U.S. 50 Corridor East

Partnering for Progress

U.S. 50 Corridor East
Tier 1 Draft Environmental Impact Statement

Wetland and Riparian Resources Technical Memorandum

June 2016

Table of Contents

Chapter **Pages**

1. Project Overview 1
2. Resource Definition 2
3. Applicable Laws, Regulations, and Guidance 3
3.1. Clean Water Act and Water Quality Act of 1987 3
3.2. Emergency Wetlands Resources Act of 1986 3
3.3. Intermodal Surface Transportation Efficiency Act of 1991 3
3.4. Mitigation of Impacts to Wetlands and Natural Habitat 3
3.5. Executive Order 11990, Protection of Wetlands 4
3.6. Executive Order 11988, Floodplain Management 4
3.7. FHWA Technical Advisory T6640.8A 4
3.8. 1990 Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act, Section 404(b)(1) 4
3.9. Colorado Division of Wildlife and CDOT 2005 Memorandum of Agreement on the Administration and Implementation of Senate Bill 40 4
3.10. National Environmental Policy Act/Clean Water Act Section 404 Merger Process and Agreement for Transportation Projects in Colorado (2005) 5
3.11. U.S. Army Corps of Engineers Wetland Delineation Manuals 5
3.12. CDOT Mitigation Forms and Guidance for Wetland Finding Reports 5
4. Methodology 6
4.1. Relevant Data or Information Sources 6
4.2. Data Collection and Analysis Methodology 7
4.3. Project Area 8
4.4. Effects 9
4.5. Mitigation Options 9
4.6. Deliverables 9
5. Existing Conditions 10
5.1. Wetland/Riparian Areas 10
5.2. Non-Wetland Waters of the United States 14
6. Effects 16
6.1. No-Build Alternative 16
6.2. Build Alternative 16
7. Mitigation Strategies 30
8. References 31
Appendices 35

Appendix A. Resource Methodology Overview for Wetland and Riparian Resources 37

Appendix B. Abbreviations and Acronyms 41

Appendix C. Accuracy Assessment of Southwest Regional Gap Analysis Project and Colorado Division of Wildlife Riparian Vegetation Mapping Along the U.S. 50 Corridor 43

C.1. Introduction 43

C.2. Results 43

C.3. Observations and Possible Explanations for Discrepancies 46

Appendix D. Geographic Information System-Based Wetland/Riparian Functional Assessment Methodology 47

D.1. Introduction 47

D.2. Overview 47

D.3. Assumptions and Limitations 47

D.4. Functions 48

D.5. Quality Control Review Process of Data for Potential Errors and Changes 52

Appendix E. Figures (E-1 through E-31) 55

Tables

Table 5-1. Hydric Soil Series in the Project Area 11
Table 5-2. Extent of Wetland/Riparian Vegetation Types within the Project Area 11
Table 5-3. Summary of Wetland/Riparian Functional Categories in the Project Area 13
Table 5-4. Named Ditches, Streams, and Rivers Located in the Project Area 14
Table 6-1. Summary of Estimated Direct, Permanent Effects to Wetland/Riparian Areas by Location (Acres) 19
Table 6-2. Summary of the Estimated Direct, Permanent Effects to Non-Wetland Linear Waterbodies in the Build Alternative 21
Table 6-3. Summary of Estimated Direct, Permanent Effects to Non-Wetland Standing Waterbodies in the Build Alternative 23

Figures

Figure 1-1. U.S. 50 Tier 1 EIS Project Area 1
Figure 4-1. Tier 1 vs. Tier 2 Decision 9
Figure 6-1. Build Alternatives 17

1. Project Overview

The U.S. 50 Corridor East Tier 1 Environmental Impact Statement (U.S. 50 Tier 1 EIS) was initiated by the project's lead agencies, the Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA). The purpose of the U.S. 50 Tier 1 EIS is to provide, within the framework of the National Environmental Policy Act of 1969 (NEPA), a corridor location decision for U.S. Highway 50 (U.S. 50) from Pueblo, Colorado, to the vicinity of the Colorado-Kansas state line that. The location decision will be used by CDOT and the communities along the corridor can use to plan and program future improvements, preserve right -of- way, pursue funding opportunities, and allow for resource planning efforts.

The U.S. 50 Tier 1 EIS officially began in January 2006 when the Notice of Intent was published in the *Federal Register*. The U.S. 50 Tier 1 EIS project area (Figure 1-1) is the area in which U.S. 50 Tier 1 EIS alternatives were assessed. This area traverses nine municipalities and four counties in the Lower Arkansas Valley of Colorado. The nine municipalities include (from west to east) the city of Pueblo, town of Fowler, town of Manzanola, city of Rocky Ford, town of Swink, city of La Junta, city of Las Animas, town of Granada, and town of Holly. The four counties that fall within this project area are Pueblo, Otero, Bent, and Prowers counties.

The project area does not include the city of Lamar. A separate Environmental Assessment (EA), the *U.S. 287 at Lamar Reliever Route Environmental Assessment*, includes both U.S. 50 and U.S. Highway 287 (U.S. 287) in its project area, since they share the same alignment. The Finding of No Significant Impact (FONSI) for the project was signed November 10, 2014. The EA/FONSI identified a proposed action that bypasses the city of Lamar to the east. The proposed action of the *U.S. 287 at Lamar Reliever Route Environmental Assessment* begins at the southern end of U.S. 287 near County Road (CR) C-C and extends nine miles to State Highway (SH) 196. Therefore, alternatives at Lamar are not considered in this U.S. 50 Tier 1 EIS.

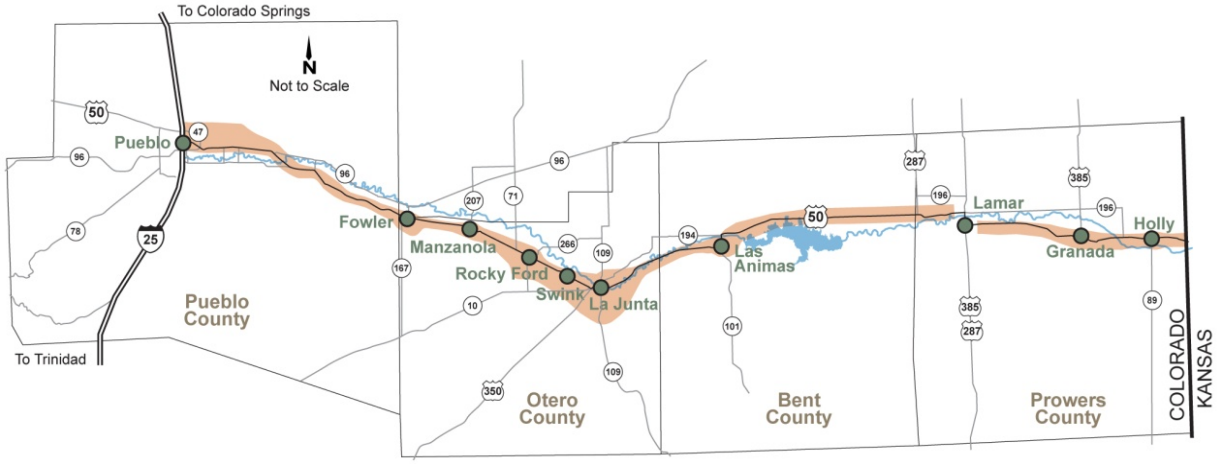


Figure 1-1. U.S. 50 Tier 1 EIS Project Area

2. Resource Definition

Wetland and riparian science and federal and state water quality laws are relatively young and are still evolving. Definitions of terminology used in this report, including the definitions of wetlands, riparian areas, and waters of the United States are presented below to ensure that all readers have a clear understanding of these terms.

Riparian areas—Many definitions of riparian areas have been used by various agencies (NRC 2002). For the purposes of this technical memorandum and the U.S. 50 Tier 1 EIS, riparian areas are defined as "areas that are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines" (NRC 2002, p 33). Since it is beyond the scope of this Technical Memorandum to distinguish between mapped riparian areas and wetlands, the term "wetland/riparian area" is used throughout this report.

Wetlands—The interaction of a site's hydrology, vegetation, and anaerobic soils results in the development of characteristics unique to wetlands. The term "wetland" has a specific definition, which typically includes the wettest portions of riparian areas (33 Code of Federal Regulations [CFR] 328.3). Wetlands are commonly referred to as swamps, marshes, wet meadows, willow carrs, and bogs. Activities in wetlands are regulated by the U.S. Army Corps of Engineers. Since it is beyond the scope of this Technical Memorandum to distinguish between mapped riparian areas and wetlands, the term "wetland/riparian area" is used throughout this report.

Waters of the United States—The term "waters of the United States" is a legal term defined in 33 CFR 328.3. It generally includes all historically navigable waterways (e.g., streams, rivers, lakes, reservoirs, etc.) and their tributaries, waterbodies used in some way for interstate or foreign commerce, and wetlands adjacent to these waterbodies. Activities in waters of the United States are regulated by the U.S. Army Corps of Engineers. All non-wetland waters of the United States (Section 5.2) within the project area are assumed to be jurisdictional for the purpose of this analysis. However, the jurisdictional status of wetlands in the project area was not determined during this Tier 1 project phase for the following reasons:

- It is not needed for the planning purposes embodied by the U.S. 50 Tier 1 EIS.
- The size of the project area (150 miles long by 2 miles wide) would make this effort cost prohibitive.
- The level of accuracy and precision of the wetland/riparian data used in this analysis does not allow for such a determination.
- The evolving nature of how jurisdiction under the Clean Water Act is interpreted by the courts means that, over the expected build-out period for Tier 2 projects (i.e., decades, not months or years), this status could change for many of the identified wetland/riparian areas.
- CDOT typically conducts compensatory mitigation for all wetlands, regardless of jurisdiction.

3. Applicable Laws, Regulations, and Guidance

In addition to adhering to NEPA and its regulations (23 CFR 771), the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500–1508), and the Moving Ahead for Progress in the 21st Century Act (MAP-21) of 2012, the following laws, regulations, and guidance also were followed during this analysis of wetland/riparian areas. They are described in more detail below.

- Clean Water Act and Water Quality Act of 1987
- Emergency Wetlands Resources Act of 1986
- Intermodal Surface Transportation Efficiency Act of 1991
- Mitigation of Impacts to Wetlands and Natural Habitat
- Executive Order 11990, Protection of Wetlands
- Executive Order 11988, Floodplain Management
- FHWA Technical Advisory T6640.8A
- 1990 Memorandum of Agreement Between the U.S. Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act, Section 404(b)(1)
- Colorado Division of Wildlife (CDOW) and CDOT 2005 Memorandum of Agreement on the Administration and Implementation of Senate Bill 40
- National Environmental Policy Act/Clean Water Act Section 404 Merger Process and Agreement for Transportation Projects in Colorado (2005)
- U.S. Army Corps of Engineers Wetland Delineation Manual, 1987
- CDOT Mitigation Forms and Guidance for Wetland Finding Reports

3.1. Clean Water Act and Water Quality Act of 1987

The Clean Water Act authorizes the federal government, in cooperation with state and local entities, to initiate programs to reduce or eliminate the pollution of interstate waters and tributaries and improve the sanitary condition of surface and underground waters. The Water Quality Act of 1987 amended the Clean Water Act, including many of its regulatory programs.

3.2. Emergency Wetlands Resources Act of 1986

The Emergency Wetlands Resources Act of 1986 mandated reporting to Congress on wetlands loss, including an analysis of the role of federal programs and policies in inducing such losses.

3.3. Intermodal Surface Transportation Efficiency Act of 1991

The Intermodal Surface Transportation Efficiency Act of 1991 includes guidance on mitigating wetlands impacts directly associated with projects funded through the National Highway Safety Program and the Surface Transportation Program. This includes guidance on the establishment of wetlands mitigation banks.

3.4. Mitigation of Impacts to Wetlands and Natural Habitat

Federal regulation 23 CFR 777 provides policy and procedures for evaluating and mitigating adverse impacts to wetlands and natural habitat resulting from federal-aid projects. The policies and procedures outlined in the regulation apply to projects under the Federal Lands Highway Program to the extent that such application is deemed appropriate by the FHWA.

3.5. Executive Order 11990, Protection of Wetlands

Executive Order (EO) 11990 requires all federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands while carrying out certain agency responsibilities, including:

- Acquiring, managing, and disposing of federal lands and facilities
- Funding construction or improvements
- Conducting activities or programs affecting land use

The EO also provides additional guidance to help agencies implement this initiative.

3.6. Executive Order 11988, Floodplain Management

EO 11988 requires all federal agencies to take actions to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains while carrying out certain agency responsibilities, including:

- Acquiring, managing, and disposing of federal lands and facilities
- Funding construction or improvements
- Conducting activities or programs affecting land use

The EO also provides additional guidance to help agencies implement this initiative.

3.7. FHWA Technical Advisory T6640.8A

FHWA Technical Advisory T6640.8A states that when an alternative will impact wetlands, the environmental impact statement should identify the wetlands (including function), describe the impacts, evaluate alternatives that would avoid the wetlands, and identify practicable measures to minimize harm to the wetlands. The technical advisory continues by noting that:

- During the impacts evaluation, the environmental impact statement should address the importance of the impacted wetlands and the severity of those impacts.
- This evaluation should consider several factors, including functionality, importance to the surrounding ecosystem, and uniqueness.

3.8. 1990 Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act, Section 404(b)(1)

The purpose of the U.S. Environmental Protection Agency (EPA)/Department of the Army Memorandum of Agreement (MOA) concerning mitigation under the Clean Water Act is to provide policy and procedures to help users determine the type and level of mitigation necessary to demonstrate compliance with Section 404(b)(1) of the Clean Water Act. The MOA also expresses the intent of the agreeing parties to meet the objective of the Clean Water Act to restore and maintain the chemical, physical, and biological integrity of U.S. waters, including wetlands.

3.9. Colorado Division of Wildlife and CDOT 2005 Memorandum of Agreement on the Administration and Implementation of Senate Bill 40

In the CDOW (now known as Colorado Parks and Wildlife [CPW]) and CDOT 2005 MOA concerning the administration and implementation of Senate Bill 40, these agencies agreed that future transportation

construction and maintenance activities described in Senate Bill 40 may be undertaken without written certification from CPW. The parties also agreed that all other activities that impact any stream or its banks or tributaries will require CPW certification.

3.10. National Environmental Policy Act/Clean Water Act Section 404 Merger Process and Agreement for Transportation Projects in Colorado (2005)

The purpose of the NEPA/Clean Water Act Section 404 Merger Process and Agreement for Transportation Projects in Colorado is "... to establish a procedure and provide guidance to ensure that documentation and coordination conducted to comply with the [NEPA] will meet the standards of all signatories and that any preferred alternative selected under this joint [National Environmental Policy Act/Clean Water Act] Section 404 decision-making process also complies with [Clean Water Act] Section 404(b)(1) guidelines" (NEPA/404 Merger).

3.11. U.S. Army Corps of Engineers Wetland Delineation Manuals

The purpose of the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual and subsequent Regional Supplements is to help users determine whether an area is a wetland for purposes of Section 404 of the Clean Water Act.

3.12. CDOT Mitigation Forms and Guidance for Wetland Finding Reports

Information from these reports will be used, where relevant, in describing existing conditions in the project area and in the evaluation of cumulative effects.

4. Methodology

The U.S. 50 Corridor East project is a Tier 1 environmental impact statement (EIS). "Tiering" for this process means that the work involved will be conducted in two phases, or tiers, as follows:

- Tier 1—A broad-based (i.e., corridor level) NEPA analysis and data collection effort. The goal of Tier 1 is to determine a general corridor location (not an alternative footprint). Data sources will include existing quantitative data, qualitative information, or both. Mitigation strategies (not necessarily specific mitigation activities) and corridor-wide mitigation opportunities will be identified. Additionally, the Tier 1 EIS will identify sections of independent utility (SIUs) and provide strategies for access management and corridor preservation.
- Tier 2—A detailed (i.e., project level) NEPA analysis and data collection effort. The goal of Tier 2 studies will be to determine an alignment location for each SIU identified in Tier 1. Data sources will include project-level data, including field data collection when appropriate. Tier 2 activities will provide project-specific impacts, mitigation, and permitting for each proposed project.

Resource methodology overviews were developed to identify and document which resource evaluation activities would be completed during the Tier 1 EIS, and which would be completed during Tier 2 studies. These overviews are intended to be guidelines to ensure that the Tier 1 EIS remains a broad-based analysis, while clarifying (to the public and resource agencies) when particular data and decisions would be addressed in the tiered process.

These overviews were approved by FHWA and CDOT in 2005, and they were agreed upon by the resource agencies during the project's scoping process between February and April of 2006.

Each overview summarizes the following information for the given resource:

- Relevant data or information sources—the types of corridor-level data that will be collected and the sources of those data
- Data collection and analysis methodology—how the data collection and analysis will be completed
- Project area—defined as one to four miles wide surrounding the existing U.S. 50 facility beginning at Pueblo, Colorado, at Interstate 25 (I-25) and extending to the Colorado-Kansas state line (resources will be reviewed within this band, and it is the same for all resources)
- Effects—the type(s) of effect(s) to be identified
- Mitigation options—how mitigation will be addressed
- Deliverables—how the activities above will be documented
- Regulatory guidance/requirements—a list of applicable laws, regulations, agreements, and guidance that will be followed during the review of the resources

These overviews were used by the project's resource specialists as guidelines to ensure that their activities were relevant to the Tier 1 decision (i.e., corridor location). As the resource specialists conducted their work, data sources or analysis factors were added or removed. The final actions of the resource specialists are described below. The resource methodology overview for wetland and riparian resources is attached to this technical memorandum as Appendix A for reference only. Additionally, abbreviations and acronyms used in this report are listed in Appendix B.

4.1. Relevant Data or Information Sources

The following data and information were collected to review wetland/riparian areas within the project area:

- CPW (formerly Colorado Division of Wildlife) riparian mapping data
- Southwest Regional Gap Analysis Project (SWReGAP) vegetation mapping data (2006)
- Hydrology information (from multiple sources)

The CPW riparian mapping data (2004) was completed for the corridor using stereo pairs of National Aerial Photography Program aerial color infrared photographs at a nominal scale of 1:40,000 feet. The minimum mapping unit used during their photo interpretation was 0.5 acre (CDOW 2004). The aerial photographs were taken circa 1988 (McLean 2006).

The SWReGAP is an update of the Gap Analysis Project's mapping and assessment of biodiversity for the five-state region encompassing Arizona, Colorado, Nevada, New Mexico, and Utah (SWReGAP 2006). The land cover map was generated using regionally consistent geospatial data (Landsat Enhanced Thematic Mapper + imagery and digital elevation model derivatives), similar field data collection protocols, a standardized land cover legend, and a common modeling approach (decision tree classifier) (Lowry et al. 2005). Landsat Enhanced Thematic Mapper data were acquired between 1999 and 2001. The minimum mapping unit for the SWReGAP data was one acre (Lowry et al. 2005).

The locations and names of surface waterbodies (e.g., streams, rivers, lakes, and reservoirs) were determined through the use of the following data sources:

- U.S. Geological Survey National Hydrography Dataset data for the project area (in geographic information system format)
- U.S. Geological Survey 7.5-minute topographic quadrangles
- *Colorado Atlas and Gazetteer* (DeLorme 1997)

4.2. Data Collection and Analysis Methodology

The following tasks were completed during the U.S. 50 Tier 1 EIS's review of wetland/riparian areas within the project area and are described in detail below.

- Identify wetland/riparian areas within the project area
- Conduct an accuracy assessment of vegetation data
- Develop a wetland/riparian functional assessment model

Wetland/riparian areas within the project area were identified. Using a geographic information system (GIS) application, the CPW riparian mapping data were combined with the SWReGAP wetland/riparian data (2006). This produced a single, comprehensive, and relatively up-to-date data set of wetland/riparian areas in the project area. Priority was given to the CPW riparian data because several leading experts at CPW thought that it provided the most complete and accurate dataset. The SWReGAP data were used to supplement areas where CPW riparian data did not exist.

After the data sets were combined, the existing wetland/riparian types were reclassified into the standard classes used by the U.S. Fish and Wildlife Service (USFWS) (Cowardin et al. 1979). These classes also are recognized by the U.S. Army Corps of Engineers (USACE), EPA, and CPW. These classes included palustrine emergent, palustrine scrub-shrub, and palustrine forested (Cowardin et al. 1979). This reclassification was necessary to normalize the two datasets into one coherent, consistent, and usable format.

This combined and reclassified dataset was used with a GIS application to produce acreage estimates for the three different wetland/riparian classes found in the project area. It is important to note that since this information was derived from aerial imagery and satellite information, the boundaries of the wetland/riparian areas are estimates and may differ from what is found on the ground.

Wetland/riparian areas from CPW riparian mapping and SWReGAP (i.e., GIS polygons) were field-checked for accuracy by comparing mapped polygons to actual on-site land use and vegetation during the fall of 2006. The SWReGAP wetland/riparian polygons had an overall accuracy of nearly 64 percent, and the CPW riparian mapping polygons had an overall accuracy of nearly 77 percent (specific vegetation types were found to have varying levels of accuracy). In a different part of Colorado, Worthey (2007) found that the overall accuracy of the SWReGAP data was 65 percent, which supports the conclusions of the accuracy

assessment performed for this project. Additional information about this accuracy assessment can be found in Appendix C.

When the location of the Build Alternative was determined, wetland/riparian areas within the alternative underwent a more detailed review. A two-step process was used for this review. The first step compared each wetland/riparian area (i.e., polygon) to what appeared in that area on 2005 color aerial photography. During this step, wetland/riparian areas were classified into the following classes:

- Probably wetland/riparian
- Unlikely wetland/riparian
- Check wetland/riparian

All CPW polygons were assigned the designation of probably wetland/riparian.

The second step in the review was done in the field by representatives of the consultant team, CDOT Environmental Programs Branch, and the USACE. All accessible polygons that had been designated as "check" polygons during the review of aerial photographs were visited. These areas included locations at Fowler, Manzanola, Rocky Ford, Swink, La Junta, and Las Animas. The status of these polygons as "probably" or "unlikely" was determined on the ground.

After this field review, polygons within the Build Alternative at Pueblo, between Pueblo and Fowler, at Granada, and at Holly were reviewed again using the 2005 aerial photographs. The field review and prior knowledge of these areas allowed the polygons classified as "check" in these areas to be reclassified. In some cases, it was found that large areas of uplands were included in wetland/riparian polygons. In these areas, polygons were split apart to better reflect on-the-ground conditions. During this effort, no new polygons were drawn, and the overall configuration of polygons was not altered (i.e., the outermost boundaries of polygons were not adjusted). The resultant polygons then were assigned a "probably" or "unlikely" designation. Polygons receiving an unlikely designation were not considered to be wetland/riparian areas by this analysis.

A third field review was conducted in October 2008. This field review included the entire length of the project area and focused specifically on removing irrigated farmlands that were incorrectly classified by SWReGAP as wetland/riparian areas. As with the previous field review, the polygons identified as irrigated farmland were classified as "unlikely" and removed from further consideration as wetland/riparian areas.

A GIS-based functional assessment was developed and performed on identified wetland/riparian areas found within the project area. Three functions were analyzed, including wildlife habitat, hydrology, and water quality. A detailed description of the functional assessment methodology is presented in Appendix D.

4.3. Project Area

The project area for the U.S. 50 Tier 1 EIS has been defined as one to four miles wide surrounding the existing U.S. 50 facility and extending from Pueblo, Colorado, at I-25 to the Colorado-Kansas state line (Figure 1-1). The project area encompasses the study area limits, which is where the Tier 1 corridor alternatives considered by this project would be located. The study area is 1,000 feet wide centered on the corridor alternatives, beginning on or near the existing U.S. 50 between I-25 in Pueblo, Colorado, and extending to just east of Holly, Colorado, in the vicinity of the Colorado-Kansas state line. The limits of the project were approved by the lead agencies and other project stakeholders during the U.S. 50 Tier 1 EIS's scoping activities.

4.4. Effects

Potential effects to wetland/riparian areas and other waters of the United States were identified within the study area (1,000-foot-wide Build Alternative) using a GIS application. To calculate the potential effects, the total acreage was multiplied by a fraction, or effect ratio, that the actual future construction footprint would represent. The width of the (Tier 1) Build Alternative is generally 1,000 feet wide, and the width of the roadway footprint (to be identified during Tier 2 studies) is assumed to be 250 feet (see Figure 4-1). Therefore, the effect ratio was calculated to be 250 feet/1,000 feet = 0.25 or 0.25:1. For example, if the 1,000-foot-wide Tier 1 alternative affects 10 acres, and the recommended ultimate typical section is 250 feet, the Tier 1 potential effect at this site would be calculated as: 10 acres x (0.25) = 2.5 acres.

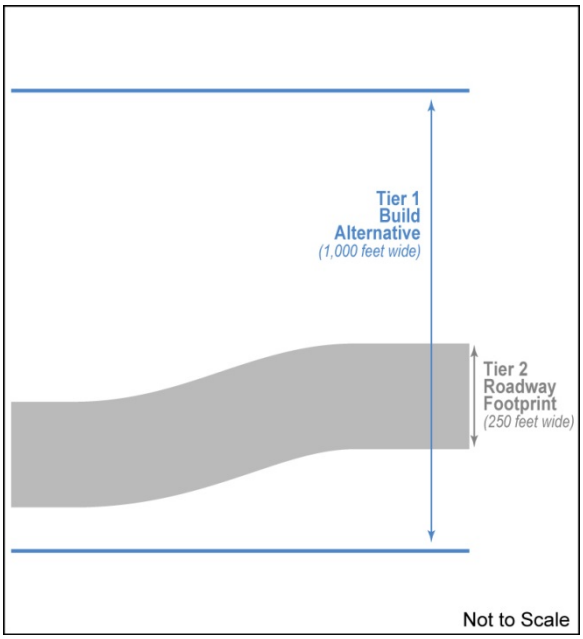


Figure 4-1. Tier 1 vs. Tier 2 Decision

The effect ratio of 0.25 reflects that only one-quarter of the alternative width would be needed for highway right of way within a 1,000-foot wide Build Alternative. However, at three locations, the Build Alternative has a variable width—or a width less than or more than 1,000 feet. This difference creates the need for different effect ratios in these locations. Effect ratios in these areas were calculated by determining the total area of the Build Alternative at that location and dividing it by the total area of the projected construction footprint. There are three exceptions to using the 0.25:1 effect ratio: (1) Section 1, Alternative 2: Pueblo Existing Alignment, which uses a 1:1 effect ratio, since the proposed segment corridor is only 250 feet in width, (2) Section 1, Alternative 3: Pueblo SH 47 Connection, which uses a 0.25:1 effect ratio for the western half, since this area would be new location and is 1,000 feet wide, and it uses a 1:1 effect ratio along the eastern half, where this option uses the existing alignment, and (3) Section 7, Alternative 1: Rocky Ford North, which uses a 0.31:1 effect ratio to account for a wider construction footprint (approximately 310 feet) associated with the adjacent railroad corridor.

Given the 1,000-foot width of the Build Alternative, it is presumed that avoidance may be reasonably achieved through strategies identified in the U.S. 50 Tier 1 EIS, during Tier 2 studies, or both.

4.5. Mitigation Options

The development of compensatory mitigation strategies is an ongoing process and occurs in consultation with several different agencies, including CDOT, FHWA, USACE, EPA, USFWS, and CPW. Mitigation strategies for identified impacts could be a combination of banking and habitat restoration/enhancement for multiple resources. These include wetland, riparian, water quality, and habitat. Mitigation teaming opportunities also will be explored.

4.6. Deliverables

This Wetland and Riparian Technical Memorandum is the primary deliverable being produced for this analysis of wetland/riparian areas for the U.S. 50 Tier 1 EIS.

5. Existing Conditions

This section has been divided into discussions about wetland/riparian areas and non-wetland waters of the United States.

5.1. Wetland/Riparian Areas

In general terms, wetland/riparian areas can be identified in the project area during the summer months as the green belt adjacent to streams, rivers, lakes, and reservoirs. They also can occur as seeps, sloughs, or wet meadows in areas where ground water is close to the soil surface. Approximately 14 percent of the project area has been identified as wetland/riparian areas. The locations of these wetland/riparian areas are presented in Appendix E (Figure E-1 through Figure E-4). The following section describes existing conditions in terms of the environmental characteristics that indicate the presence or absence of wetland/riparian areas, including:

- Hydrology
- Soils
- Vegetation types
- Functionality
- Threats
- Non-wetland waters of the United States

5.1.1. Hydrology

Site hydrology is the overriding characteristic that distinguishes wetland/riparian areas from adjacent uplands. The hydrology of any site or region is ultimately linked to precipitation, but the development of wetland/riparian areas is dependent on the longer-term presence of available water.

In the project area, precipitation ranges between approximately 11 inches to 16 inches per year (WRCC 2006). Evapotranspiration rates during the April through September (WRCC 2006) growing season range from 0.15 inches to 0.5 inches per day (CoAgMet 2007) depending on location and vegetation, which results in an evapotranspiration rate of greater than 30 inches per year. This indicates a water deficit and that precipitation alone is insufficient to support the establishment or persistence of wetland/riparian areas. Therefore, the hydrology of wetland/riparian areas in the project area originates primarily from surface water, ground water, or both.

Maps showing the hydrology of the project area are located in Appendix E (Figure E-9 through Figure E-12).

5.1.2. Soils

Soils in wetland/riparian areas differ from upland soils by their formation and the presence of water. Riparian soils form under two general types of conditions: flowing water (lotic) and standing water (lentic) environments (Lewis et al. 2003). Soils in flowing water conditions, such as floodplains, typically exhibit a high level of stratification developed by successive depositional events during floods. Organic matter in these areas often can be found as deposits derived from offsite sources. Soils in standing water environments, such as in depressional areas or lakes, frequently have higher levels of organic matter accumulation than either lotic areas or uplands (Lewis et al. 2003). The amount of organic matter accumulation in lentic areas is affected by the type of vegetation and the amount of wave action the site receives, among other factors (Lewis et al. 2003).

When a soil becomes saturated with water, the bio-geochemical processes change due to the lack of oxygen (anaerobic). These changes in soil chemistry are unique to saturated soils and have been termed ”hydric.” Hydric soils are defined as “... a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (NRCS 2007). Hydric soils are most commonly found in wetland areas and can be identified by field indicators such as mottling,

gleying, and darker color (i.e., chroma), among others. Hydric soils within the project area can be expected on active floodplains, floodplain terraces, depressional areas, swales, playas, and drainageways (NRCS 2007). Hydric soils also can be found as inclusions in other, non-hydric, soil types. This analysis considered the specific hydric soil series that occur in the project area (see Table 5-1). These series were identified by the Natural Resources Conservation Service (NRCS).

Table 5-1. Hydric Soil Series in the Project Area

Symbol	Series Name[a]	Landform of Occurrence
Aa	Apishapa loamy sand	Floodplains, stream terraces
Ac	Apishapa clay loam	Floodplains, terraces
Ap	Apishapa silty clay	Floodplain steps
Bm	Bloom loam	Drainageways, stream terraces
Lb	Las loam, clay substratum	Floodplains, terraces
Ld	Las clay loam, clay substratum	Floodplains, terraces
Lm	Las Animas soils	Floodplains, terraces, depressions
Lp	Las clay, wet, saline	Floodplains, terraces
Lt	Las Animas soils	Floodplains, terraces
NpB	Nepesta clay loam, saline, 1 to 3 percent slopes	Floodplains, terraces

[a]Partially hydric soil series are not included
Source: NRCS 2007

5.1.3. Vegetation Types

Within the project area, approximately 27,620 acres of wetland/riparian area have been identified, representing more than 14 percent of the total project area (see Table 5-2 and Figure E-1 through Figure E-4, located in Appendix E). All wetland/riparian areas are important to many animals in the project area, but wetland/riparian areas adjacent to streams also frequently serve as wildlife movement corridors.

Three basic wetland/riparian vegetation types, or habitats, have been identified within the project area. These habitat types are palustrine emergent, palustrine scrub-shrub, and palustrine forested (see Table 5-2).

For the purposes of this analysis, “palustrine” refers to freshwater wetland/riparian areas dominated by persistent vegetation (Cowardin et al. 1979). These vegetation types are described in more detail below.

Table 5-2. Extent of Wetland/Riparian Vegetation Types within the Project Area

Wetland/Riparian Vegetation Type[a]	Estimated Acreage
Palustrine emergent	11,139
Palustrine scrub-shrub	14,854
Palustrine forested	1,627
Total	**27,620**

[a]U.S. Fish and Wildlife Service classification system
Note: The sum of individual items may not equal totals due to rounding.
Sources: SWReGAP 2006, Cowardin et al. 1979

Palustrine Emergent

Palustrine emergent habitats are dominated by herbaceous vegetation (Cowardin et al. 1979). Palustrine emergent wetland/riparian areas within the project area comprise approximately 40 percent of the total

wetland/riparian acreage. These areas occur throughout the project area, but they generally are more prevalent from Las Animas eastward. According to the available data, the largest palustrine emergent wetland/riparian areas within the project area occur along the Arkansas River, near crossings of U.S. 50 over the Arkansas River, and on the south side of U.S. 50 just east of the unincorporated area known as Hasty. The Colorado Natural Heritage Program (CNHP) (2006) has identified three palustrine emergent community types that are considered to be imperiled (S2) in or near the project area. These community types are:

1. Alkali Sacaton-Vine Mesquite (*Sporobolus airoides-Panicum obtusum*) Herbaceous Vegetation
2. Great Plains Marsh (*Schoenoplectus acutus-Typha latifolia-Schoenoplectus tabernaemontani*) Sandhills Herbaceous Vegetation
3. Clustered Sedge Wetland (*Carex praegracilis)* Herbaceous Vegetation

Within the project area, palustrine emergent zones typically consist of cattail (*Typha* sp.) and bulrush (*Scirpus* sp.) marshes, reed canarygrass (*Phalaris arundinaceae*), and sedge (*Carex* sp.), rush (*Juncus* sp.), and mesic grass meadows. This type of wetland/riparian area is particularly important to waterfowl, shorebirds, and wading birds—such as herons, cranes, and rails—which depend on these areas for nesting, foraging, or both. The Black Rail (*Laterallus jamaicensis*), in particular, is known to occupy cattail marsh habitat in the vicinity of the Mike Higbee State Wildlife Area, as well as emergent marshes near Hasty. Red-Winged Blackbirds (*Agelaius phoeniceus*) and Yellow-Headed Blackbirds (*Xanthocephalus xanthocephalus*) are common residents of cattail marshes. Amphibians such as the northern leopard frog (*Rana pipiens*) and western chorus frog (*Pseudocris triseriata*) are associated with palustrine emergent habitats. Reptiles such as the northern water snake (*Nerodia sipedon*) and the painted turtle (*Chrysemys picta*) occupy these habitats. In addition, a variety of mammalian species use palustrine emergent habitats at different times of the year for grazing, foraging, or both.

Palustrine Scrub-Shrub

Palustrine scrub-shrub habitats are dominated by woody vegetation less than 20 feet in height (Cowardin et al. 1979). Palustrine scrub-shrub wetland/riparian areas within the project area comprise approximately 54 percent of the total wetland/riparian area and generally occur along major waterways, such as the Arkansas and Huerfano rivers. According to the CNHP (2006), two palustrine scrub-shrub community types are considered to be imperiled (S2) in or near the project area. These community types are:

1. Saline Bottomland Shrublands (*Sarcobatus vermiculatus/Sporobolus airoides)* Sparse Vegetation
2. Coyote Willow/Bulrush (*Salix exigua/Schoenoplectus pungens*)

Palustrine scrub-shrub vegetation within the project area consists of an overstory of salt cedar (also known as tamarisk) or willow (*Salix* sp.) and an understory of mixed graminoids. Salt cedar-dominated palustrine scrub-shrub areas frequently have little to no understory and provide much diminished value to birds and wildlife when compared to willow-dominated palustrine scrub-shrub areas. A variety of neo-tropical songbirds, such as Bullock's Oriole (*Icterus bullockii*), Bell's Vireo (*Vireo bellii*), Veery (*Catharus fuscescens*), and Swamp Sparrow (*Melospiza georgiana*) utilize palustrine scrub-shrub habitat for foraging, breeding, or both. The Black-Crowned Night Heron (*Nycticorax nycticorax*) breeds in these habitats. Beaver (*Castor canadensis*) occur in willow-dominated areas.

Palustrine Forested

Palustrine forested habitats are dominated by woody vegetation greater than 20 feet in height (Cowardin et al. 1979). Palustrine forested wetland/riparian areas within the project area comprise approximately 6 percent of the total wetland/riparian area and generally occur along major waterways, such as the Arkansas and Huerfano rivers. According to the CNHP (2006), three palustrine forested community types are considered to be critically imperiled (S1) or imperiled (S2) in or near the project area. These community types are:

1. Narrowleaf Cottonwood/Western Wheatgrass (*Populus angustifolia/Pascopyrum smithii*) Forest
2. Plains Cottonwood/Sand Dropseed (*Populus deltoides/Sporobolus cryptandrus*)
3. Plains Cottonwood/Western Wheatgrass-Vine Mesquite (*Populus deltoides/Pascopyrum smithii-Panicum obtusum*)

Palustrine forested areas in the project area typically occur along larger streams or rivers, such as the Arkansas River, and are characterized by an overstory of plains cottonwood. Understory vegetation is variable, and can consist of shrubby or herbaceous vegetation, or both. Many wildlife species occupy this habitat. For example, breeding colonies of Great Blue Herons (*Ardea herodias*) and Double-Crested Cormorants (*Phalacrocorax auritus*) can be found in these areas, and many raptor species utilize large cottonwoods for nesting, roosting, and perching habitat. Many mammalian species also utilize palustrine forested habitats for different portions of their life cycles. Mammals commonly associated with these wetland/riparian habitats include the white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), mink (*Mustela vison*), mountain cottontail (*Sylvilagus nuttallii*), beaver, muskrat (*Ondatra zibethicus*), white-footed mouse (*Peromyscus leucopus*), and a variety of bats (NDIS 2007).

5.1.4. Functionality

Wetland/riparian areas are transition zones between aquatic and terrestrial systems. As such, they frequently occupy important positions in the landscape for providing a variety of physical, chemical, and biological functions important to society. These functions are linked not only to processes occurring within the wetland, but also are directly linked to watershed-scale processes. Functions commonly associated with freshwater wetland/riparian areas typically fall into four basic categories, including:

1. Water storage
2. Flood flow attenuation
3. Water quality improvement
4. Wildlife/bird habitat

As part of the U.S. 50 Tier 1 EIS, a GIS-based functional assessment of wetland/riparian areas in the project area was performed to identify highly functional areas that should be considered for avoidance. This does not obviate the need for on-the-ground functional assessments during implementation of Tier 2 studies for specific segments of the U.S. 50 corridor. It does, however, provide a first approximation of where high-quality wetland/riparian areas occur and, therefore, is useful in the planning process. This analysis provides a breakdown of the acreages of the different categories (i.e., functionality) of wetland/riparian areas found in the project area (see Table 5-3) and their locations (Figure E-5 through Figure E-8, located in Appendix E). An overview of the GIS-based functional assessment methodology is presented in Appendix D.

Table 5-3. Summary of Wetland/Riparian Functional Categories in the Project Area

Wetland/Riparian Functional Category	Estimated Acreage
Category I (highest quality and/or highest function)	3,699
Category II	7,084
Category III	13,233
Category IV (lowest quality and/or lowest function)	3,603
Total	27,620

Note: The sum of individual items may not equal totals due to rounding.
Sources: McLean 2006; SWReGAP 2006

While all wetland/riparian areas should be avoided if possible, avoidance of Category I and Category II wetland/riparian areas is a higher priority than simply avoiding any wetland in the project area. These two categories are discussed in more detail below.

Category I wetland/riparian acreage represents 13 percent of the wetland/riparian areas in the project area. They are located primarily along the Arkansas River (Figure E-5 through Figure E-8, located in Appendix E). Palustrine forested wetland/riparian areas are the most common type of Category I wetland/riparian area. It is important to note that many of the palustrine forested areas rated as Category I wetlands may be degraded due to the presence of salt cedar.

Category II wetland/riparian acreage represents 26 percent of the wetland/riparian areas in the project area. They are primarily located along perennial and intermittent streams (Figure E-5 through Figure E-8, located in Appendix E). Native palustrine scrub-shrub wetland/riparian areas are the most common type of Category II wetland/riparian area.

5.1.5. Threats

Perhaps the greatest threat to all wetland/riparian areas in the project area is the invasion of salt cedar (commonly known as tamarisk). This is a highly invasive, non-native tree that has become a major problem in the entire southwest region of Colorado. According to SWReGAP (2006) and CDOW(2004), now CPW, data show that approximately 11,300 acres of salt cedar occur throughout the project area. The largest, contiguous blocks of salt cedar occur along the Arkansas and Huerfano rivers, but smaller patches of salt cedar occur wherever water persists long enough to facilitate their establishment and continued persistence. Salt cedar not only invades native wetland/riparian communities, it also can cause channelization (of stream channels), which effectively changes the formation of sandbars needed by native wetland/riparian species (e.g., cottonwood and willow) for establishment. Consequently, not only is the salt cedar degrading existing native wetland/riparian habitat, it also is preventing the creation of new native dominated wetland/riparian areas.

Other threats to wetland/riparian areas in the project area include public or private development, dewatering, and over-utilization by livestock.

5.2. Non-Wetland Waters of the United States

Approximately 900 miles of streams, rivers, canals, and ditches, plus 1,000 acres of lakes and reservoirs occur in the project area. These water resources that have been named are listed in Table 5-4. The John Martin Reservoir is a major water resource in the Lower Arkansas Valley although the reservoir itself is located outside of the project area. The reservoir is a known breeding ground for the Piping Plover (*Charadrius melodus),* a federally and state listed threatened species, and the federally and state endangered Least Tern (*Sterna antillarum*). According to available published information, the G.W. Verhoeff Reservoir, located just east of Hasty, is the only other named reservoir or lake found in the project area. Numerous unnamed streams, rivers, ditches, lakes, and reservoirs also occur in the project area. These waterbodies whether named or unnamed, are considered non-wetland waters of the United States, and their locations are shown in Figure E-9 through Figure E-12 (Appendix E).

Table 5-4. Named Ditches, Streams, and Rivers Located in the Project Area

Name	Resource Type	Location (County)
Amity Canal	Canal or ditch	Prowers
Anderson Arroyo	River or stream	Otero
Apishapa River	River or stream	Otero
Arkansas River	River or stream	Pueblo, Otero, Bent, Prowers
Buffalo Canal	Canal or ditch	Prowers
Catlin Canal	Canal or ditch	Otero
Cheyenne Creek	River or stream	Prowers
Chico Creek	River or stream	Pueblo
Chicosa Creek	River or stream	Pueblo
Clay Creek	River or stream	Prowers
Consolidated Ditch	Canal or ditch	Bent
Crooked Arroyo	River or stream	Otero
Excelsior Ditch	Canal or ditch	Pueblo
Fort Bent Canal	Canal or ditch	Prowers
Fort Lyon Canal	Canal or ditch	Otero

Name	Resource Type	Location (County)
Fountain Creek	River or stream	Pueblo
Gageby Creek	River or stream	Bent
Granada Creek	River or stream	Prowers
Graveyard Creek	River or stream	Bent
Holly Ditch	Canal or ditch	Prowers
Huerfano River	River or stream	Pueblo
Jones Ditch	Canal or ditch	Bent
King Arroyo	River or stream	Otero
Lamar Canal	Canal or ditch	Prowers
Las Animas Town Ditch	Canal or ditch	Bent
Levere Ditch	Canal or ditch	Bent
Limestone Creek	River or stream	Bent
Lubers Ditch	Canal or ditch	Bent
Lubers Drainage Ditch	Canal or ditch	Bent
Manvel Canal	Canal or ditch	Prowers
McClave Drainage Ditch	Canal or ditch	Bent
Miller Ditch	Canal or ditch	Bent
North Granada Ditch	Canal or ditch	Prowers
Old Otero Canal	Canal or ditch	Otero
Otero Canal	Canal or ditch	Otero
Oxford Farmers Ditch	Canal or ditch	Pueblo, Otero
Prowers Arroyo	River or stream	Bent
Purgatoire River	River or stream	Bent
Riverview Ditch	Canal or ditch	Bent, Prowers
Rocky Ford Canal	Canal or ditch	Otero
Rocky Ford Highline Canal	Canal or ditch	Pueblo, Otero
South Granada Ditch	Canal or ditch	Prowers
Sunflower Ditch	Canal or ditch	Bent
Thompson Arroyo	River or stream	Otero
Timpas Creek	River or stream	Otero
Vandiver Arroyo	River or stream	Otero
Wild Horse Creek	River or stream	Prowers
Wiley Drainage Ditch	Canal or ditch	Prowers
Wolf Creek	River or stream	Prowers
X-Y Canal	Canal or ditch	Prowers

Numerous unnamed streams and ditches also occur in the project area
Source: USGS 2007

6. Effects

The following sections discuss the potential of the No-Build Alternative and the Build Alternative to affect wetland/riparian areas within the study area limits.

6.1. No-Build Alternative

Under the No-Build Alternative, only minor and isolated construction would occur. Routine maintenance and repairs would be made as necessary to keep U.S. 50 in usable condition, including standard overlays and repairs of weather- or crash-related damage. Additionally, smaller scale improvements may be undertaken, such as short passing lanes and other minor safety improvements.

Because routine maintenance and repairs are conducted on the existing highway, these activities generally would not affect wetland/riparian resources except potentially when repairing or replacing culverts. Smaller-scale improvements have the potential to affect resources located directly adjacent to the highway; however, few resources are located in these areas.

6.2. Build Alternative

The Build Alternatives consist of constructing a four-lane expressway on or near the existing U.S. 50 from I-25 in Pueblo, Colorado, to approximately one mile east of Holly, Colorado. There are a total of 30 Build Alternatives. In Pueblo, three Build Alternatives are proposed that either improve U.S. 50 on its existing alignment and/or reroute it to the north to utilize SH 47. East of Pueblo, the remaining 27 Build Alternatives are divided into nine between-town alternatives and 18 around-town alternatives. The nine between-town alternatives improve U.S. 50 on its current alignment, with the exception of near Fort Reynolds, where there is an alternative to realign the roadway to the south. The 18 around-town alternatives propose relocating U.S. 50 from its current through-town route at Fowler, Manzanola, Rocky Ford, Swink, La Junta, Las Animas, Granada, and Holly. Figure 6-1 provides an overview of the Build Alternatives as proposed.

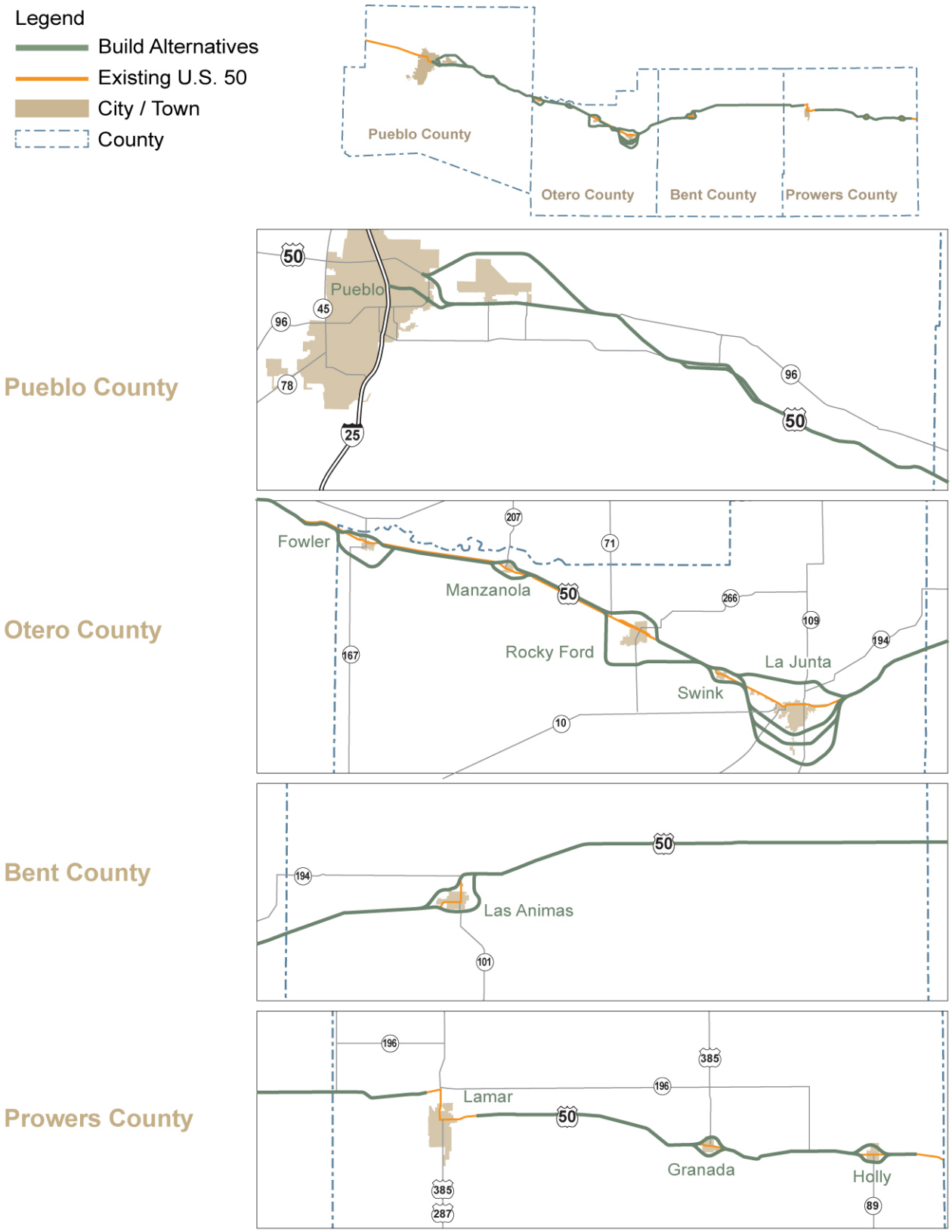


Figure 6-1. Build Alternatives

Effects resulting from the Build Alternative could occur as direct or indirect effects. These effects are discussed below.

6.2.1. Direct Effects

Direct effects are the result of the physical destruction or degradation of a resource. An example of a direct effect is the clearing, excavation, fill, or grading of wetland/riparian areas during the construction of a road. Direct effects to wetland/riparian areas by the Build Alternative are discussed in terms of:

- The overall effects of the Build Alternative
- Effects in locations where only one alternative remains under consideration
- Effects in locations where more than one alternative remains under consideration

Overall Effects of the Build Alternative

Table 6-1, Table 6-2, and Table 6-3 provide estimates of the direct, permanent effects from the Build Alternatives to wetland/riparian areas, non-wetland linear waterbodies (e.g., streams, canals, ditches, etc.), and non-wetland standing bodies of water, respectively. The Functional Unit Loss column in Table 6-1 integrates wetland/riparian acreage with functionality. Therefore, it is a useful tool in comparing effects. The estimated effects in all three of these tables should be regarded as approximate and preliminary.

Furthermore, it is important to keep in mind that the potential effects listed in Table 6-1 include effects to wetland *and* riparian areas. Without formal wetland delineation for the study area, the actual extent of wetlands within each of the corridor alternatives is unknown. However, because wetlands are by definition the wettest portions of riparian areas, it is likely that a substantial amount of the potential effects to wetland/riparian areas would occur to riparian areas, and a lesser amount of effect would occur to wetland areas. More detailed reviews, including wetland delineations, as well as more refined effects analyses, will be conducted during Tier 2 studies. Furthermore, CDOT will incorporate highway design features to avoid and minimize adverse impacts to wetlands and riparian resources.

Table 6-1. Summary of Estimated Direct, Permanent Effects to Wetland/Riparian Areas by Location (Acres)

Section	Build Alternatives (if applicable)	Wetland Category				Wetland Class			Total Acres	Functional Loss	Tamarisk
		I	II	III	IV	PEM	PSS	PFO			
Section 1: Pueblo	Alternative 1: Pueblo Airport North	0	1	9	3	1	12	0	13	260	12
	Alternative 2: Pueblo Existing Alignment	0	1	22	37	1	59	0	60	1,092	59
	Alternative 3: Pueblo SH 47 Connection	0	0	21	27	0	48	0	48	902	47
Section 2: Pueblo to Fowler	Alternative 1: Fort Reynolds Existing Alignment	14	22	63	27	19	99	7	126	2,827	83
	Alternative 2: Fort Reynolds Realignment	14	20	54	24	15	89	8	112	2,559	72
Section 3: Fowler	Alternative 1: Fowler North	11	5	7	2	5	9	11	25	629	7
	Alternative 2: Fowler South	2	1	1	3	1	6	1	8	169	5
Section 4: Fowler to Manzanola	—	14	4	27	4	4	41	4	49	1,129	36
Section 5: Manzanola	Alternative 1: Manzanola North	1	0	2	2	2	2	1	5	102	2
	Alternative 2: Manzanola South	3	1	0	0	0	2	2	4	114	0
Section 6: Manzanola to Rocky Ford	—	0	1	0	0	0	1	0	1	30	1
Section 7: Rocky Ford	Alternative 1: Rocky Ford North	0	4	6	0	6	4	0	10	247	0
	Alternative 2: Rocky Ford South	1	2	10	0	5	6	1	13	299	4
Section 8: Rocky Ford to Swink	—	1	0	2	0	1	2	0	3	72	2
Section 9: Swink	Alternative 1: Swink North	3	2	2	0	2	4	0	7	162	3
	Alternative 2: Swink South	0	0	1	0	0	1	0	1	35	0
Section 10: La Junta	Alternative 1: La Junta North	9	3	15	1	4	24	0	28	723	15
	Alternative 2: La Junta South	1	1	11	2	3	11	1	15	297	11
	Alternative 3: La Junta South	3	7	8	1	7	10	2	19	466	5
	Alternative 4: La Junta South	3	1	7	0	5	5	1	11	271	4

Section	Build Alternatives (if applicable)	Wetland Category				Wetland Class			Total Acres	Functional Loss	Tamarisk
		I	II	III	IV	PEM	PSS	PFO			
Section 11: La Junta to Las Animas	—	0	4	13	3	8	11	1	20	417	9
Section 12: Las Animas	Alternative 1: Las Animas North	5	5	16	14	6	32	2	40	916	27
	Alternative 2: Las Animas South	3	3	16	1	13	10	0	23	573	6
Section 13: Las Animas to Lamar[a]	—	3	36	77	14	97	31	2	130	2,921	25
Section 14: Lamar to Granada[a]	—	9	10	66	23	18	84	6	108	2,403	74
Section 15: Granada	Alternative 1: Granada North	0	4	1	0	4	1	0	5	126	0
	Alternative 2: Granada South	1	0	1	0	1	0	1	2	44	0
Section 16: Granada to Holly	—	0	20	34	1	32	23	0	55	1,290	23
Section 17: Holly	Alternative 1: Holly North	1	8	7	0	10	5	1	16	415	5
	Alternative 2: Holly South	0	2	18	0	7	13	0	20	428	13
Section 18: Holly Transition	—	1	14	6	1	16	5	1	22	551	5

[a]U.S. Fish and Wildlife Service classification system (Cowardin et al. 1979). PEM = palustrine emergent; PSS = palustrine scrub-shrub; PFO = palustrine forested
[b]A GIS-based methodology developed for this project was used to categorize wetland/riparian areas into functional categories (See Appendix D). Category I = highest functionality; Category IV = lowest functionality. Functional units = acreage x functional points
[c]Estimated based on a 250-foot-wide construction footprint; effects include riparian and wetland areas (these two resources have not been differentiated as part of this Tier 1 effects analysis)
Note: The sum of individual items may not equal totals due to rounding.
Sources: CDOW 2004, SWReGAP 2006, CWCB 2006

Table 6-2. Summary of the Estimated Direct, Permanent Effects to Non-Wetland Linear Waterbodies in the Build Alternative

Location	Build Alternatives (if applicable)	Flow Type (feet)			Stream Type (feet)				Total[a] (feet)
		Perennial	Intermittent	Other	Natural	Canal/ Ditch	Artificial Path/ Connector	Pipeline/ Siphon	
Section 1: Pueblo	Alternative 1: Pueblo Airport North	0	5,441	1,248	5,441	1,248	0	0	6,689
	Alternative 2: Pueblo Existing Alignment	0	3,541	669	3,541	495	174	0	4,210
	Alternative 3: Pueblo SH 47 Connection	0	4,514	495	4,514	495	0	0	5,009
Section 2: Pueblo to Fowler	Alternative 1: Fort Reynolds Existing Alignment	476	697	2,351	1,173	1,784	567	0	3,524
	Alternative 2: Fort Reynolds Realignment	343	931	2,315	1,274	1,721	594	0	3,589
Section 3: Fowler	Alternative 1: Fowler North	271	117	202	388	0	202	0	590
	Alternative 2: Fowler South	0	245	1,493	245	1,493	0	0	1,738
Section 4: Fowler to Manzanola	—	248	381	3,782	628	3,167	563	52	4,410
Section 5: Manzanola	Alternative 1: Manzanola North	0	20	1,043	20	1,043	0	0	1,063
	Alternative 2: Manzanola South	0	0	2,174	0	2,174	0	0	2,174
Section 6: Manzanola to Rocky Ford	—	0	325	281	325	281	0	0	606
Section 7: Rocky Ford	Alternative 1: Rocky Ford North	0	0	2,072	0	2,072	0	0	2,072
	Alternative 2: Rocky Ford South	0	0	2,662	0	2,662	0	0	2,662
Section 8: Rocky Ford to Swink	—	281	0	0	281	0	0	0	281
Section 9: Swink	Alternative 1: Swink North	0	491	1,209	491	1,209	0	0	1,700
	Alternative 2: Swink South	108	0	259	108	259	0	0	366

Location	Build Alternatives (if applicable)	Flow Type (feet)			Stream Type (feet)				Total[a] (feet)
		Perennial	Intermittent	Other	Natural	Canal/ Ditch	Artificial Path/ Connector	Pipeline/ Siphon	
Section 10: La Junta	Alternative 1: La Junta North	0	4,105	2,477	4,105	1,157	1,319	0	6,582
	Alternative 2: La Junta South	661	2,961	1,649	3,622	1,634	14	0	5,270
	Alternative 3: La Junta South	984	3,650	2,212	4,634	2,063	80	68	6,846
	Alternative 4: La Junta South	768	5,974	1,589	6,743	1,319	270	0	8,331
Section 11: La Junta to Las Animas	—	0	5,071	2,270	5,071	2,270	0	0	7,340
Section 12: Las Animas	Alternative 1: Las Animas North	74	2,055	2,103	2,128	1,176	927	0	4,231
	Alternative 2: Las Animas South	270	60	2,969	331	2,510	459	0	3,299
Section 13: Las Animas to Lamar	—	1,112	391	4,941	1,503	4,713	227	0	6,443
Section 14: Lamar to Granada	—	530	592	6,725	1,122	6,722	0	2	7,847
Section 15: Granada	Alternative 1: Granada North	835	15	1,141	849	1,141	0	0	1,990
	Alternative 2: Granada South	0	0	1,113	0	1,113	0	0	1,113
Section 16: Granada to Holly	—	130	885	9,324	1,016	7,868	1,417	39	10,340
Section 17: Holly	Alternative 1: Holly North	441	0	3,112	441	3,036	0	75	3,552
	Alternative 2: Holly South	0	0	178	0	144	33	0	178
Section 18: Holly Transition	—	0	560	3279	560	3,008	271	0	3,839

[a]*Estimated based on a 250-foot wide construction footprint*
Note: The sum of individual items may not equal totals due to rounding.
Source: National Hydrography Dataset, USGS 2007

Table 6-3. Summary of Estimated Direct, Permanent Effects to Non-Wetland Standing Waterbodies in the Build Alternative

Location	Build Alternatives (if applicable)	Estimated Potential Effects[a] (acres)
Section 1: Pueblo	Alternative 1: Pueblo Airport North	0.1
	Alternative 2: Pueblo Existing Alignment	0.0
	Alternative 3: Pueblo SH 47 Connection	0.0
Section 2: Pueblo to Fowler	Alternative 1: Fort Reynolds Existing Alignment	1.1
	Alternative 2: Fort Reynolds Realignment	1.1
Section 3: Fowler	Alternative 1: Fowler North	0.0
	Alternative 2: Fowler South	0.0
Section 4: Fowler to Manzanola	—	0.0
Section 5: Manzanola	Alternative 1: Manzanola North	0.0
	Alternative 2: Manzanola South	0.0
Section 6: Manzanola to Rocky Ford	—	0.0
Section 7: Rocky Ford	Alternative 1: Rocky Ford North	0.0
	Alternative 2: Rocky Ford South	0.2
Section 8: Rocky Ford to Swink	—	0.0
Section 9: Swink	Alternative 1: Swink North	0.1
	Alternative 2: Swink South	0.0
Section 10: La Junta	Alternative 1: La Junta North	0.1
	Alternative 2: La Junta South	0.1
	Alternative 3: La Junta South	0.6
	Alternative 4: La Junta South	1.2
Section 11: La Junta to Las Animas	—	0.0
Section 12: Las Animas	Alternative 1: Las Animas North	1.2
	Alternative 2: Las Animas South	0.6
Section 13: Las Animas to Lamar	—	1.4
Section 14: Lamar to Granada	—	0.0
Section 15: Granada	Alternative 1: Granada North	0.0
	Alternative 2: Granada South	0.0
Section 16: Granada to Holly	—	3.0
Section 17: Holly	Alternative 1: Holly North	0.4
	Alternative 2: Holly South	0.2
Section 18: Holly Transition	—	2.8

[a]*Estimated based on a 250-foot-wide construction footprint*
Note: The sum of individual items may not equal totals due to rounding.
Source: National Hydrography Dataset, USGS 2007

Based on the estimated direct, permanent effects to wetland/riparian areas at each location as presented in Table 6-1, the Build Alternative would cumulatively affect a range of resources. Under the best-case scenario (i.e., the least effects), the Build Alternative would affect approximately 588 acres of wetland/riparian areas. Under a worst-case scenario, the Build Alternative would affect nearly 717 acres of wetland/riparian areas, which is a difference of 129 acres. This range of effect represents roughly 2.1 percent for the best-case scenario and 2.6 percent for the worst-case scenario of the 27,620 acres of wetland/riparian resources identified in the project study area. From the total range of potential effects to wetland/riparian areas from the Build Alternative, effects to palustrine forested wetland areas would be between 23 acres and 41 acres, while effects to Category I or Category II wetland areas would be between 168 acres and 222 acres. The total potential functional loss resulting from the Build Alternative ranges from roughly 13,487 units to 16,129 units.

The range of estimated direct, permanent effects to non-wetland flowing bodies of water from the Build Alternative as shown in Table 6-2 is between 12.6 miles and 15.4 miles. From the total range of potential effects to flowing bodies of water, effects to perennial streams comprise between 0.6 mile and 1.2 miles, while effects to intermittent streams are between 3.1 miles and 4.6 miles. The range of estimated direct, permanent effects to non-wetland standing waterbodies, as shown in Table 6-3, is between 9 acres and 13 acres.

Effects to wetland/riparian areas, non-wetland linear waterbodies, and non-wetland standing bodies of water by the Build Alternative are discussed below by location (from west to east along U.S. 50). The effects presented in Table 6-1, Table 6-2, and Table 6-3, and discussed below, are shown on figures located in Appendix E.

Section 1: Pueblo (Figure E-13)

Three local corridor alternatives are under consideration for Pueblo, including a relocation of U.S. 50 north of the Pueblo Airport (Alternative 1: Pueblo Airport North), use of the existing four-lane alignment (Alternative 2: Pueblo Existing Alignment), and a new SH 47 connection along with the existing alignment (Alternative 3: Pueblo SH 47 Connection).

Alternative 1 consists of a 7.9-mile corridor north of Pueblo that is anticipated to affect the least amount of wetland/riparian areas. Of the 13 acres estimated to be affected, none are classified as palustrine forested and roughly 8 percent are Category I or Category II. With a functional unit loss of approximately 260, this alternative also would have the least adverse effect on overall wetland/riparian functionality when compared to the other two alternatives. Approximately 6,689 feet of non-wetland channels would be directly affected by Alternative 1, of which none are perennial. Approximately 0.1 acre of standing waterbodies is expected to be directly affected under this alternative.

Alternative 2 would stay on the existing alignment and is anticipated to affect approximately 60 acres of wetland/riparian areas, none of which are palustrine forested and one acre are Category I or II. The projected functional loss resulting from Alternative 2 is 1,092 units. Approximately 4,210 feet of non-wetland channels would be directly affected by Alternative 2, of which none are perennial. No standing waterbodies are expected to be directly affected under this alternative.

Alternative 3 includes staying on the existing alignment with a new SH 47 connection. Effects analyses for this alternative indicate that 47 acres of wetland/riparian area would be affected, of which 0.2 acre are forested wetland/riparian areas and 0.6 acre are Category I or II areas. The projected functional loss for Alternative 3 is 902 units. No effect to perennial stream channels occur in this alternative, but approximately 5,009 feet of other non-wetland channel types would be affected (4,514 feet of intermittent channels and 495 feet of canal/ditch). No standing waterbodies are expected to be affected by Alternative 3.

Section 2: Pueblo to Fowler (Figure E-14)

Between Pueblo and Fowler, the Build Alternative consists of a 1,000-foot-wide corridor centered on the existing alignment. The exception to this is near Fort Reynolds, between Milepost 333 and Milepost 339, where two options are under consideration. Alternative 1: Fort Reynolds Existing Alignment would remain on the existing alignment and reconstruct the highway to a four-lane, divided expressway. Alternative 2: Fort

Reynolds Realignment realigns the highway to the south to avoid acquisition of homes in the area of Fort Reynolds. Alternative 1 is anticipated to affect 125 acres of wetland/riparian area, of which approximately 5 percent are palustrine forested and 28 percent are Category I or Category II. Slightly fewer wetland/riparian areas are anticipated to be affected by Alternative 2 (13 acres less). With regards to non-wetland channels, the anticipated effects are nearly the same between Alternative 1 and Alternative 2—estimated to be 3,524 feet and 3,589 feet, respectively. Four percent more of the anticipated effects are to perennial channels in Alternative 1. Both Pueblo to Fowler alternatives are anticipated to affect 1.1 acres of standing waterbodies.

Section 3: Fowler (Figure E-15)

Alternative 1: Fowler North is more than three miles long and is anticipated to directly affect a greater amount of wetland/riparian areas than Alternative 2: Fowler South. Under Alternative 1, 25 acres of wetland/riparian area would be adversely affected, of which 11.4 acres are classified as palustrine forested, and 16.5 acres are Category I or Category II wetland/riparian areas. In addition, construction of this alternative would likely result in a functional loss of approximately 629 units. Based on available mapping, approximately 28 percent of the wetland/riparian areas in this alternative are dominated by salt cedar. Alternative 1 would affect approximately 271 feet of perennial stream channel and an additional 319 feet of other non-wetland channels (590 feet total). No standing waterbodies are expected to be directly affected under this alternative.

Alternative 2: Fowler South is longer than Alternative 1 (nearly five miles), but would adversely affect substantially less wetland/riparian acreage due to it being farther away from the Arkansas River. Under this alternative, approximately eight acres of wetland/riparian area would be affected, of which 0.8 acre (10 percent) is classified as palustrine forested, and 3.4 acres (43 percent) are Category I or Category II wetland/riparian areas. With a functional unit loss of roughly 169, this alternative also would have less of an adverse effect on overall wetland/riparian functionality when compared to Alternative 1. Nearly 63 percent of the wetland/riparian areas in this alternative are classified by available mapping as being dominated by salt cedar. No perennial streams would be affected under this alternative; however, a greater length (approximately 1,148 feet more) of non-wetland channels would be adversely affected when compared to Alternative 1. As with Alternative 1, no standing waterbodies are expected to be affected by Alternative 2.

Section 4: Fowler to Manzanola (Figure E-16)

The Build Alternative in this section consists of a 1,000-foot-wide corridor on the existing U.S. 50 alignment. This section is estimated to affect approximately 49 acres of wetland/riparian areas, of which four acres are classified as palustrine forested (8 percent) and 18 acres are Category I or Category II (36 percent). Construction in this section would result in a loss of 1,129 functional units. Effects to perennial streams would total approximately 248 feet and total effects to non-wetland channels are estimated to be nearly 4,410 feet. No standing waterbodies are expected to be affected.

Section 5: Manzanola (Figure E-17)

Both north-of-town and south-of-town alternatives remain under consideration in Manzanola. The alternatives are nearly the same length, at a little more than 2.5 miles each. Alternative 1: Manzanola North is anticipated to affect approximately five acres of wetland/riparian areas with a functional loss of 102 units. Approximately 40 percent of the wetland/riparian areas in this alternative are classified by available mapping as being dominated by salt cedar. Alternative 1 would affect approximately 1,063 feet of non-wetland channels, of which none are perennial and only 20 feet are intermittent. No standing waterbodies are expected to be directly affected under this alternative.

Alternative 2: Manzanola South is anticipated to directly affect a total of four acres of wetland/riparian areas, of which approximately 50 percent are classified as palustrine forested, and 93 percent are Category I or Category II. Construction of this alternative would result in a loss of 114 functional units, which is slightly more than Alternative 1. Approximately 2,174 feet of non-wetland channels would be directly affected by Alternative 2, more than twice the length affected by Alternative 1. None of the affected channels are perennial or intermittent. As with Alternative 1, no standing waterbodies are expected to be affected.

Section 6: Manzanola to Rocky Ford (Figure E-18)

The Build Alternative in this section consists of a 1,000-foot-wide corridor on the existing U.S. 50 alignment. This section is estimated to affect approximately one acre of wetland/riparian areas, which is not classified as palustrine forested, but approximately half is Category II. Construction in this section would result in a loss of 30 functional units. No perennial streams would be affected in this section, but a total of approximately 325 feet of intermittent streams and 281 feet of other non-wetland channels are estimated to be affected. No standing waterbodies are expected to be affected.

Section 7: Rocky Ford (Figure E-19)

Alternative 1: Rocky Ford North is slightly less than seven miles long and is situated between the City of Rocky Ford and the Arkansas River. Approximately 11 acres of wetland/riparian areas are anticipated to be affected by Alternative 1, of which less than one acre are classified as palustrine forested, and four acres are Category I or Category II. In addition, construction of this alternative likely would result in a functional loss of approximately 247 units. Approximately 2,072 feet of non-wetland channels would be directly affected by the Rocky Ford North Alternative, all of which are classified as canal/ditch. No standing waterbodies are expected to be directly affected under this alternative.

At 8.2-miles in length, Alternative 2: Rocky Ford South is slightly longer than Alternative 1. It would adversely affect 12 acres of wetland/riparian areas with approximately one acre categorized as palustrine forested and three acres are Category I or Category II. With a functional loss of 299 units, this alternative would have a greater adverse effect on overall wetland/riparian functionality when compared to Alternative 1. As with Alternative 1, no perennial or intermittent streams are anticipated to be adversely affected by this alternative. All of the 2,662 feet of non-wetland channel impacts are classified as canal/ditch. Approximately 0.2 acres of standing waterbodies are expected to be affected.

Section 8: Rocky Ford to Swink (Figure E-20)

The Build Alternative in this section consists of a 1,000-foot wide corridor on the existing U.S. 50 alignment. This section is estimated to affect approximately three acres of wetland/riparian areas, of which none are classified as palustrine forested and less than one acre is Category I or Category II. Construction in this section would result in a loss of 72 functional units. Effects to perennial streams would total approximately 281 feet, which accounts for all the effects to non-wetland channels. No standing waterbodies are expected to be affected.

Section 9: Swink (Figure E-20)

Alternative 1: Swink North is roughly 2.5 miles long and is comparable in length to Alternative 2: Swink South. Under Alternative 1, approximately 6 acres of effect to wetland/riparian areas likely would occur, of which none are palustrine forested, but 4.5 acres (approximately 75 percent) are rated as Category I and Category II wetland/riparian areas. The Swink North Alternative would cause the functional loss of roughly 162 units, substantially more than the Swink South Alternative. Salt cedar dominates roughly 50 percent (or nearly three acres) of the wetland/riparian areas likely to be affected by this alternative. Though no perennial streams occur in the Swink North Alternative, it would affect up to 1,700 feet of other non-wetland channels and approximately 0.1 acre of standing waterbodies.

Alternative 2 is slightly longer (by roughly a quarter of a mile) than Alternative 1. Effects analyses for this alternative indicate that only one acre of wetland/riparian area would be affected, of which there would be no effects to palustrine forested wetland/riparian areas. Approximately half of wetland/riparian areas are Category I and Category II areas. These effects are presented in Figure E-20, located in Appendix E. The projected functional unit loss for the Swink South Alternative (35 units) is substantially less than for the Swink North Alternative. Effects to perennial streams would total approximately 108 feet and total effects to non-wetland channels are estimated to be 366 feet. No standing waterbodies are expected to be affected by this alternative.

Section 10: La Junta (Figure E-31)

La Junta includes four alternatives under consideration including one north-of-town alternative, and three south-of-town alternatives that differ by length and proximity to the town. Alternative 1: La Junta North is

approximately 8.9 miles in length and includes two new bridges over the Arkansas River. The estimated adverse effect to wetland/riparian areas in the north alternative is approximately 28 acres, of which less than one acre classified as palustrine forested and approximately 13 acres (45 percent) are Category I or Category II wetland/riparian areas. If Alternative 1 were constructed, 723 wetland/riparian functional units would be lost, which is more than any of the other La Junta alternatives. No perennial stream channels occur in Alternative 1, but approximately 6,582 feet of other non-wetland channel types would be affected. In addition, the La Junta North Alternative is projected to affect 0.1 acre of standing waterbodies.

Alternative 2: La Junta South is the shortest of the La Junta alternatives at 8.5 miles in length, and is located approximately two miles south of town. This alternative is estimated to affect 15 acres of wetland/riparian areas with a functional loss of 297 units. Salt cedar is prevalent in this alternative, dominating approximately 73 percent (or 11 acres) of the wetland/riparian acreage that would be affected. Alternative 2 would affect approximately 661 feet of perennial stream channel and 2,961 feet of intermittent channels. In total, approximately 5,270 feet of non-wetland channels are anticipated to be affected, which is the fewest of all the La Junta alternatives. Approximately 0.1 acre of standing waterbodies is expected to be directly affected under this alternative.

Alternative 3: La Junta South is approximately 8.5 miles long and would cause less effect to wetland/riparian areas than Alternative 1. Approximately 19 acres of effect is estimated to occur to wetland/riparian areas, of which 1.5 acres are classified as forested and approximately 10 acres (nearly 50 percent) are rated as Category I or Category II wetland/riparian areas. These effects are presented in Figure E-31, located in Appendix E. Alternative 3 would cause a functional loss of 466 units. Of the potentially affected wetland/riparian areas, roughly 25 percent (or five acres) are classified as dominated by salt cedar. Approximately 984 feet of perennial stream channel would be affected by this alternative, which is the most among the La Junta alternatives. In addition, approximately 3,650 feet of intermittent stream channel, 2,212 feet of other non-wetland channel, and 0.6 acre of standing waterbodies likely would be affected by Alternative 3.

Alternative 4: La Junta South is the longest alternative at 11.9 miles, and farthest south at 3.3 miles from town. This alternative is anticipated to affect approximately 11 acres of wetland/riparian areas, with a functional unit loss of 271. Approximately 36 percent of the wetland/riparian areas in this alternative are classified by available mapping as being dominated by salt cedar. Alternative 4 would affect the most non-wetland channels at approximately 8,331 feet, of which 768 feet are perennial and 5,974 feet are intermittent. This alternative also affects the most standing waterbodies compared to other La Junta alternatives at 1.2 acres.

Section 11: La Junta to Las Animas (Figure E-21)

The Build Alternative in this section consists of a 1,000-foot-wide corridor on the existing U.S. 50 alignment. This section is estimated to affect approximately 20 acres of wetland/riparian areas, of which one-half acre is classified as palustrine forested and four acres are Category II. Construction in this section would result in a loss of 417 functional units. No perennial streams would be affected in this section, but a total of approximately 7,340 feet of other non-wetland channels are estimated to be affected (5,071 feet of intermittent stream and 2,270 feet of canal/ditch). No standing waterbodies are expected to be affected.

Section 12: Las Animas (Figure E-22)

Alternative 1: Las Animas North is approximately 3.5 miles long and includes a replacement of the existing bridge over the Arkansas River. Despite being more than one mile shorter than the south alternative, this alternative is anticipated to adversely affect more wetland/riparian areas. Approximately 40 acres of effect is estimated to occur to wetland/riparian areas, of which two acres (6 percent) are classified as palustrine forested and 10 acres (25 percent) are rated as Category I or Category II wetland/riparian areas. If this alternative were constructed, 916 wetland/riparian functional units would be lost. Alternative 1 would affect approximately 74 feet of perennial stream channel and an additional 2,055 feet of intermittent channels. In total, approximately 4,231 feet of non-wetland channels are anticipated to be affected, nearly 1,000 feet more than Alternative 2: Las Animas South. Alternative 1 also affects more standing waterbodies compared to the South Alternative at 1.2 acres.

Alternative 2: Las Animas South is approximately 4.7 miles long and will include a new bridge crossing over the Arkansas River. Under this alternative, approximately 23 acres of effect to wetland/riparian areas likely would occur, of which none are palustrine forested and seven acres (30 percent) are rated as Category I and Category II wetland/riparian areas. Alternative 2 would cause the functional loss of approximately 573 units, 343 less than Alternative 1. Salt cedar dominates roughly 26 percent (or six acres) of the wetland/riparian areas likely to be affected by this alternative. Alternative 2 would affect fewer non-wetland channels than Alternative 1 at approximately 3,299 feet, but more of those effects are to perennial streams than Alternative 1. Approximately 0.6 acre of standing waterbodies is expected to be directly affected under this alternative.

Section 13: Las Animas to Lamar (Figure E-23 and E-24)

The Build Alternative in this section consists of a 1,000-foot wide corridor on the existing U.S. 50 alignment. This section is estimated to affect approximately 130 acres of wetland/riparian areas, of which two acres are classified as palustrine forested (1.6 percent) and 39 acres are Category I or Category II (30 percent). Construction in this section would result in a loss of 2,921 functional units. Effects to perennial streams would total approximately 1,112 feet and total effects to non-wetland channels are estimated to be nearly 6,443 feet. Approximately 1.4 acres of standing waterbodies are expected to be affected.

Section 14: Lamar to Granada (Figure E-25)

The Build Alternative in this section consists of a 1,000-foot wide corridor on the existing U.S. 50 alignment. However, between Lamar and the U.S. 50 and CR GC.5 intersection, the corridor begins on the north edge of U.S 50 and extends 1,000 feet south to avoid the railroad on the north side. This section is estimated to affect approximately 108 acres of wetland/riparian areas, of which 6.5 acres are classified as palustrine forested (6 percent) and 19 acres are Category I or Category II (17.4 percent). Construction in this section would result in a loss of 2,403 functional units. Effects to perennial streams would total approximately 530 feet and total effects to non-wetland channels are estimated to be nearly 7,847 feet. No standing waterbodies are expected to be affected.

Section 15: Granada (Figure E-26)

The two alternatives under consideration in Granada include north-of-town and south-of-town routes, which are nearly the same length at 2.2 miles and 2.1 miles, respectively. Alternative 1: Granada North is anticipated to affect approximately five acres of wetland/riparian areas with a functional loss of 126 units. None of the five acres is palustrine forested, but four of the five acres are classified as Category II wetland/riparian areas. Alternative 1 also would affect approximately 1,990 feet of non-wetland channels, of which 835 feet are perennial and 15 feet are intermittent. No standing waterbodies are expected to be directly affected under this alternative.

At 2.1 miles in length, Alternative 2: Granada South is slightly shorter, and would adversely affect two acres of wetland/riparian area, three acres less than the North Alternative. Of the two acres anticipated to be affected, one-half acre is palustrine forested, and one-half acre is Category I. With a functional loss of approximately 44 units, this alternative also would have less of an adverse effect on overall wetland/riparian functionality when compared to Alternative 1. No perennial or intermittent streams are anticipated to be adversely affected by this alternative. All of the 1,113 feet of non-wetland channel impacts are classified as canal/ditch. As with the North Alternative, no standing waterbodies are expected to be affected by Alternative 2.

Section 16: Granada to Holly (Figure E-27)

The Build Alternative in this section consists of a 1,000-foot wide corridor on the existing U.S. 50 alignment. This section is estimated to affect approximately 55 acres of wetland/riparian areas, of which none are classified as palustrine forested, but 20 acres are Category II (37 percent). Construction in this section would result in a loss of 1,290 functional units. This section is estimated to affect approximately 130 feet of perennial stream channel and an additional 885 feet of intermittent channels. In total, approximately 10,340 feet of non-wetland channels are anticipated to be affected. Approximately three acres of standing waterbodies are expected to be affected.

Section 17: Holly (Figure E-28)

The Build Alternative includes a north-of-town option (Alternative 1: Holly North) and a south-of-town option (Alternative 2: Holly South) in Holly. Both alternatives are approximately 2.1-miles long. Approximately 16 acres of wetland/riparian areas are anticipated to be affected by Alternative 1, of which one acre is classified as palustrine forested, and nine acres are Category I or Category II. Construction of this alternative results in fewer wetland/riparian area effects, as well a smaller functional loss of approximately 415 units compared to Alternative 2. Approximately 3,552 feet of non-wetland channels would be directly affected by Alternative 1, of which 441 feet are perennial and the remainder are classified as canal/ditch. Approximately 0.4 acre of standing waterbodies is expected to be directly affected under this alternative.

Alternative 2 is situated between the city of Holly and the Arkansas River. Effects analyses for this alternative indicate that 20 acres of wetland/riparian area would be affected, of which there would be no effects to palustrine forested areas and only two acres (8.5 percent) of effect to Category II areas. The projected functional unit loss for the south alternative (428 units) is roughly 13 units more than the Alternative 1. No perennial stream channels occur in the south alternative, and only 178 feet of other non-wetland channel types would be affected. Approximately 0.2 acre of standing waterbodies is expected to be affected by this alternative.

Section 18: Holly Transition (Figure E-29)

The Build Alternative in this section consists of a 1,000-foot wide corridor on the existing U.S. 50 alignment. This section is estimated to affect approximately 22 acres of wetland/riparian areas, of which one acre is classified as palustrine forested and 15 acres are Category I or Category II. Construction in this section would result in a loss of 551 functional units. No perennial streams would be affected in this section, but a total of approximately 3,839 feet of other non-wetland channels are estimated to be affected. Approximately 2.8 acres of standing waterbodies are expected to be directly affected.

6.2.2. Indirect Effects

Indirect effects also can contribute to the overall, or cumulative, effects to resources in the Lower Arkansas River watershed. Indirect effects occur away from the project site in time, space, or both. By their very nature, indirect effects are difficult to quantify. At this Tier 1 level of analysis, indirect effects to wetland/riparian areas by the Build Alternative cannot be determined. This is because such an evaluation depends on the specific location of the roadway footprint (i.e., alignment), and that will not be determined until Tier 2 studies. However, potential indirect effects to wetland/riparian areas include the following:

- Changes in drainage/flow routing—Changes in the way water is routed across the landscape (i.e., by adding a roadway or widening an existing roadway) could result in higher, lower, or no substantial change in surface water or ground water levels. Changes in water levels could result in a shift in the plant species that exist at the site.
- Decrease in water quality—Decreased water quality can affect the plant and animal species that inhabit a particular area.
- Introduction of invasive plant species—Seeds and plant parts of noxious weeds and other invasive plant species can be carried into a project site on construction equipment. Also, existing weed seeds can be spread during construction, and the wind can deliver weed seeds to newly disturbed soils. When established, they can spread into nearby undisturbed areas and will slowly degrade habitat quality for various wildlife species and result in a shift in plant and animal species composition found in a particular area.
- Increased noise levels—Increased noise levels could cause resident animal species in adjacent habitats to relocate. This effect generally lasts until resident wildlife becomes habituated to the changes.

7. Mitigation Strategies

The U.S. 50 Tier 1 EIS has developed a Natural Resources Mitigation Strategies Plan. This plan is intended to guide mitigation activities for natural resource impacts that occur during Tier 2 studies, primarily impacts to wildlife and their habitat. Since wetland/riparian areas serve as habitat to certain types of wildlife, they are discussed in this plan. The Natural Resources Mitigation Strategies Plan has been included as an appendix to the U.S. 50 Tier 1 EIS. All applicable laws and regulations will be followed, and mitigation measures would be applied, as needed, to offset identified impacts during Tier 2 studies.

8. References

Berglund, J. *Montana Wetland Assessment Method.* Washington, D.C.: Transportation Research Board. 1999. Print.

Colorado Agricultural Meteorological Network (CoAgMet). *Evapotranspiration Data for Sites in the Arkansas Valley.* Web. Jan. 2007. <http://ccc.atmos.colostate.edu/%7Ecoagmet/etr_form.php>.

Colorado Atlas and Gazetteer. Yarmouth, ME: DeLorme Mapping Company. 1997. Print.

Colorado Department of Transportation (CDOT). Mitigation forms and guidance for wetland finding reports. Print.

Colorado Department of Transportation (CDOT). *U.S. 50 Tier 1 EIS Vegetation Accuracy Assessment of SWReGAP and Colorado Division of Wildlife (CDOW) Riparian Vegetation Mapping Along the U.S. 50 Corridor.* Bozeman, MT: Colorado Department of Transportation (CDOT), Region 2. 23–27 Oct. 2006. Print.

Colorado Division of Wildlife (CDOW). *Riparian Mapping Methodology*. 2004. Web. Jan. 2007. <http://ndis1.nrel.colostate.edu/riparian/Methods.htm>.

Colorado Natural Heritage Program (CNHP). *County List of Tracked Species.* Updated 11 Aug. 2006. Web. Jan. 2007. <http://www.cnhp.colostate.edu/list.html>.

Colorado Water Conservation Board (CWCB). *Tamarisk Inventory for the Colorado, Arkansas, and Purgatoire Rivers*. Grand Junction, CO: Tamarisk Coalition, 25 Jan. 2006. Print.

Copeland, C. “Water Quality: Implementing the Clean Water Act.” *Issue Brief 89102 for Congress.* Washington, D.C.: Congressional Research Service. Aug. 2001. Print.

Council on Environmental Quality (CEQ). *Regulations for Implementing NEPA.* 40 CFR Parts 1500-1508. Washington, D.C. 1978. Print.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. *Classification of Wetlands and Deepwater Habitats of the United States* (FWS/OBS-79/31). Washington, D.C.: U.S. Fish and Wildlife Service (USFWS). 1979. Print.

Executive Order 11988. *Floodplain Management*. May 24, 1977.

Executive Order 11990. *Protection of Wetlands*. May 24, 1977.

Federal Highway Administration (FHWA). *Technical Advisory T6640.8A.* “Guidance for Preparing and Processing Environmental and Section 4(f) Documents.” Washington, D.C.: FHWA. 30 Oct. 1987. Print.

Lewis, L., L. Clark, R. Krapf, M. Manning, J. Staats, T. Subirge, L. Townsend, and B. Ypsilantis. *Technical Reference 1737-19.* “Riparian Area Management: Riparian-Wetland Soils.” Denver, CO: Bureau of Land Management (BLM). 2003. Web. Jan. 2007. <http://www.blm.gov/nstc/library/pdf/FinalTR1737-19.pdf>.

Lowry, J.H, Jr., R.D. Ramsey, K. Boykin, D. Bradford, P. Comer, S. Falzarano, W. Kepner, J. Kirby, L. Langs, J. Prior-Magee, G. Manis, L. O’Brien, T. Sajwaj, K.A. Thomas, W. Rieth, S. Schrader, D. Schrupp, K. Schulz, B. Thompson, C. Velasquez, C. Wallace, E. Waller, and B. Wolk. *Southwest*

Regional Gap Analysis Project: Final Report on Land Cover Mapping Methods. Logan, Utah: RS/GIS Laboratory, Utah State University. 2005. Print.

McLean, S. Colorado Division of Wildlife (CDOW) riparian mapping data. Apr 28, 2006.

Memorandum of agreement between the U.S. Environmental Protection Agency (EPA) and the Department of the Army (DOA) concerning the determination of mitigation under the Clean Water Act Section 404(b)(1). 1990.

Memorandum of agreement on the administration and implementation of Senate Bill (SB) 40. Colorado Division of Wildlife (CDOW) and Colorado Department of Transportation (CDOT). 2005.

Mitigation of impacts to wetlands and natural habitat. 23 CFR 777. 2000.

National Environmental Policy Act/Clean Water Act Section 404 (NEPA/404) merger process and agreement for transportation projects in Colorado. 2005.

National Environmental Policy Act of 1969 (NEPA) Regulations. 23 CFR 771. 1987.

National Research Council (NRC). Riparian areas: Functions and strategies for management. Committee on Riparian Zone Functioning and Strategies for Management; Water Science and Technology Board; Board on Environmental Studies and Toxicology; Division on Earth and Life Studies. Washington, D.C.: National Academy Press; 2002. 428 p.

Natural Diversity Information Source (NDIS). Species and habitat information. 2007. Available from: http://ndis.nrel.colostate.edu/wildlife.asp. Site accessed Jan 2007.

Natural Resources Conservation Service (NRCS). Hydric soils definition. 2007. Available from: http://soils.usda.gov/use/hydric/intro.html. Site accessed Jan 2007.

Natural Resources Conservation Service (NRCS). Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 2006. Available from: http://soils.usda.gov/survey/geography/mlra/index.html. Site accessed Jan 2007.

Smith, R.D., Ammann, A., Bartoldus, C., Brinson, M.M. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station; 1995. Technical Report WRP-DE-9.

Southwest Regional Gap Analysis Project (SWReGAP). Land cover datasets. 2006. Available from: http://fws-nmcfwru.nmsu.edu/swregap/. Site accessed Jan 2007.

Sutter, L.A., Stanfill, J.B., Haupt, D.M., Bruce, C.J., Wuenscher, J.E. NC-CREWS: North Carolina coastal region evaluation of wetland significance. May 1999. North Carolina Department of Environment and Natural Resources. Available from: http://dcm2.enr.state.nc.us/Wetlands/NCCREWSDOC.pdf. Site accessed Apr 26, 2006.

U.S. Army Corps of Engineers (USACE). Arkansas River from John Martin Reservoir to the Colorado-Kansas state line: Channel capacity and riparian habitat planning study. Prepared for the Colorado Conservation Board, Denver, CO. Planning Assistance to States Program. Albuquerque District. Jul 1999.

U.S. Army Corps of Engineers (USACE). Corps of Engineers wetlands delineation manual. Wetlands Research Program Technical Report Y-87-1. Vicksburg, Mississippi: USACE, U.S. Department of the Army (DOA); 1987.

U.S. Congress. *Clean Water Act of 1972 (CWA),* as amended by the Water Quality Act of 1987. 33 USC 1251–1376. Print.

U.S. Congress. *Definition of Waters of the United States.* 33 CFR 328.3. 1986.

U.S. Congress. *Emergency Wetlands Resources Act.* 16 USC 3921; 3931. 1986.

U.S. Congress. *Intermodal Surface Transportation Efficiency Act of 1991*, wetland mitigation provisions. 23 USC 103(i)(13) and 23 USC 133(b)(11).

U.S. Congress. *National Environmental Policy Act of 1969 (NEPA).* 42 USC 4321-4347. 1969.

U.S. Geological Survey (USGS). National Hydrography Dataset: Geographic information system hydrography data for the Arkansas River basin. U.S. Geological Survey (USGS). Available from: http://nhd.usgs.gov/. Site accessed Dec 2007.

Western Regional Climate Center (WRCC). Climate of Colorado narrative and state temperature and precipitation data. 2006. Available from: http://www/wrcc/dri.edu. Site accessed May 2006 and Jan 2007.

Worthey, M. Rapid field verification: A new method for assessing the accuracy of land cover data in the field [thesis]. Colorado Springs, CO: University of Colorado; 2007. 68 p.

This page left intentionally blank.

Appendices

This page left intentionally blank.

Appendix A. Resource Methodology Overview for Wetland and Riparian Resources

This resource methodology overview is attached to this technical memorandum for reference only. The lead agencies for the U.S. 50 Tier 1 EIS (i.e., CDOT and FHWA) drafted resource methodology overviews to identify and document which resource evaluation activities would be completed during the Tier 1 EIS, and which would be completed during Tier 2 studies. These overviews were intended to be guidelines to ensure that the Tier 1 EIS remained a broad-based analysis, while clarifying (to the public and resource agencies) when particular data and decisions would be addressed in the tiered process. These overviews were approved by the lead agencies, and they were agreed upon by the resource agencies during the project's scoping process. They were subsequently used by the project's resource specialists as guidelines to ensure that their activities were relevant to the Tier 1 (i.e., corridor location) decision.

Table A-1. Resource Methodology Overview for Wetland and Riparian Resources

Methodology Overview	Wetlands and Riparian Resources	
	Tier 1	**Tier 2**
Relevant Data/ Information Sources	• Recent aerial photography • General location of all wetlands (jurisdictional or non-jurisdictional) • NRCS, LAWCD, SECWCD, CPW, NWI mapping and other appropriate data sources • Review existing USACE and CPW mitigation permits/agreements/ programs within the project area	• Review and update Tier 1 data search and identify additional data collection requirements to complete the appropriate standard NEPA analysis • Wetland delineations (including those by others)
Collection and/or Analysis Methodology	• NWI maps, existing land cover data, aerial photography (photo interpretation), and other best available data will be used to identify generalized wetland and riparian areas • These identified wetland and riparian corridor locations will be plotted on topographic maps and aerial photos • Coordination with USACE and CPW will occur to discuss study area wetlands and riparian areas and develop appropriate corridor-wide replacement wetland and riparian banking criteria. These discussions will also determine if existing regional mitigation sites may be available for use in this process • Limited windshield surveys to field verify NWI maps and desktop analysis • A very basic functional assessment will be conducted for wetlands within the area of the recommended corridor alternative	• Review of Tier 1 efforts and agreements • Determination of applicability of the NEPA/404 merger agreement. If applicable, then follow procedures defined in the agreement • Field review to investigate study area wetlands; all wetlands will be mapped with GPS • Wetland and riparian corridor locations will be plotted on topographic maps and aerial photos. These will be used to conduct formal wetland delineations, as needed • If field review determines impact on wetlands, delineations would be conducted as detailed in the 1987 USACE Wetland Delineation Manual • If construction is planned in any area meeting the relevant criteria, SB 40 Certifications will be completed through coordination with CPW

Methodology Overview	Wetlands and Riparian Resources	
	Tier 1	**Tier 2**
	• No additional field surveys will be conducted during Tier 1 analysis	• Field surveys and testing will be limited to the proposed corridor alignments, identified through the alternatives screening process • FACWet analysis will be completed for each project impacting a minimum of 0.1 acre of wetlands
Project Area	One to four miles wide surrounding the existing U.S. 50 facility beginning at I-25 in Pueblo to the Colorado-Kansas state line	Tier 2 specific section of independent utility corridor boundaries
Impacts	Impacts on wetlands, springs/fens, other waters of the United States, and riparian areas will be determined through a GIS process in which the impact will be determined by taking the footprint of the full Tier 1 corridor alternative at that specific location, multiplying the potentially impacted acreage by the recommended ultimate typical section footprint, divided by the Tier 1 corridor width at that location. [For example, if 1,000 feet wide Tier 1 corridor impacts 5 acres and the recommended ultimate typical section is 300 feet, the Tier 1 impact at this site would be calculated as: 5 acres x (300 feet/1,000 feet) = 1.5 acres. This example does not take into account functionality.]	Impacts on wetlands, springs/fens, other waters of the United States, and riparian areas in compliance with standard NEPA and other regulatory guidance
Mitigation Options	• Mitigation strategies will be developed for identified impacts and will likely include banking, restoration, and enhancement for multiple resource benefits, including wetland, riparian, water quality, and habitat that address future impacts and resource agency initiatives • Mitigation teaming opportunities with other public land managers will be explored	Standard mitigation procedures, as defined by regulatory guidance and/or requirements, and any additional strategies defined in the Tier 1 EIS/ROD or through other agreements
Deliverables	• Wetland and Riparian Technical Memorandum, including: wetland maps, identification and classification of potential wetland banking sites, enhancement strategies, and 404(b)(1) compliance determination • Corridor-wide PA with USACE and CPW, if needed	• CDOT Wetland Finding Report, including wetland maps (if necessary and as appropriate for Tier 2 section of independent utility level of NEPA documentation) • SB 40 Certifications, as needed • 404 Permits, as needed

Methodology Overview	Wetlands and Riparian Resources	
	Tier 1	**Tier 2**
Regulatory Guidance/ Requirements	• Clean Water Act/Water Quality Act of 1987 (33 USC 1251-1376) • EO 11990 Protection of Wetlands • Mitigation of Impacts to Wetlands and Natural Habitat (23 CFR 777) • USACE Wetland Delineation Manual, 1987 • Wetlands Mitigation Banks (23 USC 103(i)(13)) (23 USC 133(b)(11) (PL 102-240) • Emergency Wetlands Resources Act of 1986 (16 USC 3921; 3931) (PL 99-645) • National Environmental Policy Act/Clean Water Act Section 404 (NEPA/404) merger process and agreement for transportation projects in Colorado of 2005 • CPW and CDOT 2005 MOA on the administration and implementation of SB 40 • CDOT mitigation forms and guidance for wetland finding reports • CDOT, FHWA and USACE NEPA/404 Merger Agreement • Moving Ahead for Progress in the 21st Century Act (MAP-21)	

This page left intentionally blank.

Appendix B. Abbreviations and Acronyms

CDOT	Colorado Department of Transportation
CDOW	Colorado Division of Wildlife
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNHP	Colorado Natural Heritage Program
CPW	Colorado Parks and Wildlife
CR	County Road
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
GIS	Geographic information system
I-25	Interstate 25
MAP-21	Moving Ahead for Progress in the 21st Century Act of 2012
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act of 1969
NRCS	Natural Resources Conservation Service
SH	State Highway
SIU	Section of independent utility
SWReGAP	Southwest Regional Gap Analysis Project
U.S. 50	U.S. Highway 50
U.S. 50 Tier 1 EIS	U.S. Highway 50 Tier 1 Environmental Impact Statement
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

This page left intentionally blank.

Appendix C. Accuracy Assessment of Southwest Regional Gap Analysis Project and Colorado Division of Wildlife Riparian Vegetation Mapping Along the U.S. 50 Corridor

C.1. Introduction

Vegetation mapping data were field-checked for accuracy along the U.S. 50 corridor from Pueblo to the Kansas state line during the week of October 23, 2006. Points, not polygons, along the corridor were checked for accuracy. The data checked for accuracy included the SWReGAP data and the Colorado Division of Wildlife (CDOW), now known as Colorado Parks and Wildlife (CPW), riparian mapping data. Sites were evaluated for their accuracy in identifying the type of vegetation that actually occurs on the ground. The extent and the configuration of the polygons were not verified.

Analysts drove the corridor, starting from the state line, and sites were checked from east to west. A speed of approximately 55 miles per hour was maintained, making frequent stops. An in-depth analysis of each site was not conducted. Sites were verified simply by looking at the site in the field and comparing it to the mapped vegetation type at a specific location. A simple “yes” or “no” was used to denote whether the mapped vegetation type matched what was observed on the ground.

C.2. Results

A total of 448 points were checked, including 346 points of the Southwest Regional Gap Analysis Project SWReGAP data and 102 points of the CDOW riparian data. Overall, the SWReGAP data had an accuracy of 77.2 percent (Table C-1 and Figure C-1), while the CDOW data had an accuracy of 76.5 percent (Table C-2 and Figure C-2). The SWReGAP data were collected from 1999 to 2001. The CDOW data were derived from aerial photographs taken in the late 1980s.

Table C-1. Accuracy Assessment of Southwest Regional Gap Analysis Project Data along the U.S. 50 Corridor from Pueblo to the Kansas State Line

Type	Mapped Versus Actual		Total Checked	Percent Correct
	Match	No Match		
Agriculture	88	6	94	93.6
Developed, medium to high intensity	24	6	30	80.0
Developed, open space—low intensity	22	2	24	91.7
Intermountain basins semi-desert shrub-steppe	4	2	6	66.7
Invasive SW riparian woodland/shrubland	47	35	82	57.3
Open water	3	—	3	100.0
Recent mining	1	—	1	100.0

Type	Mapped Versus Actual		Total Checked	Percent Correct
	Match	No Match		
Western Great Plains floodplain herbaceous wetland	23	11	34	67.6
Western Great Plains riparian woodland/shrubland	20	5	25	80.0
Western Great Plains sandhill shrubland	12	8	20	60.0
Western Great Plains shortgrass prairie	23	4	27	85.2
TOTAL	**267**	**79**	**346**	**77.2**

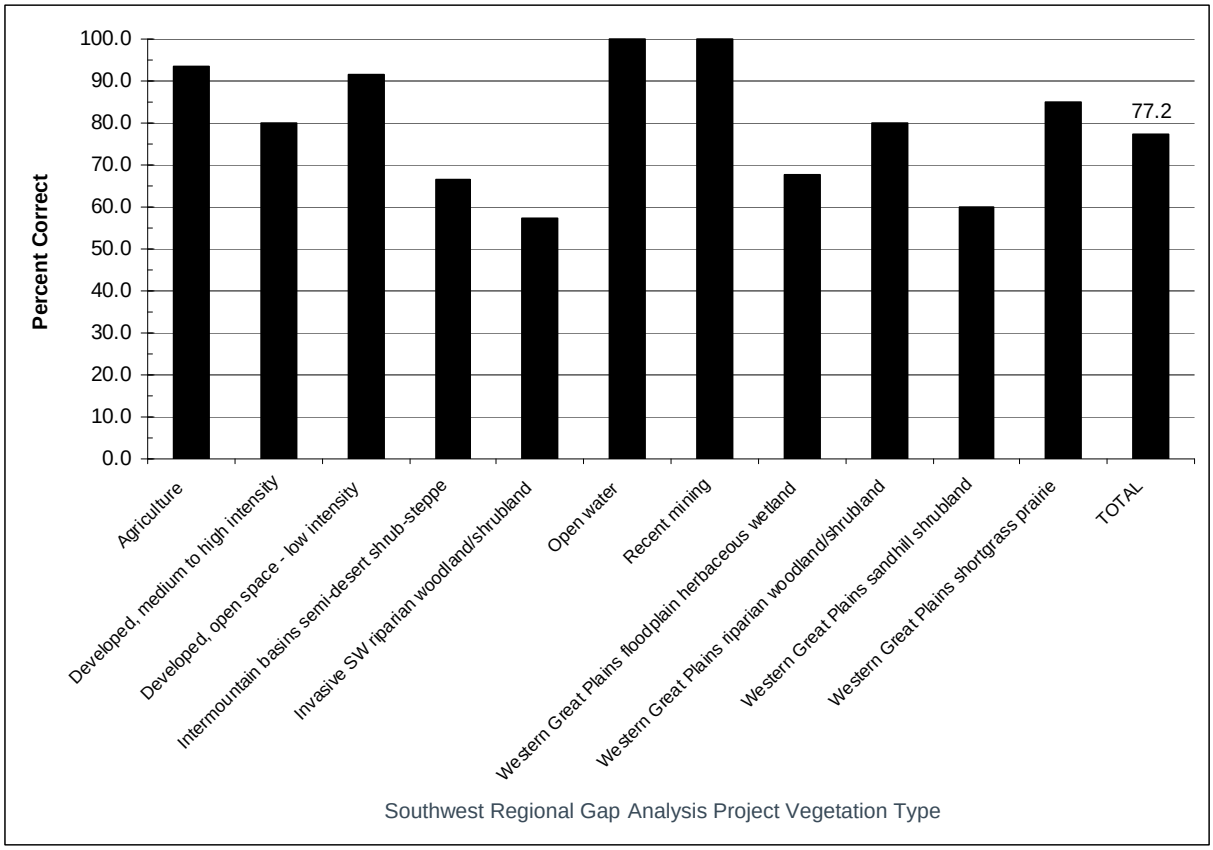


Figure C-1. Summary of Accuracy Assessment for Southwest Regional Gap Analysis Project Data along the U.S. 50 Corridor from Pueblo to the Kansas State Line

Table C-2. Accuracy Assessment of Colorado Division of Wildlife Data along the U.S. 50 Corridor from Pueblo to the Kansas State Line

Type	Mapped Versus Actual		Total Checked	Percent Correct
	Match	No Match		
Open water—riverine	3	—	3	100.0
Open water—standing	4	1	5	80.0
Riparian deciduous tree—cottonwood	32	—	32	100.0
Riparian herbaceous—sedges/rushes/mesic grasses	20	12	32	62.5
Riparian herbaceous—cattails/sedges/rushes	2	5	7	28.6
Riparian shrub—general	9	—	9	100.0
Riparian tree—tamarisk	8	2	10	80.0
Riparian shrub—willow	—	4	4	0.0
TOTAL	**78**	**24**	**102**	**76.5**

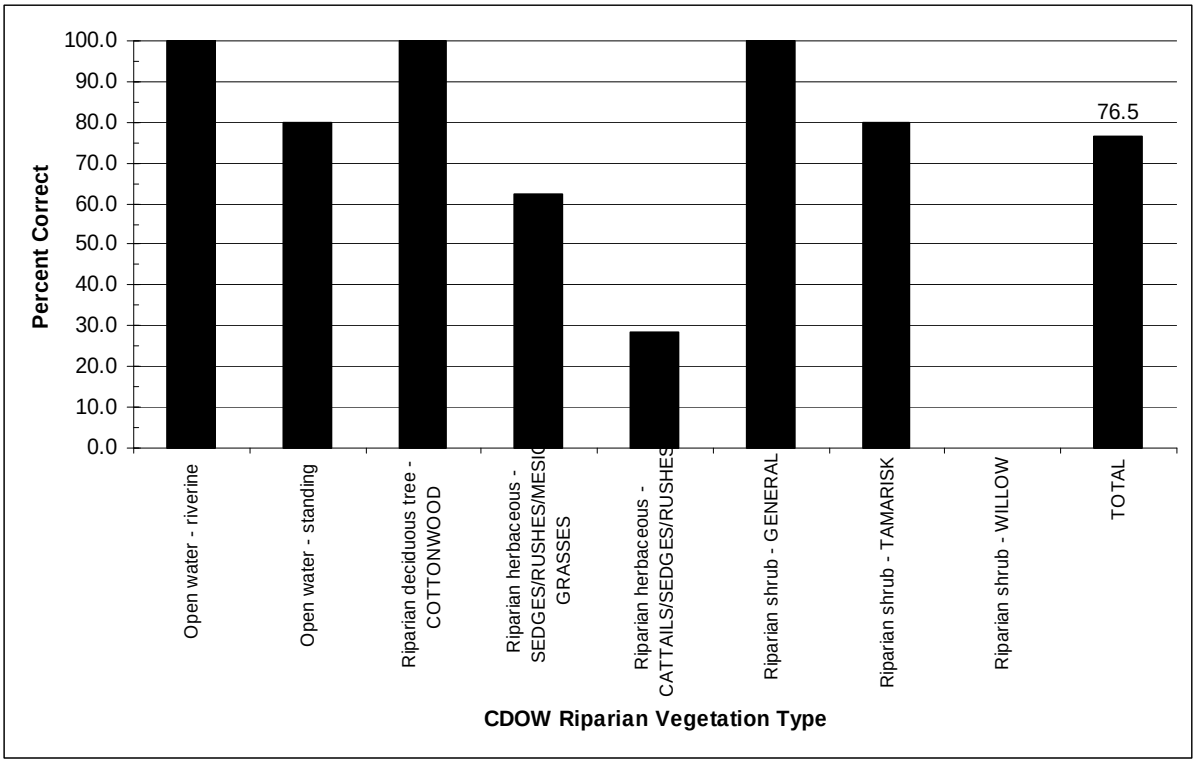


Figure C-2. Summary of Accuracy Assessment for Colorado Division of Wildlife Data along the U.S. 50 Corridor from Pueblo to the Kansas State Line

C.3. Observations and Possible Explanations for Discrepancies

- Land conversion, especially around towns
- Tamarisk control—some tamarisk-infested areas may have been eradicated since the mapping effort was completed
- Invasive wetland shrubs and trees (Southwest Regional Gap Analysis Project) consist primarily of tamarisk and chinese elm—some russian olive also exists
- Area around Montebello Road in Pueblo is changing rapidly
- Tamarisk invasion of emergent and willow areas
- Irrigated areas may give false positives for SWReGAP wetland polygons
- SWReGAP data seemed to have a problem differentiating between shortgrass prairie and shrub-steppe
- SWReGAP data seemed to have a problem with smaller polygons
- SWReGAP data did well with large polygons
- Developed, open space—low intensity category classified urban residential areas as this class, also feed lots—main criterion appears to be percent impervious cover—data might be skewed due to tree cover in urban and residential settings
- Colorado Division of Wildlife data did well with cottonwood-dominated areas
- Fallow agricultural lands and overgrazed prairie often become dominated by kochia, russian thistle, or both
- In the case of Colorado Division of Wildlife wetland and riparian areas checked, in most cases the wetland area existed, but the vegetation class simply differed from what was mapped.
- Small SWReGAP wetland polygons frequently appear to be incorrect—consider imposing a size limit on the SWReGAP polygons used in the analysis

Appendix D. Geographic Information System-Based Wetland/Riparian Functional Assessment Methodology

D.1. Introduction

Wetland/riparian areas in the project area were evaluated using a geographic information system(GIS)-based functional assessment that was adapted from the Montana Wetland Functional Assessment Method (Berglund 1999) and North Carolina Coastal Region Evaluation of Wetland Significance (Sutter et al. 1999). The Montana Wetland Functional Assessment Method is a field-oriented method developed in Montana and used throughout the western United States, including Colorado. The North Carolina Coastal Region Evaluation of Wetland Significance is a GIS-based method that was developed in North Carolina. Fusing the strengths of both of these methods resulted in a GIS-based functional assessment methodology that is appropriate for use in the project area, and potentially elsewhere in the western United States.

D.2. Overview

The U.S. 50 Tier 1 EIS functional assessment method assesses three functions, including general wildlife habitat, hydrology (e.g., flood flow attenuation and dynamic water storage), and water quality improvement for each mapped wetland/riparian area (i.e., GIS polygon). It assesses these functions through the use of several indicators, or predictors, such as the wetland type, adjacent land uses, proximity to streams, and presence or absence of salt cedar, among others.

Each indicator for a function is first rated as high (3 points), moderate (2 points), or low (1 point), and then summed together to arrive at a score for a particular function. The scores for each function are then summed, and a total functional score is arrived at for each polygon. One of four functional categories then is assigned to each polygon based on the functional scores and other factors. It is important to note that wetland/riparian areas were mapped by vegetation type (i.e., palustrine emergent, palustrine scrub-shrub, and palustrine forested). Therefore wetland/riparian complexes comprised of different vegetation types can have multiple functional scores and categories (Figure D-1).

D.3. Assumptions and Limitations

The assumptions and limitations of the GIS-based wetland/riparian functional assessment method are described below.

1. The method must be a GIS-based method due to the size of the project area and level of analysis required (i.e., for a Tier 1 environmental impact statement).
2. The method must utilize existing data (some data manipulation will be necessary).
3. The accuracy of the functional assessment is limited by the accuracy of the geospatial data used.
4. Some limited field verification will be performed to validate and refine the functional assessment model described in this document.
5. Field-based functional assessments of potentially affected wetland/riparian areas will be performed during the Tier 2 environmental review process.
6. Individual assessment areas for the functional assessment are comprised of one wetland/riparian vegetation polygon (i.e., palustrine emergent, palustrine scrub-shrub, and palustrine forested), which was derived from CDOW riparian mapping data and SWReGAP data. As such, the assessment areas used in his analysis will not typically correspond to assessment areas that would be defined in the field.

7. The adjacent land use analysis used in the habitat and water quality functions may not represent the dominant land use surrounding a wetland/riparian area. In most cases, this does not affect the overall functional category assigned to polygons.
8. U.S. 50 is not mapped as a land use; thus, it is not considered in the adjacent land use analysis.

D.4. Functions

Three general functions were assessed and are discussed in Figure D-1.

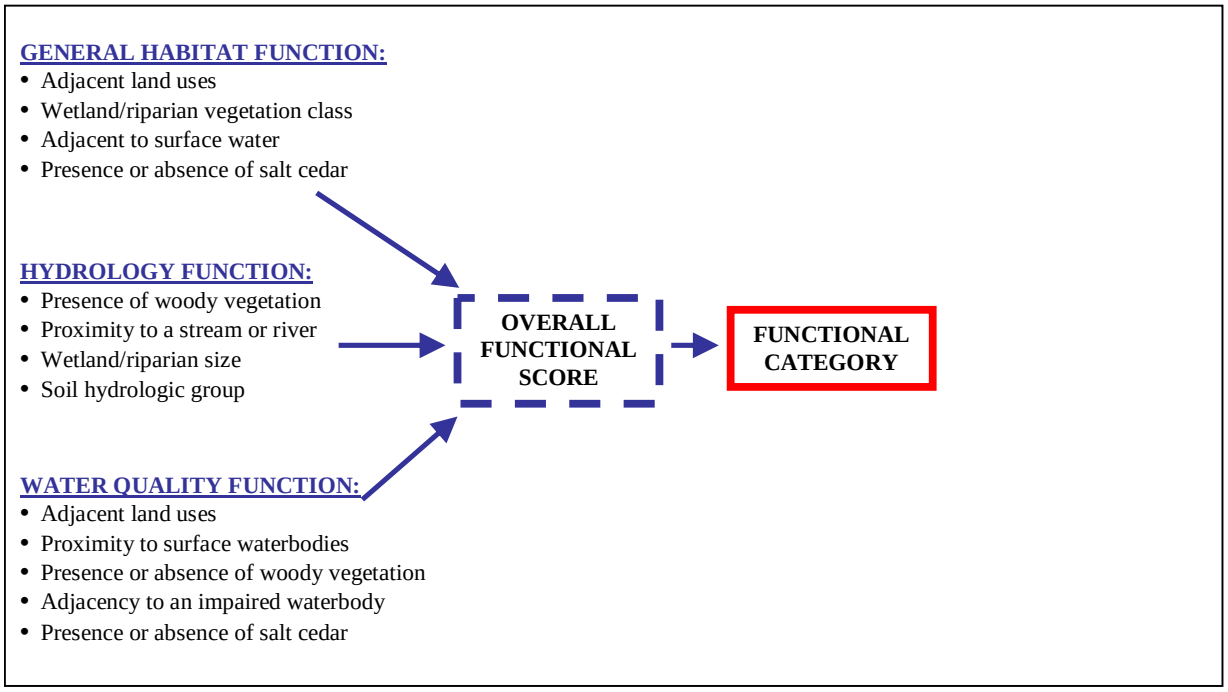


Figure D-1. Diagram of the U.S. 50 Tier 1 GIS-Based Wetland and Riparian Functional Assessment Method

Function 1—General Wildlife Habitat

The general wildlife habitat function assesses the overall suitability of the site for use by wildlife, including bird species. The indicators used to assess this function are:

- Adjacent land uses
- Riparian vegetation class
- Adjacency to surface water
- Presence or absence of salt cedar

The maximum score for general wildlife habitat is 12 points.

Adjacent Land Uses

The underlying assumption of this indicator is that more natural communities in the surrounding landscape will facilitate use of wetland/riparian areas by wildlife. The “adjacent land use” indicator was evaluated in a stepwise fashion. First, polygons that shared a line segment with—or that were completely within (i.e., intersected)—a particular land use cover type received an assigned score of 1 point (low), 2 points (moderate), or 3 points (high). For instance, polygons sharing a line segment with, or completely within, the ”urban” cover type were identified and scored as 1 point, or low. Second, polygons that had a common line segment and intersected the “agricultural” cover type, and that weren’t already scored as a 1 in the first step,

were scored as 2 points, or moderate. Finally, polygons that had a common line segment and intersected native vegetation types (e.g., grasslands), and weren't already scored as 1 point or 2 points, were scored as 3 points, or high.

Riparian Vegetation Class

It is generally recognized that as vertical structural diversity increases, habitat diversity also increases. Therefore, more complex structural diversity is generally attractive to, and used by, more wildlife and bird species than less complex areas. Scoring for this indicator was based on the structural complexity of the habitat, as indicated below.

- 3 points (high) were given to those in the palustrine forested class
- 2.5 points (moderate-high) were given to those in the palustrine scrub-shrub class (native vegetation)
- 2 points (moderate) were given to those in the palustrine scrub-shrub class (general)
- 1 point (low) was given to those in the palustrine emergent class
- 0.5 points were given to those in the palustrine scrub-shrub class (non-native vegetation)

The non-native palustrine scrub-shrub class in the project area is dominated by salt cedar (i.e., *tamarisk* sp.), and is not frequently used by most wildlife.

Adjacent to Surface Water

The presence of surface water increases use of the site by wildlife. This indicator was scored as indicated below.

- Those adjacent to a perennial waterbody were given 3 points (high)
- Those adjacent to an intermittent waterbody were given 2 points (moderate)
- Those not adjacent to a waterbody were given 1 point (low)

Presence or Absence of Salt Cedar

Salt cedar is a very aggressive non-native shrub that has overwhelmed the Arkansas River Valley in the last 100 years. Inclusion of this indicator is an attempt to recognize its detrimental effects on the value of native wetland/riparian habitats to wildlife. This indicator is scored by giving 0 points to areas dominated by salt cedar and "rewarding" native areas with a score of 3 points. Note that because much of the wetland/riparian mapping data were compiled by the CDOW using aerial photographs from the late 1980s and early 1990s, the scoring for this indicator may under-represent the current extent of salt cedar in the area.

Function 2—Hydrology

The hydrology function is designed to score a site based on its ability to slow flood waters and to store water. The indicators used to score this function are:

- Presence or absence of woody vegetation
- Proximity to a stream or river
- Size
- Soil hydrologic group

The maximum possible score for the hydrology function is 12 points.

Presence or Absence of Woody Vegetation

Woody vegetation slows flood waters more effectively than herbaceous vegetation, thereby dissipating energy and allowing time for water to infiltrate into the soil. For this reason, wetland/riparian areas containing

palustrine forested class or palustrine scrub-shrub class vegetation were given 3 points (high), and palustrine emergent class vegetated areas were scored as 1 point (low).

Proximity to a Stream or River

The closer a wetland/riparian area is to a stream or river, the more it will affect flood flows. For this reason, this indicator was scored as indicated below.

- Those areas up to 50 feet in proximity were given 3 points (high)
- Those areas from 51 to 150 feet in proximity were given 2 points (moderate)
- Those areas from 151 to 300 feet in proximity were given 1 point (low)
- Those areas farther than 300 feet from a stream or river were given 0 points

Size

This indicator assumes that the larger an area is, the greater the effect it has on flood flows and water storage. Therefore, the scoring categories below were used.

- 3 points (high) were given to areas of five or more acres
- 2 points (moderate) were given to areas measuring one to five acres
- 1 point (low) was given to areas less than one acre

Soil Hydrologic Group

Soil hydrologic groups relate to the rate at which water is able to infiltrate a particular soil. This indicator assumes that the higher the infiltration rate, the higher the likelihood that water will be stored in the wetland. The scoring of this indicator was accomplished by assigning:

- High ratings (3 points) to soil hydrologic groups A and B, which have the highest infiltration rates
- A moderate score (2 points) to soil hydrologic group C
- A low rating to soil hydrologic group D, which has the slowest infiltration rate

Scores for sites containing more than one soil hydrologic group were determined by using a weighted average based on the area covered by each of the hydrologic groups present.

Function 3—Water Quality

The water quality function is designed to score a site based on its ability and opportunity to improve water. The indicators used to score this function are:

- Adjacent land uses
- Proximity to surface waterbodies
- Presence or absence of woody vegetation
- Adjacency to an impaired waterbody
- Presence or absence of salt cedar

The maximum possible score for the water quality function is 15 points.

Adjacent Land Uses

This indicator is scored in the same way as the general wildlife habitat function. The underlying assumption of this indicator with respect to water quality is that natural communities in the surrounding landscape will supply fewer pollutants to the wetland, and, therefore, cause less degradation of the wetland than other land uses. This indicator was evaluated in a stepwise fashion. First, polygons that shared a line segment with—or that were completely within (intersected)—a particular land use cover type received an assigned score of 1

point (low), 2 points (moderate), or 3 points (high). For instance, polygons sharing a line segment with, or completely within, the ”urban” cover type were identified and scored as 1 point, or low. Second, polygons that had a common line segment and intersected the “agricultural” cover type, and that weren’t already scored as 1 point in the first step, were scored as 2 points, or moderate. Finally, polygons that had a common line segment and intersected native vegetation types (e.g., grasslands), and weren’t already scored as 1 point or 2 points, were scored as 3 points, or high.

Proximity to Surface Waterbodies

In general terms, the closer a wetland/riparian area is to a waterbody, the greater the likelihood is that the area will have an effect on water quality in the waterbody. No distinctions were made to the many possible exceptions to this, such as the area being down-gradient from the waterbody, or some sort of topographic barrier separating the area from the waterbody. This indicator was scored as indicated below:

- 3 points (high) if the area was equal to or less than 300 feet from a perennial waterbody
- 2 points (moderate) if it was equal to or less than 300 feet to an intermittent waterbody
- 1 point (low) if it was more than 300 feet to a waterbody

Presence or Absence of Woody Vegetation

Woody vegetation slows flood waters more effectively than herbaceous vegetation, thereby allowing pollutants to settle out and be processed by microbes. The rating categories indicated below were used to assess this quality.

- Palustrine forested or palustrine scrub-shrub class areas were rated as 3 points (high)
- Palustrine emergent class areas were rated as 1 point (low)

Adjacent to Impaired Waterbody

Wetland/riparian areas closer to waterbodies considered to be impaired by the Colorado Department of Public Health and Environment have higher potential to function as buffers for these impaired waters, reducing the opportunity for additional degradation. This indicator was rated as:

- 3 points (high) if the area is located adjacent to an impaired waterbody
- 1 point (low) if it is not adjacent to an impaired waterbody

Presence or Absence of Salt Cedar

Salt cedar uses large quantities of water, thereby reducing the volume of water and increasing the concentration of pollutants in waterbodies. In fact, it is estimated that current water losses from salt cedar exceed native vegetation use along the Arkansas River by approximately 53,834 acre-feet per year (salt cedar minus the water used by native plants) (CWCB 2006). For this reason, the presence of salt cedar was scored as -3 points, whereas areas with no salt cedar were scored as +3 points.

Scoring

For each function, the scores from all indicators are summed. Maximum scores for each function are as indicated below:

- Habitat is 12 points
- Hydrology is 12 points
- Water quality is 15 points

The overall functional score for a site calculated as the sum of the three functions. The maximum wetland/riparian area functional score is 39 points. After a riparian area was scored, the following four categories were used for avoidance prioritization.

Category I

Category I includes riparian areas of exceptionally high quality. These areas are generally rare to uncommon in the state or region, or are important from a regulatory standpoint. To be rated as a Category I site, the riparian area must:

- Score 12 functional points for habitat, or
- Be classified as a palustrine forested area, or
- Score 12 functional points for hydrology, or
- Have total actual functional points higher than 80 percent (more than 31.2 points) of total possible functional points

Category II

Category II riparian areas are more common than Category I riparian areas, and include those that function at very high levels for habitat, or are assigned high ratings for many of the assessed functions and values. To be rated as a Category II site, the area must not qualify as a Category I site and must:

- Have two of the three functions achieve more than 80 percent of points possible for those functions, or
- Be classified as palustrine scrub-shrub where tamarisk is not dominant, or
- Have total actual functional points achieve more than 65 percent (more than 25.4 points) of total possible functional points

Category III

Category III riparian areas are more common and generally less diverse than Category I or Category II areas. They can provide many functions and values, although they may not be assigned high ratings for as many parameters as are Category I and Category II areas. To be rated as a Category III site, the area must not qualify as a Category I, Category II, or Category IV site.

Category IV

Category IV wetland/riparian areas generally are small, isolated, lack vegetative diversity, or possess a combination of these characteristics. These sites provide little in the way of habitat, and often are directly or indirectly disturbed by urban and agricultural land uses. To be rated as a Category IV site, the area must not qualify as a Category I, II, or III site and must:

- Have two of the three functions achieve equal or less than 30 percent of points possible for those functions, or
- Have total actual functional points equal or less than 30 percent (11.7) of total possible functional points

D.5. Quality Control Review Process of Data for Potential Errors and Changes

The base dataset consists of two different source datasets. The dataset was too large to be able to check all entries. Thus, to ensure data quality, a quality control checklist was created to track data development for completeness and maintain integrity of the database. This quality control checklist included visual quality control and spatial analysis checks, which are described in more detail below.

Visual Quality Control

Visual quality control refers to manually reviewing the data for anomalies. This process was used to evaluate data for:

- Completeness (i.e., no missing features or layers)
- Positional accuracy to the source data
- Correct attribution
- Annotation placement, notation, and spelling

Spatial Analysis Checks

Spatial analysis checks were completed to validate the functional assessment model results. Random area checks were performed throughout each functional indicator to identify errors in the spatial analysis application, as indicated below:

- Random area checks were completed to identify polygons smaller than a specified size
- Checks were completed to identify duplication of line segments (e.g., rivers and streams)
- Checks were performed for duplicate polygons to identify overlapping polygons within the same feature class that would result in classification conflict
- Logic checks were conducted on all spatial analyses to ensure results supported indicator parameter queries

Field verification of selected polygons was completed in July 2007.

This page left intentionally blank.

Appendix E. Figures (E-1 through E-31)

This appendix contains the following figures (in the order listed):

Figure E-1. Wetland/Riparian Types—Pueblo County
Figure E-2. Wetland/Riparian Types—Otero County
Figure E-3. Wetland/Riparian Types—Bent County
Figure E-4. Wetland/Riparian Types—Prowers County
Figure E-5. Wetland/Riparian Functional Assessment Areas—Pueblo County
Figure E-6. Wetland/Riparian Functional Assessment Areas—Otero County
Figure E-7. Wetland/Riparian Functional Assessment Areas—Bent County
Figure E-8. Wetland/Riparian Functional Assessment Areas—Prowers County
Figure E-9. Hydrography—Pueblo County
Figure E-10. Hydrography—Otero County
Figure E-11. Hydrography—Bent County
Figure E-12. Hydrography—Prowers County
Figure E-13. Wetland/Riparian Impacts—Pueblo
Figure E-14. Wetland/Riparian Impacts—Pueblo to Fowler (west)
Figure E-15. Wetland/Riparian Impacts—Pueblo to Fowler (east)
Figure E-16. Wetland/Riparian Impacts—Fowler to Manzanola
Figure E-17. Wetland/Riparian Impacts—Manzanola
Figure E-18. Wetland/Riparian Impacts—Manzanola to Rocky Ford
Figure E-19. Wetland/Riparian Impacts—Rocky Ford
Figure E-20. Wetland/Riparian Impacts—Rocky Ford to Swink, Swink North and Swink South Alternatives
Figure E-21. Wetland/Riparian Impacts—La Junta to Las Animas
Figure E-22. Wetland/Riparian Impacts—Las Animas
Figure E-23. Wetland/Riparian Impacts—Las Animas to Lamar (west)
Figure E-24. Wetland/Riparian Impacts—Las Animas to Lamar (east)
Figure E-25. Wetland/Riparian Impacts—Lamar to Granada
Figure E-26. Wetland/Riparian Impacts—Granada
Figure E-27. Wetland/Riparian Impacts—Granada to Holly
Figure E-28. Wetland/Riparian Impacts—Holly
Figure E-29. Wetland/Riparian Impacts—Holly Transition
Figure E-30. Wetland/Riparian Impacts—Fowler North and Fowler South Alternatives
Figure E-31. Wetland/Riparian Impacts—La Junta South 1 and La Junta South 2 Alternatives

This page left intentionally blank.

Figure E-1. Wetland/Riparian Types—Pueblo County

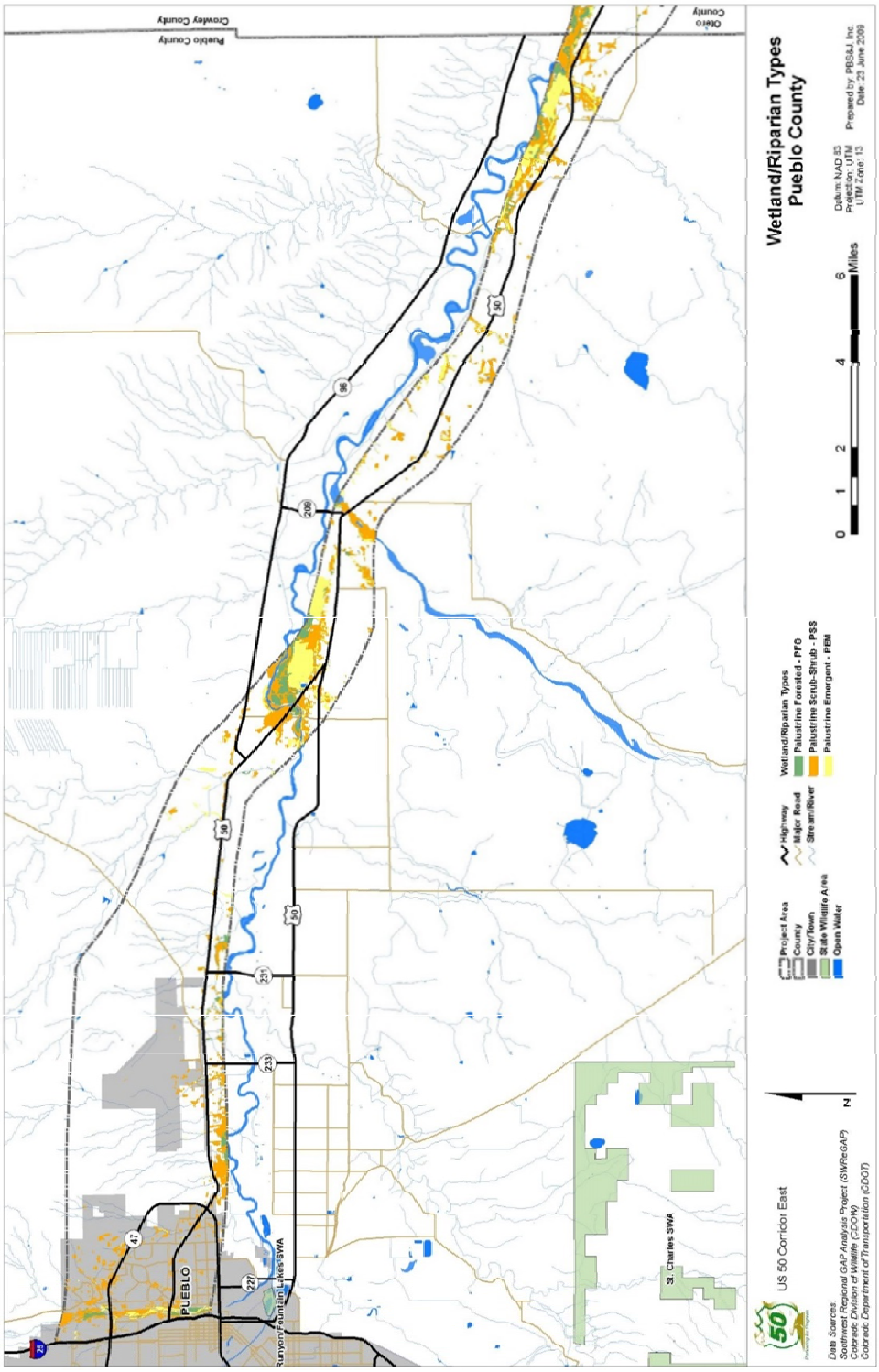


Figure E-2. Wetland/Riparian Types—Otero County

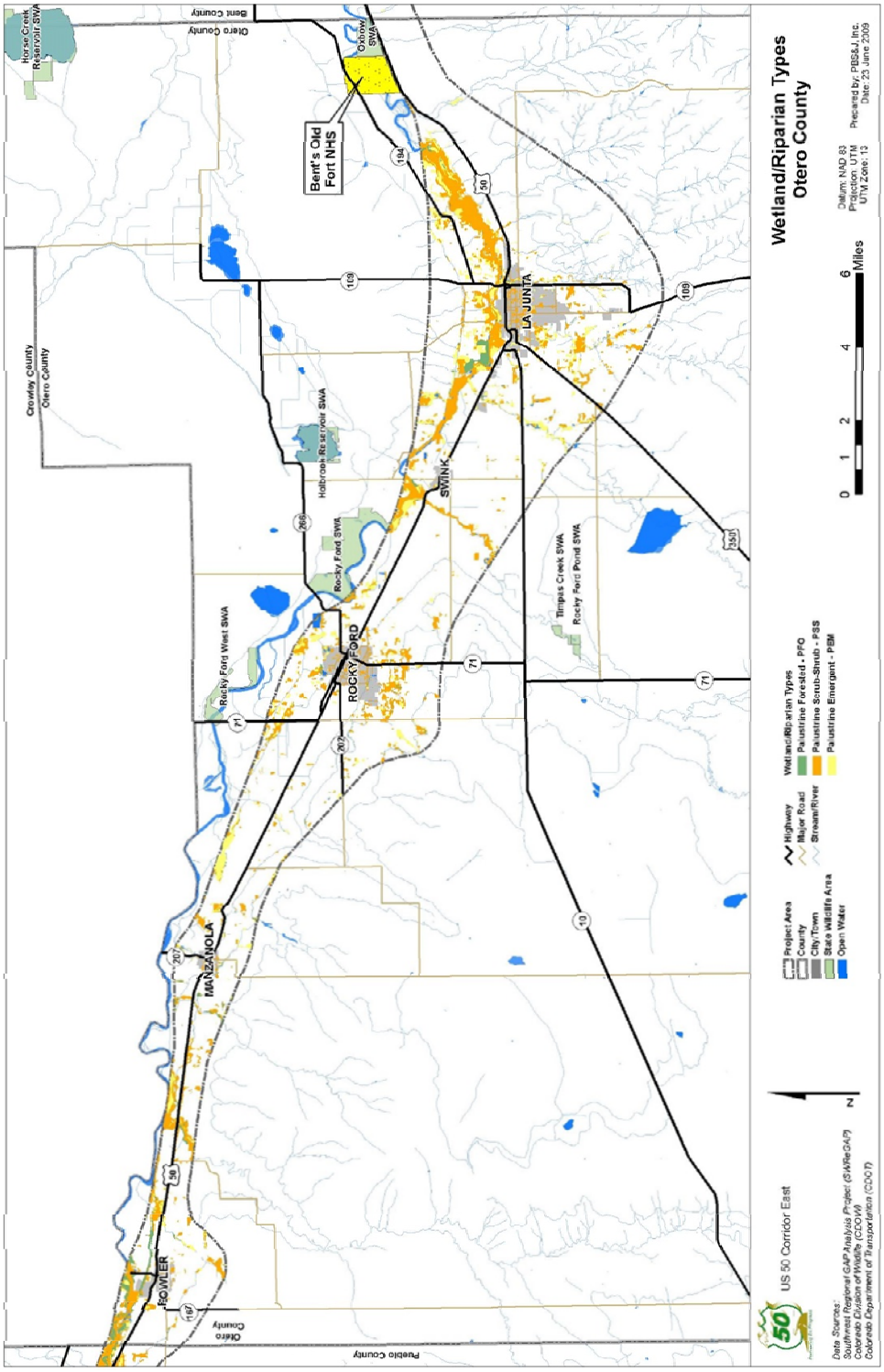


Figure E-3. Wetland/Riparian Types—Bent County

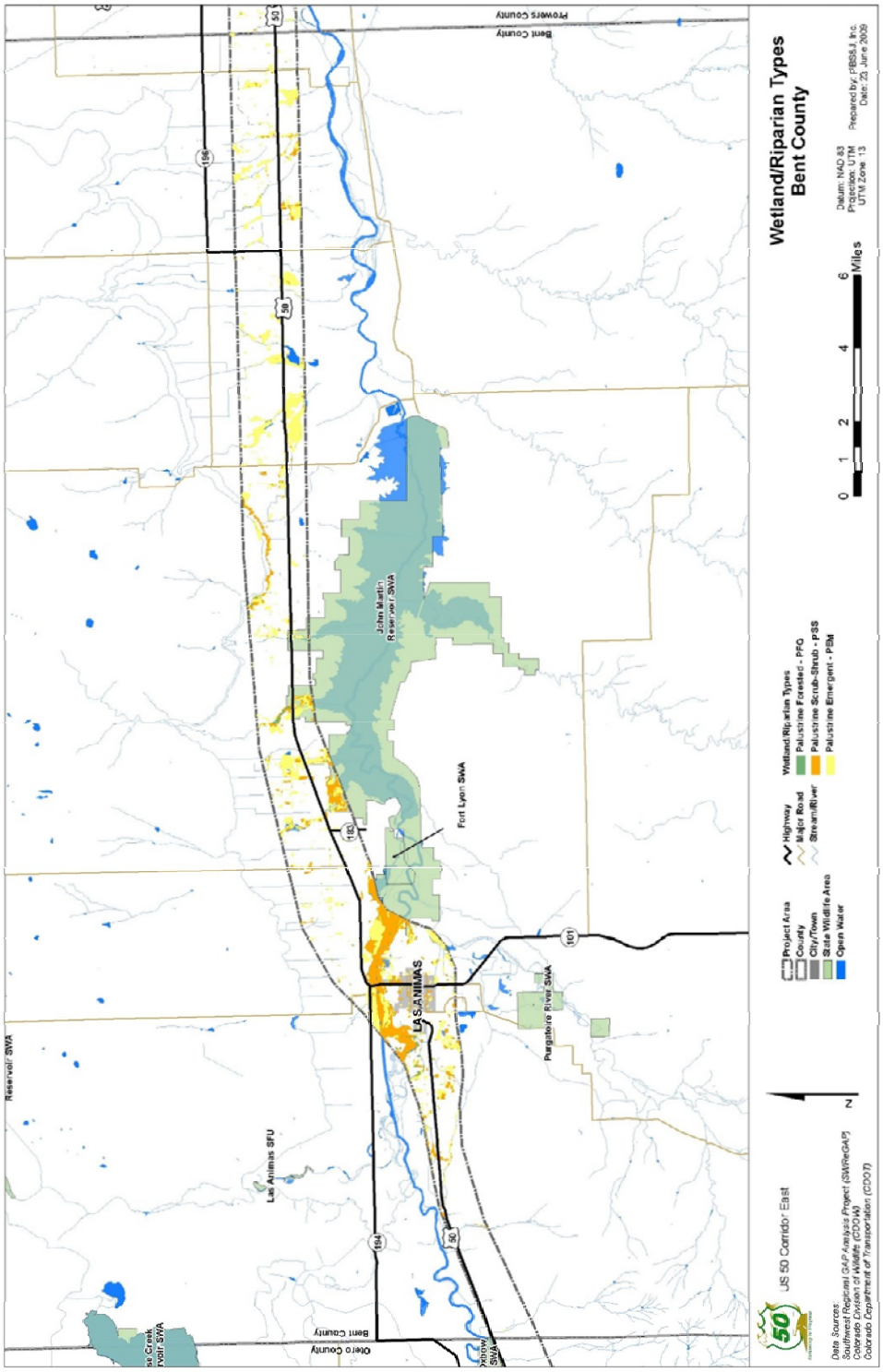


Figure E-4. Wetland/Riparian Types—Prowers County

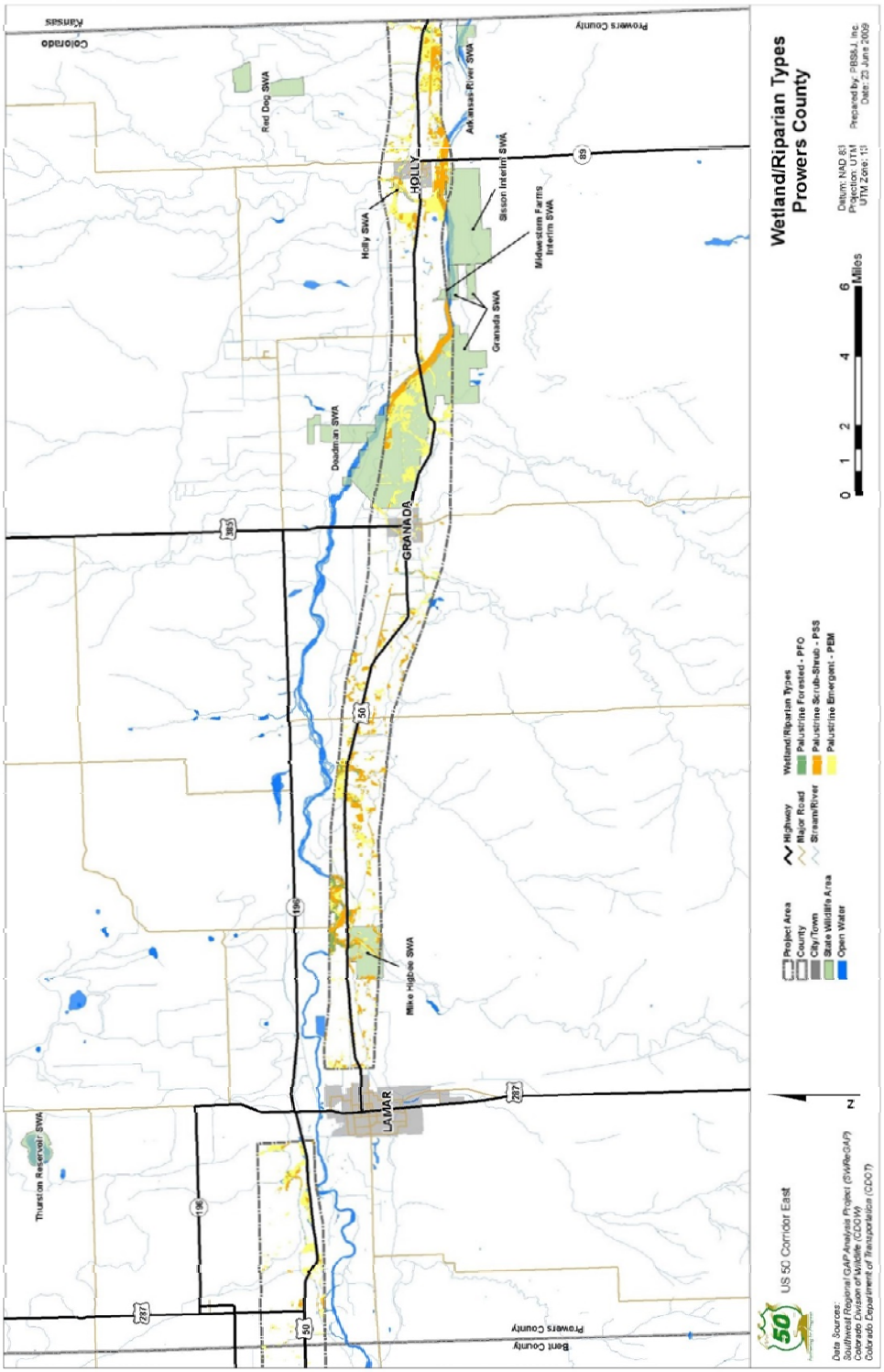


Figure E-5. Wetland/Riparian Functional Assessment Areas—Pueblo County

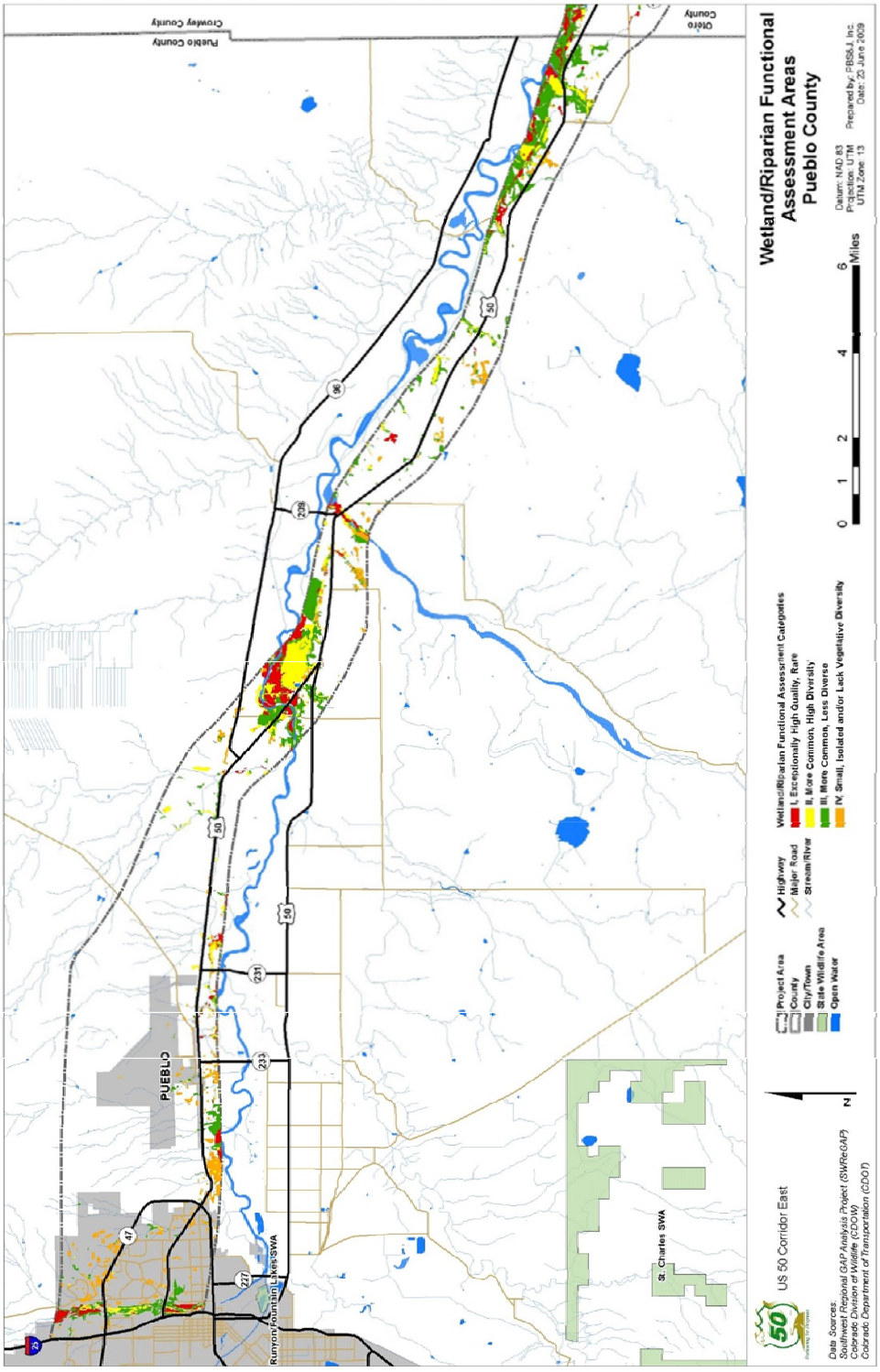


Figure E-6. Wetland/Riparian Functional Assessment Areas—Otero County

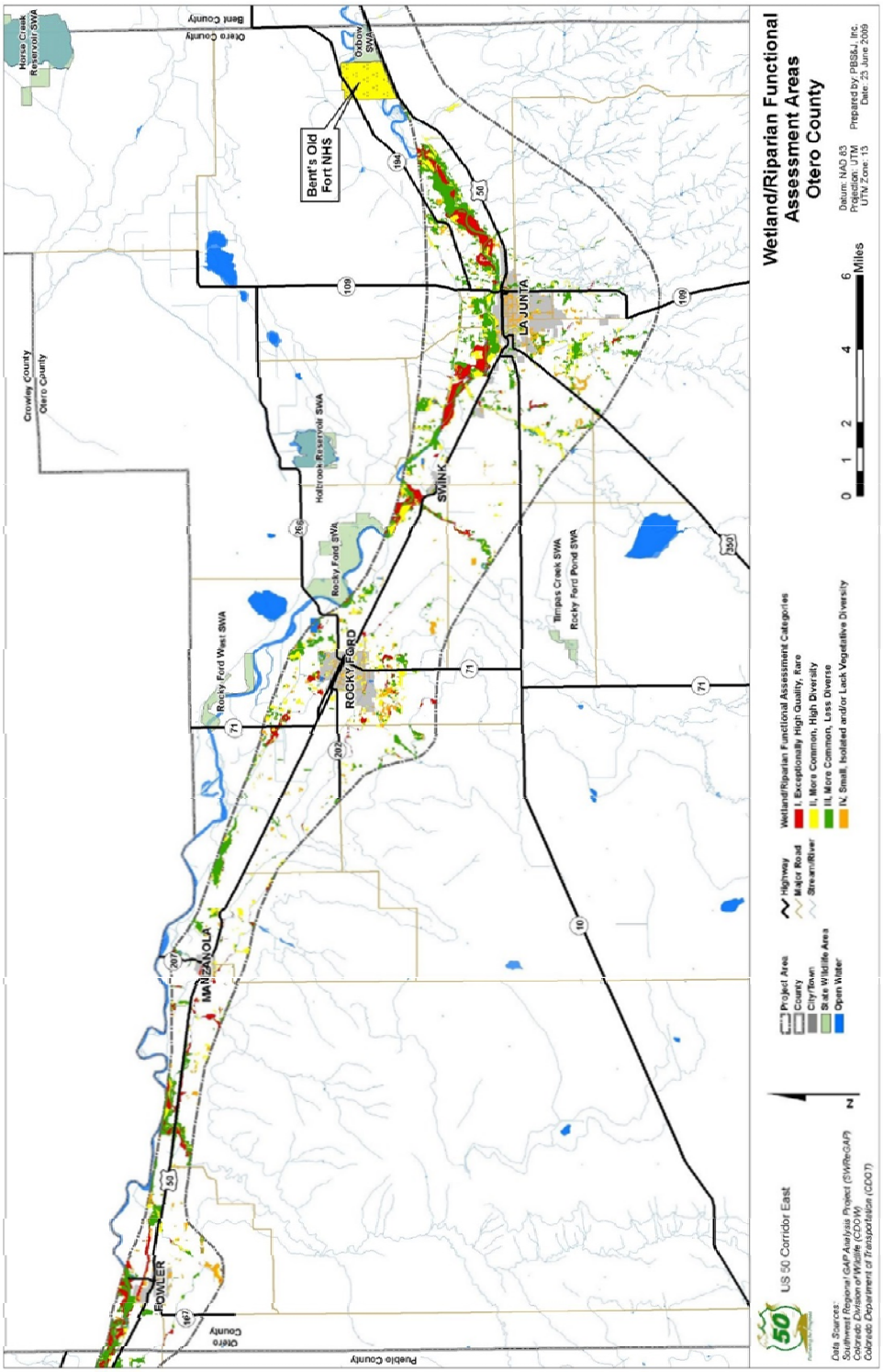


Figure E-7. Wetland/Riparian Functional Assessment Areas—Bent County

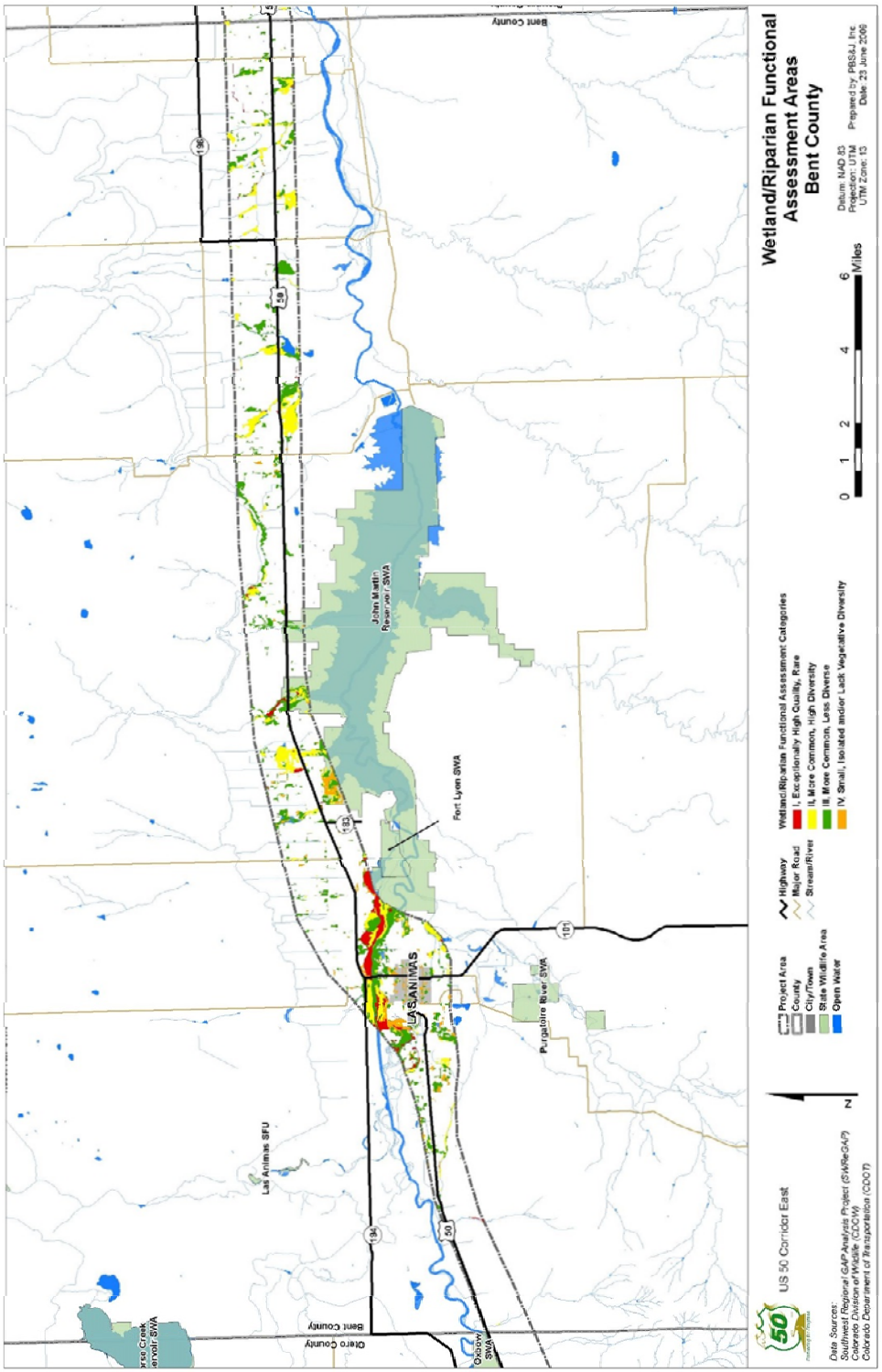


Figure E-8. Wetland/Riparian Functional Assessment Areas—Prowers County

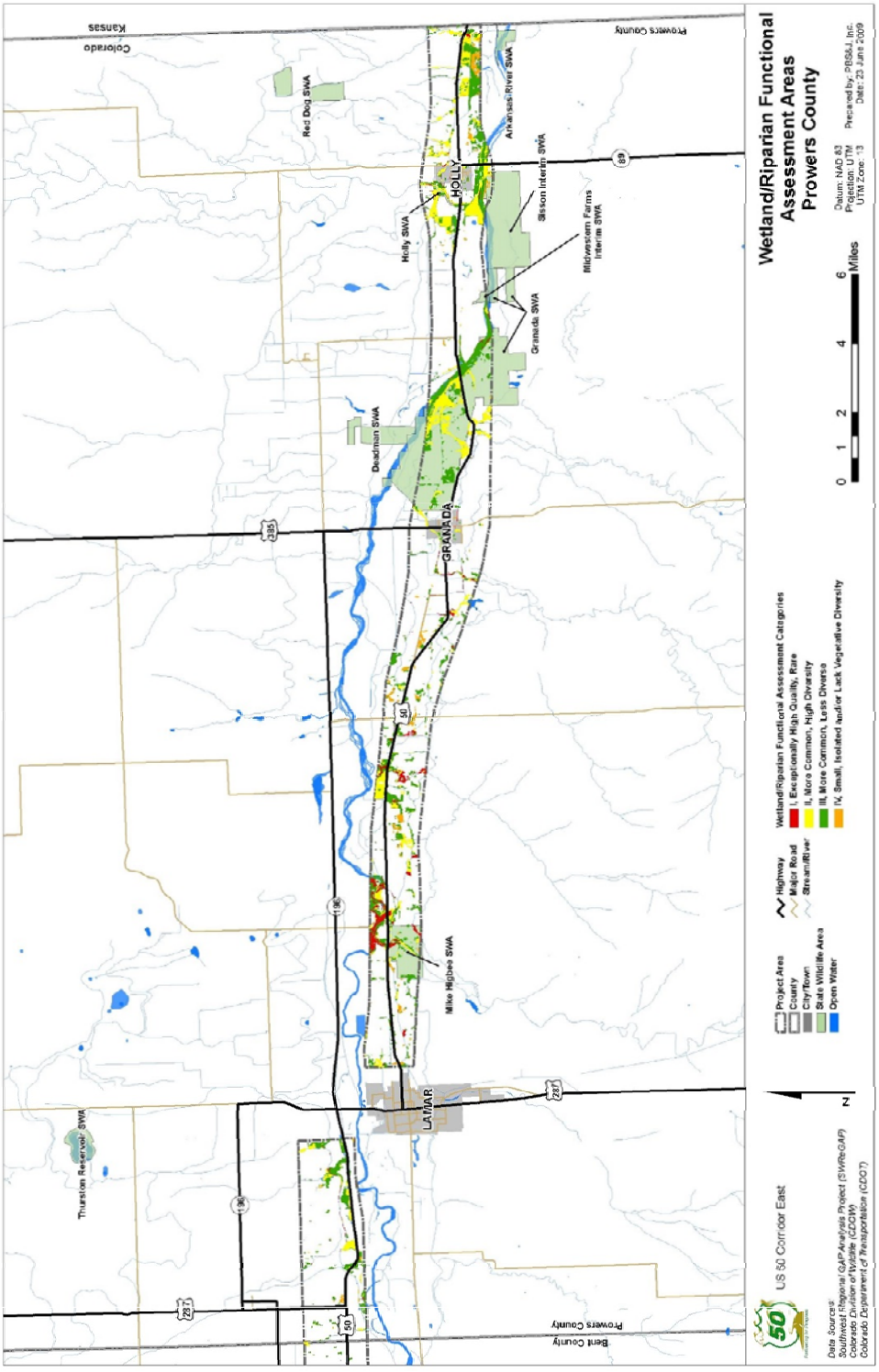


Figure E-9. Hydrography—Pueblo County

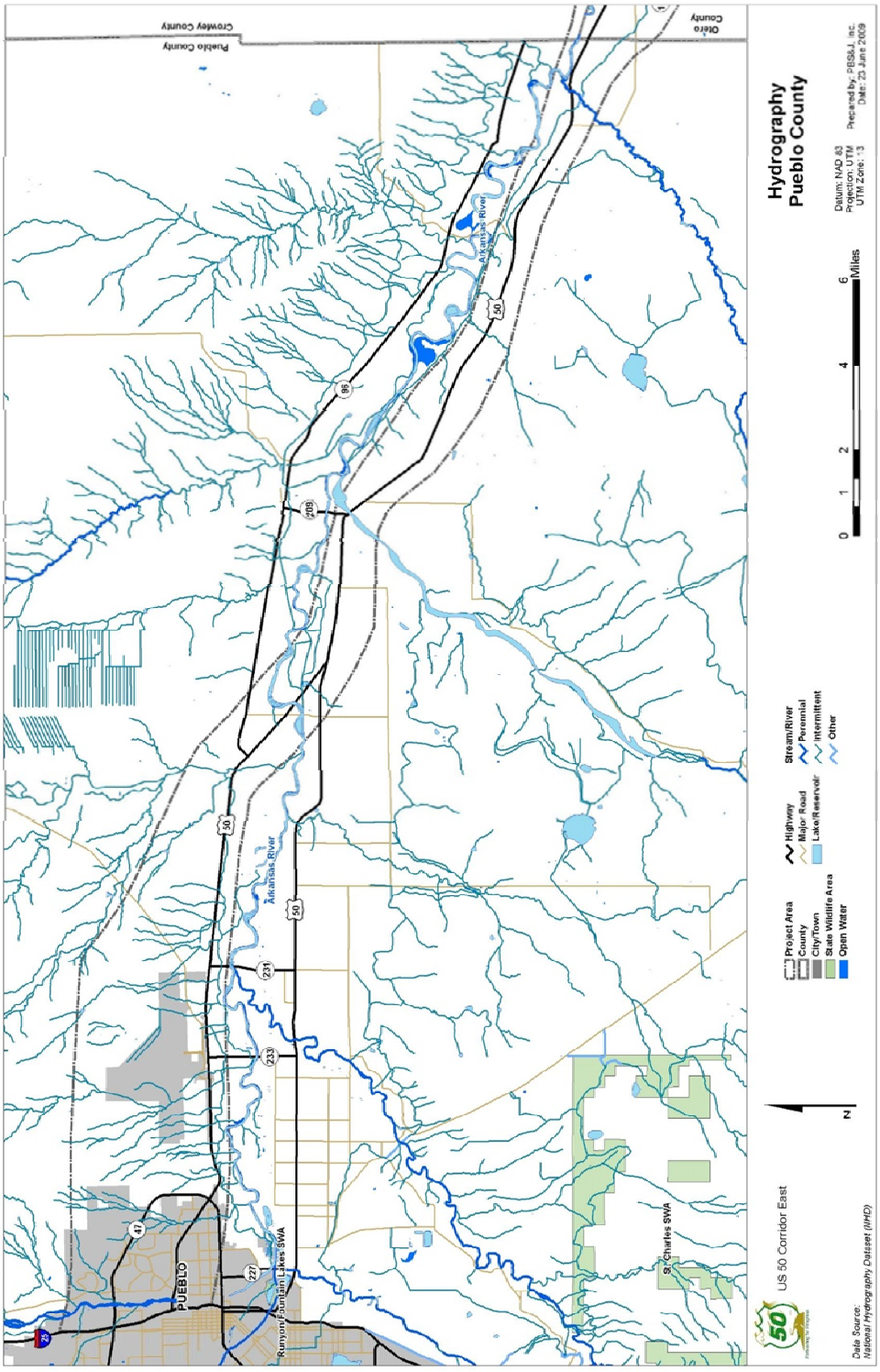


Figure E-10. Hydrography—Otero County

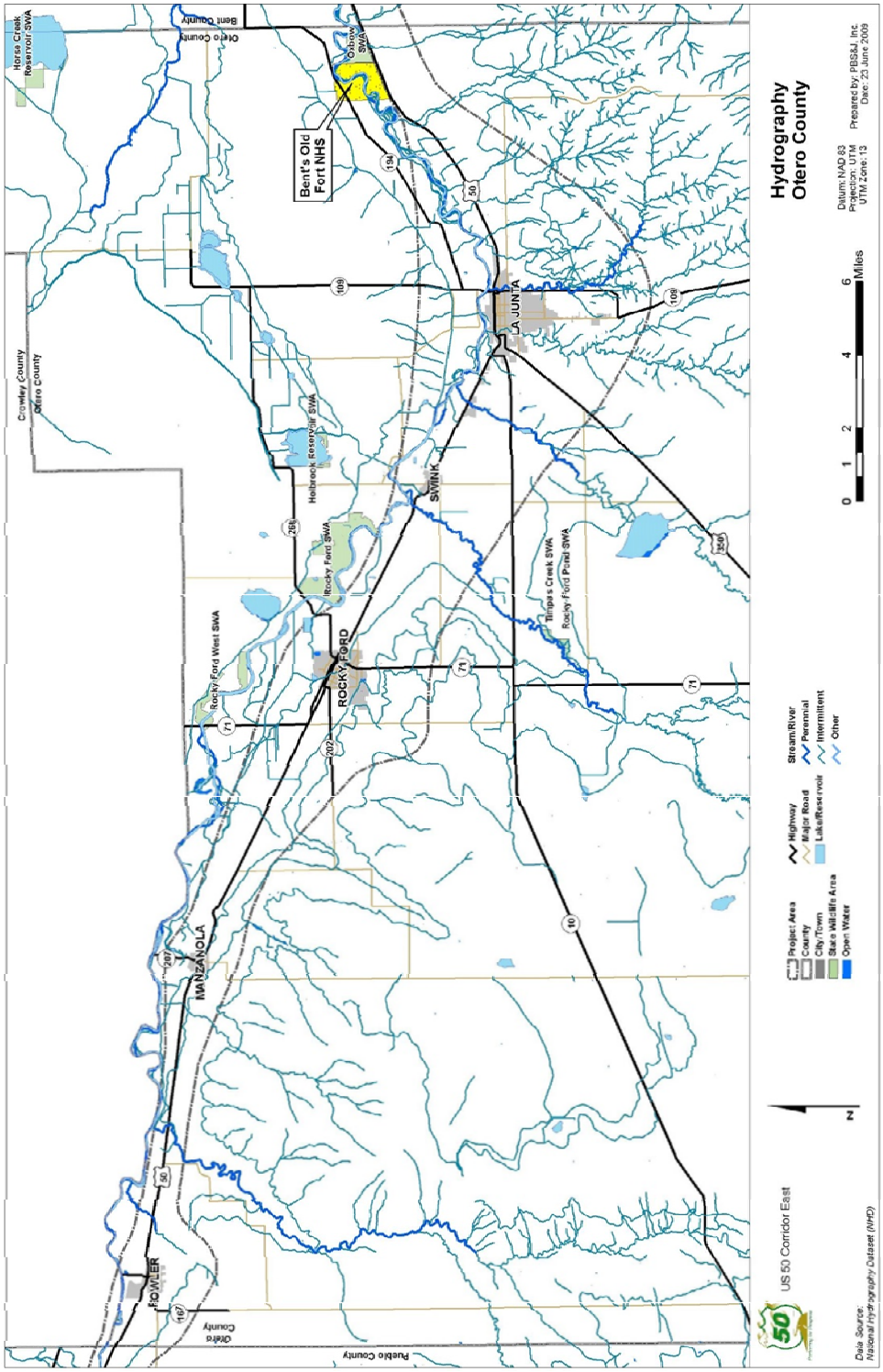


Figure E-11. Hydrography—Bent County

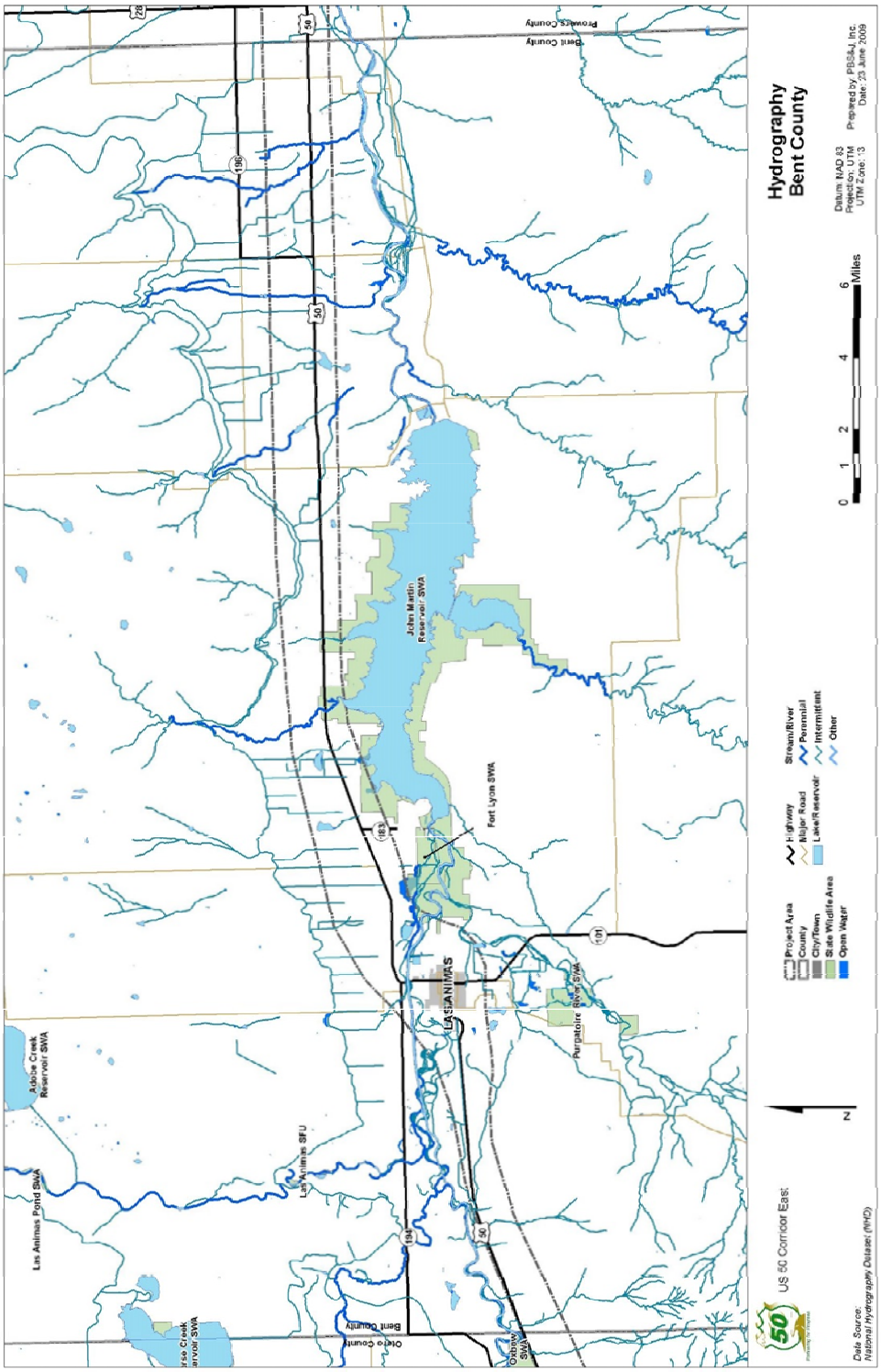


Figure E-12. Hydrography—Prowers County

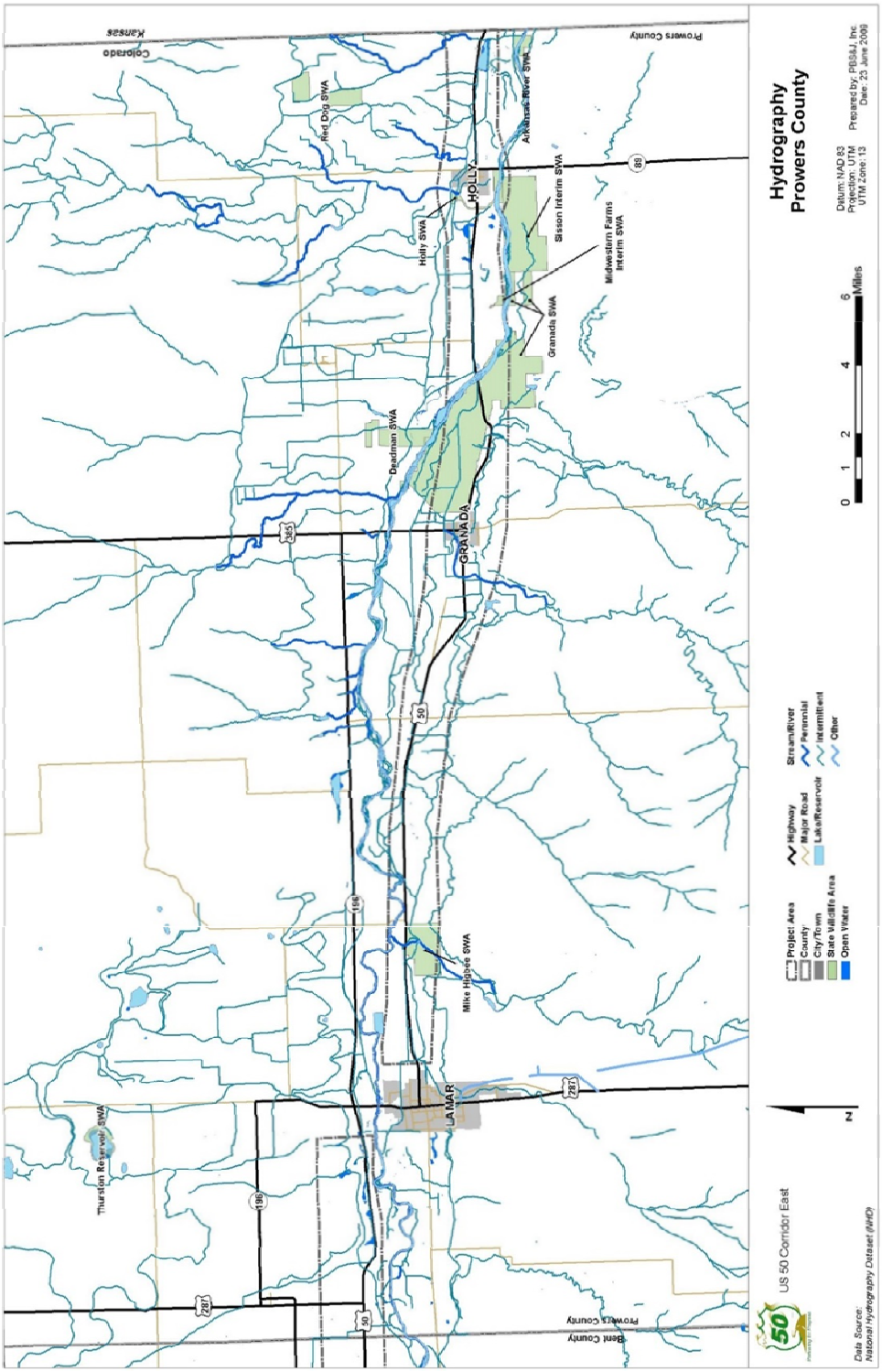


Figure E-13. Wetland/Riparian Impacts—Pueblo

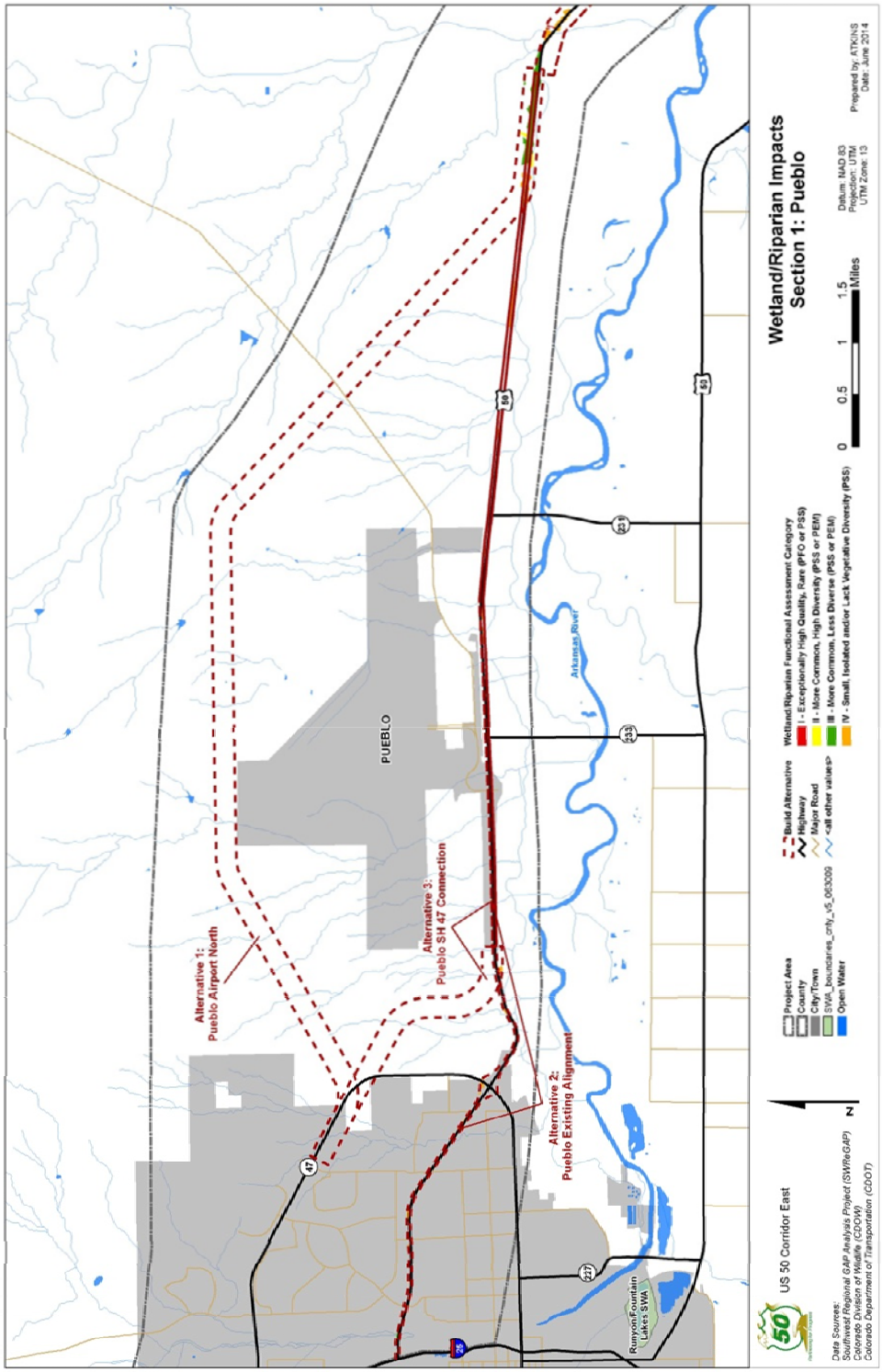


Figure E-14. Wetland/Riparian Impacts—Pueblo to Fowler (west)

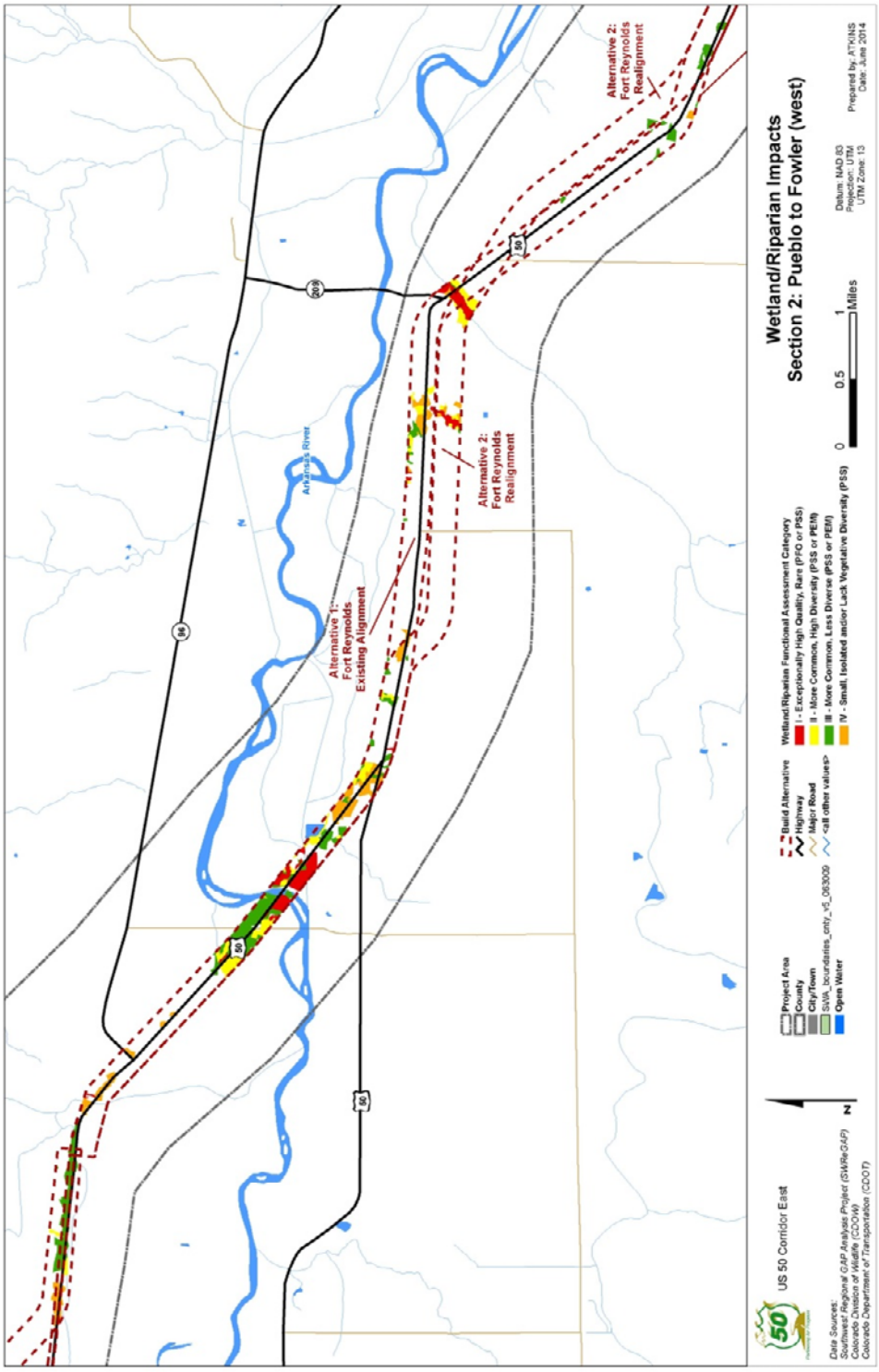
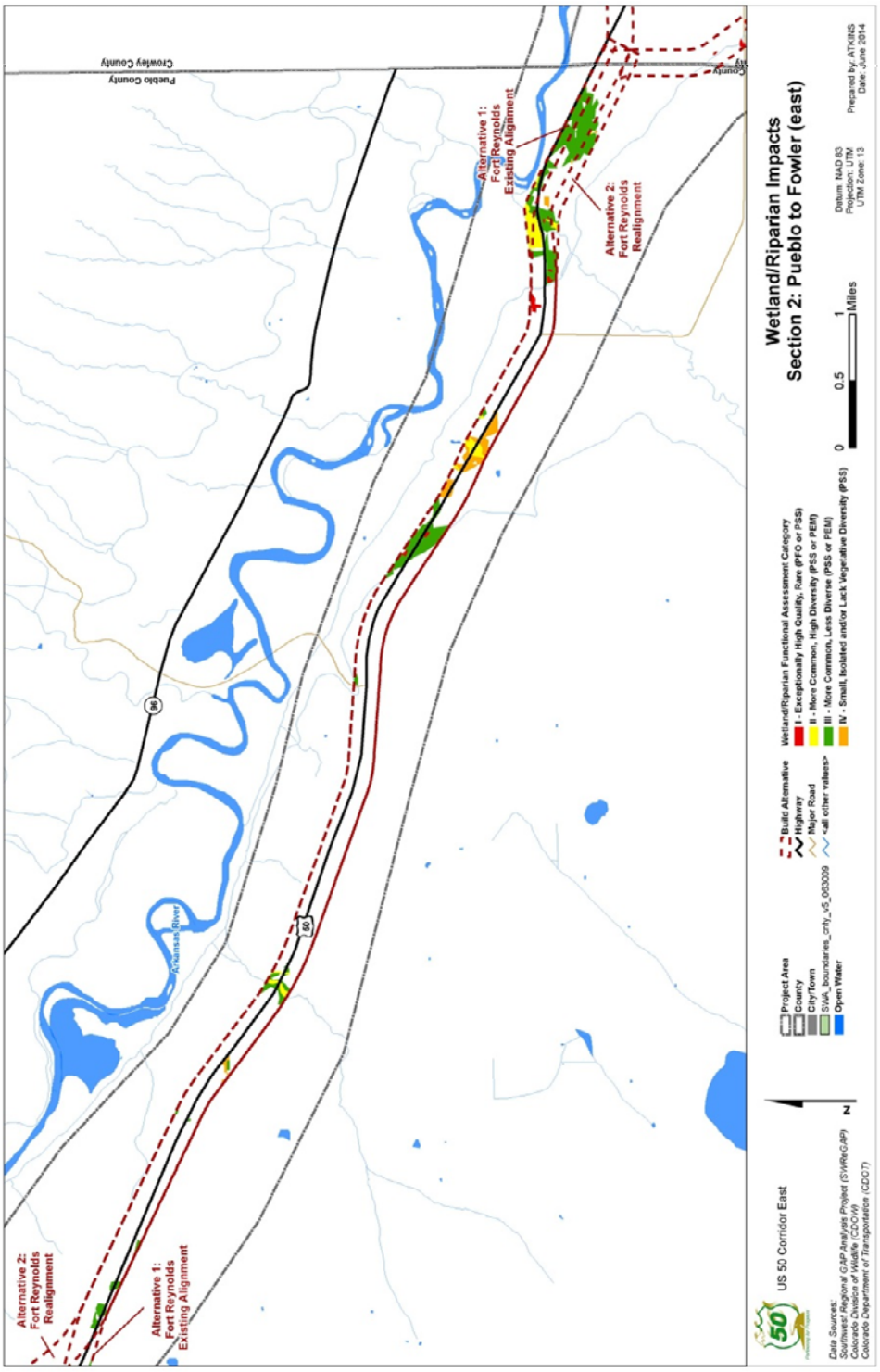


Figure E-15. Wetland/Riparian Impacts—Pueblo to Fowler (east)



9.

Figure E-16. Wetland/Riparian Impacts—Fowler to Manzanola

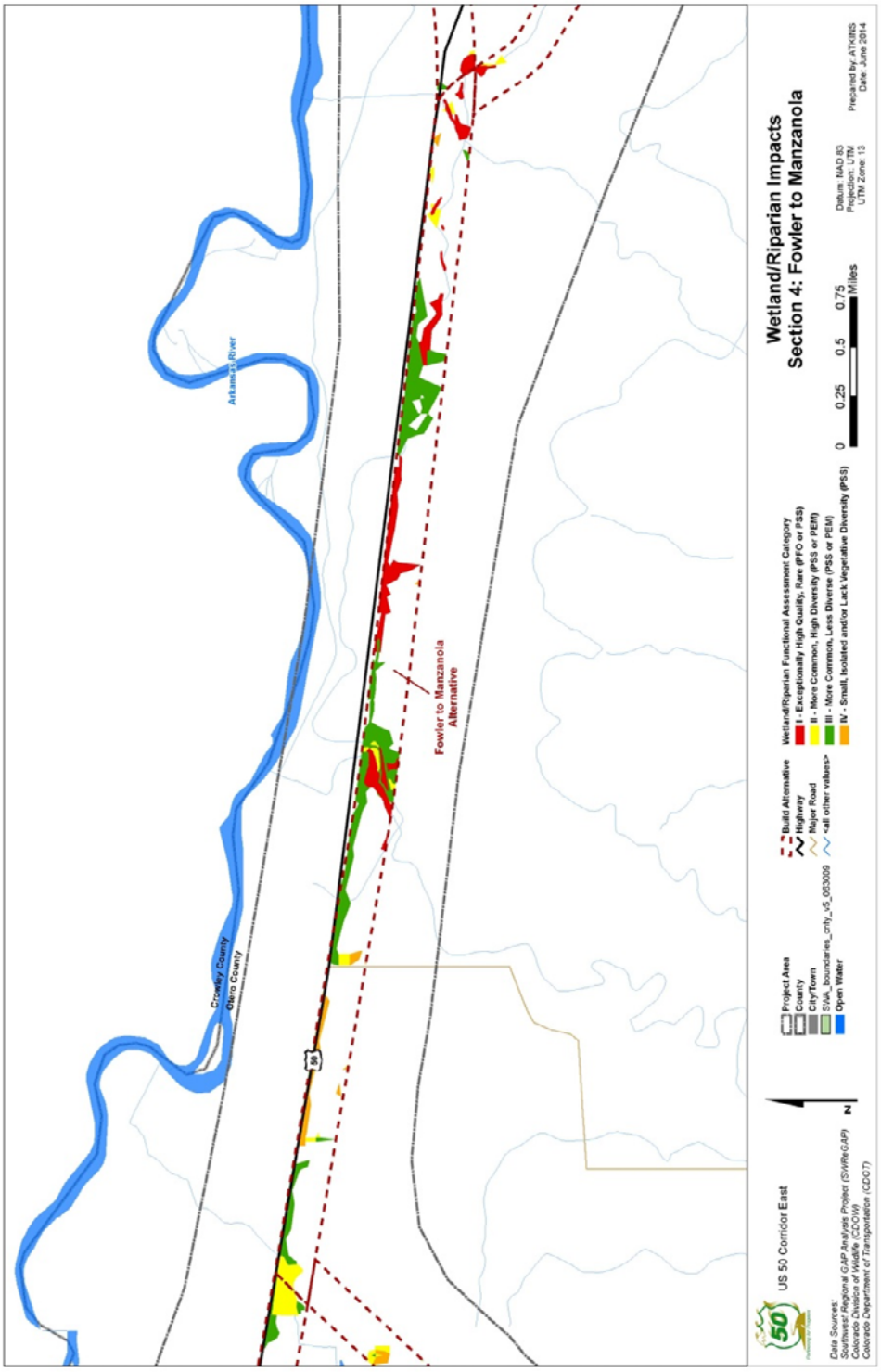


Figure E-17. Wetland/Riparian Impacts—Manzanola

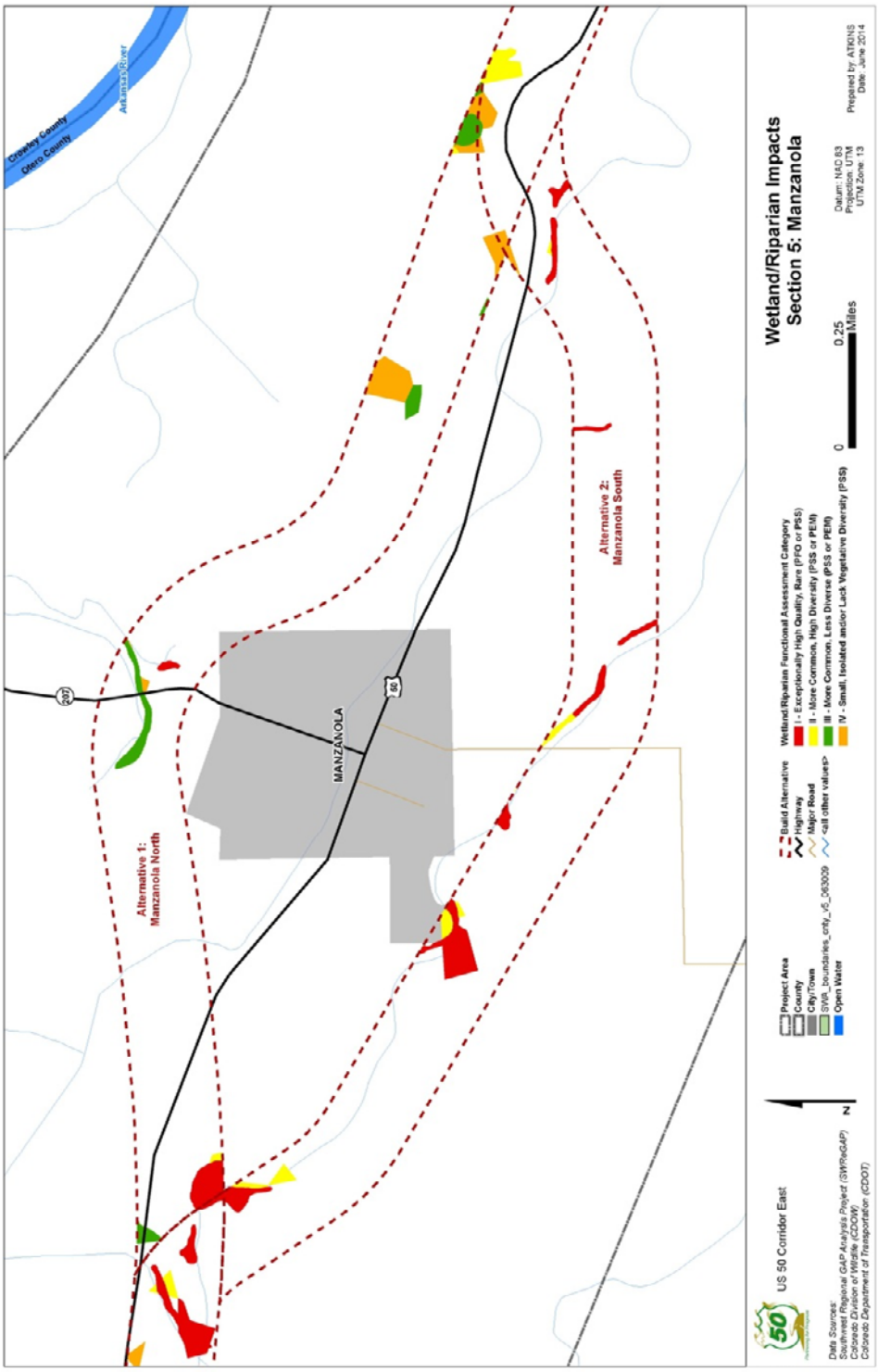


Figure E-18. Wetland/Riparian Impacts—Manzanola to Rocky Ford

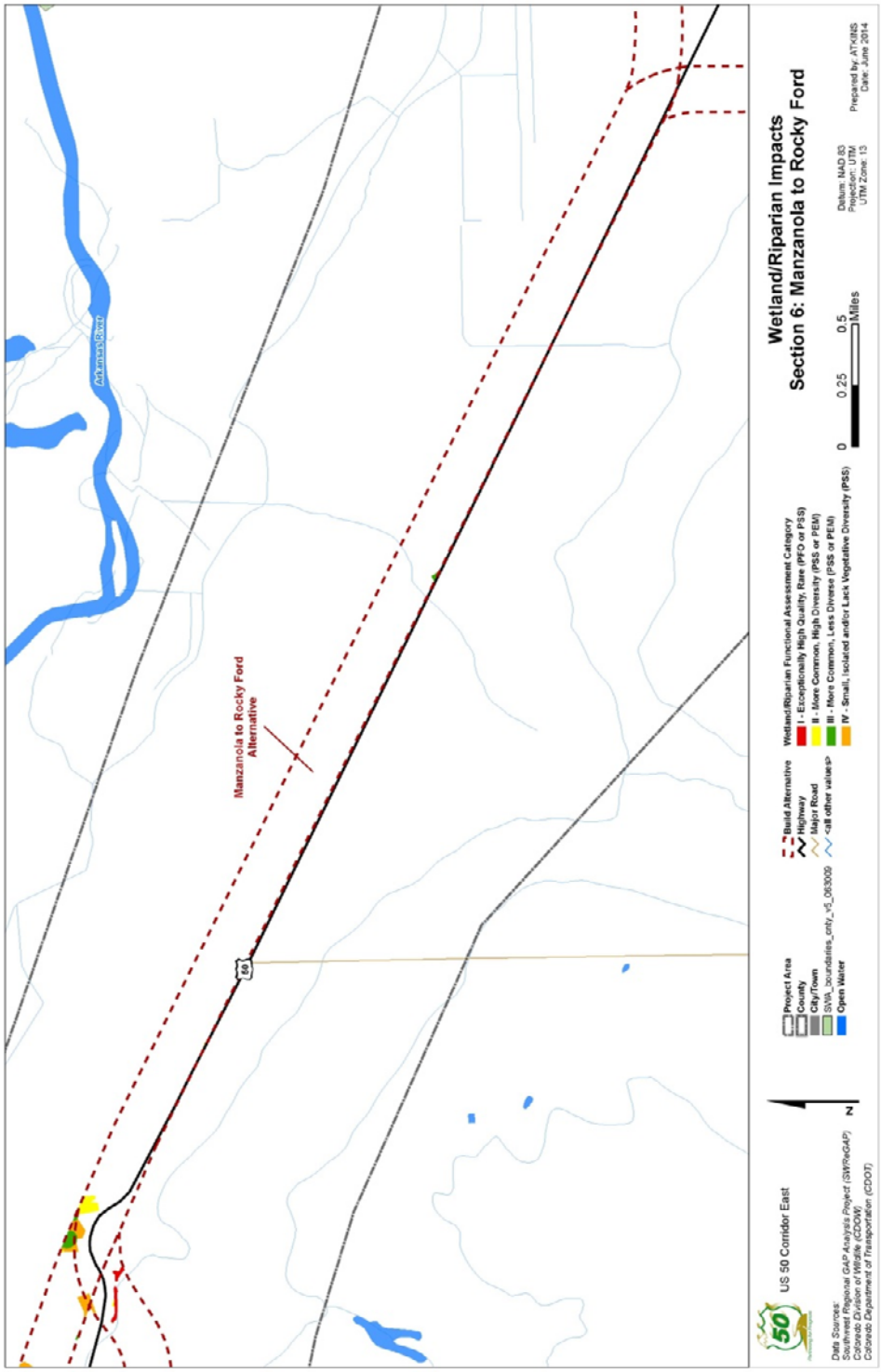


Figure E-19. Wetland/Riparian Impacts—Rocky Ford

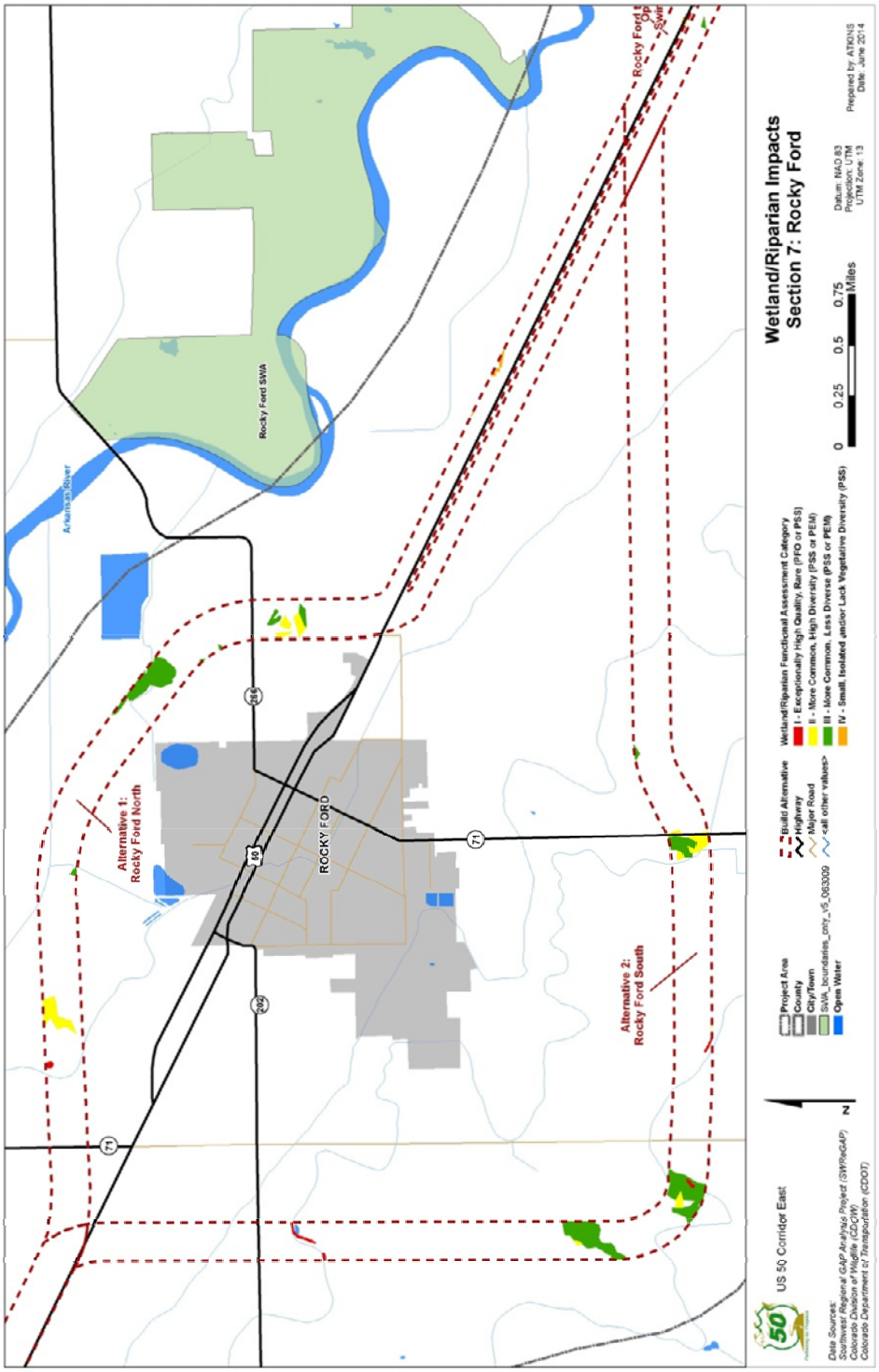


Figure E-20. Wetland/Riparian Impacts—Rocky Ford to Swink, Swink North and Swink South Alternatives

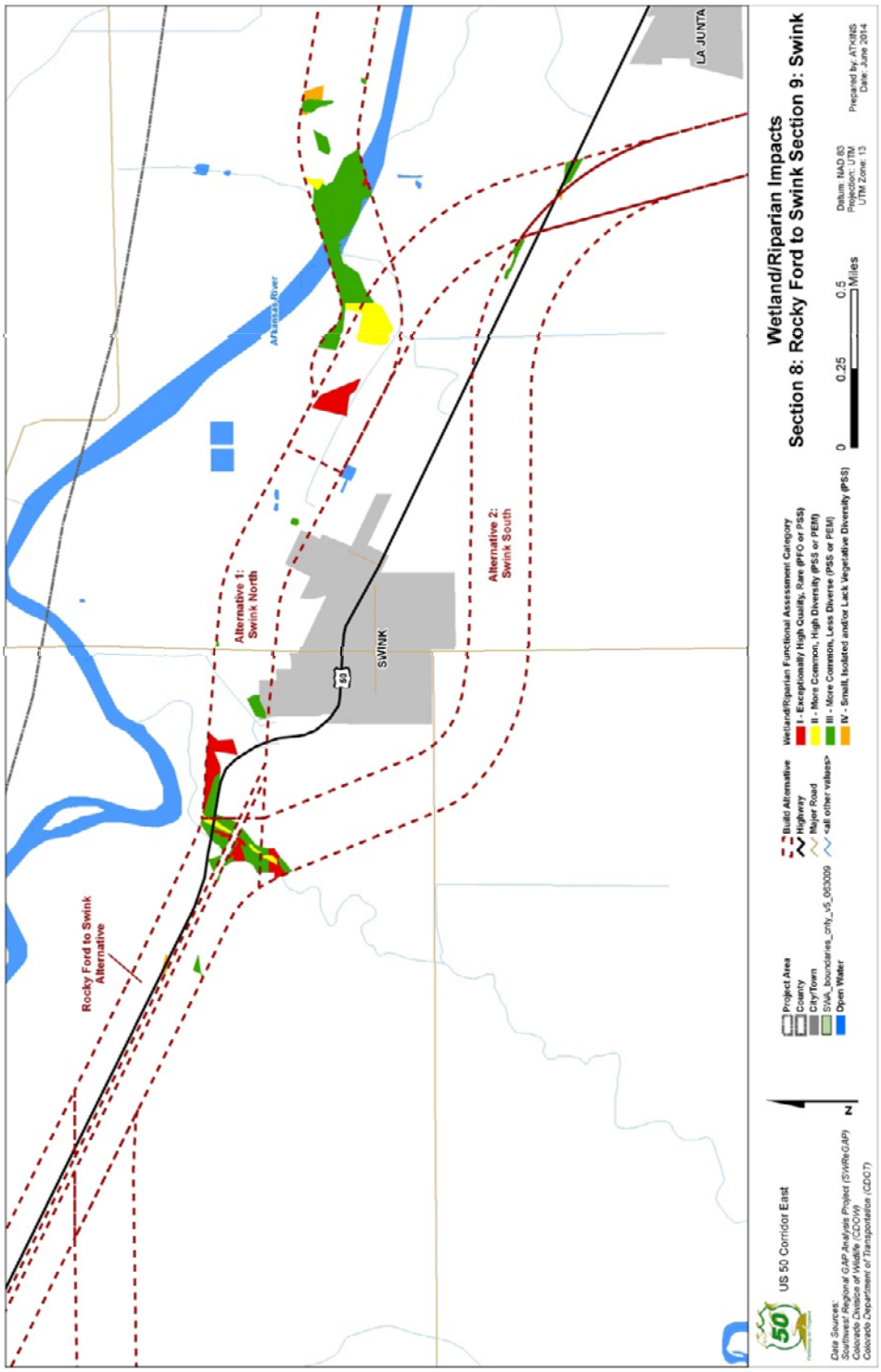


Figure E-21. Wetland/Riparian Impacts—La Junta to Las Animas

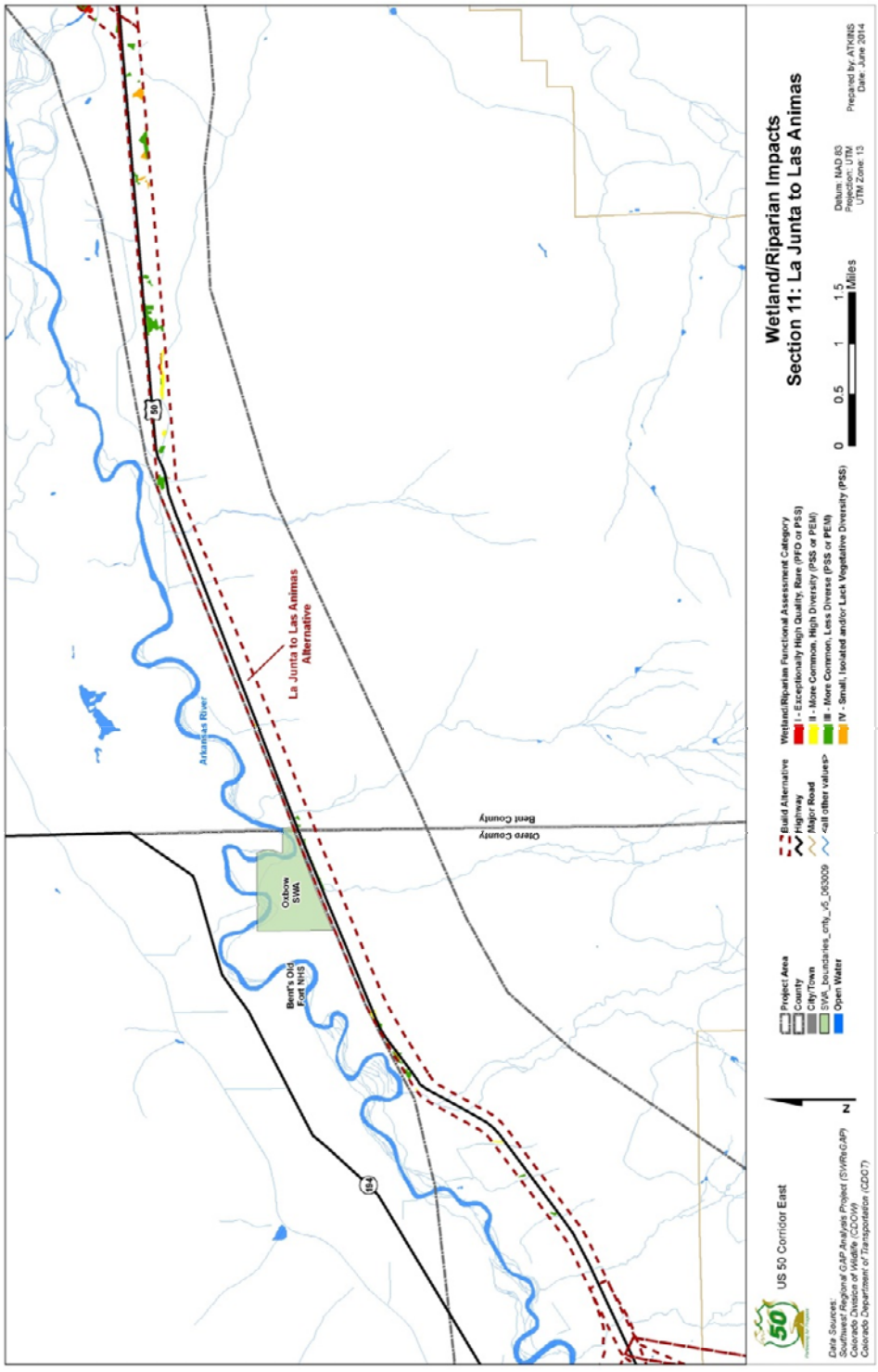


Figure E-22. Wetland/Riparian Impacts—Las Animas

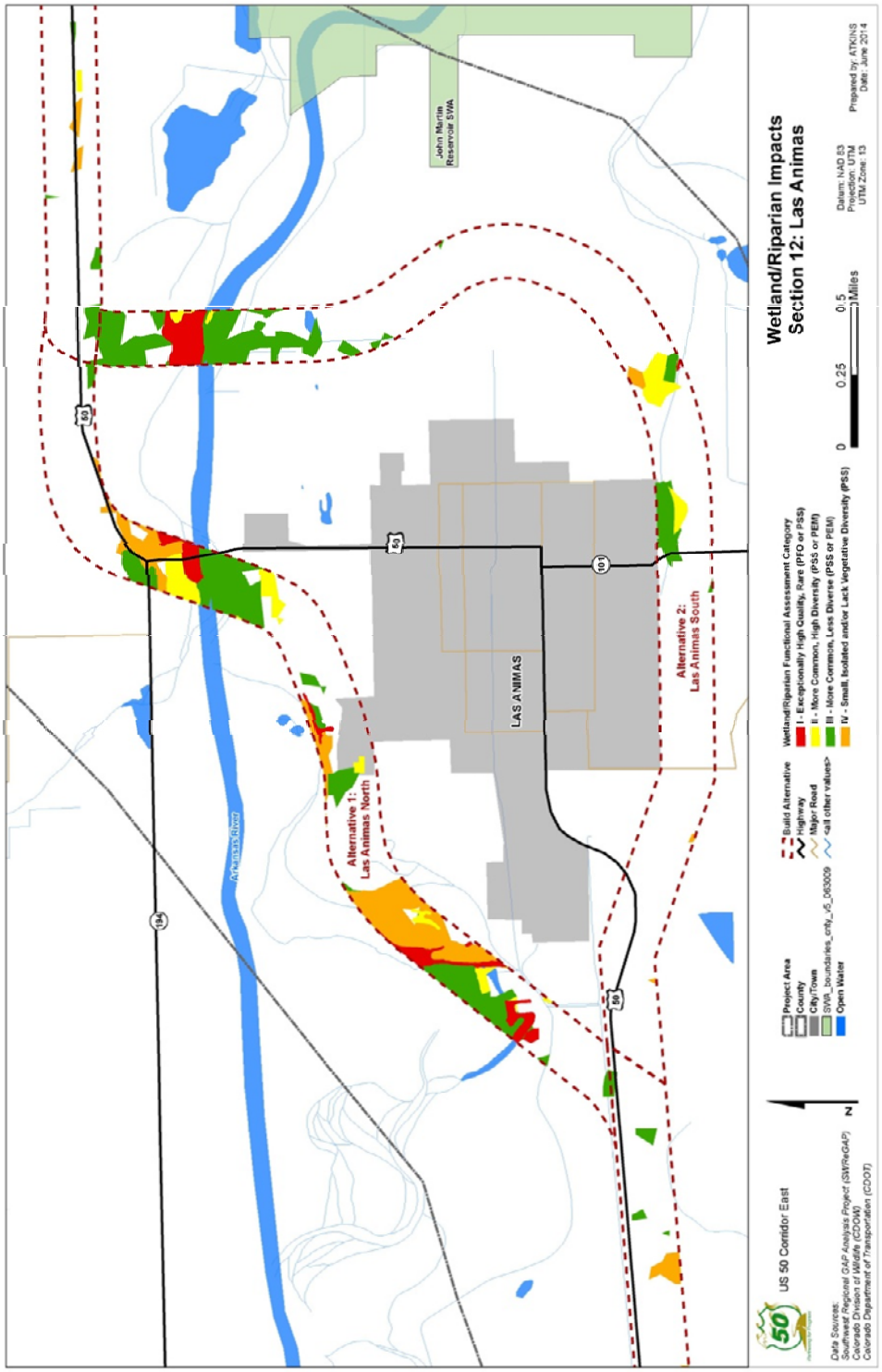


Figure E-23. Wetland/Riparian Impacts—Las Animas to Lamar (west)

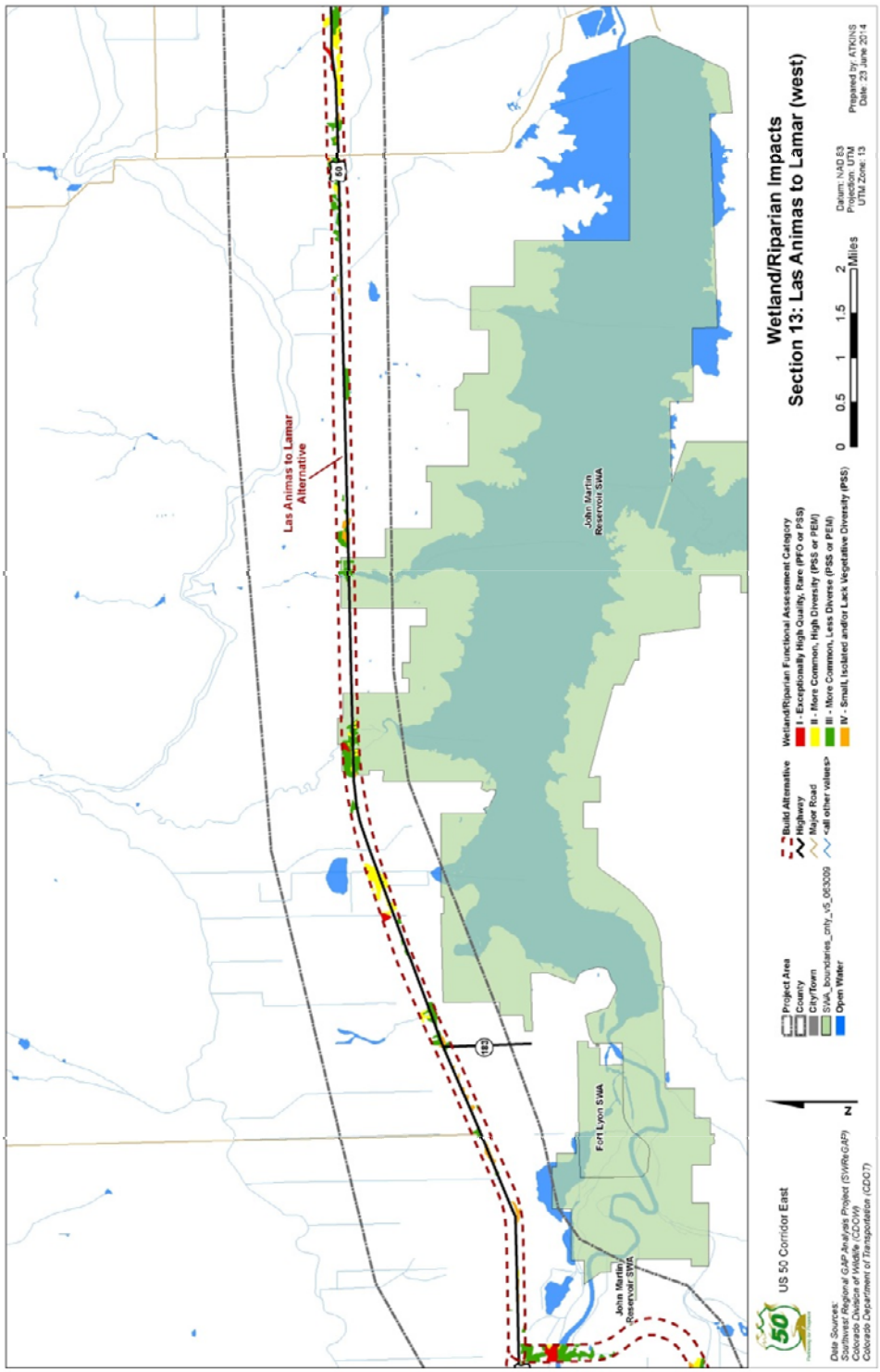


Figure E-24. Wetland/Riparian Impacts—Las Animas to Lamar (east)

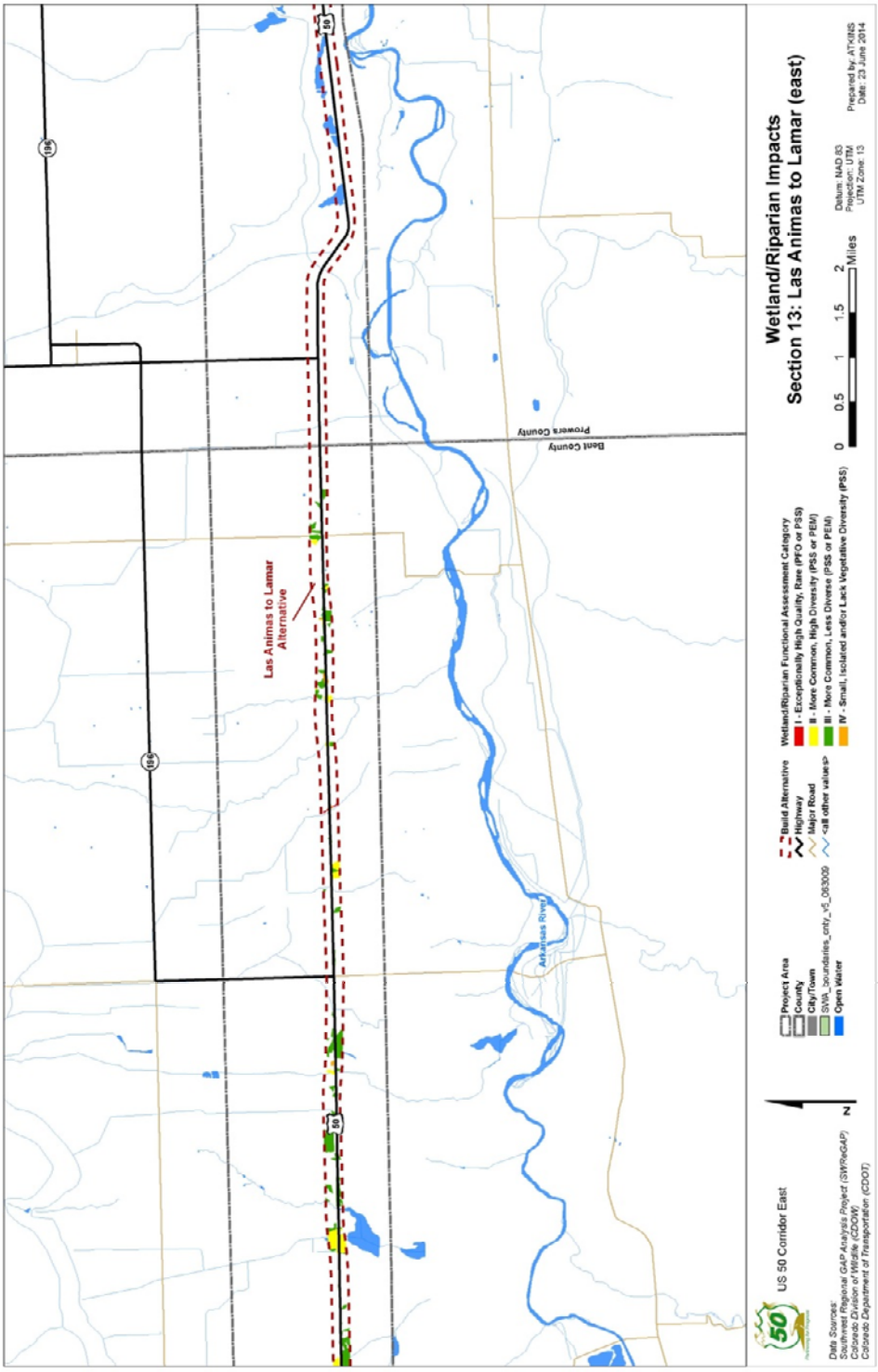


Figure E-25. Wetland/Riparian Impacts—Lamar to Granada

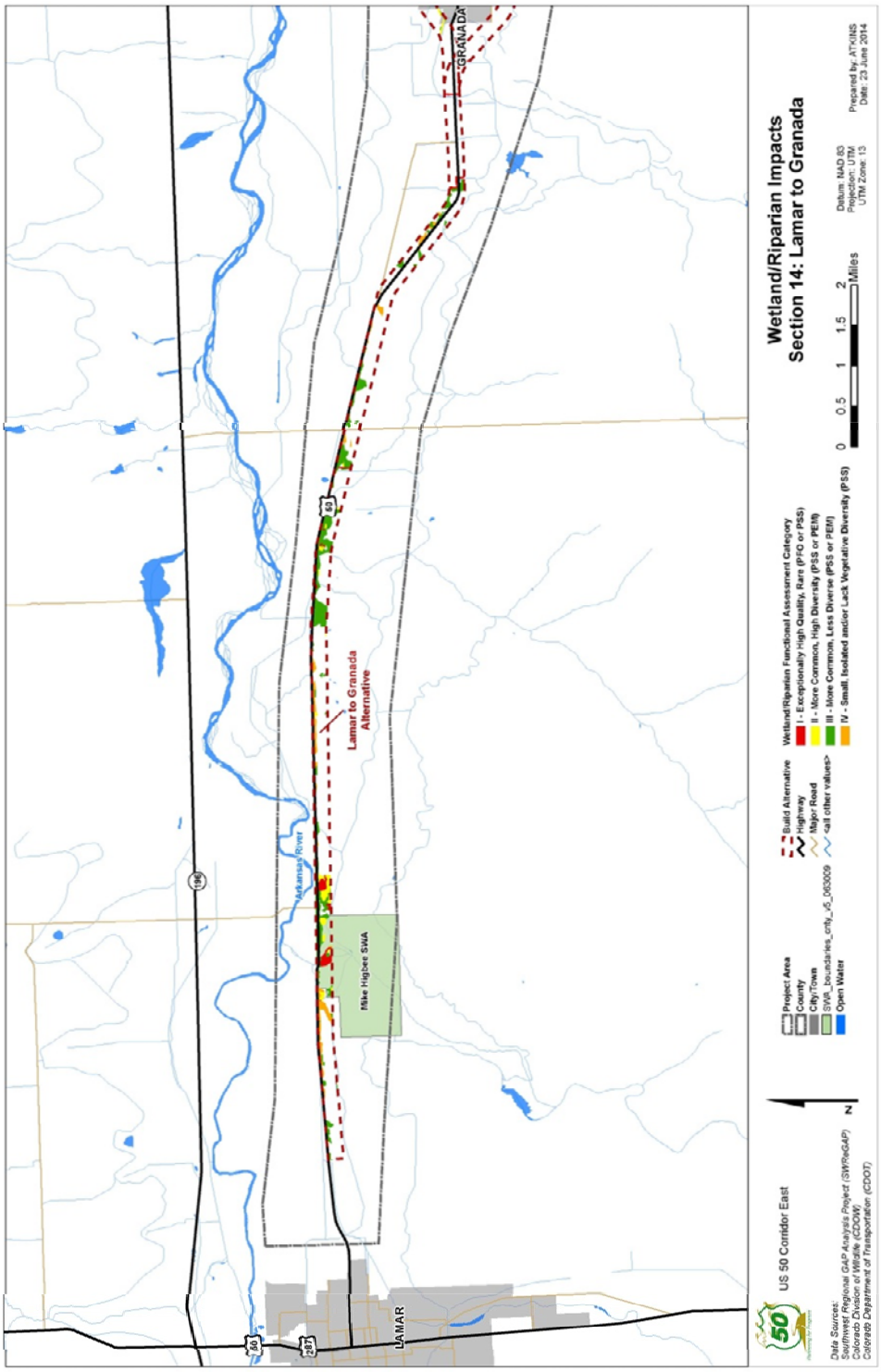


Figure E-26. Wetland/Riparian Impacts—Granada

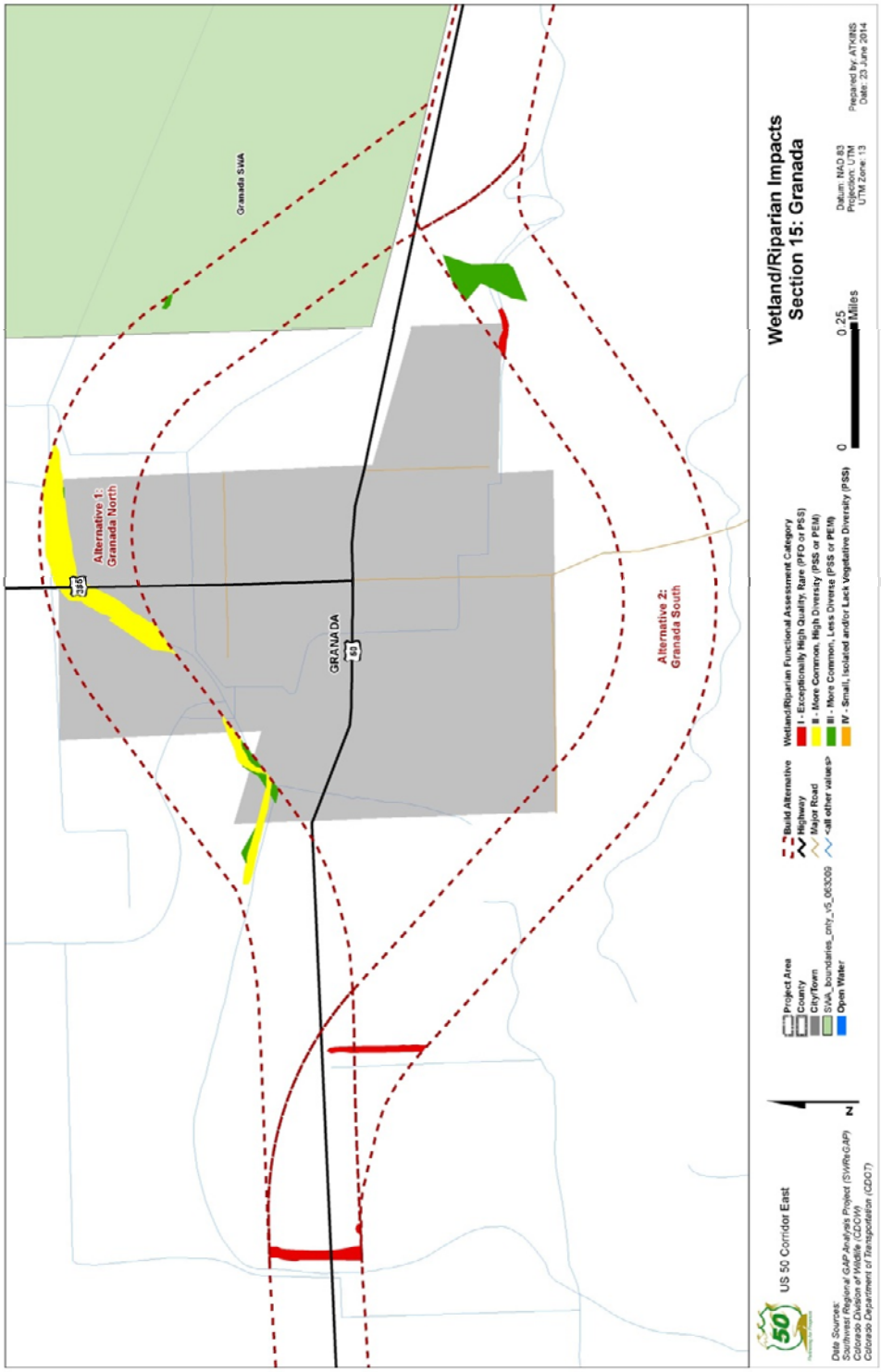


Figure E-27. Wetland/Riparian Impacts—Granada to Holly

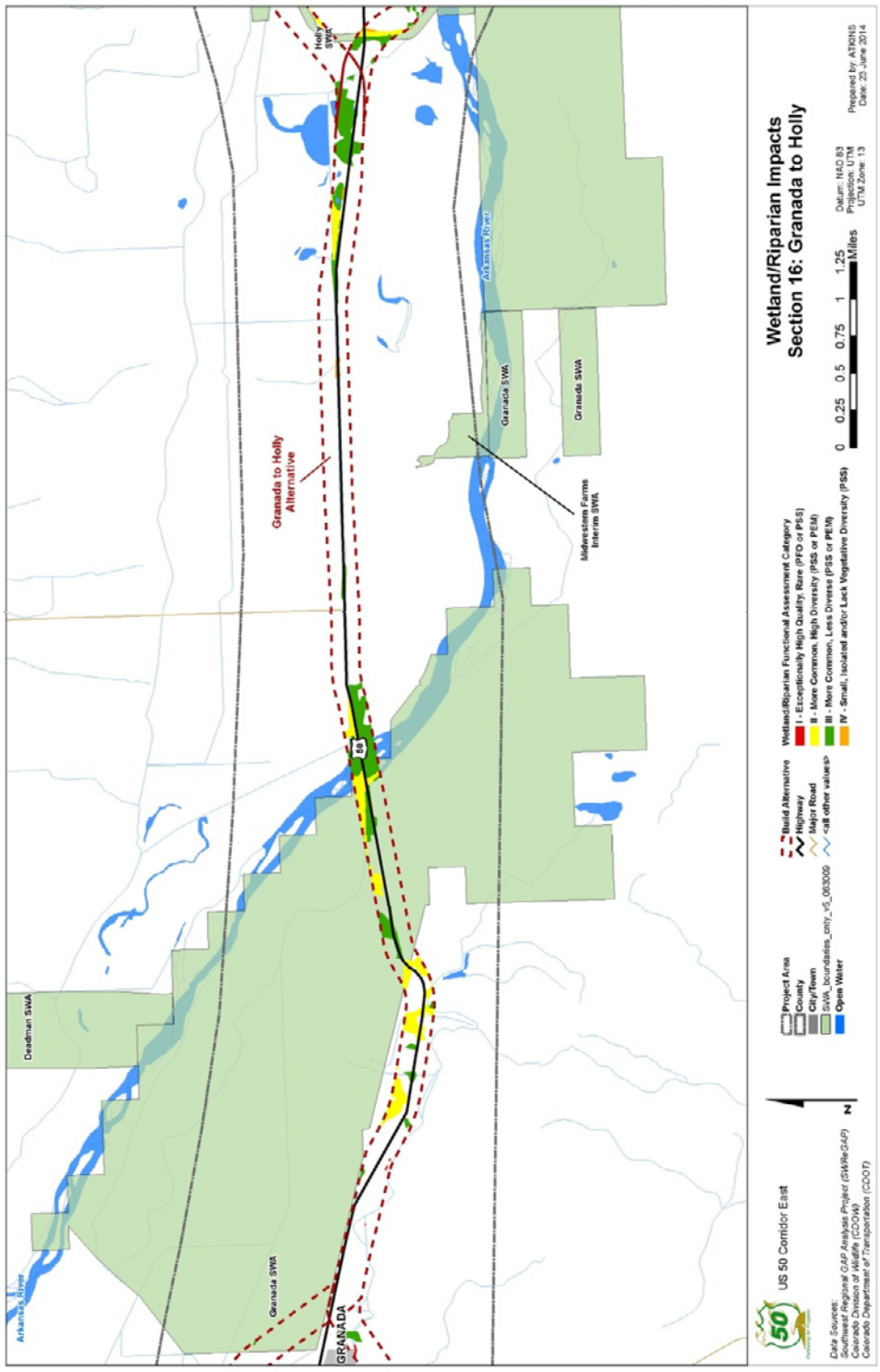


Figure E-28. Wetland/Riparian Impacts—Holly

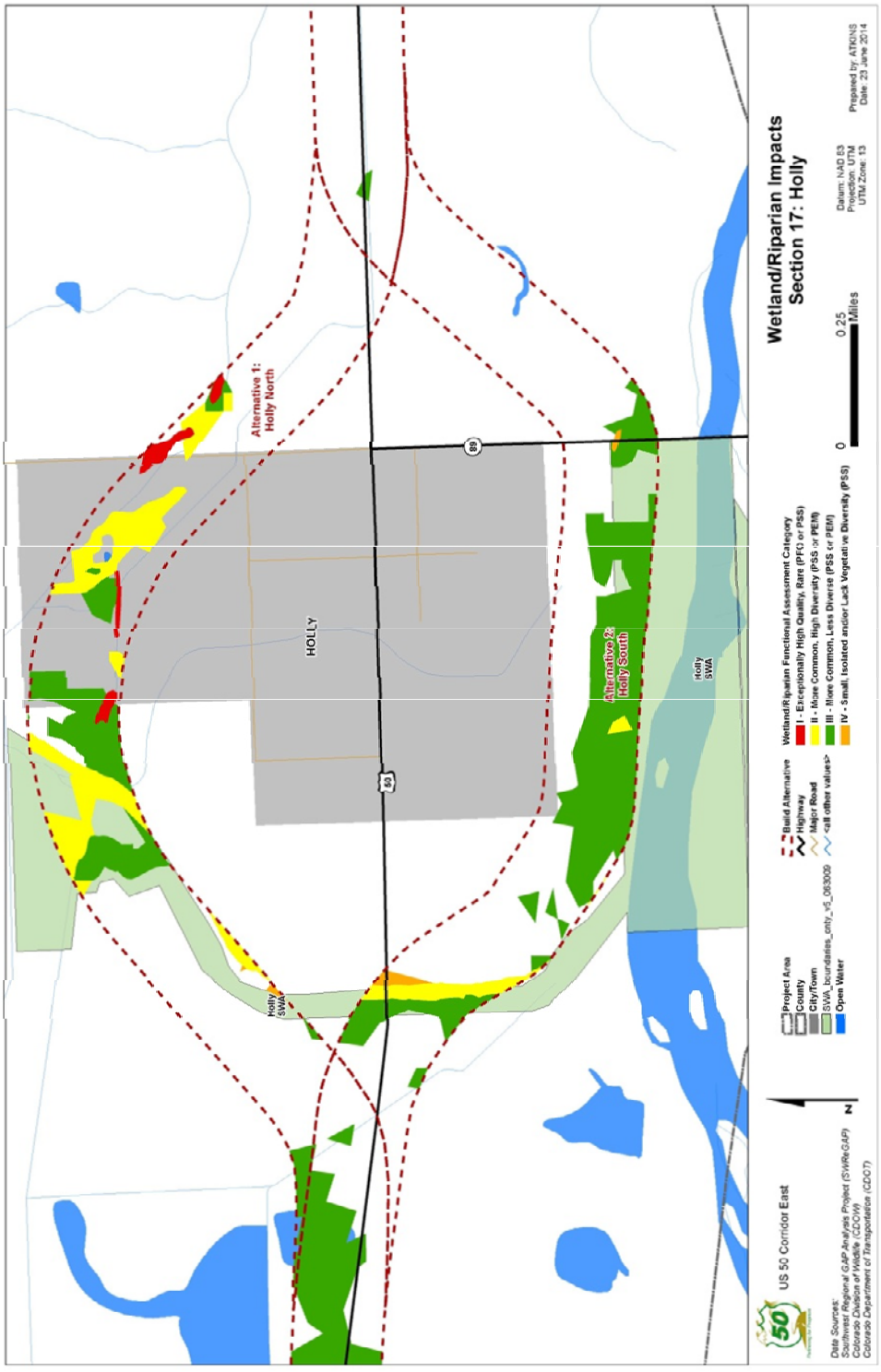


Figure E-29. Wetland/Riparian Impacts—Holly Transition

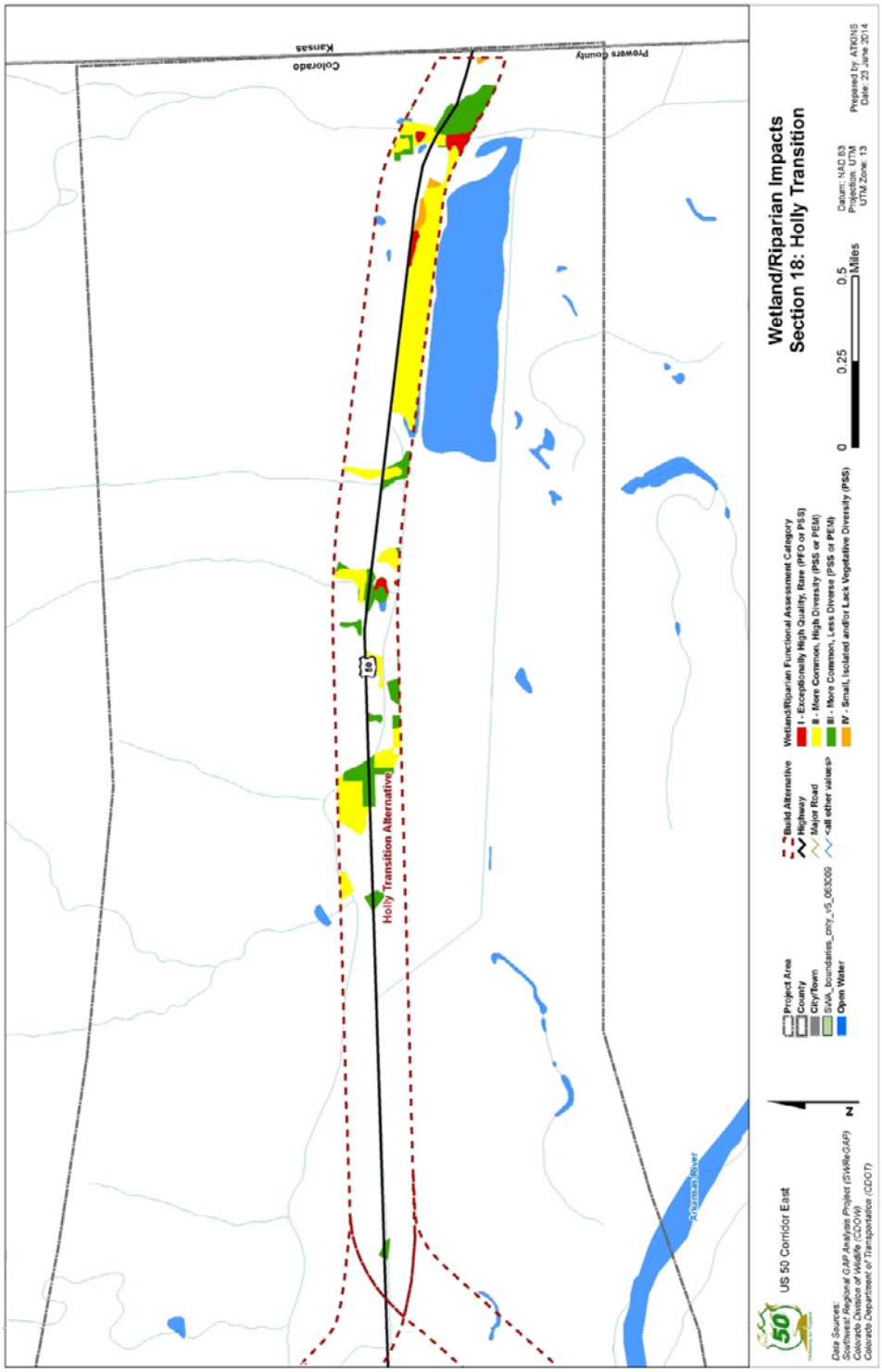


Figure E-30. Wetland/Riparian Impacts—Fowler North and Fowler South Alternatives

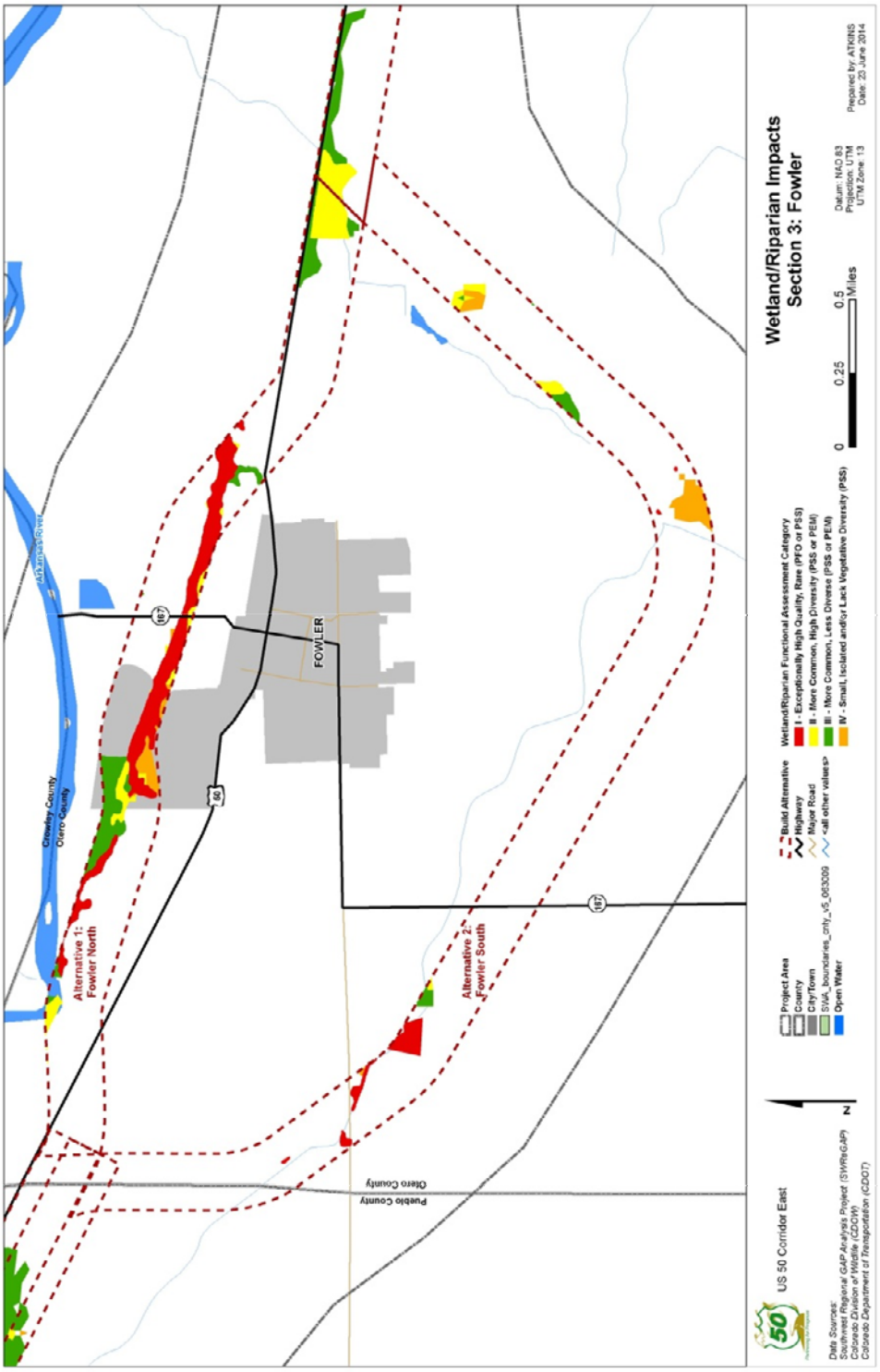
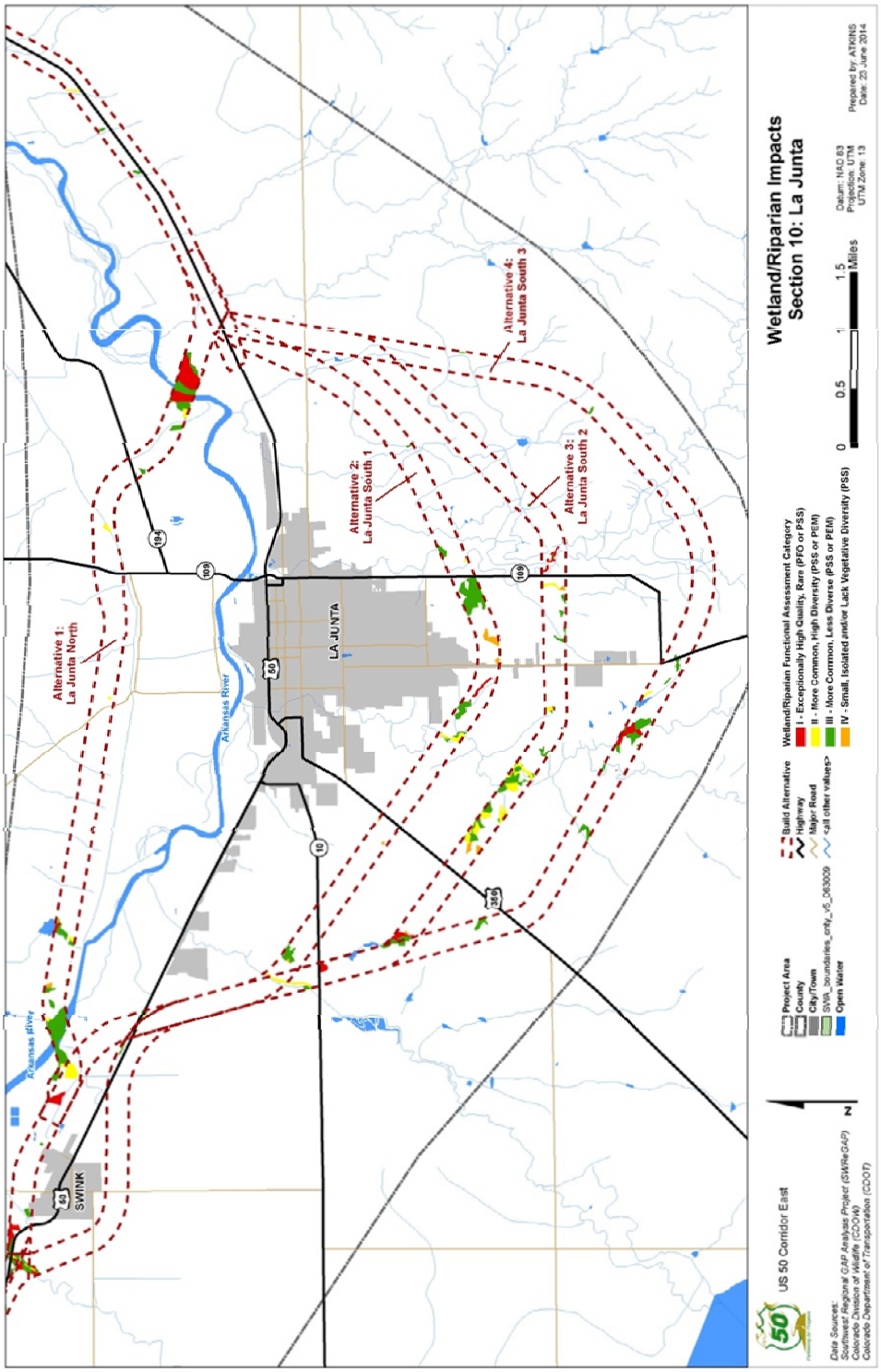


Figure E-31. Wetland/Riparian Impacts—La Junta South 1 and La Junta South 2 Alternatives



This page left intentionally blank.