the embankments would not affect wetland or riparian vegetation in the Rio de Flag channel, although it would require the permanent removal of several ponderosa pine trees, including some over 60 feet in height. No old-growth ponderosa pines are associated with this site.

Impacts to wildlife and wildlife use at Thorpe Park would be insignificant for the following reasons: (1) Thorpe Park is in an urban setting with high levels of human activity; (2) current levels of human activity limit wildlife use of the park; and (3) anticipated impacts to vegetation would be minor relative to the amount of vegetation remaining in and adjacent to the park. The loss of 0.3 acre of riparian vegetation would be significant despite these factors due to the sensitivity of this vegetation community and the protection it is afforded under Section 404 of the Clean Water Act.

[As described in Appendix E, the majority of the wetlands in and along the Rio de Flag are classified as riverine intermittent streambed. The loss of wetland functions within this classification would be mitigated to a less than significant level through wetland creation and restoration \(refer to Appendix E for a discussion of the wetland function variables and mitigation requirements\). Considering the overall](#)

net gain of high value wetland habitat as a result of the mitigation, the project would improve the functions and values of the mitigation areas along the Rio de Flag.

Importing soil to Thorpe Park to construct the embankments and the floodwall berms could introduce nonnative weed species into the Rio de Flag system if weed seeds are included in the imported soil. Because invasive weed species frequently out-compete native plant species in highly disturbed areas, invasive weeds are often present at sites where soil is available for export. This potentially significant impact would be mitigated as described in Section 4.3.3.

### Channel Modifications

#### *Downstream of Thorpe Park to Route 66*

As indicated in Figure 3-3 (in Section 3.3), this section of the Rio de Flag is classified as “urban disturbed” because the vast majority of it has been heavily modified and it does not support wetland or riparian vegetation. There is, however, approximately 0.6 acre of mixed riparian and wetland habitat between Bonito Street and Dale Street that would be affected by construction of the open, trapezoidal channel. This impact would be considered significant and would require mitigation. Construction-related impacts to the other (non-wetland or riparian) vegetation present within the channel would not constitute a significant biological resources impact. Approximately 80 to 100 trees that line this section of channel would be removed during construction. These trees consist of a variety of species, including many nonnative ornamental species and numerous mature ash (*Fraxinus* sp.). From a biological resources standpoint, the loss of these trees would not be significant because they occur in a highly urbanized setting and provide limited wildlife use. Following construction, the new, wider channel would be planted with native vegetation. The native vegetation would incrementally improve the Rio de Flag’s natural functions and values through downtown Flagstaff; however, the area’s urban setting would continue to limit the biological resources value of this channel reach.

Impacts to wetland functions would be less than significant after mitigation. The replacement of the 0.6 acres of mixed riparian and wetland habitat with 0.9 acres of high quality riparian wetland habitat along the Rio de Flag would improve the functions of wetlands and “waters of the United States” in the project area.

### *Route 66 to Phoenix Avenue*

From south of Route 66 to Phoenix Avenue (where the Rio de Flag enters a box culvert), water would be diverted into a new channel and approximately 590 feet of the present channel would be abandoned. Within the abandoned channel, approximately 540 square feet of hydrophytic plant species such as cattail (*Typha* sp.) and rush (*Juncus* sp.) would be eliminated. (Hydrophytic plants are those that grow in moist ground, and they generally represent wetland or riparian vegetation). The realignment of this channel section would affect a total of approximately 0.3 acre of habitat, including the hydrophytic vegetation listed above. The realigned channel would be vegetated with wetland and riparian habitat to compensate for this loss. No impacts to exotic poplar (*Poplar* sp.) trees (which provide esthetic screening of the Union Pacific Railroad lines) are anticipated in this reach.

Impacts to wetland functions would be less than significant after mitigation. The replacement of the 0.3 acres of mixed riparian and wetland habitat with 0.45 acres of high quality riparian wetland habitat along the Rio de Flag would improve functions of wetlands and “waters of the United States” in the project area.

### Upstream of Beaver Street to Butler Avenue (Historic Rio de Flag Channel Alignment)

New channel construction would result in impacts to existing vegetation. These impacts would occur (1) where the channel transitions from an open, riprap-lined channel to an underground, concrete-lined channel (upstream of Beaver Street); (2) where the underground channel is constructed south of, and parallel to, the railroad tracks; and (3) at the downstream limits of the channel modifications, where the greenbelt channel would be constructed.

Construction of the transition from an open channel to an underground channel would affect primarily weedy grasses and forbs. These are not sensitive vegetation species and they do not provide high quality wildlife habitat; accordingly, this impact would not be significant. The construction of the underground channel parallel to the railroad tracks would occur in a disturbed, urban environment with little existing vegetation. As with the area upstream of Beaver Street, the vegetation that is present in this area consists primarily of weedy grasses and forbs.

Downstream of underground channel’s terminus, the greenbelt channel would be constructed. The greenbelt channel would connect to an existing remnant section of the historic Rio de Flag channel. In

order to accommodate the construction of the greenbelt channel, approximately three acres of ponderosa pine and mixed riparian vegetation would be affected. The affected vegetation communities are not considered high quality habitat, in large part due to edge effects from surrounding industrial and other urban uses (e.g., the presence of debris, nonnative weedy species, and ground disturbances) and because the lack of storm flows or other surface water in this section of remnant channel severely restricts the survival of riparian species.

The net effect of the channel modifications in this area would be beneficial due to the establishment of the 56-foot-wide greenbelt channel with shallow side slopes. The greenbelt would be vegetated with native species, and it would receive storm flows from its connection to the existing Rio de Flag channel (via the underground channel parallel to the railroad tracks). This would more than offset the impacts associated with the greenbelt channel's construction.

#### Sinclair Wash

Under this alternative, flows associated with stormwater runoff in the present Rio de Flag channel near its confluence with Sinclair wash would be reduced as a direct result of flows in the Rio de Flag being diverted into a new channel (i.e., the channel following the approximate historic channel of the Rio de Flag adjacent to the railroad tracks). However, no significant impacts to the riparian vegetation downstream of the point of diversion are anticipated to result for the following reasons: (1) the existing Rio de Flag channel would still receive some storm flows, including flows from Sinclair Wash and local drainages, and (2) this section of the existing Rio de Flag channel is typically dry under present conditions, and vegetation associated with the wash is therefore adapted to long periods with little or no surface flow.

#### Clay Avenue Wash Detention Basin To Mike's Pike

Channelization of Clay Avenue Wash would occur in areas with disturbed vegetation (or areas lacking vegetation). Between Blackbird Roost and Milton Street, approximately 0.4 acre of disturbed riparian and wetland habitat would be replaced with a concrete-lined channel (including both open and underground channel). This loss of habitat would be considered significant for two reasons: (1) lining a drainage channel with concrete incrementally reduces its natural functions and values, and (2) riparian and wetland habitat are generally protected under Section 404 of the Clean Water Act. [The conversion of 0.4 acres of habitat to a concrete-lined channel would also contribute incrementally to a](#)

loss of the Rio de Flag's natural functions as values. This incremental loss would be mitigated through wetland habitat restoration and creation elsewhere along the Rio de Flag. As mitigated, impacts to biological resources would be less than significant.

#### Clay Avenue Wash Detention Basin

Approximately 2.5 acres of second-growth ponderosa pine woodland and 1.9 acre of mesic montane meadow vegetation would be removed for the construction of the detention basin's three embankments. No old-growth ponderosa pines are associated with this site. Impacts to the ponderosa pine forest would not be significant due to the relative abundance of this habitat type in the area, because it is not critical habitat for threatened or endangered species, and because its loss would not impede the migration of wildlife. The impacts to the mesic montane meadow vegetation would not be considered significant for similar reasons.

Periodic flooding may temporarily prevent access by wildlife to approximately 71 acres of montane meadow grasslands and ponderosa pine forest (i.e., habitat located within the 100-year ponding limits of the detention basin). Wildlife that may be temporarily impacted through loss of access to forage plants or small mammal prey species include deer, elk, coyote, and fox. Due to the short duration of flooding (less than 60 hours of water storage following the 100-year flood), impacts on these wildlife species are not likely to be significant.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Impacts associated with this alternative would be identical to those described for Alternative 6a, except that approximately two blocks of the Rio de Flag channel would be converted into an underground concrete arch. As a result, approximately 0.4 acre of channel (i.e., channel bottom and side slopes) would be changed from an earthen to a concrete-lined channel. Although the affected channel section does not support wetland or other sensitive habitat, its conversion to a concrete-lined channel would contribute incrementally to a loss of the Rio de Flag's natural functions as values. This incremental loss would be mitigated through wetland habitat restoration and creation elsewhere along the Rio de Flag. As mitigated, impacts to biological resources would be less than significant.

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### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The biological resource impacts of Alternative 7 would be the same as those occurring under Alternative 6b, with the exception of additional short- and long-term impacts at the potential Cheshire Park and Thorpe Park detention basin sites. It is highly unlikely that there would be significant impacts to threatened, endangered, or proposed threatened or endangered species or their habitats under this alternative. No such species are known to occur in or near the proposed detention basins. Furthermore, the vegetation communities in the basins do not resemble those known to be used for breeding or foraging by any threatened and endangered species. Due to the anticipated short period of basin inundation, the movements of fish and wildlife would not be impeded under this alternative. Impacts to vegetation at the detention basin sites are described below.

#### Cheshire Park

Long-term impacts would include the physical removal of approximately 1.6 acres of ponderosa pine woodland, 0.8 acres of small riparian willows, 0.3 acres of montane meadow grasslands, and 0.3 acres of wetland vegetation. The loss of riparian willows and wetland vegetation would be considered significant due to the sensitivity of these vegetation communities and the protection they are afforded under Section 404 of the Clean Water Act. Impacts to montane meadow grasslands and ponderosa pine woodland would not be significant because of the low sensitivity of these habitats and because of the relatively small area of impact in comparison to the large amounts of similar habitat in the vicinity of Flagstaff.

Short-term impacts would be limited to displacement of wildlife use resulting from project construction activities. Wildlife that may be temporarily impacted through loss of access to forage plants or small mammal prey species include deer, elk, coyote, fox, and numerous bird species including raptors such as American kestrel, red-tailed hawk, and great-horned owl.

After project construction, use by wildlife of the area would be expected to return, however, not to a level equal to pre-construction conditions. The reduction in wildlife use would be associated with the increased human presence resulting from additional passive recreation features (such as trails and picnic tables) that would be located in the area following detention basin construction. Additionally, it could take several decades for ponderosa pines and other trees planted in the basin to reach maturity. This

loss of use would not be considered significant because the site does not provide habitat for threatened or endangered species and because of the prevalence of similar habitats available in nearby less urbanized areas.

### Thorpe Park

The excavation of a detention basin at Thorpe Park and the associated construction of a bypass channel and embankment would result in the temporary elimination of virtually all wetland and riparian habitat along the Rio de Flag at Thorpe Park. A total of approximately 1.2 acres of riparian and wetland habitat would be removed from the Rio de Flag channel during construction. In addition, all of the wetland habitat in and along Frances Short Pond would be affected. The vegetation loss along the Rio de Flag channel would be considered permanent because the existing channel would be realigned to the east; thus, the existing channel vegetation would be cut off from future flows. The impacts to wetland vegetation at Frances Short Pond would be temporary because, following construction, the pond would be wider and shallower at the banks. These conditions would actually encourage the growth of more wetland vegetation than is currently located at the pond. Both the temporary and permanent impacts to wetland and riparian vegetation at Thorpe Park would be considered significant and would require mitigation.

In addition to the loss of wetland vegetation, construction-related impacts to Frances Short Pond would likely include fish kill and loss of potential nesting habitat for several bird species. The fish stocked in the pond are not sensitive native species, and their loss would be offset because the pond would be restocked with fish following construction. The loss of nesting habitat would be mitigated as described in Section 4.3.3.

Construction of the detention basin features would require the removal of approximately 350 trees, including approximately 280 mature ponderosa pines and numerous willows. A large snag (dead tree) designated as a “wildlife tree” by the U.S. Fish and Wildlife Service (USFWS) would also be removed. As described for Alternative 6a, the trees at Thorpe Park provide only limited wildlife value, in large part because of the high level of human activity at the park. As a result, the loss of 350 trees would not constitute a significant biological resource impact. (The human value placed on these trees is reflected in the assessment of recreation impacts in Section 4.6 and the assessment of esthetic impacts in Section 4.11). Because of the wildlife tree’s USFWS designation, its loss would be considered significant

despite the level of human activity at the park. Mitigation is provided to reduce this impact to a less than significant level.

Similar to Alternative 6a, importing fill to Thorpe Park could introduce a source of invasive nonnative weed seeds. This impact would be mitigated as described in Section 4.3.3.

Incorporation of the mitigation measures identified for this alternative would reduce the biological resource impacts to a less than significant level.

#### **Alternative D: Localized Non-Structural Flood Proofing Alternative**

No significant impacts to federally listed threatened, endangered, or proposed threatened or endangered species or their habitats would occur under this alternative. Furthermore, there would be no impacts to the movement or migration of fish or wildlife. Under this alternative, there would be no channelization or detention basin construction and thus no long-term impacts to wetland or riparian vegetation as detailed for the previous three alternatives.

Short-term impacts under this alternative would be limited to the Continental Estates area where the levees would be constructed. Disturbances would be limited to disturbed/urban habitats (e.g., golf courses) and to montane meadow grasslands. Because these earthen levees would be landscaped pursuant to the native plant revegetation plan developed by the USACOE in consultation with the Arboretum at Flagstaff, the net effect of the berms on habitat would be nominal. Additionally, no federally-listed threatened, endangered, or proposed threatened or endangered species regularly utilize these habitats in the proposed berm locations (which are generally near residences or commercial structures). Based on these factors, the biological resource impacts of the berms would be insignificant.

#### **No Action Alternative**

Under this Alternative, there would be no impacts to vegetation communities, wildlife and wildlife use, or to federally-listed threatened, endangered, or proposed threatened or endangered species. Furthermore, there would be no loss of habitat value for any federally-listed species and no impediments to the movement of fish or wildlife.

### 4.3.3 Mitigation Measures

This flood control project requires construction in and around existing drainage features; therefore, complete avoidance of “waters of the United States” and other sensitive habitats would be impossible. In consideration of the project’s hydrologic, economic, environmental, and technical considerations, however, the USACOE has undertaken all possible measures to avoid and minimize impacts to biological resources. For example, the layout of the floodwalls along the east side of Thorpe Park was modified during the plan formulation process for Alternatives 6a and 6b to avoid all but 0.3 acres of riparian and wetland habitat. Additionally, channel modifications along the Clay Avenue Wash and Rio de Flag would result in a only 0.8 acres of permanent impacts to highly disturbed mixed riparian and wetland habitat. Where temporary and permanent impacts to wetlands are unavoidable, compensatory mitigation measures are provided.

#### **Alternative 6a**

Mitigation for Alternative 6a would be required for the temporary impacts to wetland and riparian habitat associated with construction of the floodwalls and the elevation of Thorpe Road, the loss of hydrophytic vegetation south of Route 66, and impacts to disturbed wetland habitat within the Clay Avenue Wash channel. These impacts would be mitigated as described below:

- on-site restoration at a 1:1 ratio and off-site habitat creation at a 1:2 ratio for the 0.3 acre of riparian vegetation temporarily affected by the floodwalls and road elevation at Thorpe Park (for 0.45 acre of mitigation total)—the off-site creation of 0.15 acre of habitat will be accomplished prior to construction to compensate for temporal habitat losses
- on-site restoration at a 1:1 ratio and off-site habitat creation at a 1:2 ratio for the temporary impacts to 0.6 acre of wetland and riparian habitat between Bonito Street and Dale Street (for 0.9 acre of mitigation total)—the off-site creation of 0.3 acre of habitat will be accomplished prior to construction to compensate for temporal habitat losses
- creation of habitat at a 1.5:1 ratio for the 0.3 acre of temporary impact between Route 66 and Beaver Street (for 0.45 acre of mitigation total)—at least 0.15 acre of habitat creation will be accomplished off site prior to construction to compensate for temporal habitat losses

- creation of wetland habitat at a 1.5:1 ratio for the 0.4 acre of impact along Clay Avenue Wash (i.e., creation of 0.6 acre of habitat), which reflects that while the impact in this location would be permanent, the affected habitat is highly disturbed and has a correspondingly low resource value.

Thus, the total mitigation for Alternative 6a will be 1.2 acres of on-site restoration at Thorpe Park and in the Rio de Flag Channel, with an additional 1.2 acres of habitat creation. Subject to the timing constraints identified above, and to the extent feasible, the additional habitat creation for the channel modifications downstream of Thorpe Park and along Clay Avenue Wash will be accomplished in the realigned Rio de Flag channel between Route 66 and Beaver Street. If the realigned channel in this area cannot accommodate all of the required wetland and riparian habitat creation, the additional mitigation will be provided in the greenbelt channel or immediately downstream from the greenbelt channel in the remnant historic channel.

In addition, mitigation will be required to minimize the potential for introducing nonnative weed species into the Rio de Flag system. This will be accomplished by maximizing the reuse of soil excavated from the Rio de Flag channel modifications to cover riprap in the channel and to construct berms and embankments. By reusing soil that is already within the system, the potential for introduced weed seeds will be reduced. Where imported soil is necessary, preference will be given to soil from sites with minimal invasive weed species. The native plant revegetation plan developed by the USACOE in consultation with the Arboretum at Flagstaff contains post-construction monitoring and maintenance requirements for revegetated areas, including exotic species management measures (see Appendix J). Limiting the importation of potentially weedy soil to the Rio de Flag system and fostering the growth of native plant species will minimize the potential for invasive weed species to become established as result of this alternative.

As mitigated, the biological resource impacts of Alternative 6a would be less than significant.

### **Alternative 6b**

The mitigation required for Alternative 6b would be identical to that required for Alternative 6a, with the addition of the following measure to compensate for the conversion of approximately two blocks of earthen channel to an underground concrete-lined arch:

- wetland habitat creation at a ratio of 1.5:1 for the 0.4 acre of impacts (0.6 acre total), which reflects that this will be a permanent conversion of the affected area to concrete-lined channel.

With this addition, the total mitigation for Alternative 6b will be 1.2 acres of on-site restoration at Thorpe Park and in the Rio de Flag Channel, with an additional 1.8 acres of habitat creation. Subject to the timing constraints identified above, and to the extent feasible, the additional habitat creation for the channel modifications downstream of Thorpe Park and along Clay Avenue Wash will be accomplished in the realigned Rio de Flag channel between Route 66 and Beaver Street. If the realigned channel in this area cannot accommodate all of the required wetland and riparian habitat creation, the additional mitigation will be provided in the greenbelt channel or immediately downstream from the greenbelt channel in the remnant historic channel. The mitigation measures identified for Alternative 6a regarding the introduction of nonnative weed species during soil import also apply to Alternative 6b.

As mitigated, the biological resource impacts of Alternative 6b would be less than significant.

### **Alternative 7**

Alternative 7 would require the same mitigation as Alternative 6b for impacts downstream of Thorpe Park and along Clay Avenue Wash. Additional mitigation would be required for impacts to wetland and riparian habitat at Cheshire Park and Thorpe Park, as described below.

- in-kind habitat creation at a 1.5:1 ratio for impacts to approximately 0.8 acre of small riparian willows and approximately 0.3 acre of wetland vegetation at Cheshire Park (for a total of 1.65 acres of habitat creation)
- in-kind habitat creation at a 1.5:1 ratio for approximately 1.2 acres of impacts to wetland and riparian habitat along the Rio de Flag channel at Thorpe Park (for a total of 1.8 acres of habitat creation)
- on-site restoration at a 1:1 ratio for the wetland and riparian habitat impacts to Frances Short Pond

- replacement on-site of the USFWS-designated “wildlife tree” (snag) near its current location at Thorpe Park (because the tree is dead, it could be cemented or anchored to the ground by other means).

In addition, detention basin excavation at Thorpe Park will be started before April 1 or after May 31 to avoid impacts to nesting birds at Frances Short Pond.

Wetland and riparian (including willow) habitat creation will first be accomplished on-site at the new Rio de Flag bypass channel segments created at Cheshire Park and Thorpe Park, respectively. This will include replacing the willows removed during construction with new willows using a pole planting technique. Habitat creation requirements that cannot be accommodated along the Rio de Flag bypass channels at Cheshire or Thorpe Park will be met through wetland and riparian habitat creation at the I-40 wetlands. This will keep the created habitat within the Rio de Flag system and it will also help ensure that the habitat is located in an environment conducive to its long-term survival.

As mitigated, the biological resources impacts of Alternative 7 would be less than significant.

#### **Alternative D: Localized Non-Structural Flood Proofing Alternative**

This alternative would not result in significant biological resource impacts and would not require mitigation.

#### **No Action Alternative**

This alternative would not result in significant biological resource impacts and would not require mitigation.

## 4.4 CULTURAL RESOURCES

### 4.4.1 Significance Criteria

Adverse effects to sites and properties listed on, or eligible for, the National Register of Historic Places (National Register) are evaluated based on the *Criteria of Adverse Effect* as outlined in 36 Code of Federal Regulations (CFR) 800.5 of the regulations implementing Section 106 of the National Historic Preservation Act (NHPA). These regulations were recently amended and became final in June 1999. The *Criteria of Adverse Effect* is as follows:

An adverse effect is found when an undertaking may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. Adverse effects on historic properties include, but are not limited to:

- (i) Physical destruction of or damage to all or part of the property;
- (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;
- (iii) Removal of the property from its historic location;
- (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- (v) Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- (vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- (vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

#### **4.4.2 Impact Assessment**

##### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

###### Bridge Modifications

Impacts to the wingwall at Meade Lane and the Anderson Road and Beal Road bridges are not known at this time. A cultural resources survey of these three locations will need to be done if Alternative 6a is selected.

###### Thorpe Park Modifications

The Thorpe Park location area has been completely developed for recreation. Three artifacts (mano, biface frag, and groundstone axe) found in the area of the northernmost softball field suggest a prehistoric archeology site that may have been graded away during its construction. Otherwise, no potentially eligible cultural resources have been identified in this location.

###### Channel Modifications

###### *Clay Avenue Wash from the Detention Basin to Mike's Pike*

This reach along Clay Avenue Wash was surveyed by the USACOE for cultural resources and was found to be negative. There will be no impacts to historic properties along the channel alignment between the historic railroad bridge at the channel's western terminus and Mike's Pike.

###### *Thorpe Park to Upstream of Beaver Street*

This alignment has been surveyed twice, once for the historic building surveys in the 1970s and again in 1998 by the USACOE. Alternative 6a requires removal of three houses that are located at 314 Sitgreaves Street, and 311 and 314 West Cherry Street. They are within the boundaries of the Flagstaff Townsite Historic District but are not listed as contributing elements to the District.

### *Mike's Pike Alignment*

No impacts are expected due to the alignment being comprised of an underground channel within the footprint of the roadway; however, eight National Register-listed properties are on the periphery of the Mike's Pike right-of-way. They are:

- C&M (Double circle) Garage - 204 Mike's Pike
- E. T. McGonigle house/B&M auto camp - 100 S. Mike's Pike
- Gavin/Hensing rental house - 37. S. Mike's Pike
- Mary A. Gavin's rental houses at 31-35 S. Mike's Pike
- an unnamed house at 17 S. Mike's Pike.

An additional building, the Flagstaff Steam Laundry, is at the southwest corner of Mike's Pike and Phoenix Avenue at 210 W. Phoenix Avenue. These historic buildings are all listed as contributors to the Southside/Oldtown Historic District. If construction remains within the specified corridor, these historic properties would not be affected.

### *Upstream of Beaver Street to Butler Avenue*

No impacts are expected in the reach; however, two historic resources within the southern extent of the Railroad Addition Historic District Extension are very close to the proposed alignment. The proposed underground realignment of the channel will narrowly avoid affecting the historic Flagstaff Lumber Company Warehouse at 23 South San Francisco Street and the Northern Motor Company building on the corner of San Francisco and Phoenix streets.

### Clay Avenue Wash Detention Basin

The existing ranch house complex at the southwestern side of the detention basin will need to be evaluated for its eligibility for inclusion in the National Register. Three of the buildings were built in 1935, 1944, and 1954 respectively. Current project design indicates potential inundation of the ranch complex during a 100-year event. Also within the basin's 100-year ponding limit are six other unevaluated resources. At the point where the channel opens into the easternmost end of the detention basin lies the former Atlantic and Pacific railroad alignment with abandoned railroad bridge abutments. The bridge, built in 1883 from the local Coconino Sandstone, was abandoned in 1937 when the

Atchison, Topeka, and Santa Fe (A.T. & S.F.) Railroad purchased the tracks and realigned them 50-meters north. Continuing west there are two historic trash scatters composed primarily of cans, barrels, and miscellaneous rusted automobile parts. Between the two trash scatters is a historic trail remnant with a trail marker comprised of a rock pile. There are two additional historic resources on the private property portion of the detention basin. One is the obliterated remains of a small 1930s- to 1940s- era cabin, and the other is a small trash scatter.

A request for a determination of eligibility for the railroad bridge was submitted to the Arizona State Historic Officer (SHPO) in a letter dated July 23, 1999. SHPO responded with a concurrence of the USACOE's determination on September 15, 1999. With the exception of the Railroad Bridge, no other resources have been evaluated for National Register eligibility. They probably are not eligible for the National Register; however, impacts to these historic features would be less than significant even if they are determined to be eligible. Short term inundation would not greatly degrade them any more than natural weathering already has.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

This alternative includes all of the components described for Alternative 6a; however, Alternative 6b includes a two-block-long covered channel segment extending from Dale Avenue downstream to Birch Avenue. Alternative 6b would avoid taking the three houses at the Sitgreaves Street and Cherry Avenue locations. The significant culture resource impacts of Alternative 6b would be the same as described for Alternative 6a.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

This alternative is the same as Alternative 6b except that it also includes the Thorpe Park and Cheshire Park detention basins.

#### **Cheshire Park Detention Basin**

At the southeastern end of the APE the Narrows dam defines the terminus of the proposed detention basin. Much of the area north and west of the Narrows dam is undisturbed. A narrow foot trail runs

diagonally through the property running northeast to the southwest. A utility pole has been recently placed in the ground near the trail. A small chert side scraper was found near the utility pole with a few pieces of chert debitage. There is no way to formally ascribe the debitage to prehistoric activity because it (1) was located in the path of vehicle tracks associated with installation of the poles and (2) student flint knappers from the Harold S. Colton research Center have apparently been leaving evidence of their activities throughout the area. The scraper was recorded as an isolated find. A small site, AZ:I:3112 (MNA), had been recorded by the Museum of Northern Arizona in 1977. However, the site was only a 10 feet by 10 feet cleared area where a cabin may have once stood. There was no physical evidence of anything structural. The Cheshire Park geological setting is comprised almost solely basalt bedrock. This largely precludes the potential for subsurface archeological deposits.

The Narrows dam does not appear to be eligible for listing in the National Register of historic Places. The archeological materials from the area east of the dam are insufficient to make any meaningful statements, and are thus, considered to be ineligible as well.

#### Thorpe Park Detention Basin

The Thorpe Park detention basin location area has been completely developed for recreation. Three artifacts (mano, biface frag, and groundstone axe) found in the area of the northernmost softball field suggest a prehistoric archeology site that may have been graded away during its construction. Otherwise no potentially National Register eligible cultural resources have been found in the baseball field location.

Two small historic buildings are located on the western side of the access road/weir. One is a log cabin and the other is a small building constructed from river cobbles. Boy Scouts moved the log cabin, built in 1895, to that location in 1978 from the Veit Ranch on the San Francisco Peaks. The cabin was moved in pieces for educational use by the Flagstaff Middle School. The cobble stone building was built by the city when City Park (now Thorpe Park) was completed in 1923. It is now used for storage of maintenance equipment. Neither of these structures has been evaluated for National Register eligibility. Both buildings fall within the limits of grading for the embankment.

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### **Alternative D: Localized Non-Structural Flood Proofing**

There would be no cultural resource impacts expected for this alternative. This conclusion is derived from the fact that the area is recently developed. However, if this alternative is selected, a cultural resources survey of the affected area would be conducted.

### **No Action Alternative**

Under the No Action Alternative there would be potentially significant effects to several potentially National Register-eligible structures in the City of Flagstaff. Periodic flooding that would continue to occur would damage these structures' structural and historic integrity. It is probable that over time damage would reach a threshold where their characteristics, which would qualify them for the National Register, would no longer have sufficient integrity.

### **4.4.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

The three houses that would be taken for construction of this alternative are not listed as contributors to the Flagstaff Historic District. There are no other impacts in the open channel segment of the Rio de Flag modifications.

Along Clay Avenue Wash impacts to the railroad bridge from floodwaters would be less serious than when it was built in 1883. Based on its placement on the natural drainage, the bridge abutment will allow the passage of floodwater. It will thereby continue to function as originally intended. However, because an outlet structure is proposed west of the bridge, water flows will be significantly reduced below historic levels. Scheduled release rates will be at lower levels than the without-project condition. The outlet structure is designed to be anchored to the railroad bed approximately 250 feet west of the bridge abutments. The railroad bed was recorded in 1996 as part of the remaining Atlantic and Pacific Railroad Bridge system (AZ:I:14:334). Anchoring the outlet structure into it will constitute an impact, albeit a minor one. Mitigation would be expected to be limited to Historic American Engineering Record (HAER) recordation of the bridge.

**Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Mitigation measures for the Clay Avenue Wash Detention Basin would be the same as Alternative 6a.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Dale and Birch Avenues)**

Mitigation measures for the Clay Avenue Wash Detention Basin would be the same as Alternative 6a. In the absence of National Register eligible cultural resources, Cheshire Park Detention Basin does not require any mitigation. The two unevaluated buildings in Thorpe Park need to be evaluated and if they are determined to be eligible for the National Register mitigation may be required. Mitigation would probably be Historic American Building Survey (HABS) recordation. No mitigation is required along any of the channels. Since impacts to the wingwall at Meade Lane and the Anderson Road and Beal Road bridges are not known at this time, no mitigation measures are recommended.

**Alternative D: Localized Non-Structural Flood Proofing**

No significant impacts are anticipated under this alternative; therefore, no mitigation is required.

**No Action Alternative**

Continued flooding could result in potentially significant effects to several potentially National Register-eligible and eligible structures in the City of Flagstaff. Mitigation for these impacts would normally be to protect the structures from flooding. However, implementing a flood control project would not be considered mitigation for the No Action Alternative; instead, the provision of flood protection is represented by project Alternatives 6a, 6b, and 7. Therefore, no mitigation measures are provided.

## 4.5 LAND/WATER USE

### 4.5.1 Significance Criteria

The analysis of land use impacts addresses: (1) the compatibility of the alternatives with existing and planned land uses in and around the study area and (2) the conformance of the alternatives with local land use plans. Impacts are considered significant if the alternative results in permanent physical impacts related to either land use compatibility or conformance with adopted plans.

### 4.5.2 Impact Assessment

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

##### Existing Land Use

Existing land use impacts are addressed with regard to how this alternative will affect those land uses in and around the proposed flood control structures. As discussed in the Section 2.2.1, Alternative 6a would improve flood protection along the Rio de Flag and Clay Avenue Wash. This increased flood protection would be considered a beneficial impact to existing land uses, particularly in the downtown area. Impacts associated with the displacement of residents by flood control facilities are addressed separately in Socioeconomics (Section 4.7).

##### *Bridge Modifications*

The construction of wingwalls at the Meade Lane bridge and the replacement of the Anderson Road and Beal Road bridges would have a negligible effect on existing land uses.

##### *Thorpe Park Modifications*

Under Alternative 6a, the structural modifications at Thorpe Park would include floodwalls along the eastern park boundary, two small embankments south of the existing weir, and elevation of North Thorpe Road by approximately five feet. The historic weir at Frances Short Pond would not be replaced or modified. The proposed flood control features would be compatible with existing land

uses, including the residences to the east of the park. The floodwalls would replace existing fences along the adjacent property boundaries and would not exceed five feet in height; therefore, impacts to existing land uses would be less than significant.

The effect of the project components on traffic circulation and visual resources (including views from the neighboring residences) is described in Section 4.8 and 4.11, respectively.

### *Channel Modifications*

*Thorpe Park to Upstream of Beaver Street.* Under Alternative 6a, an open, buried riprap channel would be constructed from Bonito Street to just upstream of Beaver Street. Construction of the channel would require private property acquisition in the downtown area including three residences on the west side of the Rio de Flag between Dale Avenue and Cherry Avenue. The modified channel would pass within 30 feet of several other residences between Cherry Avenue and Birch Avenue. Further south, the proposed riprap channel would pass within 20 feet of City Hall and 60 feet of the Flagstaff Public Library.

Construction of this channel segment would result in a negative impact on existing land uses, but it would not be considered a significant land use impact. The acquisition and removal of three homes would result in significant socioeconomic impacts (see Section 4.7); however, the loss of these homes would not significantly alter the overall residential land use pattern of this area and the modified channel would not conflict with the remaining surrounding land uses. The channel would continue under Route 66 and, once the alignment crosses the railroad tracks, it would parallel the tracks north of Phoenix Avenue. The riprap channel would pass through a currently open disturbed lot and would replace the northern half of a city-owned paved parking lot north of Phoenix Road between Beaver Street and Milton Road. As it continues downstream towards Beaver Street, the alignment would displace a small portion of another city parking lot. This portion of the alignment would adversely effect existing land uses because it would change a land use previously dedicated to public parking to a flood control facility. This impact would not be considered significant because the parking spaces removed would be replaced in the immediate vicinity. Transportation impacts resulting from temporary road closures and the loss in parking spaces are discussed in Section 4.8.

*Clay Avenue Wash Detention Basin to Mike's Pike.* No channel modifications would take place along the Clay Avenue Wash from the proposed detention basin downstream to the west side of the

Chateau Royale Mobile Homes. Channel modifications would begin at the west end of the Chateau Mobile Home Park (just north of Chateau Drive) along the existing wash and would continue downstream to Mike's Pike. Construction would occur just north of the Chateau Mobile Homes Park and would displace up to 15 mobile homes at the adjacent mobile home park further downstream (at the intersection of Blackbirds Roost and Chateau Royale). The channel modifications would continue past the University Roost Apartment complex and would pass between several commercial and institutional uses (e.g., McCracken Place and the Greyhound Bus Station). The channel would pass just south of City Fire Station No. 1 and north of the Motel Canyon Inn before entering the "Five-Points" Intersection. (i.e., the intersection of Route 66, Milton Road, Butler Avenue, Mike's Pike and Clay Avenue).

For this reach, the proposed channel modifications would follow the existing Clay Avenue Wash alignment. Impacts on existing land use would occur in those areas where the proposed channel would occupy a greater area than the existing channel. Although the majority of the channel would be widened with the addition of a service road, impacts to structures would be limited to those occurring at the mobile home park described previously. The remaining portions of this reach would impact existing undeveloped areas or would stay within the confines of the existing channel alignment.

The proposed riprap channel would enter the mobile home park just east of the Chateau Royale Mobile Homes. The channel would displace 12 mobile homes in the northern portion of the mobile home park and would isolate an additional three homes. Although not within the limits of grading, these three mobile homes would be removed because they would be inaccessible and set apart from the remaining homes on the south side of the channel. A total of 15 mobile homes at the mobile home park would therefore be removed under this alternative.

The conversion of 15 mobile homes to a flood control channel would be a negative impact on existing land uses, but would not be considered significant. The loss of the mobile homes would not significantly alter the overall residential land use pattern of this area, and the modified Clay Avenue Wash channel would not conflict with the remaining surrounding land uses. (The impacts to the residents of those mobile homes are considered socioeconomic, not land use, impacts. The significant socioeconomic impacts to those residents are addressed in Section 4.7.)

*Mike's Pike Alignment.* There are currently twelve commercial/retail facilities and six residential units located along Mike's Pike between Milton Road and Phoenix Avenue. These land uses would not be

significantly impacted because site access would be maintained throughout construction of the underground channel (see Section 4.8, Transportation). Upon construction of the Clay Avenue Wash channel under Mike's Pike, the road would be returned to its pre-construction condition.

*Upstream of Beaver Street to Butler Avenue.* The channel improvements along this reach would involve the construction of a covered channel that transitions to an open greenbelt channel just north of South Colorado Street. The covered channel would be constructed within the railroad right-of-way immediately north of several commercial/industrial buildings on Phoenix Avenue. The greenbelt channel would extend through a currently undeveloped area and connect with the historic Rio de Flag channel near the Butler Avenue crossing (see Figure 2-1). A covered arch would be constructed at the Butler Avenue crossing, replacing the existing culverts under the road.

Construction of the covered channel may result in temporary inconveniences at some of the adjoining properties (e.g., noise, air quality), but no impacts on existing land use would be expected. Upon completion, the railroad right-of-way would be returned to its pre-construction condition. The greenbelt channel would not conflict with existing land uses because it would replace an undeveloped dirt corridor south the railroad tracks and would be contained within the historic Rio de Flag alignment. Traffic impacts associated with construction of the concrete arch under Butler Avenue are discussed in Section 4.8. Land use impacts would be less than significant.

#### *Clay Avenue Wash Detention Basin*

The flood control modifications for the Clay Avenue Wash detention basin include the construction of three embankments (see Figure 2-3). The proposed detention basin is situated in a primarily undeveloped area on the western outskirts of the Flagstaff. The basin area is bordered by the railroad tracks to the immediate north, the Hidden Hollow Mobile Homes and open space to the east, Historic Route 66 to the south, and the Coconino National Forest to the west. In a more regional context, the basin area is surrounded by the Coconino National Forest to the north, south, and west and sparse residential development to the east (mainly mobile home parks).

There are only three structures located within the 100-year water storage limit of the proposed basin. These structures are associated with a small ranch located in the southern portion of the proposed basin, just north of Historic Route 66 (see Figure 2-3). The significant cultural resource and socioeconomic impacts associated with the flooding of this structure are discussed in Sections 4.4 and

4.7, respectively. From a land use standpoint, however, the flooding or demolition of one ranch complex at the outskirts of the city limits would not represent a significant impact. This assessment is based on the fact that the majority of this property would remain its current state (i.e., undeveloped) if the site is used as a detention basin.

The proposed embankments at the Clay Avenue Wash detention basin would be compatible with the existing land uses in the area. The berms would occupy existing open space and would not affect the use of neighboring residential properties; accordingly, no existing land use compatibility impacts would result.

### Planned Land Use

Local jurisdictions regularly adopt land use plans and ordinances to guide growth in an orderly and consistent manner. The objective is the creation of a land use pattern that provides for balanced development which reflects proper consideration of the range of economic, environmental, fiscal, social, and other needs. While Federal actions are typically not subject to local jurisdictions' land use plans, these local plans do provide a basis for determining if the respective Federal action(s) would result in planned land use impacts.

The following language from the City's *Growth Management Guide 2000* (GMG 2000) (City of Flagstaff 1987) is important in understanding the planned land use designations described later in this section and in the evaluation of impacts.

The Land Use Plan [of the Growth Management Guide] designates recommended land use patterns. For this reason, the designations are by density ranges or by land use types, not by specific zoning categories...The Land Use Plan functions as the development guide by identifying compatible land uses within a given area. Specific proposals are not automatically compatible with surrounding development simply because they fall within a broad land use designation. Rather, such factors as scale of the proposal, the intensity of the specific use, the probability of alternative development on the site, the proposal's influence on traffic patterns and the physical environment, and its economic and fiscal impact to the local community and the City as a whole must be weighed when a land use decision is to be made.

Implementation of the this alternative would provide 100-year flood protection along portions of the Rio de Flag and Clay Avenue Wash and this would represent beneficial effect to the City of Flagstaff. Structures that were previously subjected to severe flood damage would no longer be at risk, and new

developments could be built without accommodating FEMA requirements for the 100-year flows. The majority of these benefits would be realized in social and economic terms, and they would not be considered land use impacts.

#### *Bridge Modifications*

The replacement of the Anderson Road and Beal Road bridges and the construction of wingwalls at the Meade Lane bridge would have a negligible effect on planned land uses.

#### *Thorpe Park Modifications*

The proposed floodwalls, embankments and road elevation would not significantly affect planned land uses in the vicinity of Thorpe Park. These flood control features would be located on land identified in the GMG 2000 as PLO (Public Lands, Open Space, and Building). The surrounding land uses are predominantly residential. The modification at Thorpe Park would not preclude future development consistent with planned land use designations.

#### *Channel Modifications*

*Thorpe Park to Upstream of Beaver Street.* South of Thorpe Park, channel modifications would begin at Bonito Street and continue downstream past Beaver Street. The channel would be an open channel configuration along the entire reach (excluding road crossings). The modified Rio de Flag would pass through a residential area designated as Medium Density Residential which allows for 6 to 12 units/acre as defined on the City Land Use Plan Map. The open channel configuration would result in the displacement of three houses on the west side of the channel near Cherry Avenue. The portion of the channel passing by the City Hall and library is identified on the Land Use Map as Commercial. The remaining portion of this reach (from Route 66 downstream to Beaver Street) is designated as Commercial.

The proposed channel construction would expand the existing Rio de Flag alignment from Bonito Street to the railroad tracks. The medium density residential area between Bonito Street and Birch Avenue is an established community with minimal space for future medium density development. The removal of three residences in this area would not significantly affect planned land use patterns. The City Hall and

library are major components of the downtown area and would be compatible with the future use of the flood control channel (and recreation trail) extending between them.

South of the tracks, the proposed alignment would diverge from the existing Rio de Flag alignment and head eastward along the railroad right-of-way. The riprap channel and parallel FUTS trail would occupy a dirt lot in an area designated as Commercial. The future use of this channel would be compatible with the surrounding land use designations which would continue to be available for commercial development. The covered channel that begins just west of Beaver Street would not significantly affect planned land use in the area because it would be located underground. The new FUTS trail along the channel access road would represent a beneficial land use impact. This multi-use channel would be consistent with the guidance provided in the Flagstaff Area Open Spaces and Greenways Plan to “provide an open channel for the Rio where possible, enhance its banks, and improve it with trails and other amenities.”

Based on these factors, planned land use impacts along this entire reach would not be significant.

*Clay Avenue Wash Detention Basin to Mike’s Pike.* Channel modifications along this reach are described in the existing land use section above. The alignment would remain essentially the same as the existing Clay Avenue Wash; however, the addition of a service road would substantially widen the majority of the reach. As with the current alignment, the modified channel would flow through an area designated as Commercial as well as an area designated as High Density Residential near Blackbird Roost. The channel would re-enter the Commercial land use designation east of the University Roost Apartments and continue downstream towards Mike’s Pike.

The areas designated as Commercial surrounding the channel modifications would remain available for commercial development and would also be removed from the 100-year floodplain under this alternative. Additionally, the high density residential area is largely built-out (near the University Roost Apartments and surrounding mobile homes) and would not be affected by the future use of the flood control facilities. Accordingly, impacts to planned land uses within this area would not be significant.

*Mike’s Pike Alignment.* The Mike’s Pike alignment would not affect planned land uses. Upon completion of the underground culvert, the street would be returned to its pre-construction condition.

*Upstream of Beaver Street to Butler Avenue.* The introduction of a new flood control channel through this area would not result in impacts regarding planned land use. Although this area is designated primarily as Heavy Industrial, the existence of a flood control channel would not preclude this use in land adjacent to the channel or significantly conflict with planned land uses.

#### *Clay Avenue Wash Detention Basin*

The proposed Clay Avenue Wash detention basin is located just outside of the corporate boundary of the City of Flagstaff, but within the Metropolitan Planning Organization boundary of the city. Because the site is located on Coconino County lands, compatibility with GMG 2000 land use policies is not applicable. Impacts related to planned land use in and around the proposed basin are; however, discussed with respect to the Flagstaff Area Open Spaces and Greenways Plan. The Open Spaces and Greenways Plan applies to development within County as well as the City of Flagstaff.

The proposed basin is located within the A-1 Mountain Landscape District of the Open Spaces and Greenways Plan. Specific land use recommendations are provided for this district, including the designation of the proposed detention basin as a “Neighborhoods” area on the Desired Futures Map. Based on the definitions provided in the plan, the future use of the detention basin would be consistent with the functions of a “Neighborhoods” area. “Neighborhoods” are described in the Plan as open spaces that would serve as recreational buffer zones between residential communities. According to the plan, these areas would have “trees, grasses, and rolling landforms...with relatively flat landscapes and ponderosa pine, pinon/juniper vegetation types, native grasses, and small pockets with unique geology or plant diversity.” The basin conforms with the goals, policies, and recommendations provided in the plan. Future preservation of this area as open space would serve as a beneficial land use impact with regard to open space. In addition, beneficial land use impacts would result downstream of the proposed basin by reducing flood damages in the floodplain.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in similar impacts to Alternative 6a; however, this alternative would not result in the removal of any homes along the Rio de Flag in the downtown area. Impacts to existing land uses would therefore be less than those described under Alternative 6a. The effect of this

alternative on existing and planned land uses would be less than significant for the reasons described under Alternative 6a.

### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

#### Existing Land Use

##### *Cheshire Park Detention Basin*

The Cheshire Park detention basin site is located in a largely undeveloped area in northern Flagstaff. The basin would occupy approximately 5 acres, including roughly 4.5 acres of city-owned land and 0.5 acre of land owned by the Museum of Northern Arizona. The existing Cheshire Park would be removed and replaced either within the limits of the new detention basin or at a new location within the same neighborhood of Flagstaff. Replacement of the park and implementation of the mitigation measure identified in Section 4.6 (Recreation) for the park would avoid long-term significant land use impacts. Refer to Section 4.6 regarding the recreation impacts associated with loss of park use during construction.

##### *Thorpe Park Detention Basin*

The flood control improvements at the Thorpe Park detention basin are described in Section 2.2.1. The modifications include basin excavation and the construction of floodwalls along the eastern boundary of the park and an embankment just south of the existing weir at Frances Short Pond. All detention basin construction activities would be located within the park boundaries.

The recreational amenities contained in the park are described in Section 3.6 and 4.6 of this document. North of Thorpe Road at the Little League fields, the basin area abuts two residences to the north, 14 houses to the east, Thorpe Road to the south, and Aztec Street on the west. At the Softball Complex, the proposed basin is bordered by Flagstaff Junior High School to the east, the Flagstaff Armory and the City Maintenance Yard to the south, and Thorpe Road to the north and west. From a regional perspective, the park is surrounded by low density suburban residential units to the north, medium density suburban residential units and townhouses to the east and south, and the Coconino National Forest to the west.

As described in Section 4.4, Cultural Resources, two historic park structures are located within the limits of grading for the embankment, a log cabin and a small building constructed from river cobbles. Other structures that would be removed during detention basin excavation include three adult softball fields, two ballfields, a concession stand, restrooms, an announcer's booth, lighting standards, and an enclosed playground. All facilities impacted during construction would be replaced to their pre-construction condition and floodproofed, as described in Sections 2.2.3 and 4.6.3. While the loss of park use during construction would constitute a significant recreation impact, it would not be considered a significant land use impact because the post-construction land use would be the same as the current use.

The detention basin would completely drain within 48 to 60 hours for the 100-year event, 36 hours for the 50-year event, and less than 24 hours for other more frequent events. During major flood events, the recreational function of the park would temporarily cease. Mitigation measures are provided in Section 4.6 (Recreation) to ensure that the park's recreational facilities would be returned to their pre-flood condition immediately following a flooding event, thus minimizing any long-term effects on existing land use. Given the infrequent nature of such events and the planned floodproofing of the replaced structures, the temporary future disruptions to recreational uses at Thorpe Park would not result in significant land use impacts (see also Section 4.6 Recreation). In addition, the proposed berms and floodwalls would be compatible with the existing land uses in and around the park and would not be considered a significant impact.

#### Planned Land Use

##### *Cheshire Park Detention Basin*

The proposed Cheshire Park detention basin site is located in a area identified in the GMG 2000 as PLO (Public Lands, Open Space, and Building). Construction of a detention basin is consistent with this zoning designation. Replacement of the Cheshire Park and creation of additional recreational features in the basin (e.g., trails) would also be consistent with the areas planned land use designations. Impacts to planned land uses would be less than significant.

### *Thorpe Park Detention Basin*

The proposed detention basin is located entirely within the existing Thorpe Park. This park is designated on the GMG 2000 Land Use Plan as Park. The surrounding land uses are classified on this map as Low Density Residential, (1-5 Units/Acre) to the north and east; Medium Density Residential, (6-12 Units/Acre), to the west and south; Public/Semi-Public to the south; and Park to the west. The City Zoning Map identifies the park as PLO and the surrounding residential areas as R1, RML, and RMM (Single Family Residential, Multi-Family Residential- Low Density, and Multi-Family Residential-Medium Density, respectively).

The future use of the proposed detention basin would be consistent with the area's land use designation as a park and its zoning classification as Public Lands, Open Space and Building. The park is considered an integral component of the Open Space and Greenbelt System and would remain as such upon completion of the project. The Plan notes that, "...in some wider sections of the Rio de Flag, golf courses, ballparks, or City parks may be suitable and adaptive to large flood events." The Thorpe Park detention basin would be consistent with the stated goals and objectives of the Open Spaces and Greenways Plan, and Thorpe Park would remain a permanent part of the City's Open Space and Greenbelt System .

Surrounding land use designations would not conflict with the future use of the Thorpe Park detention basin. Aside from temporary closures during major flood events, the proposed flood control structures described in Section 2.2.1 for the park would not prohibit future use of the park as a recreational facility. Impacts on the park's recreational resources are described in Section 4.6 (Recreation). No additional land use impacts would result from this component of Alternative 7.

### **Alternative D: Localized Non-Structural Flood Proofing**

This alternative would not require the relocation or purchase of any structures. As described in Section 3.5, the proposed berms are located in area designated as Open Space/Greenbelt in the GMG 2000. The proposed berms would be constructed to the maximum extent feasible on city property. This would help reduce conflicts with existing and planned land uses in the Continental Estates area. Some private property acquisition may be required; however, no structures would be affected under this alternative. Additionally, impacts to private property and to adjacent land uses such as the Peaceful Valley Memorial Park (cemetery) would be minimized during final berm design. For example, the

berms would be designed to ensure that they would not affect any grave sites. The berms would be compatible with the Open Space/Greenbelt land use designation, and they would therefore result in less than significant impacts on planned land use.

### **No Action Alternative**

Under the No Action Alternative, temporary land use impacts would continue to occur during major flooding events, which may disrupt the ongoing operations of local businesses or other commercial facilities (particularly those located in downtown Flagstaff). These impacts would occur relatively infrequently and would not be considered a significant land use impact.

### **4.5.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

Impacts to existing and planned land uses would be less than significant; therefore, no mitigation measures are required.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Impacts to existing and planned land uses would be less than significant; therefore, no mitigation measures are required.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Impacts to existing and planned land uses would be less than significant; therefore, no mitigation measures are required.

**Alternative D: Localized Non-Structural Flood Proofing**

Impacts to existing and planned land uses would be less than significant; therefore, no mitigation measures are required. This assessment is based on the USACOE's commitment to avoid structures and grave sites and to minimize other intrusions into private property during final project design.

**No Action Alternative**

Impacts to existing and planned land uses would be less than significant; therefore, no mitigation measures are required.

## **4.6 RECREATION**

### **4.6.1 Significance Criteria**

The evaluation of impacts on recreational facilities and opportunities considers both the short- and long-term effects of each alternative. Impacts are considered significant if the construction or operation of an alternative causes an increased demand that exceeds the resources design capacity (thus reducing its current level of service, limiting recreational opportunities, or threatening the viability of a recreational resource), prohibits recreational access, or causes termination of a recreational use (impacts lasting for less than one month are considered insignificant).

### **4.6.2 Impact Assessment**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

This alternative would result in short-term recreation impacts as a result of construction-related trail closures along the Rio de Flag segments of the Flagstaff Urban Trail System (FUTS); however, the long-term (post-construction) effects of Alternative 6a on recreation would be beneficial because improvements to the FUTS would be incorporated into the channel modifications. The recreational effects of Alternative 6a are described below in terms of its major components: Thorpe Park modifications, channel modifications, and the Clay Avenue Wash detention basin.

##### Thorpe Park Modifications

The flood protection features at Thorpe Park would be limited to the eastern boundary of the park (berms and floodwalls) and to just south of the weir (embankments). The section of the FUTS trail entering Thorpe Park near the weir would be kept open during construction of the embankments, berms, and floodwalls. Construction activities would not otherwise disrupt recreational activities of Thorpe Park (e.g., Little League, softball, and other athletic activities). Accordingly, the Alternative 6a modifications at Thorpe Park would not cause a significant recreational impact.

### Channel Modifications

This alternative would entail construction in the Rio de Flag and Clay Avenue Wash channels. There are no recreational facilities or opportunities located along the Clay Avenue Wash channel; accordingly, construction along that channel would not result in recreation impacts. In contrast to Clay Avenue, much of the downtown reach of the Rio de Flag is paralleled by a FUTS trail segment that would be closed during construction. This short-term impact would be significant; however, it would be easily mitigated by providing short detours along the residential streets in this area (see Section 4.6.3). The long-term effect of the Rio de Flag channel modifications would be beneficial in terms of recreation because an extension of the FUTS trail, including a below-grade crossing of Route 66 and the railroad tracks, would be constructed as part of the project. This would provide better connections between various segments of the FUTS, and it would also reduce delays and safety concerns associated with the current at-grade crossings. All short-term recreation impacts associated with the Rio de Flag channel modifications would be reduced to less than significant levels.

### Clay Avenue Wash Detention Basin

The Clay Avenue Wash detention basin would be situated largely on undeveloped state and privately owned lands. There are no designated trails or existing recreational facilities located within the footprint of the proposed detention basin. Construction and operation of the Clay Avenue Wash detention basin would not cause the termination of a recreational use or prohibit recreational access. The detention basin would be used for flood attenuation during major storm events and would not generate a demand for additional recreational facilities within the study area.

### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

This alternative includes all of the components described for Alternative 6a; however, Alternative 6b includes a two-block-long covered channel segment extending from Dale Avenue downstream to Birch Avenue. As with Alternative 6a, trail users would need to detour around the construction area on residential streets while the Rio de Flag channel modifications are underway. Once construction is completed, the FUTS trail along the Rio de Flag would again be available for public use.

For the approximately two-block-long segment of the Rio de Flag where an underground concrete arch would be installed (between Dale Avenue and Birch Avenue), the trail would be reconstructed at ground level after the arch is in place and the area has been backfilled with soil. In general, where trails follow water features, those water features contribute significantly to the recreational experience of trail users. The loss of two blocks of open channel in the downtown Flagstaff Reach would not, however, significantly detract from the recreational experience of this section of FUTS trail. This assessment is based on the relatively short length of trail affected and the urban environment which surrounds this section of the FUTS.

As with Alternative 6a, this alternative would result in a long-term benefit associated with the extension of the current trail and the installation of a below-grade trail crossing at Route 66 and the railroad.

### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The Rio de Flag channel modifications downstream of Thorpe Park, Clay Avenue Wash channel modifications, and Clay Avenue detention basin would be the same as for Alternative 6b, with identical recreational impacts and mitigation requirements. Alternative 7 also includes upstream detention basins along the Rio de Flag at Thorpe Park and Cheshire Park, and the recreational impacts associated with these two detention basins are discussed below.

#### Cheshire Park Detention Basin

Construction of this detention basin would entail the removal of Cheshire Park, including all of its facilities, and the construction of a replacement park either on site (within the detention basin) or at another site within the same neighborhood.

The park would be replaced on site if feasible. Under this scenario, the contours of the detention basin would be modified to allow several flat terraces which could support recreational facilities (e.g., tennis courts, play areas, picnic tables, a parking lot). During the approximately four-month detention basin construction period, local residents would not have use of the park. As described in Section 4.6.1, the loss of recreational facilities for more than one month is considered a significant impact. Accordingly, the loss of park facilities for four months would constitute an unavoidable significant impact. Following the completion of construction, park facilities would only be inundated with floodwater on rare

occasions (e.g., during very large storms). Based on the relative infrequency of inundation, and the fact that it would typically occur during rainy weather (when the demand for outdoor recreational facilities would be correspondingly lower than normal), these periodic, temporary losses of park use would not be significant. The effects of periodic flooding on park facilities would be mitigated to less than significant levels as described in Section 4.6.3.

The feasibility of reconstructing Cheshire Park within the detention basin would depend primarily on the ability to terrace the geologic formations that underlie the site. If it is determined during more detailed site testing and engineering design that on-site park replacement is not feasible, the park would be relocated elsewhere. Although a specific site for the new park location has not been identified, it would be constructed within the same general neighborhood.

Under the off-site park replacement scenario, the new park would be as large or larger than the existing Cheshire Park. To the extent practical, existing Cheshire Park facilities such as playground equipment and picnic tables would be relocated to the new park. Replacements for immovable facilities (such as the tennis and basketball courts) would be constructed at the new park site. As described in Section 4.6.3, the proposed new park would be built prior to construction of the Cheshire Park detention basin.

Because it is probable that a park could be reconstructed on site, the impact analyses in this EIS do not address construction of a new park facility. (For example, the biological resource impacts of constructing a new park at a different site are not addressed.) Should Alternative 7 be selected for implementation, and should it be determined that it is infeasible to reconstruct Cheshire Park within the detention basin, a new park site would be identified and evaluated in a Supplemental EIS at that time.

#### Thorpe Park Detention Basin

The excavation of a detention basin within Thorpe Park would cause significant short- and long-term impacts to recreation. Short-term impacts (up to 12 months) would occur to those park facilities within or immediately adjacent to the limits of excavation. This includes two Little League fields, three softball fields, concession stands, restrooms, a small parking lot just south of North Thorpe Road, and other park infrastructure (lighting standards, picnic tables, benches, monuments, etc.). These facilities would be removed prior to excavation and replaced on site at approximately two feet below their current elevation. The Thorpe Park softball complex is the primary adult softball venue in the city and, while

short-term closures of ball fields could be partially accommodated by using alternate facilities, this approach would not adequately mitigate the 12-month-long loss of these facilities.

The affected recreational facilities would be flood-proofed prior to being replaced on site, minimizing future damage associated with the detention of floodwater in the basin. It is anticipated that the Thorpe Park detention basin would drain completely within 48 to 60 hours following a 100-year event, and it would drain faster after lesser events. Although storm water would only be detained in the basin for a maximum of 60 hours at a time, most facilities, such as the Little League and softball fields, would still require some cleaning and repair following flooding of the detention basin. Because only large runoff events would flood the detention basin, this impact could be mitigated to below significant levels.

Long-term recreation impacts associated with Alternative 7 would include the effects of excavation on the topography of the ballfields, changes to Frances Short Pond, and the loss of mature ponderosa pines and other mature vegetation.

There are three baseball/softball fields that are only partially within the potential detention basin boundary. Excavating only part of these fields could leave some areas within the field of play up to two feet higher than other areas. This impact would be mitigated by revising the preliminary detention basin boundaries to ensure that all Little League and softball fields would either be entirely within or entirely outside the detention basin, thus literally providing a level playing field at each facility (see Section 4.6.3).

The detention basin footprint would alter the hydrology of Frances Short Pond. By lowering the surrounding ground level by two feet and maintaining the original water surface elevation of the pond, water would be spread out over a greater area. Accordingly, the area of shallow water would be greatly increased. From a recreational standpoint this is significant because it could encourage the growth of thick stands of emergent marsh vegetation along the edges of pond, reducing opportunities for fishing. Mitigation for this impact would entail recontouring the pond and rebuilding the pond's clay liner to facilitate better access and improved conditions for aquatic wildlife (fish) near the pond's banks.

There are approximately 350 mature trees at Thorpe Park that would be removed during the detention basin construction process, including over 280 mature ponderosa pines. These trees contribute significantly to the overall enjoyment of Thorpe Park (see also Section 4.11, Esthetics). Although new trees would be planted, it would take several decades for them to mature. Thus, although the look and

feel of Thorpe Park could ultimately be returned to pre-construction conditions, the loss of mature trees for such a long time would constitute an unavoidable significant recreation impact.

#### *Flagstaff Urban Trail System (FUTS)*

A portion of the FUTS traverses east/west past the Thorpe Park softball fields and exits the park along the Rio de Flag alignment just south of the existing weir at Frances Short Pond. This trail segment connects the Museum of Northern Arizona and portions of Observatory Mesa to the FUTS trail in downtown Flagstaff (see Figure 3-5). Because the embankment at the south end of the detention basin would block the existing FUTS trail at that location, the trail would need to be re-routed to join with the downstream portion of the trail near Dale Avenue. Realigning the trail would avoid significant long-term recreation impacts; however, since construction activities are anticipated to require over one month, the temporary closure of this trail segment would be considered a significant short-term impact requiring mitigation. Implementation of the recommended measure would reduce this impacts below the level of significance (see Section 4.6.3).

Impacts to the city bikeways are analyzed in Section 4.8, Transportation.

#### **Alternative D: Localized Non-Structural Flood Proofing**

Construction of the proposed south berm could potentially affect the users of the Continental Estates Little League fields, and it could also affect the Elden Hills golf course. The berm would be located just south of the ballfields and would traverse through the facility's dirt parking lot between the fields and Oakmont Drive. During construction, access to the fields may be restricted for several weeks. Although none of the construction activities would directly impact the ballfields, recreational activities might be postponed or canceled due to increased levels of dust or noise from construction. In addition, the berm may displace a small number of existing parking spaces in the dirt lot. Measures have been provided to reduce these impacts to a less than significant level (Section 4.6.3).

No additional recreational facilities would be directly affected by this alternative. Although portions of the south berm would be located adjacent to the Elden Hills Golf Course, mitigation has been developed to avoid significantly affecting the course (see Section 4.6.3). A planned segment of the FUTS traverses the Rio de Flag alignment in this area; however, the planned trail would not be affected by the berms.

## **No Action Alternative**

Under this alternative, there would be no direct impacts to recreation because none of the detention basins or channel modifications would be undertaken. The local population would continue to desire outdoor recreation and parks to satisfy their leisure demands. Regional population growth and increased tourism will also prompt higher use the surrounding natural and recreational areas.

### **4.6.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

The following measure has been provided to minimize recreational impacts on users of the FUTS trail during construction of the channel in the Downstream Reach:

- During construction of the channel between Thorpe Park and the railroad tracks, signs shall be posted on appropriate trail markers identifying alternative routes to re-connect to the FUTS trail. It is anticipated detours would primarily utilize residential streets.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Mitigation for this alternative would be identical to the measure identified for Alternative 6a.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

##### Cheshire Park Detention Basin

##### *On-Site Park Reconstruction*

- The preferred scenario would be to reconstruct Cheshire Park on site (if feasible). Because it would not be possible to complete basin excavation and park replacement within one month

(the significance threshold identified in Section 4.6.1), the loss of park use during construction would be considered a significant and unavoidable short-term recreation impact.

- A plan will be prepared to return all facilities in the park to their pre-flood conditions in the event of basin inundation. This plan will identify the primary locations within the water storage area that would be most susceptible to flood damage and provide measures to alleviate these impacts. This plan will be implemented by the City of Flagstaff following any event where detained waters affect recreational equipment, ball courts, or play areas.

#### *Off-Site Park Construction*

- If a replacement park needs to be constructed, the loss of park use during construction will be mitigated to less than significant levels by ensuring that the new park is open for public use prior to initiating detention basin construction. Under this approach, the affected neighborhood would only be “parkless” for the amount of time necessary to move mobile facilities (e.g., playground equipment, picnic tables) from the current park to the new park. This equipment transfer would take less than a month, mitigating the short-term impact of park closure to less than significant levels.

#### Thorpe Park Detention Basin

Construction of the detention basin components would have short- and long-term significant impacts. Mitigation would entail the following measures.

- A plan will be prepared to return all facilities in the park to their pre-flood conditions in the event of basin inundation. This plan will identify the primary locations within the water storage area that would be most susceptible to flood damage and provide measures to alleviate these impacts. This plan will be implemented by the City of Flagstaff following any event where detained waters affect recreational equipment, ball fields, or associated facilities.
- No softball/baseball field shall be partially excavated. In the case that a field is partially within the currently identified limits of excavation, detention basin design will be modified so that all fields will be completely level.

- Frances Short Pond will be recontoured and re-lined to ensure adequate public access to open water areas and to ensure favorable conditions for aquatic wildlife.
- Affected trees will be replaced at a 1:1 ratio. Five years after the initial tree replacement, any of the new trees that have not survived will be replaced at a 1.5:1 ratio.

#### Flagstaff Urban Trail System (FUTS)

Construction of the berm at Thorpe Park would result in the short-term closure (over one month) of a segment of the FUTS trail. The following measure would re-establish recreational access from downtown Flagstaff to the trails connecting to Observatory Mesa and the Museum of Northern Arizona, thus reducing this impact below the level of significance:

- During construction of the berm at the Thorpe Park detention basin, signs shall be posted on appropriate trail markers and near the construction area identifying alternative routes to re-connect the FUTS trail at Dale Avenue to the Observatory Mesa and Museum of Northern Arizona trails.

#### Summary of Unavoidable Significant Impacts

While these measures would mitigate some of the recreation impacts associated with Alternative 7, the following impacts would remain significant and unavoidable:

- Four-month loss of use of Cheshire Park (if the park is reconstructed on site)
- Twelve-month loss of use of five ballfields and associated recreational facilities at Thorpe Park
- Long-term (several decades) loss of approximately 350 mature trees at Thorpe Park

#### **Alternative D: Localized Non-Structural Flood Proofing**

Alternative D could potentially impact users of the Continental Estates Little League Fields. The following measure would reduce short and long-term impacts to users of this facility to less than significant levels:

- The final plans and specifications for construction of the south berm will include measures to reduce and, if practical, avoid direct and indirect impacts on recreational users of the Little League facilities during construction. Such measures may include restrictions on staging area locations and construction phasing plans to avoid heavy use periods of the little league fields. The plans and specifications shall also ensure that access to the fields is maintained at all times during construction.
- During the final design phase of the project, the design of the south berm shall be refined as to minimize impacts to the Continental Estates Little League Fields. These refinements shall include, but not be limited to, avoiding all structures (including the ballfields), maintaining adequate access to the fields, and minimizing the loss of parking spaces.
- During the final design stage of the project, the design of the south berm shall be refined to ensure that construction does not significantly affect the ability to use the Elden Hills Golf Course, and to ensure that the berm does not cause changes to the topography or layout of the golf course.

#### **No Action Alternative**

This alternative would not result in significant recreation impacts; therefore, no mitigation measures are provided.

## **4.7 SOCIOECONOMICS**

### **4.7.1 Significance Criteria**

This section examines the direct and indirect employment impacts, consequential demographic impacts, and estimated changes in the demand for local housing and public services. Impacts are considered significant if the alternative:

- induces growth that exceeds regional or subregional projections
- worsens the population/housing balance
- decreases the job market
- results in a recession of the local economy.

Significant impacts would also occur if residents are displaced from their homes or if an alternative does not comply with the guidance provided in Executive Order 19898, Environmental Justice, or Executive Order 13045, Health and Safety Risks to Children.

### **4.7.2 Impact Assessment**

The potential for the project alternatives to cause significant socioeconomic impacts, pursuant to the significance criteria listed above, stems primarily from (1) the effects of construction activity on the local economy and (2) the effects of property acquisition at the detention basin sites and along the proposed channel alignments. These topics are addressed below with regard to population, housing, employment, and personal income, followed by assessments of Environmental Justice and Health and Safety Risks to Children.

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

##### Population

Alternative 6a would not attract a long-term worker population to the project vicinity. Some direct and indirect project-related jobs would be created from construction of the project components. Although an incremental amount of migration to the region may occur as a result of the project's specific technical

requirements (i.e., the vicinity may gain some specialized construction equipment operators and laborers), this migration would be minimal and temporary

through completion of construction. The majority of the construction-related jobs are expected to be filled by both currently employed and unemployed labor force participants in Coconino County, therefore, construction of the project would not increase the Flagstaff area's population significantly.

### Housing

Alternative 6a would result in the displacement of several residences, including: (1) three homes on the west side of the Rio de Flag near Sitgreaves and Cherry streets; (2) one ranch house and associated structures at the Clay Avenue Wash detention basin site; and (3) 15 mobile homes located to the immediate west of the Blackbird Roost/McCracken Drive intersection. The loss of 19 houses within the region would not have a noticeable effect on the local availability of housing. As described above, no long-term increase in population is anticipated. Accordingly, this alternative would not noticeably affect the population/housing balance.

The property owners that would be affected by the acquisition are entitled by law to be justly compensated for their property, based on fair market value as determined by an independent appraiser. Relocation assistance payments and counseling would be provided in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601 (1996)) to ensure adequate relocation and a decent, safe, and sanitary home for displaced residents. All eligible displaces would be entitled to moving expenses.

Eligible homeowners would also be entitled to certain supplemental payments to compensate for increased cost of replacement homes over and above the amount received for their homes, increased interest costs, and certain other expenses. In accordance with the provisions of the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act, no residential occupant would be displaced unless replacement housing is available. All benefits and services would be provided equitably to all residential relocates without regard to race, color, religion, age, national origin, and handicap as recorded under Title VI of the 1964 Civil Rights Act (42 U.S.C. § 2000d-1).

Compliance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act will ensure adequate financial compensation for the acquired houses and other property, including

relocation expenses. This program cannot, however, substantially mitigate the loss of social ties, upheaval, and sense of loss that may be experienced by the individuals to be relocated. Therefore, while the economic effects of displacement would be reduced through compliance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act, the significant social impacts are considered unmitigable.

### Employment

Alternative 6a is expected to create temporary construction jobs within the region. As described in Section 3.7, Flagstaff's unemployment rate is high in comparison to the State of Arizona as a whole, and it tends to be dominated by tourist-related service jobs at the low end of the pay scale. In this environment, the creation of temporary construction jobs would be considered a short-term, beneficial impact.

### Income

The increased construction-related employment would have a corresponding short-term beneficial effect on the local economy. Additional personal earnings would be created in the region during the construction phase, resulting in a short-term increase in personal income. The direct employment-related increase in personal income would result in associated short-term increases in spending on goods and services, temporarily benefitting both households and businesses within the local economy. This beneficial impact would not last long after construction is completed, and it would be negligible in comparison to the regional economy. This short-term economic benefit would not lead to increased growth within the region.

### Environmental Justice

This section summarizes potential impacts from Alternative 6a with regard to Environmental Justice, as mandated by Executive Order 12898. This Executive Order requires that the relative impacts of Federal actions on minority and low-income populations be addressed to determine if disproportionate shares of high and adverse environmental and human health impacts would affect these groups.

As described previously, Alternative 6a would require the acquisition of 19 residences. Fifteen of these residences are within the Trailers Ho mobile home park which is located along the western edge of the

Old Town neighborhood depicted on Figure 3-6. As described in Section 3.7.1, Population and Demographics, this neighborhood has disproportionately higher levels of low-income and minority residents than the City of Flagstaff as a whole. The other residences that would be acquired under this alternative are the ranch house at the proposed Clay Avenue Wash detention basin site and the three residences along the Rio de Flag in the downtown area; these residences not represent low-income housing. Because 15 of the 19 homes that would be acquired under Alternative 6a are in a predominately low-income and minority neighborhood, this alternative would disproportionately affect minority and low-income families.

The proposed re-alignment of Clay Avenue Wash was not based on the income level or ethnicity of the residents; rather, the re-alignment is required as a result of modifications that occurred to the original Clay Avenue Wash channel when the area was developed. Prior to development, unimpeded flows followed the natural hydraulic grade directly through what is now the Trailers Ho mobile home park. However, Clay Avenue Wash flows currently are diverted from the channel's terminus upstream of the mobile home park onto Chateau Drive and then south along Blackbird Roost until they reach the shallow concrete channel centered in McCracken Drive. (The shallow concrete channel in McCracken Drive and the Trailers Ho mobile home park are visible in Figure 1-7, bottom photograph.) Downstream from McCracken Drive, flows enter a remnant portion of the Clay Avenue Wash channel.

Increasing flood protection through this section of Clay Avenue Wash will require modifications to the existing system. During the development of alternatives, it was determined to be infeasible from a hydraulics standpoint to realign Clay Avenue Wash to circumvent the mobile home park. Avoiding the mobile home park would require the Clay Avenue Wash channel to make a 107-degree turn from Chateau Drive to Blackbird Roost, followed approximately 120 feet further downstream by a 90-degree turn onto McCracken Drive. While this is essentially the same route along which the current flows are diverted (over street surfaces, not in a defined channel), this alignment cannot feasibly handle the flows from larger events. Sharp turns are problematic in channels designed to carry large flows, and two such turns within 120 feet would be infeasible to accommodate in channel design.<sup>1</sup> Providing a wide turning radius at these locations would necessitate removing other structures, such as the University Roost Apartment buildings. These apartments are within the Old Town Neighborhood,

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<sup>1</sup> There are several drawbacks to having sharp turns in a drainage channel, one of which is that the turns cause turbulence and significantly reduce water velocities. Reduced velocities cause flows to back up in the channel (much the way cars back up on a highway as they approach a traffic-slowing accident). In order to accommodate the backed-up flow, a much larger upstream channel is required, and upstream flood control structures such as floodwalls or levees may also be needed.

and they also represent low-income housing; accordingly, this approach would not shift the brunt of the impacts away from low-income groups. It should also be noted that Alternative 6a would provide improved flood protection to numerous residences, including minority and low-income households in the Old Town Neighborhood.

Executive Order 12898 and the Council on Environmental Quality's (CEQ's) guidance for implementing Environmental Justice under NEPA (CEQ 1997) call for NEPA compliance documents to analyze impacts that affect minority and low-income populations and to identify mitigation measures, whenever feasible, to address those impacts. As described in the CEQ guidance, however,

Under NEPA, the identification of a disproportionately high and adverse human health or environmental effect on a low-income population, minority population, or Indian Tribe does not preclude a proposed agency action from going forward, nor does it necessarily compel a conclusion that a proposed action is environmentally unsatisfactory. (Chapter III, §B.2)

This EIS analyzes those impacts that would disproportionately affect a low-income group (i.e., the acquisition of mobile homes) and identifies feasible mitigation (compensation in compliance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act). Additionally, the USACOE will work to reduce the number of affected residents during final project design. Based on these factors, the USACOE has complied with Executive Order 12898.

#### Health and Safety Risks to Children

This alternative would not be expected to result in sources of environmental health and safety risks to children, with the potential exception of safety hazards associated with the covered concrete drainage channels. Despite the inherent dangers associated with playing in a covered concrete channel, these channels may constitute an "attractive nuisance" to children. (For example, it might appear fun to enter a covered channel on one end of downtown and emerge on the other side; however, this type of activity is very dangerous.) The USACOE proposes to mitigate this risk by requiring the City of Flagstaff to implement a public information program, as described below under Mitigation.

**Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in impacts similar to those described for Alternative 6a; however, this alternative would avoid the displacement of the three residences along the Rio de Flag in the downtown area. Similar to Alternative 6a, the effects of this alternative on population housing and income would be less than significant. Potentially significant impacts regarding environmental health and safety risks to children would be reduced to less than significant levels through incorporation of the recommended mitigation measures. Social impacts from the acquisition and removal of 16 residences would be significant and unavoidable and this alternative would disproportionately affect low-income populations.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The socioeconomic impacts associated with this alternative would be similar to those described for Alternative 6b, except that more construction would be required, with a corresponding increase in the short-term beneficial effects for employment, income levels, and the local economy. No additional residences would be affected.

**Alternative D: Localized Non-Structural Flood Proofing**

This alternative would generate short-term beneficial socioeconomic benefits as a result of construction. Because this alternative would entail substantially fewer construction activities in comparison to Alternatives 6a, 6b, and 7, these effects would be negligible in terms of employment and income. This alternative would not require the acquisition of residences and would not otherwise affect the population/housing balance. Any private property acquisition associated with this alternative would be undertaken in accordance with applicable Federal laws. Because no residences would be affected by the berms, there would be no displacement of residents.

Under this alternative, impacts would occur only within the Continental Estates area. This area does not encompass a disproportionate amount of minority or low-income populations in comparison to the City of Flagstaff as a whole. Accordingly, this alternative would not result in high and adverse environmental or human health impacts that disproportionately affect low-income or minority populations. Similarly, this alternative would not result in health or safety impacts, and would therefore

not cause these types of impacts to occur to children. Overall, the socioeconomic impacts associated with this alternative would be less than significant.

### **No Action Alternative**

The No Action Alternative would not cause socioeconomic impacts; however, it would not prevent or minimize future flooding along the Rio de Flag. As a result, damages to residential, commercial, institutional, and industrial property would be expected in the future as a result of flooding. As described in Section 1.3.1, future flooding may also affect the use of the railroad tracks through Flagstaff. Thus, under the No Action Alternative, flooding could affect the housing balance and local economy, as well as regional economies (i.e., those regions that rely on rail transportation of goods through Flagstaff). See section 1.3.1 for additional discussion of potential future damages associated with flooding along the Rio de Flag and Clay Avenue Wash.

Because the No Action Alternative would not cause impacts (including environmental, human health, or safety impacts), it would not disproportionately affect minority or low income populations, and it would not cause human health or safety impacts to children.

### **4.7.3 Mitigation Measures**

#### **Alternative 6a**

This alternative would entail the acquisition of the ranch house, 3 residences along the downtown Rio de Flag reach, and 15 mobile homes along the Clay Avenue Wash channel alignment. The economic impacts of the property acquisition would be mitigated through compliance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act, but the social impacts would not be mitigated to less than significant levels.

This alternative also entails the creation of covered channels that may pose a safety risk to children. The USACOE will mitigate this potential effect by requiring the City of Flagstaff to establish and maintain a public information program regarding the potential hazards associated with drainage channels. This requirement is described under the Mitigation section of the Safety impacts analysis (see Section 4.13.3).

**Alternative 6b**

The mitigation measures for this alternative are the same as those described for Alternative 6a. Although three fewer homes would be displaced, social impacts would remain significant and unmitigable under this alternative.

**Alternative 7**

The mitigation measures for this alternative are the same as those described for Alternative 6a. Although three fewer homes would be displaced under Alternative 7 in comparison to Alternative 6a, social impacts would remain significant and unmitigable.

**Alternative D: Localized Non-Structural Flood Proofing**

This alternative would not result in significant socioeconomic impacts, and it would therefore not require socioeconomic mitigation measures.

**No Action Alternative**

This alternative would not result in socioeconomic impacts, and it would therefore not require socioeconomic mitigation measures. Mitigation to avoid the potential damages associated with future floods would entail the provision of flood control measures. These would not be considered mitigation for the No Action Alternative; rather, they would constitute project alternatives (e.g., Alternatives 6a, 6b, and 7 addressed in this EIS).

## **4.8 TRANSPORTATION**

### **4.8.1 Significance Criteria**

The assessment of the alternatives' impacts on transportation and traffic includes primary impacts in the project vicinity and induced secondary impacts. Impacts from the alternatives are considered significant if:

- expected project related traffic causes or compounds traffic congestion during peak hours
- project-related traffic impedes access to businesses or residences
- construction vehicles are not provided with adequate parking facilities
- project-related road closures substantially alter the circulation patterns of the local roadway or bikeway network
- project-related activities impede railroad operations.

Impacts regarding motorist and pedestrian safety from project generated traffic are analyzed in Section 3.13, Safety.

### **4.8.2 Impact Assessment**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

##### Bridge Modifications

Under Alternative 6a, the Anderson Road and Beal Road bridges would be closed for approximately two to four weeks each during construction; however, the bridges would not be closed simultaneously. Due to the short duration of the bridge closures and the availability of alternative routes to the immediate north and south, temporary alterations in circulation patterns would be less than significant. The effect of these bridge closures on emergency response routes is discussed in Section 4.13.2, Safety

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### Thorpe Park Modifications

The two-week closure of the North Thorpe Road segment would limit vehicular and bicycle access to an isolated residential area northwest of the park which is only accessible via Curling

*Smoke Drive.* During the closure of the this segment, vehicles and bicyclists normally accessing Thorpe Road via Hopi Drive or Bonito Street would be required to drive approximately one additional mile to access Thorpe Road from the north or south. Traffic could avoid the street closure via Cherry or Birch Avenue to the south or Beal or Anderson Road to the north. (As discussed in Section 2.2.1, the closure of Anderson Road and Beal Road would not overlap with the closure of North Thorpe Road). Given the minimal distance required to bypass the closed road segments and the temporary nature of the closures, this impact would be less than significant.

Approximately 35 truck trips per day would be generated during the six-month construction period at Thorpe Park. Construction activities and material hauling would temporarily alter circulation patterns and cause minor delays on local roads; however, mitigation measures identified in Section 4.8.3 would reduce the short-term traffic impacts from the Thorpe Park modifications to a less than significant level.

### Channel Modifications

#### *Construction-Related Traffic*

*Rio de Flag.* Construction of the Rio de Flag channel modifications would last approximately 6 to 12 months. On-site construction equipment would include backhoes, dump trucks, scrapers, cement trucks, flatbed trucks, truck trailers, pickup trucks, and construction workers' personal vehicles. Approximately 20 truck trips per hour would be generated during the six-month construction period for the channel modifications, the majority of which would take place south of the railroad tracks. The impacts of these trips on the local roadway network (combined with the trips generated from the other project components) would result in potentially significant short-term impacts on transportation. The temporary alterations in circulation patterns or traffic delays during construction would be mitigated to less than significant levels.

*Clay Avenue Wash.* Impacts from construction-related traffic would be similar to those described for the Rio de Flag channel modifications. Approximately six additional truck trips per hour would be

generated by this project component. Assuming that the project components are all operating at the same time (worst-case scenario), the total truck trip generation of this alternative would be 30 trucks per hour at different locations throughout the city. Because these trips would be spread out across the city, it would be possible to mitigate traffic impacts to less than significant levels.

### *Construction Staging*

During construction of the channel modifications, construction staging would take place primarily on vacant city-owned land. The staging areas would generally be located near the channel in order to minimize the travel distance to and from the construction site. The mitigation measures identified for this alternative would reduce impacts related to construction staging below the level of significance.

### *Road/Rail Line Closures*

*Thorpe Park to Upstream of Beaver Street.* During construction, several street segments would be temporarily closed including Bonito Street, Dale Avenue, Cherry Avenue, Birch Avenue and Aspen Avenue between Sitgreaves and Humphry Streets. These roadways would be closed for approximately five to seven days each during construction. Mitigation is provided to reduce the short-term impacts of the closure of these roads below the level of significance. The Route 66 under-crossing would be constructed as to maintain two way traffic during the entire two-week construction period. The lane reductions on Route 66 would result in short-term inconveniences that would be less than significant.

Construction of this reach would also require a Rio de Flag under-crossing and a parallel FUTS trail under-crossing at the railroad tracks between Sitgreaves Street and Humphreys Street. The construction of the railroad under-crossings would require that each of the two sets of railroad tracks be closed for 24 hours during construction; however, only one set of tracks would be closed at a time. Because one set of railroad tracks would remain open, and because each set of tracks would only be closed for 24 hours, the railroad operators would not experience a significant transportation impact.

*Clay Avenue Wash Detention Basin to Mike's Pike.* This reach would require the temporary closure of four street segments, including portions of Chateau Drive, Blackbird Roost, McCracken Drive, and Malpais Lane. As with the previous reach, these road closures could be mitigated to a less than significant level. The Five-Points intersection would remain open during construction, although some

lanes would be closed during the open-trench excavation and installation of the covered channel. Road closures would be mitigated to a less than significant level.

*Mike's Pike Alignment.* There are currently twelve commercial/retail facilities and six residential units with access along Mike's Pike (between Milton Road and Phoenix Avenue). Construction of the covered channel along this reach would result in impacts on traffic circulation but would not restrict access to these facilities. The construction activities would last approximately six weeks and would take place in the middle of the road alignment. Access would be maintained to all facilities along Mike's Pike; however, some minor detouring or routing may be required during construction. Because it is not a major thoroughfare, limited construction-related traffic along Mike's Pike would not significantly cause or compound traffic congestion during peak hours.

*Upstream of Beaver Street to Butler Avenue.* During construction of the covered channel at Beaver Street, San Francisco Street would be converted to a two-way street. Conversely, Beaver Street would become a two-way street during construction at San Francisco Street. The roadway modifications would last approximately one week per street, after which the streets would be returned to their pre-construction (one-way) orientations. Since adequate north/south access would be maintained between both sides of the railroad tracks in the downtown area, transportation impacts would be less than significant during construction. To further minimize impacts, mitigation is provided to ensure that the public is informed of these temporary changes.

Construction of the covered channel would necessitate the closure of four railroad spurs for approximately five to seven days each. These spurs are located immediately south of the main tracks between Beaver Street and the Northland Recycling Building. The spurs service several of the commercial and industrial facilities located on Phoenix Avenue, Elden Street, as well as the Northland Recycling facility. The short-term closure of these individual tracks would not be significant due to the brief nature of their closure and their relatively infrequent use.

At Butler Avenue, replacement of the corrugated metal pipe with a concrete arch could disrupt traffic; however, one lane in each direction would be kept open at all times. Accordingly, this would not cause a significant transportation impact.

### *Permanent Impacts*

The permanent transportation impacts associated with Alternative 6a would generally be beneficial. The provision of 100-year flood protection would remove trails, key railroad segments, and numerous streets from the threat of flooding that currently exists in the downtown area. There are, however, some permanent negative transportation impacts associated with this alternative. These impacts are discussed below.

Channel modifications along the Rio de Flag would require the permanent closure of Kendrick Street between Cherry and Birch Avenues. This one-way northbound street would be replaced with an larger channel and a parallel service road. With the exception of access for city maintenance crews, this road segment would be permanently closed to vehicular traffic. However, a recreation trail would be maintained along the outer edge of the channel. The closure of this portion of Kendrick Street result in an adverse impact on transportation, but it would not be considered significant for the following reasons:

- No direct residential access would be eliminated. Street access for the residential structures along this block is achieved via Cherry Avenue and Birch Avenue.
- In its existing condition, Kendrick Street terminates at Birch Avenue and therefore is not utilized as a major north/south arterial. The closure of the previous block would alter some local circulation patterns but would significantly compound traffic congestion during peak hours.
- Sitgreaves and Humphreys Streets would serve as suitable alternate routes to the west and east, respectively.

Just north of Phoenix Avenue and west of Beaver Street, the proposed channel would cross the northern half of a city-owned parking lot and would eliminate approximately 25 parking spaces. This section of the channel would also eliminate a small portion of another nearby lot. This impact would not be considered significant because the parking spaces would be replaced in the immediate vicinity of the existing lots.

### Clay Avenue Wash Detention Basin

Construction of the Clay Avenue Wash detention basin would generate on-site vehicular movement associated with the proposed embankment structures. The detention basin at Clay Avenue Wash would

require approximately 120 truck trips per day for approximately 3 weeks (12 trips per hour). Although the Clay Avenue Wash detention basin is located in a more sparsely populated area and is immediately adjacent to highway (Route 66), mitigation measures are also provided for this basin to ensure that short-term construction traffic impacts remain less than significant. The long-term operation-related traffic impacts associated with the Clay Avenue Wash detention basin would be negligible.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in the same traffic impacts as described for Alternative 6a; therefore, implementation of the mitigation measures identified for Alternative 6a would reduce short-term transportation impacts from Alternative 6b to less than significant levels.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

##### Cheshire Park Detention Basin

Construction of the Cheshire Park detention basin would not result in any street closures. In addition, equipment staging would occur within the limits of grading of the basin. Soil and rock excavation would generate approximately 26 truck trips per day for approximately four months. Although the Cheshire Park detention basin site is located in a relatively sparsely populated area and is near a highway (Highway 180), mitigation measures are also provided for this basin to ensure that short-term construction traffic impacts remain less than significant. The long-term operation-related traffic impacts associated with the Cheshire Park detention basin would be negligible.

##### Thorpe Park Detention Basin

##### *Construction-Related Traffic*

As discussed in Section 2.2.1, construction of the detention basin would require approximately 73 round truck trips per day during the three-week grading period. These trucks would haul material to the basin from off-site locations and would involve approximately seven to eight trucks entering and leaving the site every hour. On-site construction equipment would be similar to that described for Alternative 6a.

The roadways surrounding the basin area are smaller roads inherent to rural and small urban areas; therefore, the addition of 73 truck trips per day on the local roadway network could result in significant short-term impacts on transportation. Construction of all the project components simultaneously (worst-case scenario) would generate up to 36 truck trips per hour throughout the city. The potential temporary alterations in circulation patterns or traffic delays during construction would be mitigated to less than significant levels.

### *Construction Staging*

Under this alternative, adequate parking would be provided for construction-related vehicles within the limits of grading. Staging of large construction equipment would occur primarily on site and, if needed, at a city-owned inert landfill approximately 3.5 miles from the basin area. No transportation impacts related to parking of construction vehicles or staging of construction equipment are anticipated.

### *Road Closures*

Construction of the Thorpe Park detention basin would result in short-term impacts on the local roadway and bikeway network. During construction of the detention basin, the following roadway segments would be temporarily closed: (1) a segment of North Thorpe Road between Aztec Street and Hopi Drive and (2) the Flagstaff Junior High School access road. Upstream of the basin, the Anderson Road and Beal Road bridges would be temporarily closed during construction as well. The short-term impacts associated with the North Thorpe Road and upstream bridge closures are described under Alternative 6a.

Flagstaff Junior High School is serviced by two parking lots: (1) a 40-car lot that is only accessible via a road traversing the weir at the Frances Short Pond (the “junior high school access road”), and (2) an 80-car lot at the corner of Thorpe Road and Bonito Street. The junior high school access road would be closed for approximately two months during construction of the proposed detention basin embankment (upon completion, the road would be relocated to the top of the embankment). As discussed in Section 2.2.3, construction would be undertaken in the summer months when school is out of session. Although vehicular access to the 40-car lot would be terminated for a period of two months, this would not significantly impact school parking because of the timing of construction. Since the road would be reopened prior to the first day of school, impacts on transportation would be less than significant.

### *Operations-Related Traffic*

Few vehicle trips would be required to inspect, maintain, and repair the detention basin once it has been completed. These trips would have a negligible traffic impact on local streets.

## **Alternative D: Localized Non-Structural Flood Proofing**

### Construction-Related Traffic

As discussed in Section 2.2.3, this alternative would generate an average of approximately 42 construction-related truck trips per hour for the duration of the six-month construction period (12 per hour for the north berm and 30 per hour for the south berm). These trips would be associated with the hauling of imported fill material to the site to construct the earthen berms, which would range in height from 13 to 26 feet. The same type of construction equipment described for Alternative 6a (see above) would be used for this alternative.

Construction trucks would reach the two berm sites by heading south on Country Club Road from either I-40 or U.S. Highway 89. Vehicles on Route 66 can also reach Country Club Drive from the north via a short segment of U.S. Highway 89. Construction trucks would not be allowed to traverse the residential neighborhoods of Continental Estates. (While it would be possible to reach the berm sites from the west via Butler Avenue, this would generate excessive truck traffic through residential neighborhoods. In order to reach the proposed berm locations from Butler Avenue, trucks would have to drive through small residential neighborhoods via Continental Drive or Mt. Pleasant Drive to reach Country Club Drive from the south.) Trucks delivering fill to eastern portions of the south berm may also utilize a section of Oakmont Drive.

The addition of 420 construction-related vehicle trips per day on the local roadway network (Country Club Drive for both berms and Oakmont Drive for the north berm) would be considered a significant short-term impact on transportation. Short-term impacts from construction generated traffic would be reduced to less than significant levels as described in Section 4.8.3.

### Construction Staging

During construction of the berms, construction staging would take place primarily on vacant city-owned land. The staging areas would generally be located near the berms in order to minimize the travel distance to and from the construction site. The mitigation measures identified for this alternative would reduce impacts related to construction staging below the level of significance.

### Road Closures

The Localized Non-Structural Flood Proofing Alternative would result in temporary road closures at Country Club Drive and Oakmont Drive. The south berm would tie in to the east and west embankments of Country Club Drive just north of Fairview Drive and would require raising a section of Country Club Road. The same would occur further east on Oakmont Drive where the berm would be constructed up to the embankment along both sides of Oakmont Drive just east of Walnut Hills Drive. Impacts associated with these temporary road closures would be mitigated to less than significant levels.

### Operation-Related Traffic

Few vehicle trips would be required to inspect, maintain, and repair the levees once they have been completed. These trips would have an insignificant traffic impact on local streets.

### **No Action Alternative**

Under the No Action Alternative, significant transportation impacts would occur during future flood events in study area. During a major flood, there would be the potential for significant disruption of railroad operations resulting in loss of revenue, increased transport costs, and increased repair costs for the embankment and track (see Section 4.7, Socioeconomics).

In addition to the railway system, flooding also significantly affects the local roadway network. During minor flood events, Route 66 through downtown becomes completely impassable. Route 66 is a major vehicular transportation corridor through Flagstaff. During a 25-year or greater event, most of the streets on the north and south sides become impassable. Such floods could detour up to 40,000 vehicle trips per day for up to seven miles. This would not only cause traffic congestion during peak hours, but could also result in a substantial safety hazard to motorists, bicyclists and pedestrians. Mitigation for

these impacts would be to provide improved flood control. This approach would not be considered mitigation per se; rather, it is represented by Alternatives 6a, 6b, and 7, each of which improves flood protection for downtown Flagstaff.

### **4.8.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

The following measures are provided to reduce transportation impacts associated with Alternative 6a below the level of significance:

- A traffic control plan shall be prepared during the final design stage of the project, and implemented during the construction phase. The plan shall address and outline appropriate vehicular speeds in construction areas; travel routes, detours, or lane/road closures; flag-person requirements; appropriate signage and safety reflectors; coordination with the Arizona Department of Transportation (ADOT); appropriate notification to the public; any utility relocation requirements; the location of staging areas; safety procedures to reduce hazards to motorists, bicyclists, and pedestrians; approach to ensuring access to businesses and residences; and emergency information. The traffic control plan will be reviewed by the city and ADOT. The final version of the plan will be submitted to all appropriate entities.
- A road improvement plan shall be prepared during the final design stage of the project, and implemented during the actual construction phase. The plan shall identify road segments, bridges, and culverts that need to be improved and turnout locations that need to be constructed to accommodate project construction, maintenance, and operational activities. The plan will also identify any damage to existing roadways, caused by construction vehicles, that will need to be repaired.
- Construction of this alternative would result in the closure of several road segments throughout the City. During construction activities, alternate routes and detour signage will be used to ensure motorist safety and minimize commute inconveniences. In addition, it may also be advantageous to request a local radio station to assist in notifying the community of the anticipated roadway closures and major construction dates. Other public notification methods which can be implemented could

include: a roadway hotline number, local newspaper announcements/press release information, television news, city/community bulletins, or web site announcements.

**Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in potentially significant impacts related to transportation; however, implementation of the mitigation measures identified for Alternative 6a would reduce these impacts to less than significant levels.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 7 would result in potentially significant impacts related to transportation; however, implementation of the mitigation measures identified for Alternative 6a would reduce these impacts to less than significant levels.

**Alternative D: Localized Non-Structural Flood Proofing**

The same measures identified for Alternative 6a would apply to this alternative. In addition, the following measures would be required to reduce transportation impacts associated with Alternative D below the level of significance:

- All construction-related traffic will access the proposed berm locations via Country Club Drive from the north. Construction traffic shall not be allowed on the local roadway network before 8:30 a.m. or after 4:00 p.m. on weekdays. These stipulations will be incorporated into a traffic control plan prepared during final design.
- During construction to raise the elevations of Country Club Road and Oakmont Drive, respectively, on-site detours will be provided to ensure continual access along these roads. Specific detour designs will be included in the project's traffic control plan.

### **No Action Alternative**

The significant transportation impacts associated with the No Action Alternative cannot be mitigated below the level of significance.

## 4.9 NOISE

### 4.9.1 Significance Criteria

Noise impacts are analyzed with regard to the construction activities associated with each alternative. Long-term noise effects would be negligible because of the limited level of activity required for the alternatives' operation and maintenance. Accordingly, operation-related noise impacts are not analyzed in this section. Noise impacts have been assessed in consideration of the projected construction schedule, anticipated equipment usage, and existing noise levels. Impacts are considered significant if:

- project-generated noise levels exceed the limits of local noise ordinances or noise regulations promulgated on the Federal or state level
- project traffic-related noise increases the traffic noise to sensitive receptors by more than three dBA
- project-generated noise levels exceed 70 dBA  $L_{eq}$  at noise-sensitive biological resource sites
- project-generated noise levels would substantially disrupt sensitive receptors for extended periods of time.

In compliance with the City of Flagstaff Noise Ordinance (No. 1511), no construction activity would be conducted between the hours of 12:00 a.m. (midnight) and 6:00 a.m. Monday through Friday or between 1:00 a.m. and 7:00 a.m. on Saturday or Sunday. Accordingly, none of the alternatives would violate this element of the noise ordinance, which prohibits loud noises during these hours. Construction activities for all alternatives would be limited to 6:00 a.m. through 6:00 p.m. on weekdays and occasionally on weekends between 7:00 a.m. and 5:00 p.m.

### 4.9.2 Impact Assessment

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

##### Bridge Modifications

Noise would be generated during the construction operations required to build wingwalls at the Meade Lane bridge and replace the Anderson Road and Beal Road bridges. The loudest construction noise is typically that of diesel engine-driven construction equipment, which is commonly used for site

preparation, paving, and materials handling. Additional noise would be generated by the demolition of the existing bridges at Anderson Road and Beal Road. Construction noise levels may average 85 to 90 dB  $L_{eq}$  at a distance of 50 feet from the equipment during demolition, site preparation, grading, and paving. During other construction operations, noise levels would likely average 65 to 75 dB  $L_{eq}$  at a distance of 50 feet. Construction equipment noise is usually considered as a point source, with attenuation at a rate of 6 dB per doubling of distance (e.g., a noise level of 90 dB at 50 feet will be 84 dB at 100 feet, 78 dB at 200 feet, and 65 dB at 400 feet). The nature of construction projects, with equipment moving from one point to another, work breaks, and idle time, is such that long-term noise averages are less than short-term noise levels.

Construction of wingwalls at the Meade Lane bridge would not generate significant levels of noise due to the relatively short construction period (two to four weeks) and the location of the construction activities within the channel invert. The replacement of the Anderson Road and Beal Road bridges would, however, generate greater levels of noise at the neighboring residences. The closest noise receptors to the proposed bridge construction activities are the neighboring residences on Aztec Road and Navajo Road. These sensitive receptors are located adjacent to the Rio de Flag and within 50 to 100 feet of the affected bridges. At these sensitive receptors, noise impacts would result from the nearby construction activities. These noise levels, however, would not be anticipated to exceed 75 dB  $L_{eq}$  for more than a few minutes on a few occasions, if at all. For most of the construction period, hourly noise levels in excess of 60 dB  $L_{eq}$  would not be expected. In addition, the construction period at each bridge would not be expected to exceed two to four weeks. Based on these factors, the construction noise impacts to local residents would not be significant.

### Thorpe Park Modifications

#### *On-Site Construction Noise*

Noise would be generated during the construction operations required to build the embankment, floodwalls, and road modifications at Thorpe Park (see Figure 2-2). The closest noise receptors to the proposed construction activities are the adjoining residences on the south side of Beal Road and the west side of Navajo Road as well as the Flagstaff Junior High School. The sensitive receptors are all located adjacent to the park and within 20 to 60 feet of the proposed floodwalls. At these sensitive receptors, noise impacts would result from the nearby construction activities. As with the upstream bridge replacements, however, noise levels would rarely exceed 75 dB  $L_{eq}$ . For most of the

construction period, hourly noise levels in excess of 60 dB  $L_{eq}$  would not be expected. In addition, construction of the floodwalls would be undertaken in the summer, eliminating potential noise impacts to students from this project component. Based on these factors, the construction noise impacts to local residents and the Flagstaff Junior High School would not be significant.

There are no sensitive biological resource sites in the vicinity of the proposed construction activities.

### *Roadway Noise*

Noise would also be generated by construction vehicles accessing Thorpe Park via local roads. These vehicles would include heavy trucks hauling materials and equipment to the site and automobiles and light trucks used by the construction crews. Since any excavated material would be used on site, roadway noise impacts would be limited to trucks importing materials (i.e., soil and riprap) to the proposed basin area. Temporary noise increases generated by this traffic could potentially increase roadway noise by more than three dB in the residential area, thus noticeably increasing noise levels. It is expected that these impacts would occur infrequently and, because the hauling period is limited to three weeks, impacts would be less than significant.

### Channel Modifications

#### *Thorpe Park to Upstream of Beaver Street*

Along this reach, construction activities would occur within 30 feet of several residences between Bonito Street and Aspen Avenue along the existing Rio de Flag alignment (not including the three displaced residences on the west side of the channel near Cherry Street). In addition, the limits of grading for the proposed riprap channel are located within 20 feet of City Hall and 60 feet of the Flagstaff Public Library. Construction activities in this area are expected to last several weeks and would involve open-trench construction. Some blasting could be required during channel excavation; however, this is not anticipated.

Construction operations would be audible from City Hall and sensitive land uses such as the adjoining residences and the library. Due to the proximity of the construction activity to these resources, short-term noise impacts would be significant along this reach. At these sensitive receptors, noise levels could exceed 75 dB  $L_{eq}$  for extended periods of time. Mitigation measures are provided to reduce these

impacts below the level of significance. Noise impacts downstream of Route 66 would not affect any sensitive noise receptors. No sensitive biological resources would be affected by construction noise.

As with the Thorpe Park modifications, roadway noise from project-generated truck trips could result in a noticeable increase in noise levels. Increases in traffic noise to sensitive receptors by more than three dBA would occur infrequently and therefore would not be significant. Most of the truck trips associated with this reach would occur south of the railroad tracks, away from any sensitive receptors.

In the event of blasting activities near the residences, the library, or City Hall, short-term noise impacts would be significant and unavoidable. Adherence to standard construction practices would reduce noise impacts associated with blasting activities; however, not below the level of significance.

*Clay Avenue Wash Detention Basin to Mike's Pike.* Channel modifications would take place along the existing Clay Avenue Wash from the west end of the Chateau Mobile Homes eastward to Mike's Pike. Construction operations would occur within 30 feet of twelve mobile homes at the Chateau Mobile Homes Park, 25 feet of several mobile homes at another mobile home park, and 25 feet of twelve apartments at the University Roost apartment complex. Construction would also occur near several institutional and commercial uses (e.g., McCracken Place and the Greyhound Bus Station).

At the sensitive receptors identified above, construction noise impacts would be similar to those described for the previous reach between Thorpe Park and Beaver Street. As described above, these impacts may be significant; however, they could be mitigated below the level of significance. No sensitive biological resources would be affected by these activities. Impacts from blasting would be the same as those described for the previous reach.

*Mike's Pike Alignment.* Construction noise impacts would be similar to those described for the previous reaches. There are twelve commercial/retail facilities and six residential units located along Mike's Pike (between Milton Road and Phoenix Avenue). Short-term noise levels generated by construction operations would result in potentially significant impacts requiring mitigation.

*Upstream of Beaver Street to Butler Avenue.* The channel modifications along this reach involve the construction of a covered channel that transitions to an open greenbelt channel just north of South Colorado Street. These flood control improvements would take place within 30 feet of several commercial/industrial land uses that are located just south of the railroad tracks. There are no sensitive

receptors, including biological resources, located within 100 feet of the proposed construction area. Construction operations would be audible at the commercial/industrial facilities but would not be considered significant because these types of land uses are less sensitive to increased noise levels.

### Clay Avenue Wash Detention Basin

#### *On-Site Construction Noise*

Construction of the Clay Avenue Wash detention basin would be audible from some residences at the Hidden Hollow Mobile Homes (particularly in the northwest corner of the park). Noise impacts from construction activities would be temporary and would comply with the restrictions of the City Noise Ordinance as discussed above. Noise impacts would occur primarily during the construction activities associated with the berm near the northwest corner of the mobile home park. Noise levels at the mobile homes would be similar to noise levels at the residences along Thorpe Park during construction of the floodwall. Also, there are no noise sensitive biological resource sites in the vicinity of the proposed construction activities. Based on these factors, no significant noise impacts would occur from the construction activities associated with the Clay Avenue Wash detention basin.

#### *Roadway Noise*

All excavated material would be re-used on-site, thus eliminating a potential source of roadway noise. Approximately 14,947 cubic yards of fill material would be imported to the site for embankment construction. Temporary noise increases generated by this traffic could potentially increase roadway noise by more than three dB in some areas, thus noticeably increasing noise levels. Due to the brief material hauling phase required to import the embankment fill material (approximately 120 truck trips per day for three weeks) and the primarily rural nature of the surrounding area, noise resulting from construction traffic on the local roadways would be less than significant.

### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in impacts similar to those described for Alternative 6a. The difference between the two alternatives is the two-block-long covered channel segment along the Rio de Flag between Dale Avenue and Birch Avenue. Due to the smaller right-of-way requirements for the covered

channel, no homes would be removed along the downtown reach. Correspondingly, three additional homes would be subject to temporary noise impacts during channel construction. Implementation of the measures identified for Alternative 6a would reduce all non-blasting-related construction impacts to less than significant levels. If blasting is required along the downtown portion of the Rio de Flag, noise impacts would be significant and unavoidable during construction.

### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

#### Cheshire Park Detention Basin

The Cheshire Park detention basin site is located in a undeveloped area in northern Flagstaff. To the north, sensitive receptors include residences along Fremont Boulevard located across the street from Cheshire Park. The nearest of these residences is located approximately 100 feet from the northern boundary of the proposed detention basin site (see Figure 2-8). To the west, the nearest rural residential unit is located approximately 175 feet from the western boundary of the basin area. To the south of the site, residential properties are located immediately next to the limits of excavation. The closest structure is within 25 feet of the detention basin site. To the east of the site is primarily undeveloped ponderosa pine forest.

Detention basin construction would involve the excavation of soil and rock material and construction of an outlet structure downstream of the existing Narrows dam. The construction activities that would be most audible at the nearby sensitive receptors would result from excavation activities at the northern and western borders of the basin. Due to the proximity of these construction activities to sensitive receptors, short-term noise impacts would be significant for short durations of the construction period. At these sensitive receptors, normal construction noise levels could exceed 75 dB  $L_{eq}$  for brief periods of time. It is probable that extensive blasting would be required. Mitigation measures are provided to reduce the non-blasting impacts below the level of significance; however, the impacts associated with blasting could not be mitigated due to the amount of blasting likely to be required and the close proximity of residences to the site. No noise-sensitive biological resources would be affected by construction noise.

### Thorpe Park Detention Basin

Construction of the Thorpe Park detention basin would result in noise impacts similar to those described under Alternative 6a, *Thorpe Park Modifications*. Noise would be generated during excavation activities and the construction of the floodwalls, embankment, and road modifications at Thorpe Park (see Figure 2-9). Noise levels at sensitive receptors would generally not be anticipated to exceed 75 dB  $L_{eq}$ . For most of the construction period, hourly noise levels in excess of 60 dB  $L_{eq}$  would not be expected. In addition, construction of the embankment and junior high school access road would be undertaken in the summer, eliminating potential noise impacts to students from this project component. Based on these factors, the construction noise impacts to local residents and the Flagstaff Junior High School would not be significant. It is not anticipated that blasting would be required at Thorpe Park due to the relatively shallow (two-foot) excavation depth.

There are no noise-sensitive biological resource sites in the vicinity of the proposed construction activities.

### **Alternative D: Localized Non-Structural Flood Proofing**

The construction operations associated with the two proposed berms in the Continental Estates area would cause short-term impacts at nearby residences. The noise levels would be similar to those described for construction of the Thorpe Park Detention Basin (Alternative 7), with hourly noise levels expected to average 60 dB  $L_{eq}$  or less. Based on this assessment, the noise impacts to residents would not be significant. As with the previous alternatives, noise impacts would be short-term and would not conflict with the City Noise Ordinance or impact any noise-sensitive biological resources.

### **No Action Alternative**

The No Action Alternative would not result in significant noise-related impacts. The channel modifications and detention basins described above would not be developed, and no construction would occur for flood control improvements.

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### 4.9.3 Mitigation Measures

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

Alternative 6a would result in potentially significant short-term noise impacts requiring mitigation. The following measures would be expected to reduce noise impacts associated with channel construction below the level of significance:

- All construction equipment shall have sound-control devices that are at least as effective as those devices provided on the original equipment. No equipment shall have an unmuffled exhaust.
- All construction equipment shall be located, stored, and maintained as far as possible from adjacent residents, City Hall, and the Flagstaff Public Library.
- No construction staging shall take place within the Rio de Flag Channel between Cherry Avenue and Route 66. Due to the proximity of sensitive noise receptors, all construction equipment in this area will be turned off when not in use.
- Prior to construction, appropriate personnel at the City Hall and Flagstaff Public Library will be notified of the proposed construction activities and schedule. Recommendations will be provided to alleviate construction noise at these locations, including the closure of all windows facing the construction activities (assuming the proper ventilation systems are in place) and the rescheduling or relocation of special events away from the affected areas.

In the event of blasting in the vicinity of the nearby residences, the library or City Hall, noise impacts would be significant and unavoidable.

Mitigation measures provided in Section 4.8 (Transportation) would also alleviate traffic noise impacts associated with this alternative. Notification of the public with regard to planned construction activities would allow for voluntary avoidance of some construction activities.

**Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in potentially significant impacts during construction; however, implementation of Alternative 6a mitigation measures would reduce the short-term (non-blasting) noise impacts associated with this alternative to a less than significant level. If blasting is required, short-term noise impacts would be significant.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 7 would result in potentially significant impacts during construction; however, implementation of Alternative 6a mitigation measures would reduce the short-term noise impacts associated with this alternative to a less than significant level. If blasting is required, short-term non-blasting noise impacts would be significant.

**Alternative D: Localized Non-Structural Flood Proofing**

No significant impacts related to noise have been identified for this alternative; therefore, no mitigation measures are required.

**No Action Alternative**

No noise impacts would occur under the No Action Alternative; therefore, no mitigation measures are required.

## 4.10 AIR QUALITY

### 4.10.1 Significance Criteria

This section analyzes potential short- and long-term air quality impacts from each alternative. Short-term impacts are determined based on equipment usage and duration of construction activities with respect to air quality standards. Long-term impacts are assessed based on the with and without project conditions. Impacts are considered significant if the project exceeds state or Federal air quality standards. (There are no local air quality standards for the Flagstaff area.)

### 4.10.2 Impact Assessment

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

Alternative 6a would require approximately six months of construction, as described in Section 2.2.1. The air pollutant emissions associated with construction would include dust generated by earth-moving activities (e.g., grading) and exhaust generated by construction equipment and the personal vehicles of the construction crews commuting to and from the work site. Long-term emissions would be minimal—periodic inspection, maintenance, and repair of the detention basin and channel modification sites would result in vehicle emissions and potentially minor grading activities. The pollutant emissions associated with these long-term activities would be negligible.

The Flagstaff area is in attainment with Federal and state air quality standards. Additionally, the City of Flagstaff is within Arizona's Airshed 3, which is a Class II area (and therefore has less stringent air quality standards than Class I areas, as described in Section 3.10). Based on these two factors, there are no emission levels set for proposed actions such as the construction of a detention basin. The USACOE is not required to show that the generation of pollutants would fall below *de minimus* levels as defined in the Clean Air Act, and there is no State Implementation Plan which addresses the Flagstaff area. Based on these factors, the project-related pollutant emission would not exceed Federal or state air quality standards.

Grading associated with detention basin construction would generate dust, as could transporting soil in trucks. Although this would not violate Federal or state air quality standards, it can affect people who

live or work near the construction area. Most dust, especially larger size particles, tends to settle out on horizontal surfaces close to the respective construction site or haul route. This can present a nuisance factor as the dust settles on items such as plants, cars, outdoor furniture, window ledges, and sidewalks.

While the generation of dust would not constitute a significant air quality impact, measures have been identified under Section 4.10.3 that would help reduce the off-site migration of construction-generated dust.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in air quality impacts similar to those described for Alternative 6a. Although impacts would be less than significant, voluntary mitigation measures are provided to minimize the effects of airborne dust generated by the project.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Construction-related and long-term air pollutant emissions associated with this alternative would be similar to those described for Alternative 6a, although Alternative 7 would require a longer construction period (up to 12 months), more construction equipment, and a larger volume of earth moving activity. Based on a conservative emissions model, this alternative would be projected to generate approximately 70 to 75 tons per year of PM<sub>10</sub> emissions. This one-year generation of PM<sub>10</sub> would not affect Flagstaff status as an attainment area. Similarly, construction would not affect attainment status with regard to other criteria pollutants. Based on these factors, the air quality impacts of Alternative 7 would not be significant. Voluntary measures addressed under mitigation would help reduce dust-related impacts.

#### **Alternative D: Localized Non-Structural Flood Proofing**

This alternative would require less construction activity than Alternative 6a, and it would not result in significant air quality impacts for the reasons described above. Dust generation would affect the houses and other structures near the berms; however, this would not constitute a significant impact. The mitigation measures identified below would help further reduce dust-related impacts associated with this alternative.

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## **No Action Alternative**

The No Action Alternative would not require grading or the use of construction equipment, and it would not generate air pollutant emissions. Accordingly, this alternative would not result in air quality impacts.

### **4.10.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

Alternative 6a would not result in significant air quality impacts; accordingly, mitigation is not required for this alternative. The following voluntary measures would, however, help reduce the nuisance factor associated with dust generation at construction sites and along haul routes.

- Water active sites at least twice daily. Frequency should be increased if wind speeds exceed 15 mph.
- Cover inactive storage piles.
- Cover haul trucks securely or maintain at least two feet of freeboard on all haul trucks when transporting materials.
- Prohibit all grading activities during periods of high wind (i.e., winds greater than 30 mph).
- Apply nontoxic chemical soil stabilizers to inactive construction areas (i.e., disturbed lands within construction areas that are unused for at least four consecutive days), or water at least twice daily.
- Apply nontoxic binders (e.g., latex acrylic copolymer) to exposed areas after cut-and-fill operations.
- Install wheel washers for all exiting trucks.
- Sweep streets if visible soil material is carried onto adjacent public roads.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would not result in significant air quality impacts; accordingly, mitigation is not required for this alternative. The voluntary measures described for Alternative 6a would, however, help reduce the nuisance factor associated with dust generation at construction sites and along haul routes.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 7 would not result in significant air quality impacts; accordingly, mitigation is not required for this alternative. The voluntary measures described for Alternative 6a would, however, help reduce the nuisance factor associated with dust generation at construction sites and along haul routes.

**Alternative D: Localized Non-Structural Flood Proofing**

The Localized Non-Structural Flood Proofing Alternative would not result in significant air quality impacts and would not require mitigation. The voluntary measures described for Alternative 6a would help reduce dust generation and migration off site.

**No Action Alternative**

The No Action Alternative would not generate air pollutant emissions and would not require mitigation.

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## 4.11 ESTHETICS

### 4.11.1 Significance Criteria

#### Criteria

The significance of visual change depends on a variety of factors, including the degree to which the project would be seen by potentially sensitive viewers, viewer attitudes and activities, the distance from which the project would be observed, and the extent to which the project would be consistent with the established visual goals and objectives of the applicable jurisdictions. A number of variables affect the degree of visibility and visual contrast, including the scale and size of facilities, site design, color and texture, and influences of adjacent scenery or land uses.

For this analysis, impacts are considered significant when

- sensitive viewers would experience an overall moderate or strong contrast
- the action would be inconsistent with the visual quality goals and objectives of the *City of Flagstaff Growth Management Guide 2000* (GMG 2000) or the *Flagstaff Area Open Spaces and Greenways Plan*

#### Methodology

The potential esthetic impacts of the four alternatives were assessed in the field using the visual evaluation methods described below. The first step in this analysis was to define the project viewshed and then identify and describe viewers within that study area. The description includes type of view (e.g. urban or rural), length of view (i.e., nearby or distant), and duration of view (e.g., intermittent, obstructed, or unobstructed). The viewsheds for the Rio de Flag Flood Control Project and visibility for surrounding land uses are described in Section 3.14. Viewers were classified as *sensitive* or *not sensitive*, and sensitive viewers were evaluated for their changes to their view experience.

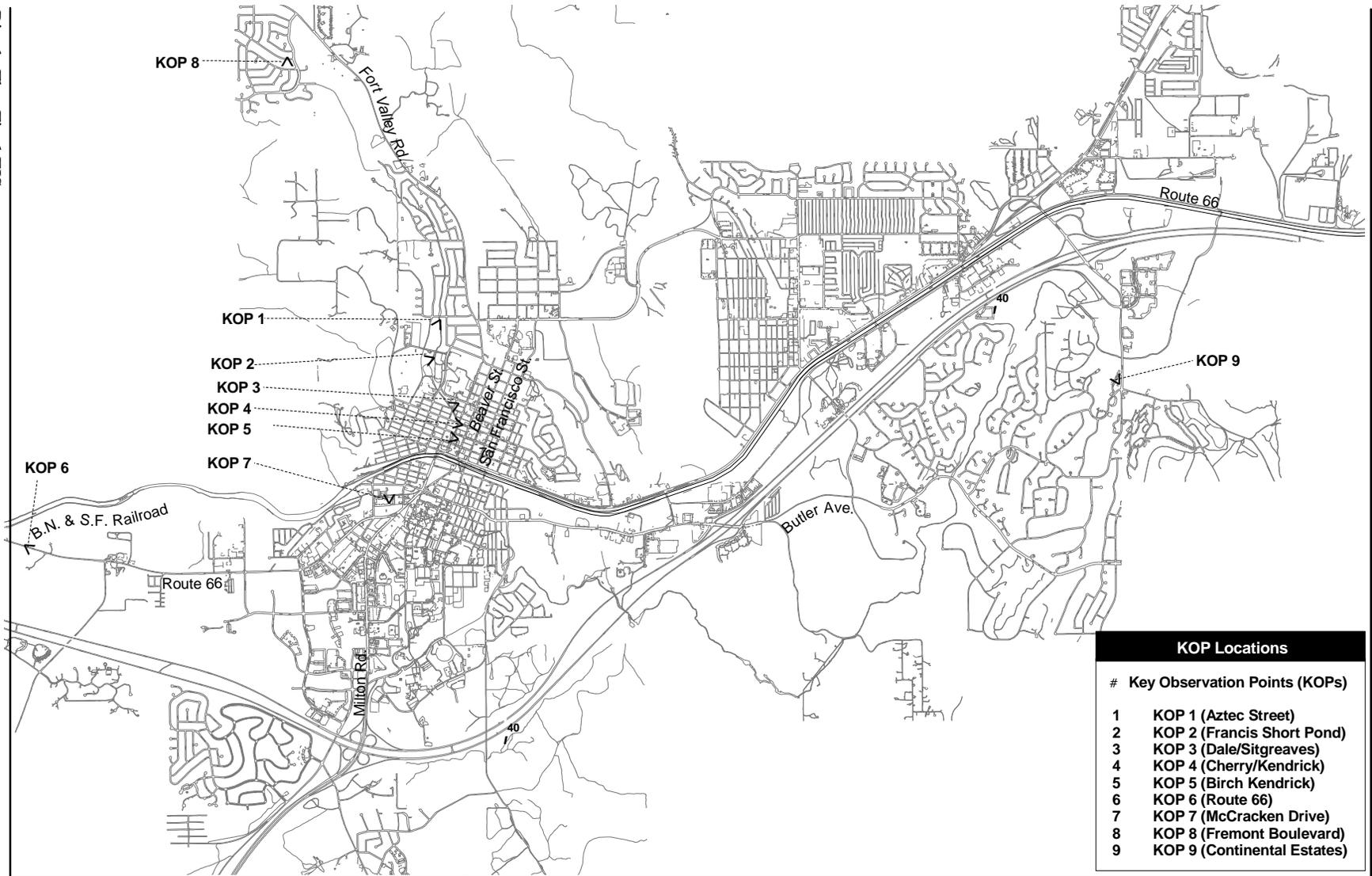
This evaluation identifies several locations that are considered to represent typical views to the proposed project components. These locations are referred to as “Key Observation Points” (KOPs). The selection of KOPs focuses on areas where members of the public would have views to proposed facilities, especially in areas where potential viewers are considered sensitive to potential changes in their

visual surroundings (e.g., residents and people engaged in outdoor recreation activity). Nine KOPs were selected for evaluation, as shown on Figure 4-1 and listed below.

- **KOP 1** represents a view of Thorpe Park from the east side of Aztec Street in an adjacent residential area
- **KOP 2** shows a view of Frances Short Pond as seen from inside Thorpe Park looking south, with the historic weir visible in the background
- **KOP 3** is a view of the downtown reach of the Rio de Flag channel, as seen looking downstream from the Sitgreaves Street crossing
- **KOP 4** is a view of Kendrick Street from the Cherry Avenue intersection facing downstream (south) towards downtown Flagstaff.
- **KOP 5** represents a view from Birch Avenue facing downstream (south) along the Rio de Flag near the library and City Hall.
- **KOP 6** shows a view from the northern shoulder of Route 66 facing eastward towards the proposed Clay Avenue Wash detention basin site.
- **KOP 7** is located just east of the intersection of McCracken Drive and Blackbird Roost and is oriented facing upstream (west).
- **KOP 8** is a view looking west to Cheshire Park from a nearby residential neighborhood
- **KOP 9** is located in the Continental Estates area and shows a potential flood control berm location.

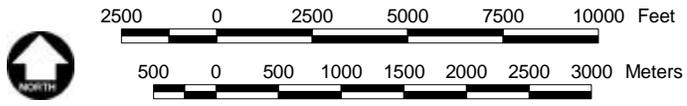
A field evaluation was undertaken at each of these KOPs to document the visual contrast of the project alternatives based on the degree of changes in line, form, color, and texture that the respective alternatives would create in conjunction with the existing environment. Three levels of contrast were considered: weak, moderate, and strong. *Weak* suggested minor or low visual contrast with the surrounding landscape, while *strong* contrast suggests the facilities would be highly evident or dominate a setting.

In addition to evaluating the potential visual changes at the nine KOPs, this section addresses the potential for flood control facilities to block local residents' views to scenic vistas. Specifically, this esthetics impact analysis also addresses the extent to which:



KOP Locations	
#	Key Observation Points (KOPs)
1	KOP 1 (Aztec Street)
2	KOP 2 (Francis Short Pond)
3	KOP 3 (Dale/Sitgreaves)
4	KOP 4 (Cherry/Kendrick)
5	KOP 5 (Birch Kendrick)
6	KOP 6 (Route 66)
7	KOP 7 (McCracken Drive)
8	KOP 8 (Fremont Boulevard)
9	KOP 9 (Continental Estates)

Source: City of Flagstaff, 1999.



**Figure 4-1**  
**KOP Locations**

- the Thorpe Park detention basin berms and floodwalls would block views from adjacent residences on Navajo Road
- the southeastern embankment at the Clay Avenue Wash detention basin would block views from adjacent residences within the Hidden Hollow mobile homes park
- the two flood control berms in the Continental Estates area would block views from nearby residents.

These potential effects are described following the assessment of visual changes at KOPs 1, 6, and 9, respectively.

The alternatives were also addressed in terms of consistency with *City of Flagstaff Growth Management Guide* (GMG 2000) and the *Flagstaff Area Open Space and Greenways Plan* policies addressing esthetics and visual resources. These land use plans provide some general design guidance for development within the city. In particular, one of the policies stated in the GMG 2000 requires the city to “develop plans and programs which carefully manage development on hillsides, ridge lines, and drainage courses in order to reduce adverse impacts and to protect the scenic quality, vegetation, and wildlife values of those areas” (City of Flagstaff 1987a). To achieve this, the GMG 2000 encourages a “non-structural approach” to flood control which seeks to incorporate such features into the City’s Open Space/Greenbelt System.

In addition, the Clay Avenue Wash is located in the A-1 Mountain Landscape District of the *Flagstaff Area Open Spaces and Greenways Plan*. For this district, the plan states that:

The southfacing slopes of the Observatory Mesa provide a backdrop and scenic vista for the communities along the historic Route 66 and to people driving this road or riding the train. Conduct vegetation and recreation management so as to meet scenic goals. Where possible work with private property owners to encourage appropriate tree screening and building height.

Consistency with the guidance described above is addressed for each alternative.

### **4.11.2 Impact Assessment**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

##### **KOP 1**

KOP 1 is located in a residential area along Aztec Street, just south of Beal Road (Figure 4-2). The photograph shown in Figure 4-2 was taken from the east side of Aztec Street, which overlooks the park from the north. This location was selected as a KOP based on the unobstructed views of the park, ease of public access, and the representative nature of the view. The photograph was taken facing southeast toward the proposed berms and esthetically treated floodwalls.

Alternative 6a would require the construction of floodwalls along the east side of the park and two small embankments just downstream from the existing weir. The berms and floodwalls would range up to a combined height of five feet and would be located west of (behind) 14 residences on Navajo Road. These residences are visible on the left side of the photograph included in Figure 4-2. The portion of the berm and floodwall along the west side of Flagstaff Junior High School would also be up to five feet tall; this section of the berm and floodwall would be obscured at KOP 1 by trees and a backstop (see Figure 4-2). The embankments would not be visible from this observation point.

Thorpe Park is used for many recreational purposes, including Little League and softball activities. As shown in Figure 4-2, the ballfields are well maintained, and surrounding residences are visible in this area. From KOP 1, berms and floodwalls would be visible beyond the ballfields along the eastern park boundary. The appearance of the berms and floodwalls would not conflict with the existing visual character of the area because the berms' landscaped surface and the wall's natural rock veneer would not stand out in this environment. Given that all of the residents along this boundary have five to six foot fences in place, and these fences are made from a variety of visually incongruous materials (e.g., wood, chain link, wire mesh, fiberglass), the introduction of landscaped berms and rock floodwalls would not appear visually incompatible. The visual impact of the berms and floodwalls at KOP 1 would represent a weak visual contrast with the surrounding environment and would not be considered a significant esthetic impact.



KOP 1- View south of Thorpe Park from residential area along Aztec Road (south of Beal Road)

**Figure 4-2**  
**Key Observation Point (KOP) 1**

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### Adjacent Residents' Views at Thorpe Park/Navajo Road

Up to 14 residences located on the eastern border of the little league complex would have their west-facing views obstructed by the berms and rock-faced floodwalls; however, the combined height of the berms and walls would be a maximum of five feet. As a result, these residences' back window and back yard views west to Observatory Mesa would not be substantially blocked by the berm/floodwall combination. In addition, the basalt veneer on the wall would be esthetically pleasing to most viewers, and the floodwall would not cause a significant visual impact.

### KOP 2

From this KOP within Thorpe Park (Figure 4-3, top photograph), a combined berm/floodwall would be visible to the east (left) of Frances Short Pond, along the side of the hill that leads up to the school. Also visible would be the tops of two embankments located downstream from the historic weir. The berm and floodwall would result in a weak contrast to the existing park environment because the landscaped berm and basalt veneer floodwall would provide a somewhat natural appearance.

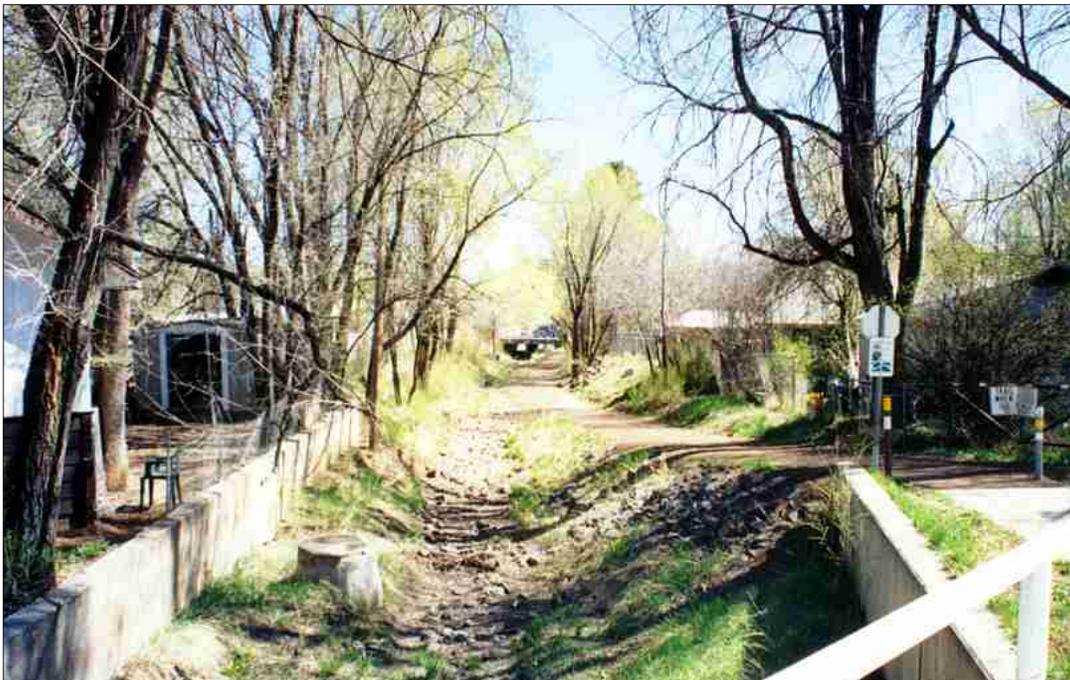
It would be hard to discern the embankments from this KOP because only their tops would be visible behind the weir. More noticeable would be the loss of some of the mature ponderosa pines visible in the background of this picture. The majority of the trees visible from this KOP would remain; therefore, the result would only be weak visual contrast with existing conditions.

### KOP 3

The view from this KOP (Figure 4-3, bottom photograph) represents both travelers on Sitgreaves Street as well as FUTS trail users. Under Alternative 6a, this section of channel would be widened. As part of channel construction, the house visible to the southwest (right) of the channel in this picture would be acquired and demolished. As can be seen in Figure 4-3, there are several trees located on both sides of the concrete wall that runs along the northeast (left) side of the channel. Trees on the creek-side (right) of the wall would be removed during construction, and construction could also damage the roots of many of the trees to on the other side of the wall, causing additional tree mortality. As a result, the tree-lined appearance of the channel would be modified, and there would be a strong visual contrast to local residents and trail users. Mitigation described in Section 4.11.3 would help reduce the severity of this impact, but not to less than significant levels.



KOP 2- Facing south towards Frances Short Pond and historic weir at Thorpe Park.



KOP 3- Facing downstream along the Rio de Flag from the Sitgreaves Street crossing.

**Figure 4-3**  
**Key Observation Points (KOP 2 and KOP 3)**

#### KOP 4

This KOP (Figure 4-4, top photograph) also represents a view looking downstream along the Rio de Flag channel in the downtown reach. At KOP 4, the channel would be widened, resulting in a larger channel with shallower side slopes. This process would include acquiring and demolishing the house visible on the right hand side of the photograph and relocating the trail currently visible in the center of the photograph to one side of the widened channel. Virtually all of the trees along the channel that are visible from this KOP would be removed. The changes to the channel and the loss of mature trees would constitute a strong visual contrast. Mitigation would help reduce this contrast, but not to less than significant levels.

#### KOP 5

KOP 5 was selected based on its proximity to the downtown area, its public visibility, and its existing condition as an open greenbelt channel. The bottom photograph shown in Figure 4-4 depicts the Rio de Flag facing downstream from Birch Avenue. Upstream of this location, the Rio de Flag occupies an open earthen-bottom channel and is surrounded by medium density residential housing. The Flagstaff Public Library is located to the west of the channel, and City Hall is located to its east (to the right and left of the channel, respectively, as shown in Figure 4-4).

Channel modifications proposed for this area would convert the grass channel to a wider channel with an access road paralleling its east (left) side. The channel would contain buried riprap covered with soil and seeded/planted with vegetation. Although wider, the modified channel would occupy the same general alignment as the existing channel. The replacement of an existing channel with a similar appearing wider channel would cause only a weak contrast to the surrounding environment, and esthetic impacts from KOP 5 would be less than significant.

#### KOP 6

The proposed Clay Avenue Wash detention basin site is located just north of Route 66 and just west of the city limits, approximately three miles west of downtown Flagstaff. The site is characterized by an open grassy field interspersed with ponderosa pines and bordered by a dense ponderosa pine forest (see Figure 4-5). KOP 6 is located along the northern shoulder of Route 66, facing eastward towards the proposed basin. (A natural gas pipeline monitoring station, enclosed by a wood fence, is visible on



KOP 4- Facing south from intersection of Cherry Avenue and Kendrick Street.



KOP 5- Facing south at intersection of Birch Avenue and Kendrick Street.

**Figure 4-4**  
**Key Observation Points (KOP 4 and KOP 5)**

the left side of the photograph in Figure 4-5. The natural gas pipeline monitoring station is not part of the proposed detention basin site, which is located to the east [right] of the monitoring station's fenced enclosure.) The potential detention basin site is clearly visible to both east and westbound traffic traveling along Route 66. This location was chosen as a KOP based on the historic and recreational significance of Route 66, the unobstructed views of the proposed basin area, and the guidance provided in the Open Spaces and Greenways Plan.

The Clay Avenue Wash detention basin would require the construction of three berms to detain flood waters during peak flows along the Clay Avenue Wash. As shown on Figure 2-3, the berms would be located at (1) the northwest corner of the Hidden Hollow Mobile Home area, (2) immediately south of the BNSF railroad embankment, and (3) approximately 700 feet north of the northeast corner of the mobile home park. The embankment located adjacent to the mobile homes would be a maximum of 12 feet tall. The northwestern embankment would be no taller than 10 feet, whereas the northeastern embankment would be up to 21 feet tall at its highest point. All three of the embankments would be landscaped with native vegetation.

Aside from the three embankments, the detention basin area would remain in its current open space condition. Virtually all of the ponderosa pine forest that characterizes the majority of the landscape would remain intact, and the proposed embankments would be nearly undetectable at KOP 6. The visual contrast of the flood control structures with the surrounding environment would be weak, and no esthetic impacts would be expected.

Because of the limited visibility of the proposed berms from Route 66, this element would not conflict with the land use planning guidance provided in the Open Spaces and Greenways Plan. Visual impacts from KOP 6 would be less than significant.

#### Adjacent Residents' Views at Clay Avenue Wash Detention Basin

As shown on Figure 2-3, seventeen residences would be located adjacent to the southeastern embankment. The embankment would have a maximum height of 12 feet, but it would have a somewhat natural appearance because it would be planted with native vegetation. The embankment would be located between the mobile homes and adjacent undeveloped ponderosa pine forest habitat. Although some ponderosa pine trees would be removed during construction, the majority of trees in this area



KOP 6- Facing east at proposed Clay Avenue Wash detention basin (just north of Route 66)

**Figure 4-5**  
**Key Observation Point (KOP) 6**

would not be affected. Accordingly, residents would still have views to a landscape dominated by these trees. Because the trees are considerably higher than the potential embankment, the residents' forest views would not be substantially altered.

Accordingly, the visual contrast in this location would be considered weak, and the impact to adjacent residents' views would not be significant.

#### KOP 7

KOP 7 is located just east of the intersection of McCracken Drive and Blackbird Roost (Figure 4-6, top photograph). This area is comprised of mobile homes, high density residential units, and commercial development. Channel modifications in this area include the construction of a buried riprap (soil- and vegetation-lined) channel that would displace the majority of the mobile homes visible in Figure 4-6. At the driveway of the mobile home park shown in this figure, the buried riprap channel would transition to a covered channel and would continue directly under McCracken Drive, which appears in the foreground of this KOP.

From this KOP, motorists, pedestrians, and residents at the University Roost Apartments would have an unobstructed view of the proposed riprap channel. Removal of the 15 mobile homes and the construction of a well-defined channel for Clay Avenue wash would result in a weak contrast because the overall appearance of this area would continue to be dominated by residential buildings in the foreground (i.e., apartment buildings and those mobile homes that would not be removed) and undeveloped hills in the background. Accordingly, esthetic impacts would not be significant.

#### KOP 8

This KOP is located near Cheshire Park and would only be affected by Alternative 7.

#### KOP 9

This KOP is located in the Continental Estates area and would only be affected by Alternative D.



KOP 7- Facing west on McCracken Drive, towards intersection with Blackbird Roost.



KOP 8- Facing east towards Cheshire Park from intersection of Fremont Blvd. and Brenda Loop

**Figure 4-6**  
**Key Observation Points (KOP 7 and KOP 8)**

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### Consistency of Alternative 6a with Adopted Plans

As discussed in Section 3.11, the GMG 2000 encourages a “non-structural approach” to flood control. From an esthetics standpoint, concrete-lined channels are typically the most undesirable structural flood control solution; however, under Alternative 6a, the use of concrete channels would not represent a significant visual impact because:

- The use of open concrete channel has been minimized. The covered Clay Avenue Wash concrete channel under Mike’s Pike would not represent the conversion of an existing open channel to a covered channel; instead, it would entail the replacement of an existing covered channel with a similar (but larger) covered channel along another alignment.
- The covered Rio de Flag channel parallel to the railroad trucks would constitute a new channel rather than a conversion of the existing channel to an underground structure. The existing open, unlined, shallow Rio de Flag channel south of Phoenix Avenue would remain. Because the visual amenities associated with this stretch of existing channel would remain, the diversion of flows into a new underground channel would not constitute a significant esthetic impact.

Alternative 6a would not otherwise conflict with esthetic-related guidance contained in locally adopted planning documents.

### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would only differ from Alternative 6a at KOPs 3 and 4. The esthetic impacts at these two KOPs and the consistency of Alternative 6b with adopted plans are addressed below.

#### KOP 3

The view from KOP 3 would be substantially different under Alternative 6b in comparison to existing conditions or Alternative 6a. Under Alternative 6b, the section of open, unlined channel visible downstream of Sitgreaves Street would be replaced with a covered, concrete channel. The FUTS trail would be relocated to the center of the current channel alignment (i.e., the trail would be at ground level, directly above the center of the underground concrete arch). As with Alternative 6a, many of the trees

which currently line the channel would either be removed or would be susceptible to severe root damage during construction. Landscaping would be provided along the edges of the trail, including trees along the sides of the alignment. (Based on the arched shape of the underground channel, trees would have room for their roots to grow along the edges of the channel, but not near its center—moving the FUTS trail to the center of the alignment would allow room for trees along the sides of the channel.) Unlike Alternative 6a, the houses to the southwest (right) of the channel would remain under Alternative 6b.

The conversion of an open, unlined channel to an underground concrete arch would represent a strong visual contrast, as would the loss of trees. Mitigation provided in Section 4.11.3 would help compensate for the loss of trees; however, the esthetic impacts at this site would remain significant after mitigation.

#### KOP 4

Under Alternative 6b, the visual changes at KOP 4 would be similar to those described at KOP 3 in that a section of the existing open, unlined channel would be replaced with a covered underground concrete arch. Similar to Alternative 6a, the majority of trees lining the channel in this location would be removed. The FUTS trail would extend along the center of the channel alignment and landscaping would be provided along the edges of the trail. Downstream of KOP 4, the channel would transition to an open riprap configuration as described for Alternative 6a from KOP 5. Impacts associated with tree loss would be mitigated; however, the overall visual contrast at this location would remain strong and significant esthetic impacts would be considered unavoidable.

#### Consistency of Alternative 6b with Adopted Plans

Because Alternative 6b uses a concrete-lined underground arch to convey Rio de Flag flood flows where there currently is an unlined channel, it is not consistent with GMG 2000 guidance encouraging the use of non-structural approaches to flood control. As described for KOPs 3 and 4, the use of an underground concrete arch along this section would result in a significant esthetic impact.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 7 only differs from Alternative 6b at KOPs 1 and 2 (Thorpe Park) and at KOP 8 (Cheshire Park). These three KOPs and the consistency of Alternative 7 with adopted plans are addressed below.

## KOP 1

While Alternative 7 would involve substantial changes to Thorpe Park; few of the park facilities seen from KOP 1 (Figure 4-2) would be noticeably altered. The trees in the foreground would remain, and the two Little League fields which dominate this view would also be kept in their current condition. Similar to Alternative 6a, a combined berm and floodwall would be constructed to the east of Thorpe Park (to the left of the photograph in Figure 4-2). The esthetic impacts of the berm and floodwall would not be significant for the reasons described under Alternative 6a. The majority of trees in the background of this KOP would be removed; however, the effects of tree removal are better described in the context of KOP 2.

## KOP 2

Alternative 7 would result in dramatic changes to the visual setting of Thorpe Park as seen from KOP 2 (Figure 4-3, top photograph). The majority of the area visible from this KOP would be excavated to a depth of two feet. This would alter the hydrology of Frances Short Pond, resulting in a larger pond and an overall increase in the area of shallow water. Over the long term, the shallow fringes of the pond would experience greater wetland vegetation growth, and there would generally be less open water. One of the more substantive changes associated with Alternative 7 would be the removal of virtually all the trees visible in at KOP 2, with the exception of those trees located near the top of the hill leading to the school (at the left edge of the photograph in Figure 4-3). Many of these trees would be removed during detention basin excavation, with the remainder displaced to accommodate the bypass channel, floodwall, or embankment.

The berm and floodwall combination would be similar in appearance to the berm and floodwall described for KOP 2 under Alternative 6a, and they would not result in a strong visual contrast to the existing setting as described for that alternative. The bypass channel would be constructed along the eastern edge of Thorpe Park, near the bottom of the hill leading up to the school. Once construction is complete, the bypass channel would be planted with wetland vegetation as a biological resources mitigation measure (see Section 4.3.3). As this vegetation matures, the channel would take on a more natural appearance would look similar to the sections of channel that currently traverse Thorpe Park.

The embankment would be constructed downstream from and to the east (right) of the historic weir, and the weir would not be affected by construction. The embankment would be planted with native

vegetation and would not differ in magnitude from other topographical changes at the park (such as the difference in elevation between KOP 1 and the Little League fields visible at that location—see Figure 4-2). Accordingly, the embankment would not result in a significant esthetic impact.

Additionally, the effects of berm, floodwall, bypass channel, and embankment construction would pale in comparison to the loss of virtually all the mature trees visible at this location. Within and immediately downstream from Thorpe Park, roughly 350 trees, including approximately 280 mature ponderosa pines, would be removed. The loss of these trees would result in a strong contrast to existing conditions at KOP 2 and at other locations within Thorpe Park. While mitigation has been provided to mitigate the loss of trees, the esthetic impact of Alternative 7 at Thorpe Park would remain significant and unavoidable.

### KOP 8

This KOP (see Figure 4-6, bottom photograph) depicts a view of Cheshire Park as seen from a residential neighborhood to the west of the park. Under Alternative 7, the park would be removed, as would most of the trees visible immediately east (behind) the park; the detention basin would be excavated; and the park would be replaced either on site or at a new location within the same neighborhood. This esthetic impacts analysis is based on the projection that the park could be replaced on site.

The post-construction view from this KOP would be of a park whose facilities are located at a slightly lower elevation (that is, within the new detention basin). Because all park facilities would be replaced, the visual contrast between the current park and the new park would be weak. The removal of mature ponderosa pines east of the park, however, would have a much more noticeable long-term esthetic impact. It may take decades for ponderosa pines to mature; thus, even with replanting (see mitigation measures described in Section 4.11.3), there would be moderate-to-strong contrast to the existing visual setting. Trees located outside of the potential detention basin limits would remain, so residents would not be subjected to an entirely treeless view. In addition, where tree removal occurs, it would open up views to the mountains which currently dominate the background of this KOP (see Figure 4-6). Thus, although Alternative 7 would cause a moderate-to-strong contrast to the existing visual setting (and therefore a significant visual impact), the views to residents in this area would remain esthetically pleasing.

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### Consistency of Alternative 7 with Adopted Plans

Of all the alternatives evaluated in detail in this EIS, Alternative 7 would involve the most structural flood control features, including

- constructing detention basins that would remove numerous mature trees at and adjacent to two separate city parks
- replacing a section of open, unlined channel along the downtown reach of the Rio de Flag with a covered concrete arch
- other channel modifications throughout the downtown reach of the Rio de Flag and along Clay Avenue Wash.

This approach would be inconsistent with many of the adopted policies described in Section 3.11.2, including the GMG 2000 policy that calls for the City to “manage development on hillsides, ridge lines, and drainage courses in order to order to protect scenic quality, [and] vegetation....” Additionally, Alternative 7 would not be consistent with GMG 2000 guidance which calls for using non-structural approaches to flood control.

### **Alternative D: Localized Non-Structural Flood Proofing**

Of the nine KOPs evaluated in this EIS, Alternative D would only be visible from KOP 9. This KOP and the consistency of Alternative D with adopted plans are addressed below.

#### KOP 9

KOP 9 (Figure 4-7) is located in the Continental Estates area just west of Country Club Drive on Fairview Drive. The photograph was taken from a parking lot on Fairview Drive, facing west towards the Elden Hills Golf Club. The parking lot services a small residential complex of approximately 30 units, and this KOP is considered representative of views from the back yards of residents along the east side of Fairview Drive.



KOP 9- Facing west from residential area on Fairview Drive in the Contintal Estates Area.

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**Figure 4-7**  
**Key Observation Point 9 (KOP 9)**

As can be seen in Figure 4-7, KOP 9 provides a view of a golf course in the foreground, with residential buildings and trees visible on the hillside beyond the fairway. Under Alternative D, a flood control berm would be constructed to the east side of the golf course fairway (i.e., between the fairway and KOP 9). This would be a section of the south berm described in Section 2.2.4. At this location the berm would be approximately 10 to 12 feet high, and it would dominate the view. The golf course would no longer be visible from the ground floors and back yards of nearby residences, and the views to the hillside across the fairway would also be obstructed. Although the berm would be vegetated with native plants—which are generally considered esthetically pleasing—the replacement of a golf course view with a view of a flood control berm would represent a strong visual contrast. Accordingly, this would constitute a significant esthetic impact.

#### Adjacent Residents' Views at Continental Estates

Many residents located adjacent to the two potential flood control berm sites would have their views obstructed under Alternative D. The south berm would extend up to 26 feet high in some locations, with the majority of the berm east of Country Club Drive ranging in height from 18 to 24 feet. The south berm would obstruct views from approximately 15 single-family and 20 multi-family residential buildings east of Country Club Drive and from three multi-family residential buildings along Fairview Drive. Many of these residences have backyard views of the hills and mountains surrounding Flagstaff, and these scenic views would be partially or totally blocked (especially from first floor windows and back yards). The loss of these views would constitute a significant esthetic impact.

The north berm would also obstruct views, particularly from the first floors of five apartment buildings located near the potential berm footprint. In this location, the berm would generally range between 10 and 14 feet high. The bases of the affected apartment buildings, however, would be roughly six feet higher in elevation than the base of the north berm in that location, reducing the extent to which the berm would block views. Thus, although portions of the views would be blocked by the north berm, residents would still be expected to have scenic views to the surrounding topography, and the partial obstruction of these views would not represent a significant esthetic impact.

### Consistency of Alternative D with Adopted Plans

The flood control berms would be located along the periphery of the floodplain between open space areas (e.g., golf course and undeveloped land) and residences or commercial structures. The berms would be vegetated with native plants and would appear compatible with the bordering open space areas. Accordingly, this alternative would be consistent with GMG 2000 and Open Space and Greenways Plan policies addressing open space areas. No other visual quality objectives in the GMG 2000 or the Open Space and Greenways Plan are considered applicable to the potential flood control berms.

### **No Action Alternative**

The No Action Alternative would not significantly alter the existing esthetic characteristics of the study area. Development would continue around the existing channels, which would presumably be consistent with the existing visual character. No esthetic impacts would result from this alternative.

### **4.11.3 Mitigation Measures**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

Alternative 6a would result in significant visual resource impacts associated with the loss of mature trees during construction of channel modifications and associated facilities. In order to help reduce the esthetic effects of tree loss, the following measures would be implemented:

- All mature trees removed or suffering significant root loss during construction will be replaced at a 1:1 ratio following construction. For this purposes of this mitigation measure, mature trees are defined as those that are five-inches or greater in diameter at breast heigh, over 20 feet tall, or both. (This is not necessarily the biological resources definition of a “mature tree.”) Significant root loss means root damage extensive enough to kill the affected tree. During tree replacement, the use of native trees will be favored over the use of nonnative ornamentals. However, homeowners adjacent to the channel who incur tree mortality may choose to have the affected trees replaced in-kind, even if they are nonnative. Trees will be replaced at or close to their original locations except where prevented by flood control project features.

- In order to facilitate regrowth, container plants will be used instead of seedlings during tree replacement.
- Five years after the initial tree planting has been conducted, an inspection will be made of all replaced trees. Trees which have died or appear to be dying will be replaced at a 1.5:1 ratio.

These measures will help offset the loss of trees associated with project construction. Because it can take some trees, such as ponderosa pines, decades to mature, the loss of trees would represent a long-term significant impact even after mitigation.

#### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The mitigation for this alternative would be identical to that described for Alternative 6a. Even with mitigation, the long-term esthetic impacts of this alternative would remain significant.

#### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

The mitigation for this alternative would be identical to that described for Alternative 7 with two exceptions:

- The affected area requiring tree replacement would be larger, including much of Thorpe Park as well as the Cheshire Park detention basin site.
- It may not be feasible to replace all displaced trees following the construction of Cheshire Park based on soil and geologic conditions and the topographical changes that may be necessary to accommodate the new park within the detention basin. Accordingly, tree replacement at the Cheshire Park detention basin site may occur at a 0.5:1 ratio.

Even with mitigation, the long-term esthetic impacts of Alternative 7 would remain significant, especially at Thorpe Park.

### **Alternative D: Localized Non-Structural Flood Proofing**

This alternative would result in significant unavoidable esthetic impacts associated with the obstruction of views by flood control berms. Because these impacts are considered unavoidable, no mitigation measures are provided.

### **No Action Alternative**

No esthetic impacts would result from the No Action Alternative; therefore, no mitigation measures are required.

## **4.12 HAZARDOUS AND TOXIC MATERIALS**

### **4.12.1 Significance Criteria**

This section analyzes the impacts of each alternative in terms of hazardous, toxic, and radioactive waste (HTRW) sites in the study area. Impacts are considered significant if there is an increased risk of exposure to local human populations or if there is an increased potential for contaminant transport and migration off-site.

Based on the nature of the potential flood control alternatives, the potential for causing a significant hazardous and toxic materials impact is generally limited to project construction. The operation of the project alternatives would not result in the creation, use, or disposal of hazardous materials or wastes. The potential for fuel or solvent spills associated with construction equipment use is addressed in Section 4.2, Water Quality.

### **4.12.2 Impact Assessment**

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

As described in Section 3.12, a comprehensive database search was conducted for a two-mile radius around the Beaver Street/Butler Avenue intersection. Based on the search and preliminary test excavations, the Rio de Flag and Clay Avenue Wash channel modifications may require construction in areas contaminated with hazardous wastes. The contaminants most likely to be encountered during construction are hydrocarbons, although it is possible that contamination along the channel alignments could include bacteria, bleach, and chemicals used during industrial processes. For known or suspected hazardous materials sites, the USACOE has developed field screening procedures and preliminary response plans that would be finalized and implemented should any hazardous or toxic waste be identified during construction. These include monitoring soil and testing for vapors in the vicinity of known or suspected sites, locating proposed channel modifications away from areas of contamination, using protective gear as necessary, containing contaminated soils on site until they are ready for disposal, and disposing of contaminated soils in compliance with local, state, and Federal remediation requirements. These measures are anticipated to avoid significant hazardous and toxic materials impacts.

In the event that previously undetected contamination is encountered during construction, the mitigation measures identified below would reduce impacts to less than significant levels.

**Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

This alternative includes all of the components described for Alternative 6a; however, Alternative 6b includes a two-block-long covered channel segment extending from Dale Avenue downstream to Birch Avenue. The use of a covered channel would not significantly affect the potential to encounter hazardous materials during construction, and the environmental effects of the channel modifications and Clay Avenue Wash detention basin would be the same as those described for Alternative 6a.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

A two-mile radius database search and preliminary test excavations were conducted for Thorpe Park, but not for the potential Clay Avenue Wash or Cheshire Park detention basin sites. Based on the tests from the Thorpe Park area, no hazardous materials are expected to be encountered during construction. Given the relatively undeveloped nature of the potential Clay Avenue Wash and Cheshire Park detention basin sites, hazardous material are not expected to be encountered at that these locations either. As a result, no hazardous materials impacts are anticipated.

It is possible, however, that either site may include previously undetected contamination. If hazardous materials are encountered during construction, the mitigation measures identified below would reduce impacts to less than significant levels.

**Alternative D: Localized Non-Structural Flood Proofing**

Although the potential berm locations were not included in the database search, no hazardous or toxic material impacts are expected given the types of uses located in the area (primarily residential and golf course) and the limited extent of grading required for berm construction (most material would be imported to the site). In the event that previously undetected contamination is encountered during construction, the mitigation measures identified below would reduce impacts to less than significant levels.

### **No Action Alternative**

The No Action Alternative would not require construction and would therefore not have the potential to disturb any hazardous or toxic material sites. Accordingly, this alternative would not result in hazardous or toxic material impacts.

#### **4.12.3 Mitigation Measures**

##### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

As described above, this alternative is not expected to result in hazardous and toxic materials impacts. However, should hazardous or toxic materials be encountered, construction will be halted and the USACOE will implement the previously described field screening procedures and response plans. Any contaminated soil or groundwater removed from the site will be transported and disposed pursuant to applicable regulations. With the implementation of these measures, hazardous and toxic materials impacts would be mitigated to less than significant levels.

##### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Mitigation for this alternative would be identical to the measures identified for Alternative 6a. As mitigated, impacts would be less than significant.

##### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Impacts are expected to be less than significant; however, if unexpected contamination is encountered during construction, the measures described for Alternative 6a would mitigate impacts to less than significant levels.

### **Alternative D: Localized Non-Structural Flood Proofing**

No hazardous or toxic materials impacts are anticipated from this alternative. If unexpected contamination is encountered during construction, the measures described for Alternative 6a would mitigate impacts to less than significant levels.

### **No Action Alternative**

Hazardous and toxic materials impacts would not result from this alternative; therefore, no mitigation measures are provided.

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## 4.13 SAFETY

### 4.13.1 Significance Criteria

Impacts on safety are considered significant if project related activities

- interfere with emergency response or evacuation plans
- result in unsafe conditions for motorists, bicyclists, or pedestrians
- involve the improper transportation, use, or storage of hazardous materials
- involve the improper disposal of hazardous waste
- increase the potential for contamination migration off-site.

Each of the project alternatives would employ standard construction safety practices, and all construction would be conducted in compliance with the Arizona Occupational Safety and Health Act of 1972 (Ariz. Rev. Stat. §23-401, *et seq.*). The Arizona Occupational Safety and Health Act of 1972 invokes in full the Federal Occupational Safety and Health Administration (OSHA) standards of construction (29 C.F.R., Part 1926). As part of compliance with these state and OSHA requirements, public access to construction sites would be restricted.

### 4.13.2 Impact Assessment

#### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

##### Bridge Modifications

Bridge modifications would occur at the locations of Meade Drive, Anderson Road, and Beal Road. The bridges on Anderson Road and Beal Road would be completely replaced and would entail closing these bridges for approximately two weeks. Modifications to the bridge on Mead Drive involve the installation of wing walls which direct flood flows, this improvement would allow for the street to remain open during construction. Road closures due to bridge modifications would not occur concurrently. Based on these factors, there would not be a significant impact to emergency response systems.

## Channel Modifications

### *Emergency Response and Evacuation Procedures*

*Thorpe Park to Upstream of Beaver Street.* During construction of the Rio de Flag channel modifications, several street segments would be temporarily closed including Bonito Street, Dale Avenue, Cherry Avenue, Birch Avenue, and Aspen Avenue at the Rio de Flag crossing. These road closures would be limited to approximately five to seven days per crossing and would not be conducted simultaneously (see Table 2-1 and Section 4.8, Transportation). Construction of the culvert under Route 66 would restrict the road to one lane eastbound and one lane westbound for approximately two weeks during construction.

The primary emergency response unit for this area is the City Fire Station No. 1 (see Figure 3-8). This area is located within a four mile radius of this four additional stations, including Station Nos. 2, 4, 5, and 6. Depending on the timing of an emergency call, any of these stations may serve as the secondary responder. As with the previous alternative, mitigation is provided to reduce impacts on emergency response times below the level of significance.

*Clay Avenue Wash Detention Basin to Mike's Pike.* This reach would require the temporary closure of five street segments, including portions of Chateau Drive, Blackbird Roost, McCracken Drive, Malpais Lane, and the "Five Points" Intersection. These roadways are located within the service area of City Fire Station No. 1, which is located immediately north of the proposed Clay Avenue Wash alignment at Malpais Lane. The secondary emergency service providers for this location include Station Nos. 2, 4, and 6 which are all located within four miles of this reach. Road closures are anticipated to last approximately 5 to 7 days at each location and would not be conducted simultaneously

During the short-term closure of Malpais Lane, emergency vehicles departing from City Fire Station No. 1 would be restricted from exiting southbound onto Malpais Lane. For some emergency situations, response times would be slightly increased due to the minor detour that would be required to access Route 66 or Milton Road (i.e., Dupont Avenue). This detour, however, is expected to be very minor and would not significantly alter or disrupt emergency response plans from Station No. 1. Similarly, the closure of the three other road segments could slightly alter response routes through the area but would not be considered significant impacts. The mitigation measures described for the previous reach would apply.

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*Mike's Pike Alignment.* Mike's Pike is located in the primary service area of Fire Station No. 1. This street is within the service radius of Station Nos. 2, 4, 5, and 6 which serve as the area's secondary emergency responders. Since Mike's Pike is not a major thoroughfare and construction operations will last only six weeks, temporary closure of the street would not significantly affect the City's emergency response plans. Access to the streets surrounding Mike's Pike would not be restricted by construction operations.

*Upstream of Beaver Street to Butler Avenue.* As discussed in Section 4.8 (Transportation), San Francisco Street would be converted to a two-way street during construction of the covered channel at Beaver Street. Conversely, Beaver Street would become a two-way street during construction at San Francisco Street. Since adequate north/south access would be maintained between both sides of the railroad tracks in the downtown area, impacts on emergency response routes would be less than significant during construction. The roadway modifications would last approximately one week per street, and each street would be returned to its pre-construction (one-way) configuration after construction.

#### *Construction Safety*

Channel modifications would result in less than significant construction safety impacts. All construction activities would incorporate standard safety requirements. If blasting is required, all applicable requirements will be undertaken to ensure the safety of construction workers and the general public.

#### *Other Hazards*

Channel modifications could result in the creation of a potential safety hazard regarding unauthorized pedestrian access in the channel during flood events. As stated in Section 2.2.2, many portions of the modified channel would not be fenced off or otherwise closed to pedestrian access. During major flood events, if people enter the channel, they would be at risk from high velocity flows. Mitigation is provided in Section 4.13.3 to reduce these potentially significant impacts to public safety below the level of significance.

### Clay Avenue Wash Detention Basin

The potential Clay Avenue Wash detention basin site is located in a sparsely populated area and would not require the closure or alteration of any city streets or emergency response routes. The primary responder to this area is the City Fire Station No. 1 and the secondary response unit is Station No. 6. The construction and operation of this detention basin would not interfere with any emergency response plans associated with these stations. As with the Thorpe Park detention basin, the construction and operation of the detention basin would not impact emergency evacuation procedures or generate unsafe conditions for construction workers or the general public.

### **Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Alternative 6b would result in two more blocks of covered channel than Alternative 6a, with a corresponding incremental increase in the public safety risks associated with covered channels. As described for Alternative 6a, the safety impacts associated with covered channels would be mitigated to less than significant levels. With the exception of the safety impacts associated with the additional section of covered channel, the safety-related impacts associated with this alternative would be identical to those described for Alternative 6a.

### **Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Under Alternative 7, the Clay Avenue detention basin, Clay Avenue Wash, and Rio de Flag channel modifications would be the same as described for Alternative 6b. The difference between these two alternatives is that Alternative 7 would also include upstream detention basins at Thorpe Park and Cheshire Park. The additional impacts associated with these two basins are discussed below.

### Emergency Response and Evacuation Procedures

#### *Cheshire Park*

The primary emergency responder for Cheshire Park is the City Fire Station No. 5, located less than one mile to the north of the project site on West Mountain Drive. Cheshire Park is located within a five

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mile radius of three additional City Fire Stations: Stations Nos. 2, 4, and 6. Any of these three stations could be the secondary responder to an emergency in the vicinity of the detention basin, depending on their availability at the time of an emergency call. The traffic impacts that would result from project construction would be minimal due to the direct site access via Highway 180 and Fremont Boulevard, and construction of the detention basin would not result in any road closures. Accordingly, the construction of the detention basin would not cause a significant impacts to emergency response systems.

### *Thorpe Park*

The primary emergency responder for Thorpe Park is the City Fire Station No. 1, located on Malpais Lane just north of its intersection with Route 66. Thorpe Park is located within a four-mile radius of four additional city fire stations, including Station Nos. 2, 4, 5, and 6 (see Figure 3-8). Any of these four stations could be the secondary responder to an emergency at the park, depending on their availability at the time of an emergency call.

During construction of the detention basin, a segment of Thorpe Road between Aztec Street and Hopi Drive may be closed for approximately two weeks. This closure would limit emergency access to an isolated residential area northwest of the park that is only accessible via Curling Smoke Drive. During the closure of this segment, secondary emergency responders arriving from the north or east would have to drive approximately one additional mile to access Thorpe Road from the south via Cherry or Birch Avenue. Given the distance required to bypass the closed road segment and the temporary nature of the closure, this impact would not be significant. In order to ensure adequate emergency response to this residential area during the closure of the Thorpe Road segment, however, a mitigation measure has been provided.

The city does not currently have an official evacuation plan in the event of flooding or other large-scale emergency (City of Flagstaff 1999b). Should such an event happen, evacuation would be directed by the police and other emergency response personnel. Construction and operation of the detention basin would not significantly interfere with emergency evacuation procedures in the area.

### **Alternative D: Localized Non-Structural Flood Proofing**

The construction-safety impacts associated with this alternative would be similar to those described under Alternative 6a. Since streets closures would not be anticipated under this alternative, impacts on emergency response routes and evacuation procedures would also be less than significant.

### **No Action Alternative**

As discussed in the transportation section, flooding in the downtown area can cause serious transportation delays during both minor and major flood events. During minor flood events, Route 66 through downtown becomes completely impassable, and during a 25-year or greater event, most of the streets on the north and south sides become impassable. Closure of these streets would affect emergency response routes throughout the city, and the provision of emergency services is in high demand during and immediately after natural disasters such as major flooding. Under this alternative, the closure of Route 66 and other intersecting roadways would represent a significant safety hazard.

#### **4.13.3 Mitigation Measures**

### **Alternative 6a: Single Detention Basin with Channel Modifications (Open Channel Between Dale and Birch Avenues)**

No significant safety-related impacts are anticipated from construction or operation of the channel modifications and Clay Avenue detention basin. The following measure is provided, however, to further reduce safety impacts associated with the temporary road closures:

- Prior to construction, City Fire Stations 1 through 6 will be provided with a schedule of all temporary road closures due to construction activities associated with project construction.

Potentially significant impacts could result from unauthorized entry into the flood control channels during flood events. In order to reduce this risks below the level of significance, the following mitigation measure has been provided:

- A public information program will be established and maintained by the City of Flagstaff. This will primarily focus on elementary and middle school visitation by city staff but will also include public

service announcements and advisory notices to be sent with utility bills. This type of program has been found to be the single most important element in reducing unauthorized access to drainage facilities. Such a program, when supplemented by appropriate signage and maintenance of facilities to assure visibility from the public right-of-way, where possible, forms an effective well-rounded program.

**Alternative 6b: Single Detention Basin with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Mitigation for this alternative would be the same as the mitigation described for the Alternative 6a. As mitigated, safety impacts would be less than significant.

**Alternative 7: Three Detention Basins with Channel Modifications (Covered Channel Between Dale and Birch Avenues)**

Mitigation for this alternative would be the same as the mitigation described for the Alternative 6a. As mitigated, safety impacts would be less than significant.

**Alternative D: Localized Non-Structural Flood Proofing**

Safety related impacts from this alternative would not be significant; therefore, no mitigation measures are provided.

**No Action Alternative**

Mitigation for the safety hazards that could result from the No Action Alternative would entail the provision of improved flood protection. The provision of flood protection is not considered as mitigation; rather, this approach is represented by the other alternatives evaluated in this EIS.

## **4.14 CUMULATIVE IMPACTS**

This cumulative impact analysis addresses the incremental effects of the proposed action in conjunction with related past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time (see CEQ Regulations Implementing NEPA, 40 C.F.R. §1508.7). In order to be considered cumulative impacts, the effects must meet the following criteria: the effects would occur in a common locale or region; the effects would not be localized (i.e., they would contribute to effects of other actions); the effects would impact a particular resource in a similar manner; and the effects would be long-term (short-term impacts would be temporary and would not typically contribute to significant cumulative impacts).

### **4.14.1 Past, Present, And Reasonably Foreseeable Actions**

With the exception of the potential Clay Avenue Wash detention basin site, the study area is located entirely within the Flagstaff city limits. The potential Clay Avenue Wash detention basin site extends to the west of the city boundary onto unincorporated Coconino County land. This unincorporated land is located within the Metropolitan Planning Organization boundary of the City of Flagstaff.

Past actions within the Flagstaff area were originally centered around the timber industry and railroad-related activities. Within the past 25 years, the amount of developed land in the city has more than doubled and residential development now extends outward to the boundaries of the surrounding Coconino National Forest. Current actions are primarily related to residential growth which is fueled by the tourism industry and the proliferation of “second residences” in the Flagstaff area. Past and present actions within the study area have led to the existing conditions that are described in Section 3.0 and provide the basis for the analysis in Section 4.0 of this document.

In order to adequately assess the potential cumulative impacts associate with the proposed action, the following section analyzes the reasonably foreseeable future actions within the study area. These actions are described with respect to the agencies or jurisdictions involved in those actions.

## **City of Flagstaff**

There are four major projects that have been identified by the City of Flagstaff as potentially occurring within the study area between 2000 and 2005. These projects were determined to be reasonably foreseeable based on their current status (design or construction phase), and the likelihood of project implementation. The four projects identified by the city are shown on Figure 4-8 and are described below.

### *Railroad Springs Subdivision*

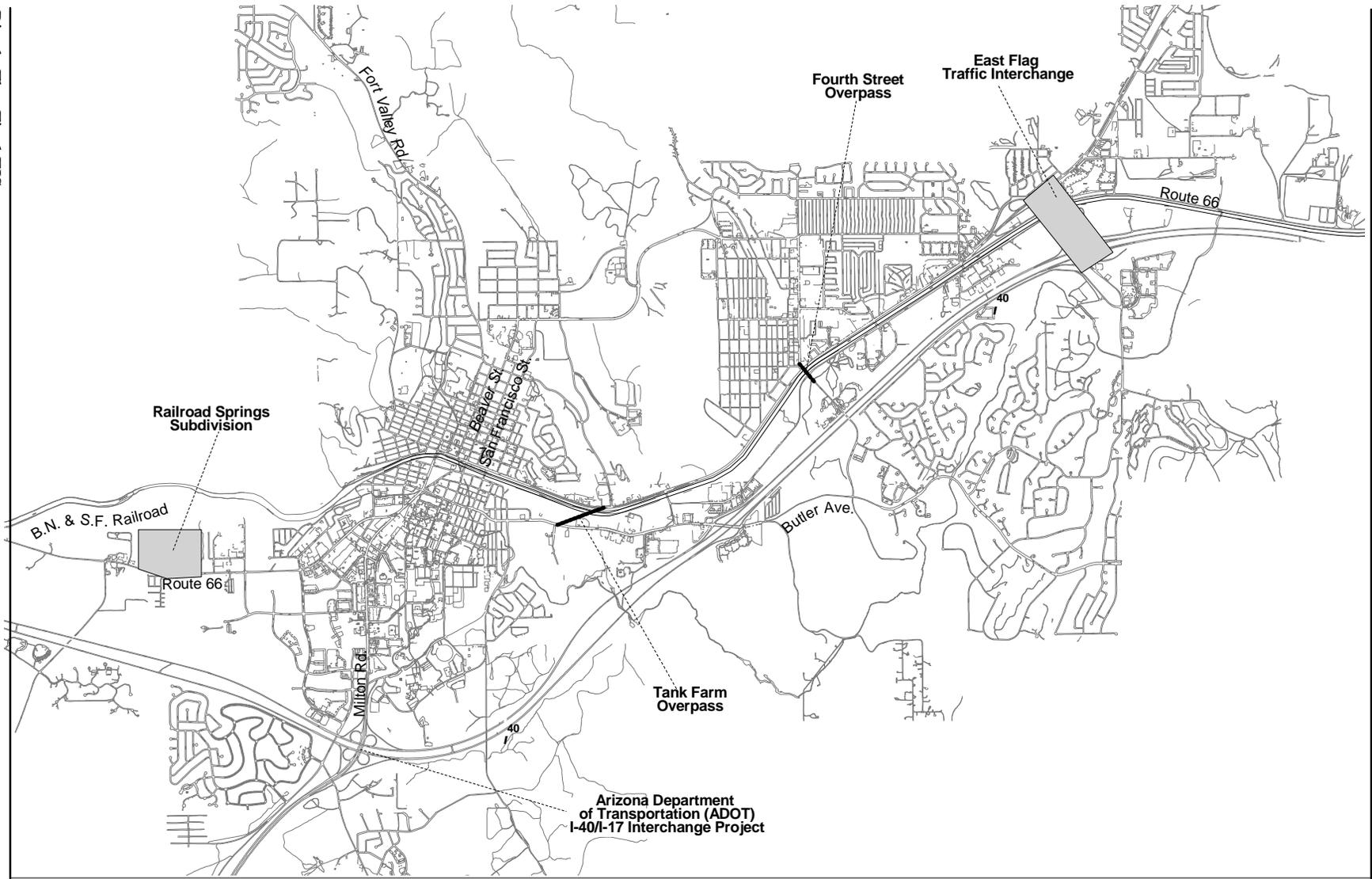
This housing development project is currently under construction in western Flagstaff and includes development of mobile home subdivisions between Dunham Street and the western city boundary. The project area is bounded on the south by Route 66 and on the north by the B.N. & S.F. Railroad tracks. It is anticipated that construction will be complete (to the western city limits) by 2003. Upon completion, the westernmost boundary of the Railroad Springs Subdivision will be located within 0.5 mile of the proposed Clay Avenue Wash detention Basin

### *Tank Farm Overpass*

As shown on Figure 4-8, the proposed Tank Farm Overpass project would connect Butler Avenue with Route 66 east of downtown. The overpass would involve construction of a bridge to traverse the railroad tracks, connecting the two major thoroughfares just west of Switzer Canyon Drive on the north side and approximately 0.5 mile east of Lumber Street on the south side. Construction is expected to begin between 2002 and 2004.

### *Fourth Street Overpass*

This overpass will connect Fourth Street over the B.N. & S.F. tracks east of downtown (see Figure 4-8). The overpass will be constructed during the same approximate time as the Tank Farm Overpass described above.



Source: City of Flagstaff, 1999.



**Figure 4-8**  
**Cumulative Projects**

### *East Flag Traffic Interchange*

The East Flag Traffic Interchange project involves construction of a new interchange between I-40, Country Club Drive, Highway 89 (north) and W. Route 66. Construction is projected to last approximately five years and begin between 2002 and 2004. The location of the proposed interchange is depicted on Figure 4-8.

### **Arizona Department of Transportation (ADOT)**

The ADOT initiated a major interchange project in the southern part of the City in early 2000. The project involves modifications to the I-40/I-17 interchange (located approximately two miles south of downtown) and is expected to require three years to construct. Phase I of this project was recently completed, and Phase II is currently underway (ADOT 20000). Major components of Phase II include:

- A new ramp connecting I-40 west to I-17 north
- A new ramp connecting I-40 west to I-17 south
- Bridge improvements at I-17 over Lake Mary Rd.
- Reconstruction of the Lake Mary Rd./University Heights North/Bevlah Blvd. intersection
- Widening of Lake Mary Rd. to four lanes
- New ramps from I-17 north to I-40 east and west
- New ramp from I-17 south to I-40 west

The daily construction activities can result in substantial highway restrictions, including lane reductions and speed limitations. In some cases, detours may be required.

### **United States Forest Service**

The study area is surrounded, in large part, by lands managed by the U.S. Forest Service (USFS). Of the 525 square miles that comprise the Greater Flagstaff Metropolitan Planning Organization area, 384 square miles are included in the Coconino National Forest and managed by the USFS. Ongoing maintenance and management of these surrounding lands would not substantially contribute to cumulative impacts for the Rio de Flag flood control project.

#### **4.14.2 Cumulative Impacts by Issue Area**

This cumulative impact analysis addresses the incremental effects of the proposed action when considered with the cumulative effects of other past, present, and reasonably foreseeable future actions. A cumulative impact analysis by resource area is presented below. The cumulative impacts are discussed with respect to Alternatives 6a, 6b, 7, and D. In most cases, the primary discussion involves Alternative 7, because it includes three detention basins and it entails substantially more construction activity than Alternative 6a, 6b, and D (see Section 2.2). Accordingly, the incremental contribution of Alternatives 6a, 6b, and D to cumulative impacts would be less than that of Alternative 7. The proposed berms associated with Alternative D are discussed with regard to cumulative impacts where the resulting cumulative impacts would be different or greater than those associated with Alternative 7. The No Action Alternative would not contribute to cumulative effects, and it is not discussed in this section.

#### **Topography/Geography**

Alternatives 6a, 6b, 7, and D would involve some grading during the construction of the flood control features (floodwalls, channel modifications, etc.). The amount of grading and earthwork required for each alternative would not contribute incrementally to a significant cumulative impact. This assessment is based on the types of other major projects anticipated to occur in the study area (primarily residential development and highway interchanges) and the effect these types of projects have on topography and geography. While other projects may contribute to localized erosion or seismic-related impacts, none of the flood control alternatives addressed in this EIS would contribute to these localized effects.

#### **Water Quality/Hydrology**

Cumulative impacts on the quality of stormwater runoff could occur if the other projects in the watershed are constructed at the same time as one of the project alternatives. The Railroad Springs subdivision will be constructed in the vicinity of the Clay Avenue Wash Detention Basin and may potentially contribute to erosion and sedimentation in the Clay Avenue Wash.

The Railroad Springs subdivision and other projects in the study area will also be subject to laws and regulations that address water quality; construction projects over five acres will require a General Construction Activity Storm Water Permit. Permit applicants are required to submit a Notice of Intent (NOI) describing the proposed action and local drainage/water quality conditions (if known), as well as

a Storm Water Pollution Prevention Plan (SWPPP) designed to eliminate or reduce pollutant discharge. Specific SWPPP provisions include requirements for identifying potential pollution sources, controlling stormwater runoff and erosion, implementing best management practices (BMPs) to prevent or reduce contaminant discharge, and conforming with applicable state and local stormwater and erosion control plans. The identification of applicable BMPs is based on site-specific characteristics, but typically involves implementing and monitoring pollution control measures both during and after construction. Based on these requirements, the cumulative impact of the projected future actions in the study area would not cause a significant construction-related impact to water quality (including impacts associated with erosion and sedimentation).

Because the alternative flood control projects addressed in this EIS would not result in post-construction water quality or hydrology impacts, the operation of the alternatives would not contribute to cumulative impacts to these resources.

### **Biological Resources**

As described in Section 4.3, none of the alternatives would affect federally threatened or endangered species. Construction of Alternatives 6a, 6b, and 7 would result in short-term impacts to wetland/riparian habitats. These impacts would be mitigated through the creation of additional wetland and riparian areas. Because there would be no net loss of wetland/riparian habitat with any of the alternatives, they would not contribute to a cumulatively significant loss of wetland or riparian resources. The loss of ponderosa pines would not contribute to a cumulatively significant biological resources impact because of the large amount of pine forest that is located within the National Forest lands surrounding Flagstaff and relatively protected from development.

### **Cultural Resources**

The proposed action could potentially result in impacts on NHPA eligible cultural resource sites. Because this alternative has the potential to affect historic properties, it therefore has the potential to contribute to a cumulative effect with regard to cultural resources.

There may be one-half to one million cultural resources (principally archeological sites) in Arizona, of which roughly 50,000 to 60,000 have been recorded (U.S. Navy 1997). The Arizona State Historic Preservation Officer (SHPO) annually reviews 2,000 to 3,000 actions that could destroy cultural

resource sites, and an unestimated number of unregulated actions (e.g., most activities on private lands) also affect sites. Legislation that has been enacted to protect cultural resources includes the National Historic Preservation Act, the Archeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act.

Although cumulative data with regard to cultural resource impacts are not precise, it seems reasonable to conclude that the destruction or disturbance of sites that may occur as a result of the proposed action would contribute to the continuing loss of cultural resources in the western United States. These losses would represent only a fraction of a percent of the resources that exist on a local, regional, or state resource basis. Based on Section 106 compliance requirements, resources that may be destroyed or disturbed by Federal actions (which may include some of the reasonably foreseeable actions) will contribute to our understanding of past societies.

Because the USACOE will comply with Section 106 compliance requirements for the Rio de Flag Flood Control Project, the project's incremental contribution to cultural resource impact would not result in a significant cumulative effect.

### **Land/Water Use**

The proposed flood control alternatives would not conflict with any relevant land use plans or policies contained in the *Flagstaff Growth Management Guide 2000 (GMG)* and the *Flagstaff Area Open Spaces and Greenways Plan*. Similarly, the reasonably foreseeable projects in the study area would be consistent with local land use plans and would not lead to cumulative land use impacts. The Railroad Springs subdivision development is an approved, ongoing project within the city limits near the proposed Clay Avenue Wash detention basin. The other projects are related to the local roadway/highway network and would provide improved transportation in the area. Implementation of the proposed action would not interfere with or alter land plans or land use designations of the anticipated future development areas; accordingly, cumulative land use impacts would not be significant.

### **Recreation**

Alternatives 6a, 6b, and 7 would provide new recreational amenities as described in Section 4.6 (Recreation). These include improvements to the FUTS trail in the downtown area by providing access under the railroad. These amenities would increase publicly available recreation facilities and would

result in a direct benefit to recreational users in the city. Short-term recreation impacts would occur, however, at Cheshire Park and Thorpe Park during construction of the various flood control features. Under Alternatives 6a and 6b, only minor disruptions would occur at Thorpe Park. Alternative 7, on the other hand, would result in significant unavoidable impacts from the closure of both parks for 4 to 12 months.

The other projects identified within the study area would not preclude the access to or otherwise impact any recreational resources; therefore, these projects would not contribute to cumulative recreational impacts. Although the Railroad Springs subdivision would generate additional demand for recreation resources in the study area, Alternatives 6a, 6b, and 7 would provide some of the needed recreation resources (i.e., FUTS trail improvements), and they would not contribute incrementally to this increased demand. Based on these factors, the cumulative recreation impact of the alternatives would not be significant.

### **Socioeconomics**

Alternative 6a, 6b, and 7 would result in significant unavoidable socioeconomic impacts regarding the displacement of several residences. The greatest socioeconomic impacts would result from Alternative 6a with the acquisition of 19 residences (3 along the downtown reach of the Rio de Flag, 1 at the proposed Clay Avenue Wash detention basin site, and 15 along the Clay Avenue Wash near Blackbird Roost).

The five reasonably foreseeable future projects that are described above would not be expected to contribute incrementally to these impacts. In contrast, the Railroad Springs subdivision would increase the supply of local housing. The short-term generation of construction-related jobs would be beneficial to the local economy and would not be expected to substantially alter the area's population/housing balance. Accordingly, significant cumulative socioeconomic impacts are not anticipated.

### **Transportation**

Alternative 7 would generate the greatest transportation-related impacts of the five alternatives. The transportation impacts associated with Alternative 7 would be potentially significant due to construction-related vehicle trips on the local roadway network (approximately 36 truck trips per hour under the "worst case" scenario). In addition, short-term road closures would occur under Alternative 7. These

impacts would be reduced to less than significant levels through incorporation of the provided mitigation measures.

The effects of the abovementioned transportation impacts would not contribute to significant cumulative transportation impacts. The incremental effects of the five reasonably foreseeable future projects are discussed below:

- The **Railroad Springs subdivision** would generate both short-term and long-term traffic impacts. Short-term traffic impacts would be associated with housing construction. However, this site is accessible from Route 66, minimizing the potential for localized traffic circulation impacts. Long-term traffic would be generated by residents of the subdivision.
- Construction of the **Tank Farm** and **Fourth Street overpasses** would not require a large amount of imported fill material and would not result in the closure of any major city roads. The long-term effect of these projects would be to improve circulation.
- The **East Flag Traffic Interchange** project is located approximately 4.5 miles east of downtown Flagstaff. Construction activities are anticipated to last approximately five years and would affect the roadway system on the eastern side of town. Given that this project is located outside of the downtown area, it would not be expected to incrementally contribute to the traffic impacts resulting from the potential flood control alternatives.
- The **Interstate-40/Interstate-17 Interchange** is another major roadway project located outside of the downtown area. This project is located approximately two miles south of downtown Flagstaff and would require lane reductions and other traffic controls. Due to the geographical isolation of this project, it would not be expected to contribute noticeably to the traffic circulation impacts associated with the potential flood control alternatives.

Although it is possible, the probability that the all of the construction activities (i.e., hauling, lane restrictions and detours) would be conducted concurrently for the above projects is low. Assuming the “worst case” scenario, however, the cumulative effects of these projects are not expected to be significant. Those projects with the greatest transportation impacts (i.e., East Flag Traffic Interchange and I-40/I-17 Interchange) would be located in different parts of the city and would not significantly contribute to transportation impacts on the local roadway network. If it is determined by the city that significant cumulative transportation impacts would occur, these impacts could be mitigated to less than

significant levels through construction phasing and implementation of a city-wide traffic control plan during periods of heavy construction.

## **Noise**

Noise impacts associated with the proposed action are limited to short-term construction noise generated by construction of the proposed channel modifications. Noise impacts would be created by on-site construction activities and, to some degree, roadway noise from construction traffic. These impacts could be mitigated to less than significant levels, with the exception of blasting related noise. In the event that blasting occurs the proposed channel modifications would result in significant unavoidable impacts.

Cumulative noise impacts would be less than significant due to the location of the proposed flood control features. The Railroad Springs subdivision is located approximately 0.5 mile from the proposed Clay Avenue Wash detention basin. Given the noise attenuation factors described in Section 4.9, this distance would reduce construction noise from the one location to the other by over 30 dB. The other reasonably foreseeable future projects are also located far enough away from the proposed detention basin sites, channel modifications, or flood control berms to avoid creating a cumulative noise impact.

## **Air Quality**

The Flagstaff area is in attainment with Federal and state air quality standards. Additionally, the City of Flagstaff is within Arizona's Airshed 3, which is a Class II area (and therefore has less stringent air quality standards than Class I areas, as described in Section 3.10). Based on these two factors, there are no emission levels set for proposed action and other local projects. Given these factors, the cumulative contributions of the reasonably foreseeable projects in the area would not be expected to affect Flagstaff's status as an attainment area, and cumulative air quality impacts would be less than significant.

## **Esthetics**

Alternatives 6a, 6b and 7 would each result in unavoidable long-term significant impacts associated with the channel modifications and the resulting loss of mature trees along Rio de Flag through downtown Flagstaff. Alternative 7 would also cause significant esthetic impacts at Thorpe and Cheshire parks. The esthetic impacts associated with Alternative D would be significant and unavoidable because the proposed berms in the Continental Estates area would significantly obstruct views from neighboring residences.

The reasonably foreseeable projects would not cumulatively result in a significant change to the visual character of the Flagstaff area. The most visible changes associated with the other potential cumulative projects would be the new houses at the Railroad Springs subdivision, and the new Tank Farm and Fourth Street overpasses. The cumulative effect of these changes would result in an increased presence of human activity in the Flagstaff area. However, these projects would not significantly change the overall appearance of the city (i.e., an urban center surrounded by scenic and relatively undeveloped terrain). Thus, while each of the potential Rio de Flag flood control alternatives would cause significant esthetic impacts, none would contribute incrementally to a significant cumulative impact in terms of the overall visual quality of the Flagstaff area.

## **Hazardous and Toxic Materials**

Impacts regarding hazardous and toxic materials are not anticipated during construction or operation of the project alternatives. Additionally, none of the reasonably foreseeable projects would be expected to generate or expose the public to hazardous and toxic materials. Thus, the potential flood control projects would not contribute incrementally to cumulatively significant hazardous and toxic materials impacts.

## **Safety**

Alternative 6a, 6b, and 7 would reduce the risk of flooding within the 100-year floodplain. In consideration of the cumulative projects in the study area (particularly development in the downtown area), the flood control project would be beneficial to numerous residential, commercial, and industrial uses. Alternative D would also provide limited flood protection; however, the safety benefits would be less, given the lesser degree of flood protection. Potential safety hazards regarding access to the flood

control channels would be mitigated to less than significant levels under each alternative. It is expected that all construction sites would be restricted from public access. Based on this expectation, none of the other reasonably foreseeable projects would cause safety impacts, and they would therefore not contribute to a significant cumulative safety impact.

#### **4.15 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES**

NEPA (40 C.F.R. § 1502.16) requires analysis of significant irreversible and irretrievable effects.

*Irreversible commitments* are damages to the environment that cannot be reversed, even after the life of a project. *Irretrievable commitments* are those that are lost for a long period of time (e.g., the life of a project). This includes the use of nonrenewable resources, such as metal, wood, fuel, paper, and other natural or cultural resources. These resources are considered committed because they would be used for the proposed action when they could have been conserved or used for other purposes.

Another impact that falls under the category of the *irreversible* and *irretrievable commitment* of resources is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

The flood control alternatives evaluated in this EIS would each result in an irreversible commitment of building materials and fuel for construction vehicles and equipment, as well as other resources. The flood control alternatives would require the commitment of work force time for construction, engineering, environmental review and compliance and, after project completion, maintenance. These commitments of resources are neither unusual nor unexpected given the nature of the proposed project, and they are generally understood to be tradeoffs for the benefits of the respective alternatives, if implemented.

The flood control alternatives would also result in long-term impacts to socioeconomics. As discussed in Section 4.14.2 (Socioeconomics), Alternatives 6a, 6b, and 7 would result in significant unmitigated social impacts from the displacement of residences, and disproportionate effects on minority and low-income neighborhoods. No other irreversible or irretrievable commitments of resources would occur with the implementation of the alternatives addressed in this EIS.

#### **4.16 RELATIONSHIP OF SHORT-TERM USES AND LONG-TERM PRODUCTIVITY**

NEPA (40 C.F.R. § 1502.16) requires an EIS to address the relationship between short-term uses of the environment and the impacts that such uses may have on the maintenance and enhancement of the long-term productivity of the affected environment. Of particular concern are impacts that would narrow the range of beneficial uses of the environment. This refers to the possibility that choosing one alternative reduces future flexibility in pursuing other options, or that transforming land or other resources to a certain land use often eliminates the possibility of other uses being performed at that site.

Short-term uses resulting from the implementation of the Alternatives 6a, 6b, 7, and D are primarily associated with construction activities. Although some short-term impacts would be significant prior to mitigation (e.g., noise and transportation), these impacts would generally be mitigated to less than significant levels and would cease upon completion of construction. While the noise impacts of blasting during channel or detention basin excavation (if necessary) could not be mitigated to less than significant levels, this short-term impact would not effect long-term productivity. The impacts associated with the loss of riparian/wetland habitat would be offset by the long-term gain in similar habitat from habitat restoration and creation. Overall, these impacts would be short-term and would not affect the long-term productivity of the area's resources.

Some alternatives would also result in long-term significant impacts. For example, significant and unavoidable social impacts would result from the displacement of several residences (Alternative 6a, 6b, and 7) as described in Section 4.14.2 (Socioeconomics). These socioeconomic impacts would not, however, be expected to affect long-term productivity.

The proposed flood control alternatives would reduce public health and safety risks from flooding dangers. Accordingly, the provision of increases flood protection would be considered as a long-term benefit to productivity within the affected portion of the Rio de Flag floodplain.

## **4.17 ENVIRONMENTAL COMMITMENTS**

This EIS incorporates environmental commitments made by the USACOE for the Rio de Flag Flood Control Project. These include elements that have been incorporated into project design that avoid or minimize environmental effects and mitigation measures identified in this EIS to reduce project impacts to less than significant levels. This section provides a summary of these commitments for Alternative 6b, including general commitments (e.g., those that may apply to more than one resource area) and resource-specific commitments (e.g. construction noise mitigation measures).

### **4.17.1 General Commitments**

- All berms and detention basin embankments will be revegetated pursuant to a native plant species revegetation plan developed by the USACOE in consultation with the Arboretum at Flagstaff (see Appendix J).
- In riprap-lined channels, the riprap will be covered with soil, allowing the establishment of some vegetation, for example, grass. See the following discussion of biological resource-specific mitigation (in Section 4.17.2) for areas where wetland and riparian vegetation will be restored or created within the Rio de Flag channel.
- At a point approximately 250 feet south/southeast of the North Elden Street/Route 66 interchange, the underground concrete channel will transition into an open greenbelt channel. The term “greenbelt” is used because this section of Rio de Flag will include several features favoring the establishment of vegetation in and along the channel, including a 56-foot wide channel bottom and shallow 4:1 (H:V) side slopes. Additionally, the channel will not be lined with riprap or concrete. This segment will extend east and south from the underground channel, joining an existing remnant section of the historic Rio de Flag channel approximately 1,700 feet upstream of Butler Avenue.
- Vehicular barriers will be provided where a riprap channel is located along a street, and pedestrian barriers will be placed where warranted. Warning signs will be posted at major access points (such as gates) and periodic maintenance inspections for vagrants/campers will be implemented along the modified channel.
- Blasting activities will comply with all applicable construction and safety requirements, and the need for blasting will be minimized or eliminated during the project design phase.

- Access will be maintained to all businesses and residences along Mike's Pike during the construction of the underground channel along this roadway.
- During construction activities, all staging areas and construction sites will be fenced to prohibit public access.

#### **4.17.2 Resource-Specific Commitments**

##### **Topography/Geography**

- The flood protection structures (embankments, floodwalls, wingwalls, etc.) will be designed and constructed according to applicable seismic safety standards.

##### **Water Quality/Hydrology**

- Construction in and along the Rio de Flag and Clay Avenue Wash will cease if and while substantial rain events are predicted or are occurring in the project vicinity. Exposed bare ground will be covered with seed-free loose straw or erosion control matting prior to these events to protect the soil from erosion while construction activities have ceased.
- Bare ground on the construction site will be covered with seed-free loose straw or erosion control matting during the post-construction period prior to establishment of vegetative cover or during periods of prolonged inactivity once the soil surface has been disturbed and bare ground exposed.
- Embankments will be planted with native vegetation as specified in the native species revegetation plan developed by the USACOE and the Flagstaff Arboretum (see Appendix J).
- The Rio de Flag and Clay Avenue Wash channels upstream of construction activity will be dammed temporarily to prevent water from entering the reach under construction should a storm occur. A diversion pipe will be installed in the dam to convey any water around the construction area for discharge downstream of the construction activity.
- Equipment will be in proper working condition and inspected for leaks and drips on a daily basis prior to commencement of work. The USACOE and/or the City of Flagstaff will develop and implement a spill prevention and remediation plan and workers will be instructed as to its requirements. Construction supervisors and workers will be instructed to be alert for indications of

equipment-related contamination such as stains and odors. Construction supervisors and workers will be instructed to respond immediately with appropriate actions as detailed in the spill prevention and remediation plan if indications of equipment-related contamination are noted. Construction equipment will only be operated within dewatered areas of the creek.

- Fuels, solvents, and lubricants will be stored in a bermed area so that potential spills and/or leaks will be contained. Soil contamination resulting from spills and/or leaks will be remediated as required by state and/or Federal law. Storage areas will be constructed so that containers will not be subjected to damage by construction equipment.

### **Biological Resources**

- Biological resources mitigation for Alternative 6b will be 1.2 acres of on-site restoration at Thorpe Park and in the Rio de Flag Channel, with an additional 1.8 acres of habitat creation. Subject to the timing constraints (which require that 0.6 acre of the habitat creation occur prior to project construction), and to the extent feasible, the additional habitat creation for the channel modifications downstream of Thorpe Park and along Clay Avenue Wash will be accomplished in the realigned Rio de Flag channel between Route 66 and Beaver Street. If the realigned channel in this area cannot accommodate all of the required wetland and riparian habitat creation, the additional mitigation will be provided in the greenbelt channel or immediately downstream from the greenbelt channel in the remnant historic channel. For more detailed information regarding the biological resource mitigation measures for Alternative 6b, see Appendix E of this EIS.
- Mitigation to reduce the potential for introducing nonnative weed species into the Rio de Flag system will be accomplished by maximizing the reuse of soil excavated from the Rio de Flag channel modifications to cover riprap in the channel and to construct berms and embankments. Where imported soil is necessary, preference will be given to soil from sites with minimal invasive weed species. The native plant revegetation plan developed by the USACOE in consultation with the Arboretum at Flagstaff contains post-construction monitoring and maintenance requirements for revegetated areas, including exotic species management measures (see Appendix J).

### **Cultural Resources**

- Following determinations of eligibility, historic properties will be assessed for the criteria of effect and adverse effect. If the project will adversely affect a historic property, mitigation measures will

be required to reduce the impacts to a level of no adverse effect. This entire procedure will be followed as specified in a Programmatic Agreement (PA). The PA is a document detailing how Section 106 of the NHPA will be implemented for this proposed action. It is an agreement between the USACOE, the SHPO, and the Advisory Council on Historic Preservation (Council). The Hopi Tribe, The Haulipai Tribe, and the Pueblo of Zuni will be invited to participate as concurring parties. The PA will contain stipulations that may involve requiring additional surveys and historic building inventories, determinations of eligibility, assessment of effects, and mitigation. When the PA is executed by the Council, the project as planned will be in compliance with Section 106 of the National Historic Preservation Act.

Mitigation can be achieved through a variety of methods. The optimal form of mitigation is avoidance or preservation in place. Barring that preferred method, the primary mode of mitigation for historic properties may be limited to, but will probably include Historic American Building Survey (HABS) recordation for any historic property that will be adversely affected by the preferred alternative. For the structural element; the Atlantic and Pacific Railroad Bridge and the ranch complex, Historic American Building Survey/Historic American Engineering Record (HABS/HAER) recordation may be used. If possible, a protective berm should be place around the ranch buildings to protect their integrity. The National Parks Service dictates the level of recordation in both cases. The National Parks Service may not be interested in overseeing mitigation of these historic features. In that case, the State of Arizona has their own approved documentation standards that are outlined in Section 41-861, *et seq*, of the Arizona Revised Statutes. Mitigation measures will be specified in a PA.

- In summary, mitigation requirements will include HABS/HAER recordation of the Atlantic and Pacific Railroad Bridge and the ranch complex on Route 66.

## **Recreation**

- During construction of the channel between Thorpe Park and the railroad tracks, signs shall be posted on appropriate trail markers identifying alternative routes to re-connect to the FUTS trail. It is anticipated detours would primarily utilize residential streets.

## **Socioeconomic Impacts**

- The property owners that will be affected by land acquisition are entitled by law to be justly compensated for their property, based on fair market value as determined by an independent appraiser. Relocation assistance payments and counseling will be provided in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601 (1996)) to ensure adequate relocation and a decent, safe, and sanitary home for displaced residents. All eligible displaces will be entitled to moving expenses. This applies to the ranch house and property at the Clay Avenue Wash detention basin site and at the Trailers Ho mobile home park at 703 South Blackbird Roost.

Eligible homeowners will also be entitled to certain supplemental payments to compensate for increased cost of replacement homes over and above the amount received for their homes, increased interest costs, and certain other expenses. In accordance with the provisions of the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act, no residential occupant will be displaced unless replacement housing is available. All benefits and services will be provided equitably to all residential relocates without regard to race, color, religion, age, national origin, and handicap as recorded under Title VI of the 1964 Civil Rights Act (42 U.S.C. § 2000d-1).

## **Traffic and Transportation**

- Closure of the Anderson Road and Beal Road bridges and North Thorpe Road would not occur simultaneously.
- To avoid access-related impacts to the schools near Thorpe Park, construction-related road closures at North Thorpe Road and the access road to Flagstaff Junior High will be conducted during the summer.
- At the Bonito Street and Dale, Cherry, Birch, and Aspen Avenue road crossings, construction of underground culverts will necessitate road closures of approximately 5 to 7 days each. At the Route 66 and Butler Avenue crossings, the two culverts will be poured by halves to maintain through traffic (to a total closure time of 5 to 7 days per half). At the Beaver Street and San Francisco Street crossings (one-way south and one-way north, respectively), construction will require about 1 week each, and will not be undertaken concurrently. In order to minimize impacts on traffic, each road will become a 2-way road during construction of the other.

- During construction of the underground culvert at the railroad crossing (approximately 700 feet west of Beaver Street), one of the two tracks at this crossing will always remain open.
- A traffic control plan shall be prepared during the final design stage of the project, and implemented during the construction phase. The plan shall address and outline appropriate vehicular speeds in construction areas; travel routes, detours, or lane/road closures; flag-person requirements; appropriate signage and safety reflectors; coordination with the Arizona Department of Transportation (ADOT); appropriate notification to the public; any utility relocation requirements; the location of staging areas; safety procedures to reduce hazards to motorists, bicyclists, and pedestrians; approach to ensuring access to businesses and residences; and emergency information. The traffic control plan will be reviewed by the city and ADOT. The final version of the plan will be submitted to all appropriate entities.
- A road improvement plan shall be prepared during the final design stage of the project, and implemented during the actual construction phase. The plan shall identify road segments, bridges, and culverts that need to be improved and turnout locations that need to be constructed to accommodate project construction, maintenance, and operational activities. The plan will also identify any damage to existing roadways, caused by construction vehicles, that will need to be repaired.
- Construction activities would result in the closure of several road segments throughout the City. During construction activities, alternate routes and detour signage will be used to ensure motorist safety and minimize commute inconveniences. In addition, it may also be advantageous to request a local radio station to assist in notifying the community of the anticipated roadway closures and major construction dates. Other public notification methods which can be implemented could include: a roadway hotline number, local newspaper announcements/press release information, television news, city/community bulletins, or web site announcements.

## Noise

- In compliance with the City of Flagstaff Noise Ordinance (Ordinance No. 1511), no construction activity will be conducted between the hours of 12:00 a.m. (midnight) and 6:00 a.m. Monday through Friday or between 1:00 a.m. and 7:00 a.m. on Saturday or Sunday. It is expected that construction activities for will be limited to 6:00 a.m. through 6:00 p.m. on weekdays and occasionally on weekends between 7:00 a.m. and 5:00 p.m.

- All construction equipment shall have sound-control devices that are at least as effective as those devices provided on the original equipment. No equipment shall have an unmuffled exhaust.
- All construction equipment shall be located, stored, and maintained as far as possible from adjacent residents, City Hall, and the Flagstaff Public Library.
- No construction staging shall take place within the Rio de Flag Channel between Cherry Avenue and Route 66. Due to the proximity of sensitive noise receptors, all construction equipment in this area will be turned off when not in use.
- Prior to construction, appropriate personnel at the City Hall and Flagstaff Public Library will be notified of the proposed construction activities and schedule. Recommendations will be provided to alleviate construction noise at these locations, including the closure of all windows facing the construction activities (assuming the proper ventilation systems are in place) and the rescheduling or relocation of special events away from the affected areas.

### **Air Quality**

The preferred alternative would not result in significant air quality impacts; accordingly, no mitigation is required. The following voluntary measures will, however, help reduce the nuisance factor associated with dust generation at construction sites and along haul routes.

- Water active sites at least twice daily. Frequency should be increased if wind speeds exceed 15 mph.
- Cover inactive storage piles.
- Cover haul trucks securely or maintain at least 2 feet of freeboard on all haul trucks when transporting materials.
- Prohibit all grading activities during periods of high wind (i.e., winds greater than 30 mph).
- Apply nontoxic chemical soil stabilizers to inactive construction areas (i.e., disturbed lands within construction areas that are unused for at least 4 consecutive days), or water at least twice daily.
- Apply nontoxic binders (e.g., latex acrylic copolymer) to exposed areas after cut-and-fill operations.
- Install wheel washers for all exiting trucks.

- Sweep streets if visible soil material is carried onto adjacent public roads.

### **Esthetics**

- The floodwalls will be constructed using reinforced concrete covered with basalt fieldstone (malpais basalt) as an esthetic treatment. The stones will be placed on the outside of the walls to form a mosaic veneer, characteristic of other recent stonework in the city (including the Flagstaff public library).
- The retaining walls for North Thorpe Road will incorporate a similar basalt fieldstone veneer.
- All mature trees removed or suffering significant root loss during construction will be replaced at a 1:1 ratio following construction. For this purposes of this mitigation measure, mature trees are defined as those that are five-inches or greater in diameter at breast height, over 20 feet tall, or both. (This is not necessarily the biological resources definition of a “mature tree.”) Significant root loss means root damage extensive enough to kill the affected tree. During tree replacement, the use of native trees will be favored over the use of nonnative ornamentals. However, homeowners adjacent to the channel who incur tree mortality may choose to have the affected trees replaced in-kind, even if they are nonnative. Trees will be replaced at or close to their original locations except where prevented by flood control project features.
- In order to facilitate regrowth, container plants will be used instead of seedlings during tree replacement.
- Five years after the initial tree planting has been conducted, an inspection will be made of all replaced trees. Trees which have died or appear to be dying will be replaced at a 1.5:1 ratio.

### **Hazardous and Toxic Materials**

- The USACOE has developed field screening procedures and preliminary response plans that will be finalized and implemented should any hazardous or toxic waste be identified during construction. These include monitoring soil and testing for vapors in the vicinity of known or suspected sites, locating proposed channel modifications away from areas of contamination, using protective gear as necessary, containing contaminated soils on site until they are ready for disposal, and disposing of contaminated soils in compliance with local, state, and Federal remediation requirements.

## **Safety**

- Prior to construction, City Fire Stations 1 through 6 will be provided with a schedule of all temporary road closures due to construction activities.
- A public information program will be required to be setup and maintained by the City of Flagstaff. This will primarily focus on elementary and middle school visitation by city staff but will also include public service announcements and advisory notices to be sent with utility bills. This type of program has been found to be the single most important element in reducing unauthorized access to drainage facilities. Such a program, when supplemented by appropriate signage and maintenance of facilities to assure visibility from the public right-of-way, where possible, forms an effective well-rounded program.

## **5.0 ENVIRONMENTAL DOCUMENTATION AND COMPLIANCE WITH FEDERAL LAWS, ORDERS, AND REGULATIONS**

This section describes the environmental compliance requirements associated with the proposed flood control alternatives addressed in this Final EIS.

### **5.1 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)**

This Environmental Impact Statement has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. § 4332 (1996)) and its Council on Environmental Quality Regulations (40 C.F.R. §§ 1500-1508 (1994)) and following guidelines contained in the Army Corps of Engineers Regulations for Implementing NEPA Procedures (33 CFR 230; 45 FR 56761, August 25, 1980, Amended by 46 FR 14745, March 2, 1981, Revised by 53 FR 3127, February 3, 1988).

NEPA is the nation's primary charter for protection of the environment. It establishes national environmental policy, provides a framework for federal agencies to prevent environmental damage, and requires federal agencies to evaluate the potential environmental impacts of their proposed actions. Under NEPA, a federal agency must prepare an EIS describing the environmental effects of any proposed action having a significant impact on the environment. The EIS must also identify measures necessary to avoid or minimize adverse impacts resulting from the proposed action. The USACOE will be the lead federal agency under NEPA for the preparation of the Rio de Flag EIS.

### **5.2 CLEAN WATER ACT OF 1972 (33 U.S.C. § 1251 (1996))**

Federal and state laws for the control of water quality establish requirements for adequate planning, implementation, management, and enforcement of actions designed to improve the quality of the nation's water resources, including penalties for non-compliance. In addition, federal regulations have been developed to augment and clarify the laws and to provide details not included in the law. Regulations and plans that are adopted by the applicable governmental body have legal stature and are enforceable. Federal guidelines and state policies, on the other hand, express the intent of the governing body and, while they are not legally enforceable, set forth direction that should be followed to achieve the goals expressed in the laws.

The Clean Water Act (CWA) of 1972 (33 U.S.C. § 1251 (1996)) is the major federal legislation concerning improvement of the nation's water resources. It provides for development of municipal and industrial wastewater treatment standards and a permitting system to control wastewater discharges to surface waters. State operation of the program is encouraged, and in Arizona, the Arizona Department of Environmental Quality (ADEQ) is the state agency responsible for carrying out the CWA. Arizona's water quality standards are contained in the Arizona Administrative Code (Title 18, Chapter 11). As described in Section 4.3 of this EIS, none of the alternatives would cause violations of these water standards.

The goals and standards of the Clean Water Act are enforced through permit provisions. Sections 401 and 404 of the Clean Water Act pertain directly to the proposed action. Section 401 requires certification from the ADEQ that the proposed action is in compliance with established water quality standards, or a waiver from those requirements. Section 404 outlines the permit program required for dredging or filling the nation's waterways. The Corps will be requesting from Congress a 404(r) exemption from state water quality certification. The USACOE does not issue itself a 404 permit but must comply with the Clean Water Act. Appendix F contains an alternatives analysis as required by Section 404(b)(1). Because the proposed action would not violate water quality standards and is consistent with Section 404 requirements, it is in compliance with the Clean Water Act.

In addition to the Clean Water Act, Executive Order 11990, Wetlands Protection (42 Fed. Reg. 2696 (1977)), and Executive Order 11988, Floodplain Management (42 Fed. Reg. 26951 (1977)), are also applicable federal regulations. The key requirement of these orders is determining whether a practicable alternative to locating an action in wetlands or floodplains exists. If there is no practicable alternative, the action must include all practical measures to minimize harm to the wetlands. The potential flood control alternatives are in compliance with these Executive Orders because it is not practicable to locate the potential detention basins or channel modifications outside of wetlands or floodplains. These types of facilities must be located in channels in order to function. In compliance with Executive Order 11990, impacts to wetlands would be minimized, including the creation and restoration of wetlands to mitigate project-related impacts.

Alternative D would not affect wetland vegetation, but would be located in the floodplain. As with the other alternatives, the flood control berms must be located inside the floodplain in order to provide flood protection. Accordingly, there is not practicable non-floodplain location for the flood control berms.

### **5.3 ENDANGERED SPECIES ACT OF 1973 (16 U.S.C. § 1531 (1996))**

The Endangered Species Act (ESA) protects threatened and endangered species by prohibiting federal actions that would jeopardize the continued existence of such species or by minimizing actions that would result in the destruction or adverse modification of any critical habitat of such species. The ESA requires that consultation regarding protection of such species be conducted with the U.S. Fish and Wildlife Service (USFWS) prior to project implementation. As described in Section 4.3, the potential flood control alternatives would not affect the continued existence of any threatened or endangered species or result in the destruction or adverse modification of any critical habitat of such species. Accordingly, the proposed action is in compliance with the ESA, and consultation under the Act is not required.

### **5.4 FISH AND WILDLIFE COORDINATION ACT (16 U.S.C. § 661 (1934)).**

The Fish and Wildlife Coordination Act (FWCA) directs the Department of the Interior (DOI) to provide assistance to and foster cooperation between federal, state, and local agencies in order to promote wildlife conservation in water resource development programs. Agencies must consult with the section of the DOI that has jurisdiction over this project, in this case USFWS, on wildlife conservation measures to be implemented during construction and maintenance of the project. Conservation measures are documented in the USFWS Coordination Act Report (CAR), which addresses the biological resources within the project area, assesses the biological impacts of the preferred alternative, and proposes mitigation measures to avoid or offset these impacts. The USFWS submitted a final CAR for the Rio de Flag project on December 20, 1999 and is currently preparing an addendum to that CAR to address the changes to the Recommend Plan. The project is in compliance with this Act. Refer to Appendix G for the final Coordination Act Report provided by USFWS.

### **5.5 MIGRATORY BIRD TREATY ACT (16 U.S.C. § 703 (1996))**

The Migratory Bird Treaty Act (1916) between the United States and Canada, the Convention for the Protection of Migratory Birds and Animals (1936) between the United States and Mexico, and subsequent amendments to these acts provide legal protection for almost all breeding bird species occurring in the United States. These acts restrict the killing, taking, collecting, and selling or purchasing of native bird species or their parts, nests, or eggs. Certain gamebird species are allowed to be hunted for specific periods determined by federal and state governments. None of the alternatives addressed

in this EIS would significantly affect native bird species or otherwise result in noncompliance with the Migratory Bird Treaty Act.

### **5.6 ARIZONA NATIVE PLANT LAW (Ariz. Rev. Stat. § 3-901 *et seq.*)**

The Arizona Native Plant Law calls for the “noncommercial salvage of highly safeguarded native plants whose existence is threatened by intended destruction.” Examples of protected native species are ironwood, paloverde, mesquite, and all cacti. The salvage of such listed plants requires prior notification and the submittal of a Notice of Intent, whereupon the Arizona State Department of Agriculture would issue a salvage permit. The Department of Agriculture will also issue tags and seals intended for taking, transporting, and possessing these plants. The Arizona Native Plant Law states that “a person shall not take, transport, or have in his possession any protected native plant taken from the original growing site in this state without having in his possession a valid permit issued by the division [of Agriculture]” (Ariz. Rev. Stat. § 3-906.A). Because the federal government is not required to comply with state-level natural resource laws, except in cases where the federal government has delegated the enforcement of federal regulations to the state level, the Arizona Native Plant Law is not applicable to the USACOE. Nonetheless, none of the potential flood control alternatives are anticipated to affect plants regulated by the Arizona Native Plant Law.

### **5.7 NATIONAL HISTORIC PRESERVATION ACT (NHPA) OF 1966 (16 U.S.C. 470 (1996))**

Cultural resources are buildings, sites, structures, or objects with historical, architectural, archaeological, cultural, or scientific importance. A number of laws exist that protect cultural resources potentially affected by federal undertakings or permitted actions. Key federal legislation includes the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470 (1996)), the Archaeological Resources Protection Act (ARPA) of 1974 (16 U.S.C. 470aa (1996)), and the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. § 3001 (1996)).

A key provision under the NHPA is Section 106, which requires a federal agency to take into account the potential effect of a proposed action on properties listed on or eligible for listing on the National Register of Historic Places. Under NHPA, the State Historic Preservation Officer and the Advisory Council on Historic Preservation (ACHP) are part of the consultation process. Regulations of the ACHP (36 C.F.R. § 800 (1994)) outline the procedures used by a federal agency to meet the

requirement of Section 106 of NHPA. Section 110 of NHPA requires adaptive reuse of historic properties to the maximum extent feasible.

Compliance with Section 106 of the NHPA and associated laws regulating the protection of cultural resource will be accomplished for the Rio de Flag Flood Control Project through the implementation of measures identified in a Programmatic Agreement (PA). The PA is a document detailing how Section 106 of the NHPA will be implemented for this proposed action. It is an agreement between the USACOE, the SHPO, and the Advisory Council on Historic Preservation (Council). The Hopi Tribe, The Haulipai Tribe, and the Pueblo of Zuni will be invited to participate as concurring parties. The PA will contain stipulations that may involve requiring additional surveys and historic building inventories, determinations of eligibility, assessment of effects, and mitigation. See Section 4.4, Cultural Resources for additional discussion of the PA.

#### **5.8 EXECUTIVE ORDER 12372, THE INTERGOVERNMENTAL REVIEW OF FEDERAL PROGRAMS (7 C.F.R. § 3015, Subpart V and final rule-related notices published at 48 Fed. Reg. 29114 (1983), and 49 Fed. Reg. 22676 (1984))**

Executive Order 12372, the Intergovernmental Review of Federal Programs (7 C.F.R. § 3015, Subpart V and final rule-related notices published at 48 Fed. Reg. 29114 (1983), and 49 Fed. Reg. 22676 (1984)), regulates land use for federal actions. The order directs federal agencies to make efforts to accommodate state and local elected officials' concerns regarding federal development. It requires that agencies consult with and solicit comments from state and local officials whose jurisdictions would be affected by the federal action. Land use issues, including compatibility with local land use plans, are addressed in Sections 3.5 and 4.5. The potential flood control projects have been developed in coordination with the City of Flagstaff, the project's local sponsor. As a result of this coordination, the Rio de Flag Flood Control Project is in compliance with Executive Order 12372.

#### **5.9 FEDERAL CLEAN AIR ACT**

The Federal Clean Air Act (CAA) of 1970 (42 U.S.C. § 7401, amendments of 1977, 1990, and 1993), sets forth National Ambient Air Quality Standards (NAAQS) for several criteria pollutants. The NAAQS for the criteria pollutants must not be exceeded more than once per year. The criteria pollutants regulated under the CAA are ozone (O<sub>3</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), particulate matter less than ten microns in diameter (PM<sub>10</sub>), and lead (Pb). The

CAA requires individual states to adopt standards that set acceptable pollutant concentrations equal to or less than the federal standards. The State of Arizona standards for these pollutants are the same as federal standards. In Arizona, the ADEQ is the implementing agency for federal air quality regulations.

The Flagstaff area is in attainment with federal and state air quality standards. Additionally, the City of Flagstaff is within Arizona's Airshed 3, which is a Class II area (and therefore has less stringent air quality standards than Class I areas, as described in Section 3.10). Based on these two factors, there are no emission levels set for proposed actions such as the potential flood control alternatives, and the construction of these alternatives would therefore be in compliance with the Federal CAA.

**5.10 EXECUTIVE ORDER 12088 - FEDERAL COMPLIANCE WITH POLLUTION CONTROL STANDARDS (43 Fed. Reg. 47707 (1978) (Codified as 3 C.F.R., 1978 Comp., p. 243) as amended by Executive Order 12580, 52 Fed. Reg. 2923 (1987))**

This order directs that federal agencies consult with state and local agencies concerning the best techniques and methods available for the prevention, control, and abatement of environmental pollution. A federal agency must also comply with applicable pollution control standards concerning air pollution, water pollution, hazardous materials, and hazardous substances.

None of the alternatives would result in the generation of hazardous wastes or other environmental pollution, and potential water quality impacts would be mitigated to less than significant levels (see Section 4.2). As described in Section 4.12, Hazardous and Toxic Materials, the USACOE has developed field screening procedures and preliminary response plans that would be finalized and implemented should any hazardous or toxic materials sites be identified during construction. Based on these factors, the potential flood control alternatives would be in compliance with Executive Order 12088.

**5.11 RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)  
(42 U.S.C. § 6901 (1996))**

RCRA was the first step in regulating the potential health and environmental problems associated with hazardous waste disposal. RCRA and the regulations developed by the EPA to implement its provisions provide the general framework of the national hazardous waste management system. RCRA provides criteria for the determination of whether hazardous wastes are being generated, techniques for

tracking wastes to eventual disposal, and the design and permitting of hazardous waste facilities. None of the alternatives addressed in this EIS would result in the generation of hazardous wastes. As described in Section 4.12, Hazardous and Toxic Materials, the USACOE has developed field screening procedures and preliminary response plans that would be finalized and implemented should any hazardous or toxic materials sites be identified during construction.

#### **5.12 HAZARDOUS AND SOLID WASTE AMENDMENTS (HSWA) (40 C.F.R. § 280 (1994))**

HSWA address regulatory gaps in the RCRA program in the area of highly toxic wastes. For example, these include regulation of carcinogens, listing and delisting of hazardous wastes, permitting for hazardous facilities, underground storage tank (UST) management, and the elimination of land disposal of hazardous wastes. None of the alternatives addressed in this EIS would result in the generation of hazardous wastes. As described in Section 4.12, Hazardous and Toxic Materials, the USACOE has developed field screening procedures and preliminary response plans that would be finalized and implemented should any hazardous or toxic materials sites be identified during construction.

#### **5.13 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA) OF 1980 (42 U.S.C. § 9601 (1996))**

CERCLA, also known as Superfund, ensures that a source of funds is available to clean up past hazardous waste sites, address releases of hazardous substances, and establish liability standards for responsible parties. CERCLA also requires the creation of a National Priorities List (NPL), which sets forth the sites considered to have the highest priority for clean-up under Superfund. There are no Superfund sites that would be affected by project construction.

#### **5.14 SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) (Pub. L. No. 99-499, 100 Stat. 1613)**

SARA was enacted in 1986 to increase the Superfund to \$8.5 billion, modify contaminated site clean-up criteria scheduling, and revise settlement procedures. It also provides a fund for leaking UST clean-ups and a broad, new emergency planning and community right-to-know program. SARA establishes directives for selecting permanent remedies, complying with state requirements by federal agencies, and establishing the role of the state in the clean-up process. None of the alternatives addressed in this EIS

would result in the generation of hazardous wastes. As described in Section 4.12, Hazardous and Toxic Materials, the USACOE has developed field screening procedures and preliminary response plans that would be finalized and implemented should any hazardous or toxic materials sites be identified during construction.

**5.15 EXECUTIVE ORDER 13045 - PROTECTION OF CHILDREN  
FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS  
(62 Fed. Reg. 19885 (1997))**

This Executive Order was issued April 21, 1997 by President Clinton. Specifically, each federal agency:

- (a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and
- (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

None of the alternatives addressed in this report would result in environmental health or safety risks that would disproportionately affect children.

**5.16 EXECUTIVE ORDER 12898 - ENVIRONMENTAL JUSTICE  
(59 Fed. Reg. 7629 (1994))**

This order was issued by President Clinton on February 11, 1994, and requires each federal agency to achieve environmental justice by addressing “disproportionately high and adverse human health and environmental effects...on minority and low-income populations.” Environmental justice is addressed in Sections 3.7 and 4.7. As discussed in Section 4.7, Alternatives 6a, 6b, and 7 would result in unmitigated social impacts (e.g., loss of social ties, upheaval, and sense of loss) associated with the acquisition of up to 17 residences. Under each of these alternatives, at least 80 percent of the affected homes are located at the Trailers Ho mobile home park, which represents low income housing. This constitutes a disproportionate effect to low income housing. Additionally, the affected mobile home park is located at the edge of the City of Flagstaff’s Oldtown neighborhood, which has a disproportionately higher level of minority residents than the City as a whole.

Compliance with Executive Order 12898 would be achieved for Alternatives 6a, 6b, or 7 (if implemented) because the USACOE has implemented an extensive public participation program, clearly identified those impacts that would disproportionately affect low-income or minority populations, and mitigated those impact to the extent feasible. The Environmental Justice discussion in Section 4.7 further addresses compliance with Executive Order 12898, including a discussion on why the impacts to those 13 mobile homes are considered unavoidable from a hydrology and hydraulics engineering standpoint.

#### **5.17 FEDERAL UNIFORM RELOCATION ASSISTANCE AND REAL PROPERTY ACQUISITION POLICIES ACT OF 1970 (42 U.S.C. § 4601 (1996))**

In order to acquisition private property, the federal government must follow guidelines set forth under the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601 (1996)). The Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act was created to ensure that (1) owners of real property to be acquired for federal and federally assisted projects are treated fairly and consistently; (2) persons displaced as a direct result of federal or federally assisted projects are treated fairly; and (3) agencies implement these regulations in a manner that is efficient and cost effective. The Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act also contains provisions for just compensation, policies for acquisition, and relocation requirements. The USACOE will comply with this act for any alternatives that require the acquisition or private property, the relocation of residents, or both.

#### **5.18 FEDERAL WATER PROJECT RECREATION ACT (Public Law 89-72)**

The Federal Water Project Recreation Act requires that any federal water project must give full consideration to opportunities afforded by the project for outdoor recreation, and fish and wildlife enhancement. As a part of Alternatives 6a, 6b, and 7, new recreational trails would provide enhanced connection with the FUTS. Alternative D provides fewer opportunities for recreational enhancement because it does not entail linear features conducive to trail creation.

The Rio de Flag and Clay Avenue Wash are ephemeral streams, which do not provide substantive fish habitat. The restoration and creation of wetland and riparian habitat and as part of Alternatives 6a, 6b, and 7 would mitigate construction-related impacts. Also, a greenbelt channel would be constructed under Alternatives 6a, 6b, and 7 providing potential wildlife habitat. Given the urban nature of the area

where the greenbelt would be constructed, however, wildlife use may be fairly low. The construction of flood control berms (Alternative D) does not provide feasible opportunities for enhancing wildlife habitat.

Because the alternatives provide for recreation and wildlife enhancement were practicable, they would be in compliance with the Federal Water Project Recreation Act.

## **6.0 PUBLIC INVOLVEMENT**

This section describes the public involvement process associated with the proposed Rio de Flag Flood Control Project.

### **6.1 PUBLIC INVOLVEMENT PROGRAM**

The USACOE and the City of Flagstaff (the project's local sponsor) implemented a public involvement program to obtain input from numerous groups, organizations, or individuals that represent business, homeowner, educational, environmental, government, neighborhood, and community interests. The program established a project "point of contact" at the City for public questions or comments, and developed a mailing list of interested parties. The mailing list was used for the distribution of invitations to public meetings and dissemination of project documents. Announcements for public meetings were also made in local newspapers, including date, time, place, and subject matter. The public input addressed the proposed flood control improvements as well as potential recreation improvements that could be incorporated into the project.

At the core of the public involvement program were a series of public meetings and workshops held throughout the plan formulation phase of the project. The goal of the meetings were to inform all interested parties of the status and direction of the project and to solicit public input during the formulation of project alternatives. Additional public meetings were held during and subsequent to the extended public review period for the Draft Feasibility Report and Environmental Impact Statement to incorporate public concerns into the re-evaluation and the design of the project. The Public meetings and/or workshops conducted through May, 2000 are identified chronologically as follows:

- Initial Public Workshop (December 11, 1997)
- EIS Scoping meeting (February 27, 1998)
- Public Workshop with Regional Land Use and Transportation Plan and the ADOT Interstate 40 Corridor Study (February 10, 1999)
- Public Open House (November 17, 1999)
- City Council Worksession (televised) [December 13, 1999]
- City of Flagstaff Park & Recreation Commission Meeting (December 15, 1999)
- Public Meeting No.1 for Draft Report and EIS (December 16, 1999)
- Public Open House (January 12, 2000)

- Workshop with local technical experts (March 15, 2000)
- Workshop for Navajo Drive Residents (March 30, 2000)
- Open House with Regional Land Use and Transportation Plan (May 24, 2000)
- Open House with Regional Land Use and Transportation Plan (May 25, 2000)

An additional public meeting was held during the 45-day public review period of the revised Draft Feasibility Report and Environmental Impact Statement. The meeting was held at 6:15 p.m. on July 25, 2000 at Flagstaff High School. A transcript of the proceedings is included in Appendix B of this Final EIS.

## **6.2 REQUIRED COORDINATION**

### **6.2.1 Past Coordination**

In February 1998, the USACOE prepared a Notice of Intent (NOI) for the Rio de Flag Flood Control Project EIS. This notice was published in the *Federal Register* (February 4, 1998, Volume 63, Number 23) in compliance with 40 C.F.R. 1508.22. As recommended in 40 C.F.R. 1501.7(b), public scoping meetings also were held for the project. The meetings were held on February 27, 1998 at 211 W. Aspell Avenue in Flagstaff. An afternoon meeting was held from 1:00 p.m. to 3:00 p.m. and an evening meeting was conducted between 5:00 p.m. and 7:00 p.m. (see Appendix B for a transcript of the public comments).

The Notice of Availability (NOA) for the initial draft EIS was published in the *Federal Register* (November 19, 1999, Volume 64, Number 223) in compliance with 40 C.F.R. 1508.22. Notices for extension of the comment period on the draft EIS were published in the *Federal Register* on December 29, 1999 (Volume 64, Number 249) and on January 26, 2000 (Volume 65, Number 17). The NOA for the revised Draft EIS was published in the *Federal Register* on Friday June 30, 2000 (Volume 65 Number 127). All public notices required for this project are included in Appendix H.

### **6.2.2 Required Future Coordination**

The initial Draft EIS and revised Draft EIS were distributed for public review and comment in accordance with NEPA requirements. Responses to public and agency comments received during the revised Draft EIS comment period are included in Part II of this Final EIS. This Final EIS will be released for a 30-day public review period, although comments received will not be given written responses.

As the lead Federal agency for the Rio de Flag Feasibility Study, the USACOE will issue a Record of Decision (ROD) after the EIS has been finalized and the 30-day public review period is completed. The ROD will indicate the alternative selected for implementation, summarize the reasons for that decision, and serve as notification that appropriate procedures and consultations have been executed. Once the ROD has been issued, the selected alternative can proceed to implementation (e.g., final engineering design, project construction, and operation).

### **6.3 PUBLIC VIEWS AND RESPONSES**

Public comments received through execution of the public involvement program, including the review and comment period for the initial draft EIS, have been incorporated into the plan formulation, feasibility, and evaluation process associated with this flood control project. The key issues that were raised during the public scoping process are summarized below.

- **Planning Process.** Several general questions were raised in the public scoping meetings regarding the USACOE planning process. These questions centered around the roles of the USACOE and the City of Flagstaff and the formulation of alternatives. Most of these questions were directly addressed by USACOE and city staff at the scoping meetings. Sections 1.6 and 2.1 of this EIS also address these issues.
- **Design Features.** At the scoping meetings, some questions were asked regarding the specific design features of the project alternatives (e.g., size of channel modifications, hydraulic specifications, etc.). The public was informed that this information would be available closer to and during the draft EIS review process. The description of the alternatives in Section 2.2 provides the type of information requested by the public.

- **General Procedure.** Some questions that arose at the public meetings concerning the general procedure associated with the project. These mostly included clarifications regarding the project timeframe and cost, the public involvement process, and the alternatives selection process. The majority of these questions were responded to directly at the public meetings. Additional clarification is provided in Sections 2.3, 5.1, and 6.2 of this EIS.
- **NEPA Process.** Some public inquiries at the scoping meetings dealt with the NEPA process. Typically, these questions were related to the schedule for completion of the EIS, the required coordination and public involvement, and the selection of the proposed action. Some questions focuses on the post-EIS process and when the flood control improvements would be constructed. As with the other procedural questions, these were answered at the scoping meetings, and the NEPA process is also discussed in Sections 5.1 and 6.2 of this document.
- **Environmental Impacts.** At the scoping meetings, the public voiced their concern over the potential effects of the project alternatives (e.g., historic resources and recreation). The impacts associated with the project alternatives are discussed in Section 4.0 of this EIS.

Additional public comments were received during the NEPA mandated public comment period of the initial Draft EIS which began on November 19, 1999 and concluded on March 31, 2000. (The 45-day public review period was officially extended on two occasions in order to accommodate interested parties.) The written comments that were received during the initial draft EIS comment period are included in Appendix A of this EIS. Although the USACOE did not prepare formal responses to these comments, they were considered during the re-evaluation of project alternatives and, where applicable, changes were made to the Feasibility Report and draft EIS. The individuals and agencies listed below submitted written comments on the initial Draft EIS during the official comment period.

- Connie Kim (17 November 1999)
- Mike and Riki Parvin (17 November 1999)
- Karen Kinne-Herman (17 November 1999)
- Maury Herman (17 November 1999)
- Stan Mish (17 November 1999)
- Peter Bloomer (17 November 1999)
- Rick Brandel (17 November 1999)
- Michael Conner (17 November 1999)
- David Evans (17 November 1999)

- Anne Wittke (17 November 1999)
- U.S. Department of Interior (28 December 1999)
- Bob and Evelyn Patterson (20 December 1999)
- Mike Clifton (20 December 1999)
- Arizona Game & Fish Department (7 January 2000)
- Heather Green (14 January 2000)
- Mimi Murov (14 January 2000)
- Linda Henden (14 January 2000)
- Maury Herman (3 January 2000)
- Michael & Nancy Gibson (13 January 2000)
- Jessie Mangum (15 December 1999)
- Sharon and Randy Waltz (15 December 1999)
- Dan and Janet Wef (15 December 1999)
- Bonnie Feather (15 December 1999)
- Sandra Hubarely and Maran Ind (15 December 1999)
- Kari Morehaise (15 December 1999)
- Lance Dislson (15 December 1999)
- Diane Weston and Caroline Pelkington (15 December 1999)
- Randy Shannon (26 February 2000)
- Rose Houk (17 January 2000)
- Maury Herman (18 January 2000)
- Rick Moore (21 Februray 2000)
- Peter Bloomer (15 March 2000)
- U.S. Environmental Protection Agency (undated letter)

The following individuals and agencies submitted comments during the 45-day comment period (June 30, 2000 to August 14, 2000) for the revised Draft EIS:

- Arizona Department of Game and Fish (30 June 2000)
- Friends of Flagstaff's Future (14 August 2000)
- Mary Ann and Jackson Keim (21 June 2000)
- Keith and Mary Hunter (19 July 2000)
- Peter Bloomer (25 July 2000)
- Rose Houk (1 August 2000)

- Mimi Murov (3 August 2000)
- Tom Brownold (3 August 2000)
- Susan Lamb Bean (8 August 2000)
- Jack D. Taylor (10 August 2000)
- Blake Whitten (11 August 2000)
- Connie Kim (not dated)

The U.S. EPA was provided a 10-day extension by the USACOE to submit written comments on the revised Draft EIS. A comment letter was received from the EPA on August 24, 2000 which is included in the public record for this project. A copy of each comment letter on the revised Draft EIS and the corresponding USACOE responses are included in Part II of this Final EIS.

**7.0 ORGANIZATIONS AND PERSONS CONSULTED**

The following organizations and/or persons were consulted prior to or during the preparation of this EIS:

**Federal**

U.S. Fish and Wildlife Service ..... Mike Martinez  
U.S. Forest Service ..... Coconino National Forest Staff

**State**

Arizona Department of Fish and Game ..... Randy Smith  
Arizona Department of Transportation ..... Rick Shilke  
Arizona Department of Water Quality ..... Staff  
Arizona State Parks Department ..... James Garrison

**Local**

City of Flagstaff ..... Kim Gavigan

**Other**

Arizona Historical Society ..... Susan Wilcox  
Arizona State Museum ..... Staff  
Flagstaff Arboretum ..... Staff  
Kinlani Archaeology, Ltd. .... Deborah S. Dosh  
Museum of Northern Arizona ..... Dave Wilcox

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## **8.0 LIST OF PREPARERS**

This Final Environmental Impact Statement was prepared for the **U.S. Army Corps of Engineers**, Los Angeles District by **KEA Environmental**.

The USACOE provided alternative descriptions, the majority of the Section 3.0 (Affected Environment), and the cultural resources impact analysis. David Compas, Regional Planning Section, is the USACOE Environmental Coordinator for this project. Timothy J. Smith, Biological Sciences Environmental Manager, Ecosystem Planning Section, managed the preparation of the EIS and related environmental studies. Additional USACOE personnel who participated in the preparation of this report include:

- Pam Castens, Ecosystems Planning Section Chief, Ecosystem Planning Section
- Richard Perry, Archaeologist, Ecosystem Planning Section
- Sam Arrowood, Plan Formulation Branch

Key Personnel from **KEA Environmental** who contributed on this project include:

Michael Schwerin, Project Manager  
B.A. Engineering, Dartmouth College  
Years of Experience: 9

Eric Wilson, Environmental Analyst  
B.A. Environment, Economics, and Politics,  
Claremont McKenna College  
Years of Experience: 4

Elizabeth Candela, Environmental Analyst  
B.A. Environmental Studies and Geography,  
University of California Santa Barbara  
Years of Experience: 1

Jacqueline Schoenecker, Environmental  
Specialist  
B.A., Business Administration and Environ-  
mental Studies, University of San Diego  
Years Experience: 7

Angela Johnson, Graphic Artist/GIS Operator  
B.A. Graphic Design, San Diego State  
University  
Years of Experience: 7

Eric Coughlin, GIS Specialist  
B.A. Geography; Emphasis in Methods of  
Geographical Analysis  
Certificate in Geographical Information Systems,  
San Diego State University  
Years of Experience: 1

Daniel Brandy, Graphic Artist  
B.A., Fine Art, San Diego State University  
Certificate of Completion, Platt College  
Years of Experience: 7

Monica Diaz, Word Processing  
Year of Experience: 3

**SWAC Inc, Environmental Consultants** prepared the biological resources sections of this report.  
Key personnel from SWCA who contribute to this report include:

Ken Kertell, Biologist  
B.S., Wildlife Biology, Humboldt State  
University; M.S., Wildlife Biology, Humboldt  
State University  
Years Experience: 11

Tom Ferguson, Biologist  
B.S., Ecology and Evolutionary Biology,  
University of Arizona  
Years Experience: 8

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## **10.0 LIST OF ACRONYMS AND ABBREVIATIONS**

ACHP	Advisory Council on Historic Preservation
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADOT	Arizona Department of Transportation
ADT	average daily traffic
ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
AGS	Arizona Geological Survey
amsl	above mean sea level
APE	Area of Potential Effect
ARPA	Archaeological Resources Protection Act
ASTM	American Society of Testing Materials
BA	Biological Assessment
BLM	Bureau of Land Management, U.S. Department of the Interior
BMP	best management practice
B.N.&S.F.	Burlington Northern & Santa Fe Railroad
BO	Biological Opinion
BOR	Bureau of Reclamation, U.S. Department of the Interior
CAA	Clean Air Act
CAR	Coordination Act Report
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
CWA	Clean Water Act
cy	cubic yards
dB	decibel
dBA	“A-weighted” noise level
DOT	Department of Transportation
EIS	Environmental Impact Statement
EPA	(United States) Environmental Protection Agency

ESA	Endangered Species Act
ESA	Environmental Site Assessment (for hazardous materials)
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FHPC	Flagstaff Historic Preservation Commission
FPPA	Farmland Protection Policy Act
FUTS	Flagstaff Urban Trail System
FWCA	Fish and Wildlife Coordination Act
GIS	Geographic Information System
GMA	Growth Management Alliance
GMG 2000	City of Flagstaff Growth Management Guide 2000
HABS/HAER	Historic American Building Survey/Historic American Engineering Record
HSWA	Hazardous and Solid Waste Amendments
HTRW	Hazardous, Toxic, and Radioactive Waste
H:V	horizontal:vertical
I-40	Interstate Highway 40
I-17	Interstate Highway 17
KOP	Key Observation Point
$L_{dn}$	day-night average sound level
$L_{eq}$	average hourly noise levels
LOS	level of service
MBTA	Migratory Bird Treaty Act
MCL	Maximum Concentration Limit
MOU	Memorandum of Understanding
mph	miles per hour
MRA	Multiple Resource Area
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO <sub>2</sub>	nitrogen dioxide
NOI	Notice of Intent

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NPDES	National Pollution Discharge Elimination System
NPL	National Prehistoric List
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
O <sub>3</sub>	ozone
OSHA	Occupational Safety and Health Act
PA	Programmatic Agreement
Pb	lead
PM <sub>10</sub>	particulate matter less than or equal to 10 microns in diameter
RBC	risk-based criteria
RCRA	Resource Conservation and Recovery Act
RMP	Resource Management Plan
ROD	Record of Decision
ROI	region of influence
RUGB	Regional Urban Growth Boundary
RV	Recreational Vehicle
RVP	Recreational Vehicle Park
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO <sub>2</sub>	sulfur dioxide
SOHD	Southside/Old Town Historic District
SRL	Soil Remediation Level
SRMA	Special Recreation Management Area
SSC	Species of Special Concern
SWPPP	Storm Water Pollution Prevention Plan
TDS	total dissolved solids
UBC	Uniform Building Code
U.S.C.	United States Code
USACOE	United States Army Corps of Engineers
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

10.0 List of Acronyms and Abbreviations

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USGS	United States Geological Survey
UST	underground storage tank
WSCA	Wildlife of Special Concern in Arizona

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