Bosque Assessment & Update Prioritization

5 Year Plan

CITY OF ALBUQUERQUE
OPEN SPACE
PARKS AND RECREATION

ONE ALBUQUERQUE
parks & recreation

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LIST OF ACRONYMS

- ABCWUA – Albuquerque Bernalillo County Water Utility Authority
- ALCC – Ancestral Lands Conservation Corps
- ACS – Albuquerque Community Safety
- ADA – Americans with Disabilities Act
- AFR – Albuquerque Fire Rescue
- AMAFCA – Albuquerque Metropolitan Area Flood Control Authority
- APS – Albuquerque Public Schools
- BAP – Bosque Action Plan
- BAUP – Bosque Assessment and Update Prioritization
- BEMP – Bosque Ecosystem Monitoring Program
- BISON-M – Biota Information System of New Mexico
- CNP – Candelaria Nature Preserve
- County – Bernalillo County
- DHSEM – Department of Homeland Security & Emergency Management
- DMD – Department of Municipal Development
- DWP – Drinking Water Project
- EE – Environmental Education
- EMNRD – New Mexico Energy, Minerals, and Natural Resources Department
- E-Team – Environmental Team
- FEMA – Federal Emergency Management Agency
- GIS – Geographic Information System
- HMGP – Hazard Mitigation Grant Program
- IDO – Integrated Development Ordinance
- JPA – Joint Powers Agreement
- MPOS – Major Public Open Space
- MRG – Middle Rio Grande
- MRG-CAP – Middle Rio Grande Conservation Action Plan
- MRGCD – Middle Rio Grande Conservancy District
- MRGESCP – Middle Rio Grande Endangered Species Collaborative Program
- NHCC – National Hispanic Cultural Center
- NMDGF – New Mexico Department of Game and Fish
- NMDOT – New Mexico Department of Transportation
- NMFD – New Mexico Forestry Division
- NMISC – New Mexico Interstate Stream Commission
- NMRPTC – New Mexico Rare Plant Technical Council
- NMSLO – New Mexico State Land Office
- NRCS – Natural Resources Conservation Service
- O&M – Operations & Maintenance
- ONRT – Office of Natural Resources Trustee
- OSD – Open Space Division

- Reclamation – U.S. Bureau of Reclamation
- RGEMP – Rio Grande Environmental Management Program
- RGNC – Rio Grande Nature Center
- RGNCSP – Rio Grande Nature Center State Park
- RGVSP – Rio Grande Valley State Park
- RM – River Mile
- SDC – South Diversion Channel
- SLO – State Land Office
- SAOB – San Antonio Oxbow Bluffs
- SWRP – Southside Water Reclamation Plant
- TPL – Trust for Public Land
- TWV – Trail Watch Volunteers
- URGWOM – Upper Rio Grande Water Operations Model
- USACE – U.S. Army Corps of Engineers
- USFWS – U.S. Fish and Wildlife Service
- VdO – Valle de Oro National Wildlife Refuge
- WWTP – Wastewater Treatment Plan

EXECUTIVE SUMMARY

The Rio Grande Valley State Park (RGVSP), also referred to as the Bosque, runs the length of the Rio Grande through the heart of Albuquerque, New Mexico, and includes 20 miles (4,300 acres) of a protected cottonwood gallery forest. The Bosque is managed by the City of Albuquerque's Open Space Division (OSD) through a Joint Powers Agreement (JPA) with the Middle Rio Grande Conservancy District (MRGCD). This major green belt provides vital services for the community and ecosystem including the following: critical water resources, carbon sequestration, cultural and historical connections, and habitat for numerous rare and iconic species. The Bosque also provides a variety of outdoor recreation activities to residents and visitors, including bird watching, hiking, biking, water sports, and educational opportunities. The Bosque Action Plan (BAP, a Rank II Plan) is the City's management document for the Bosque adopted through Resolution 111-1993. Because there have been significant changes to the Bosque since 1993, the City developed the Bosque Assessment and Update Prioritization (BAUP) based on the BAP. The purpose of the BAUP is to assess current conditions and identify desired future conditions of the Bosque; identify priority projects over the next five years; and focus on protecting and enhancing the current ecosystem while supporting sustainable public use and education.

In 2021, OSD and Tetra Tech began developing the process for the BAUP. First, they reviewed the goals and status of the projects identified in the BAP, accomplishments achieved since 1993, and major changes that had occurred throughout the area. Additionally, Tetra Tech researched and compiled a comprehensive dataset for the past 20 years of all documents and projects related to the Bosque. Tetra Tech then developed an in-depth geodatabase (an extensive data library of relevant natural resource geospatial files) to enable technical analysis and internal modeling for project development and monitoring efforts.

A team of 13 agency representatives was assembled to advise and review the BAUP process and priority projects. This "Environmental Team" (E-Team) met numerous times to discuss planned and potential priority areas, deliberate on the pressing issues facing this critical ecosystem, and develop evaluation criteria to assess projects.

In developing the BAUP, Tetra Tech updated the Hink and Ohmart vegetation mapping to look at percent cover, density, diversity, species richness, and dominant communities within the RGVSP. University of New Mexico students also participated in post-fire assessments. Additional threatened and endangered wildlife studies were conducted. These studies are critical to inform current and future management decisions.

The outcome of the BAUP is a comprehensive guidance document for the OSD for the next five years. The BAUP provides important historical information and the current context for the Bosque and Middle

Rio Grande (MRG) needed to understand and manage this complex ecosystem. The BAUP also identifies nine priority Project Areas and the current and future resources needed for each area. These nine areas include the following: San Antonio Oxbow and Oxbow Bluffs; Atrisco Acequia Madre (Central NW-SW); Alameda SE; Montaño SW; Pat Baca; Southside Water Reclamation Plant Outfall Restoration Project; and the State Land Office (SLO) Bosque adjacent to Valle de Oro; Alameda SW/Calabacillas Arroyo; and Rio Bravo Riverside Picnic Area.

In addition to these specific areas, the BAUP covers improvements and management pertaining to the entire Bosque system. Restoration is a key component and includes managing invasive species, maintaining current restoration sites, reducing fuel loads, controlling erosion, and creating additional habitat. Ecosystem resilience to climate change is also essential. The E-Team recognized that further research is needed to better understand the implications of climate change and the best management strategies for an area that will look quite different in the future from today's Bosque. The document also outlines ongoing monitoring plans through community driven science and more robust scientific studies. Monitoring allows for an adaptive management approach to managing the Bosque.

The BAUP also specifies seasonal and annual operations and management activities through a detailed matrix that provides staff with a calendar of maintenance tasks. Additionally, the BAUP identified numerous ways to improve the visitor's experience while limiting the impacts to the ecosystem with a number of projects and programs specific to recreational trails and amenities, wayfinding and interpretative signage, and education and stewardship programs.

Finally, the document identifies current resources the OSD has to manage the Bosque, what is needed for staffing, patrolling, operations and management, and the priority projects. The OSD does not have adequate resources to sufficiently manage this system. The OSD has been innovative in combining resources, including through grants, partners, and volunteer support. However, this is the most critical ecosystem throughout Albuquerque and Bernalillo County and is the premier recreation area running through the heart of the City. The area deserves dedicated and adequate annual funding, staffing, and safety personnel.

The BAUP provides clear direction for the OSD over the next five years for daily operations, priority projects, overall restoration, education, and public recreation. Through partnerships, volunteers, and sufficient city resources, this critical area will be a healthy and thriving environment for all to enjoy in the future.

1.0 PROJECT BACKGROUND

1.1 INTRODUCTION AND HISTORY

The Rio Grande Valley State Park (RGVSP) stretches across 4,300 acres along the east and west sides of the Rio Grande through Albuquerque between Sandia Pueblo to the north and Isleta Pueblo to the south (Figure 1). For this document, we will refer to this area as the Bosque. Although the Bosque encompasses a small footprint within the larger Middle Rio Grande (MRG), its position within New Mexico's most populated urban area makes it a heavily impacted riparian segment critical for its ecosystem services and passive recreation opportunities for the surrounding residents.

The Bosque serves as the most important ecological area throughout Albuquerque and Bernalillo County. The riparian woodlands, or "Bosque," (bOHs-keh) a Spanish colloquial term, refers to the riparian forest found in the MRG that is dominated by cottonwood (Populus spp.) and willow (Salix spp.) tree species in the Salicaceae family, and supports an abundance of residential and migratory animals including a number of endangered species such as the Southwestern Willow Flycatcher and Rio Grande Silvery Minnow. Albuquerque has been designated as a Migratory Bird City mainly due to the existence of the Bosque and habitat conservation efforts led by the City and multiple other partners. Additionally, essential water resources are supported by this system, which include ground and surface water, drinking water for residents, and storm drainage for the surrounding watershed. The Bosque also includes the densest concentration of vegetation as well as the largest cottonwood gallery forest in the world, which lowers temperatures, stores carbon, and improves air quality. These are just a few of the ecosystem services provided by this critical environment.

The Bosque also has a rich history and is considered the lifeblood of the community for past, current, and future peoples. This is the ancestral lands of the Tiwa- and Tewa-speaking Pueblos. Some of the Pueblos along the river are active sovereign nations, including the Pueblo of Sandia to the north and the Pueblo of Isleta to the south. There are a few remnant Pueblos, such as Piedras Marcadas Pueblo, which are no longer occupied but protected as Major Public Open Space (MPOS) while others have disappeared into the modern built environment with artifacts buried deep underground. This area also attracted the Spanish settlements that are evident today through historic neighborhoods like Alameda, Los Griegos, Barelas and Los Duranes as well as the Elena Gallegos and Atrisco Land Grants. Today the Rio Grande Valley continues to be a highly attractive area to live and includes most of the area's agricultural lands fed through the acequia ditch system from the Rio Grande as it has for centuries.

Since the 1900s, the Rio Grande has experienced primarily rapid and extreme manmade changes caused by deforestation, overgrazing, development, as well as major flood events. Farmland using acequias to irrigate from the river could not keep up with the flooding, high-water tables, and extended periods of low flows. Consequently, the MRGCD was created by the Conservancy Act of 1923 with the mission of three things: irrigation water delivery, river flood control, and drainage. Additional federal funding and management were provided around the 1950s to prevent major flooding through the construction of dams, levees, and jetty jack embankments. Eventually, the natural meandering flows of the river were straightened and heavily managed, which has greatly changed the river system.

Many people have historically valued the river for its water resources, ecological resources, history, cultural significance, and recreation activities, and have wished to protect and improve its condition. In 1969, the New Mexico State Legislature adopted The Rio Grande Valley State Park Plan that justified the need to provide both extra protections to preserve the Bosque and management for recreation and educational purposes. The City wanted to see this plan come to fruition and worked alongside an advocacy group, Bosque Society, to promote this effort and solicit additional funds that would establish the area for nature preservation and recreation. These efforts eventually paid off, and the New Mexico State Legislature approved the Rio Grande Valley State Park Act. Part of the Act includes the following declaration of policy: *"The preservation, protection and maintenance of the natural and scenic beauty of the designated portion of the Rio Grande and its immediate corridor is in the public interest. The designation of the Bosque will enable people to enjoy the recreational, environmental, educational and wildlife benefits of the river. Therefore, the legislature declares it to be in the public interest, in furtherance of sound environmental policy and for the good of the people to establish the Rio Grande Valley State Park."* The Act further states that the operating partner of the Bosque (City of Albuquerque) would enter into a management agreement with the MRGCD, and a JPA was signed in 1997. This provided the City's Open Space Division (OSD) with management responsibility over the Bosque.

The mission of the OSD is "to acquire, protect, manage, and maintain the significant natural landscapes and cultural resources while providing low impact recreation for current and future generations" (COA, 1997). Corresponding with this mission, the following plans guide policy and management of the Bosque: Albuquerque/Bernalillo County Comprehensive Plan (1975, amended in 1988 and 2017), the 1993 Bosque Action Plan (BAP), and the 1999 MPOS Facility Plan.

Since the mid-1980s, the OSD has managed the Bosque as part of its city-wide Open Space network. Initial planning for the Bosque resulted in the 1987 Rio Grande Valley State Park Management Plan followed by the 1993 BAP. This is coupled with the MPOS Facility Plan adopted in 1999, which is the management document for the entire Open Space system managed by the City. The BAP is a Rank II Plan (COA, 1993) and is intended to guide future management by addressing resource and wildlife protections, recreation, education and specific uses, environmental enhancements, and implementation. The BAP outlined and prioritized 22-phased projects aimed at implementing environmental and recreational improvements in the Bosque. The BAP also developed 24 policies, which are listed throughout this document under applicable sections. The MPOS Facility Plan established policy for planning, land use decisions, and management of the entire MPOS network, of which the Bosque is a part.

The Bosque Assessment and Update Prioritization (BAUP) adheres to guidance set forth in these documents and examines and builds off of the work prioritized in the BAP to prioritize further projects for implementation into the future. It includes the lands within the Bosque as well as those adjacent to the City owned by MPOS.

The City's OSD management strategy is designed to accommodate visitors while also avoiding adverse environmental impacts to the greatest extent possible. As part of its management efforts, the City OSD coordinates with its partners and volunteers to implement a number of projects aimed at maintaining and improving the Bosque for visitors and wildlife, including habitat restoration projects, facility improvements, and general maintenance activities. Entities involved in the management of or those that have facilities which overlap with or enter the Bosque and adjacent MPOS are listed below in Table 1.

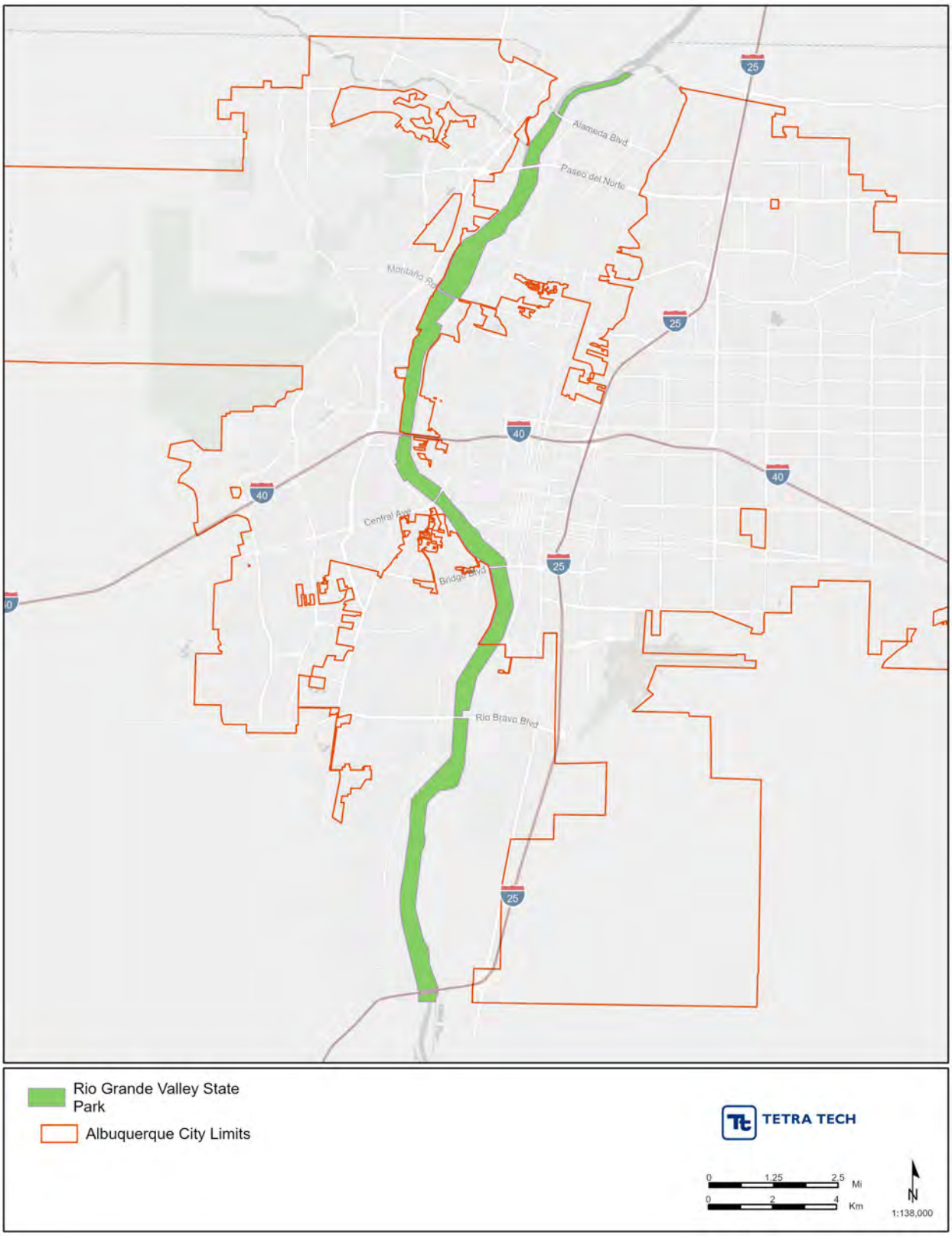


Figure 1. Project Area Boundaries (Bosque and Adjacent MPOS)

Table 1. Agencies That Have Jurisdiction and Management Responsibilities Within the Bosque

Albuquerque Bernalillo County Water Utility Authority (ABCWUA)
Albuquerque Metropolitan Area Flood Control Authority (AMAFCA)
Bernalillo County (County)
City of Albuquerque, Department of Municipal Development (DMD)
Middle Rio Grande Conservancy District (MRGCD)
Rio Grande Nature Center State Park (RGNCSP)
U.S. Army Corps of Engineers (USACE)
U.S. Bureau of Reclamation (Reclamation)
New Mexico State Land Office (SLO)
New Mexico Department of Transportation (NMDOT)
Bosque Preparatory School

1.2 PROJECT PURPOSE

The BAUP is aimed at evaluating the planning efforts documented in the BAP to provide direction for the OSD's efforts over the next five years. Priority projects as well as general operations and management will focus on those that support ongoing restoration, recreation, and education in the Bosque. This document also updates resource information from the past 20 years to develop and evaluate current priority needs and to inform project development.

The BAUP documents what has been completed in the BAP since it was developed in 1993, as well as the reasons for changes in project components or geographic locations. Since the 1980s, the OSD and its federal, state, and local partners have worked on many restoration projects as well as outdoor recreation amenities within the Bosque. The completion of these projects combined with population growth, increasing urbanization, updates to City infrastructure, and changing climate conditions over the past few decades have resulted in the need to establish current baseline conditions. This baseline will allow the OSD to identify and plan for future ecological and community needs.

The BAUP was also developed to provide planning under current and future conditions including climate change, increased population and visitation numbers, ever changing types of recreation, and major infrastructure changes since the 1993 plan. Additionally, the BAUP outlines an annual management plan as well as general improvements needed for the entire system. And most importantly, the document identifies resources needed to manage this complex and large system, including a general budget and staffing.

This BAUP serves as an update to the BAP by cataloguing the status of projects from 1993 through 2022, updating the baseline environmental conditions within the Bosque, developing and evaluating priority projects for environmental and recreational resource improvements, and presenting short- and long-term goals for OSD. It is intended as an internal management resource for the City OSD and supplements the BAP's purpose by guiding management of compatible environmental and recreational improvements that protect the Bosque as a resource while promoting sustainable community use.

1.3 OVERVIEW OF APPLICABLE PLANS

The following 10 plans were reviewed and are summarized below.

1.3.1 Rio Grande Valley State Park Management Plan

The RGVSP became a State Park as enacted by the New Mexico State legislature in 1983 with the approval of the RGVSP Act (COA, 1993). As noted above, lands within the State Park are also managed by MRGCD to meet their authority to "operate, maintain and manage irrigation, drainage, and river flood control in the Middle Rio Grande Valley; promote efficient and responsible water management; protect the environment, wildlife and endangered species in cooperation with other local, state and federal agencies; and provide multi-use recreational opportunities." Based upon the Act, MRGCD and OSD entered into a JPA for joint management and maintenance of the State Park. The RGVSP Management Plan provides guidelines for preserving, protecting, and maintaining the Bosque.

1.3.2 Bosque Action Plan

The BAP (1993) was developed to identify specific environmental and recreational improvements for the RGVSP (City of Albuquerque 1993). Projects identified were to be implemented by the City Parks and General Services Department in coordination with other City departments, MRGCD, AMAFCA, U.S. Army Corps of Engineers (USACE), U.S. Bureau of Reclamation (Reclamation), New Mexico Department of Transportation (NMDOT), and other state departments.

The BAP included four goals and supporting policies to accomplish this. Goals addressed environment and wildlife, recreation and other public uses, education, and administration. It proposed a number of projects to address the needs specific to six areas of the Bosque: North Boundary to Paseo del Norte Bridge; Paseo del Norte Bridge to I-40; I-40 to Barelas Bridge; Barelas Bridge to Rio Bravo Bridge; Rio Bravo Bridge to South Boundary; and the Paseo del Bosque Trail. The BAP also presented a strategy for phasing the projects with funding from City gross receipts taxes.

1.3.3 City of Albuquerque Comprehensive Plan

The Albuquerque/Bernalillo County Comprehensive Plan (2017) identified goals and policies relevant to management of the Bosque, including providing low-impact recreational and educational opportunities, managing sensitive lands to protect natural and cultural resources, and connecting trails to the larger multi-modal system to encourage the use of alternative types of transportation.

Policy 10.3.4 Bosque and Rio Grande:

> Carefully design access to the Rio Grande, the Bosque, and surrounding river lands to provide entry to those portions suitable for recreational, scientific, and educational purposes, while controlling access in other more sensitive areas to preserve the natural wildlife habitat and maintain essential watershed management and drainage functions.

1.3.4 Integrated Development Ordinance

The City of Albuquerque's Integrated Development Ordinance (IDO) (2021) is the zoning code that regulates all development within the City of Albuquerque, including development on, adjacent to, and within 330 feet of MPOS. The IDO ensures protections for sensitive lands, including riparian areas, as noted in Development Standards section *5-2(C) Site Design to Avoid Sensitive Lands*.

The IDO also requires that any improvement deemed an extraordinary facility on MPOS be additionally reviewed by the Open Space Advisory Board and the Environmental Planning Commission (see definition of "Extraordinary Facility").

1.3.5 MPOS Facility Plan

The MPOS Facility Plan establishes the MPOS Program with guidelines and policies for implementing the Open Space network goals developed in the Albuquerque/Bernalillo County Comprehensive Plan (1975, 1988). The MPOS network is part of a larger system of public open spaces, trails, and parks managed by federal, state, and county agencies, as well as other City departments.

The MPOS Facility Plan provides overarching and site-specific policies for planning, land-use decisions, and the acquisition and management of the MPOS network. The purpose of MPOS as defined in the Facility Plan is the conservation of natural resources and environmental features, provision of opportunities for outdoor education and recreation, shaping of the urban form, conservation of archaeological resources, provision of trail corridors, and protection of the public from natural hazards.

MPOS Facility Plan goals include the following:

- Create an inventory of existing conditions within the City MPOS network
- Encourage and promote citizen participation in determining the direction of the MPOS Program
- Identify community needs and desires related to MPOS
- Develop a strategy to meet community needs and identify necessary resources to meet those needs
- Identify management and maintenance requirements based on community needs, existing public uses, and resources

For planning purposes, , Open Space designations and their related uses within those designations, such as for restoration, recreation, and education, are listed in (Table 2).

Table 2. Open Space Designations

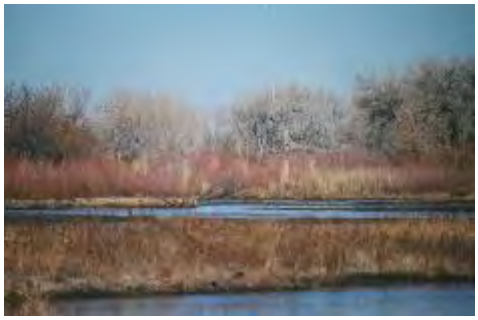
Open Space Type	Purpose
Protected, Undeveloped Open Space	Protects significant and/or unique natural areas. Opportunity for outdoor education, controlled or low impact recreation. Limited to Class I recreational facilities
Open Space Preserve	Protects highly significant and/or unique natural resources and/or features. Outdoor education is limited to scientific study or limited interpretation of resource.
Open Space Facility	Resource conservation is equal to opportunity for managed public use and appreciation of natural environment. Provides a focus for concentrated recreational use.
Open Space Trail	Trails serve to concentrate and manage public use in designated areas, reducing the impact on other land resources.
Special Use Area	Opportunity for unique facility which contributes to overall system opportunities. Opportunity for unique education and recreational facilities.

1.3.6 City of Albuquerque Climate Action Plan

The City's Climate Action Plan identifies several strategies calling for the inclusion of equitable access in the planning and prioritization process for future open space development and rehabilitation (2018). The Plan endorses development of projects aimed at improving safe trails, biking infrastructure, and ensuring that these facilities are equitably distributed to increase access to and enjoyment of open space by all residents.

1.3.7 Middle Rio Grande Conservation Action Plan

The Middle Rio Grande Conservation Action Plan (MRG-CAP) was commissioned by the MRGCD and developed by the Colorado and New Mexico Natural Heritage Programs in 2015 and is based on the dynamic patch mosaic concept for management. It is currently being updated in 2023. The MRG-CAP is a framework that identifies major conservation targets with measurable indicators of their current and desirable future conditions. It was designed to help set objective stewardship goals for the MRG ecosystem. The framework is based on the project planning process developed by The Nature Conservancy and input from a team of practitioners, managers, and scientists with regional expertise. The plan identifies the following five major conservation targets:



- Riparian and wetland vegetation communities
- Native bird habitat
- Native fish community
- Wildlife corridors
- Ditch and drain habitat

For each target, key attributes and associated indicators were defined, and the indicators were assessed for current status and goal (from very poor to very good). Nine threats were identified and assessed across the conservation targets. A risk assessment matrix is provided that can inform restoration strategies to be implemented in and among specific reaches to meet goals in collaboration with partners and stakeholders (Muldavin et al., 2019).

1.3.8 Candelaria Nature Preserve Management Plan

The Candelaria Nature Preserve Management Plan was finalized in 2019 and provides a framework for managing the 167-acre public recreation preserve under Land and Water Conservation Fund guidelines and the 1999 MPOS. The City OSD works with the New Mexico State Parks Division of Energy, Minerals and Nature Resources Department (EMNRD) on the 38.8 acres that overlap into the Rio Grande Nature Center (RGNC) State Park (SP).

This Management Plan was designed to implement habitat restoration projects for nature study and wildlife viewing. It presents a strategy for converting alfalfa production to wildlife-friendly crops and restoring native habitat throughout the farmed area, as well as initiatives for recreational activities and educational outreach. The plan aligns actions with the revised Albuquerque/Bernalillo County Comprehensive Plan (2017) goals, which are 1) to provide parks, Open Space, and recreation facilities that meet the needs of all residents and use natural resources responsibly; and 2) to protect the integrity and quality of the region's features and environmental assets and provide opportunities for outdoor recreation and education. The plan also addresses the following management issues for the preserve:

- Transitioning to serve as a nature study area and wildlife preserve that includes wet and dry areas, hedgerows, grasslands, upland shrublands, conservation buffers, and forage for wildlife
- Adaptive management and monitoring
- Public access and outdoor recreation
- Phased implementation plan and budget

1.3.9 Rio Grande Nature Center State Park Management Plan

The RGNCSP is managed by the State Parks Division through a lease with City's OSD. The RGNC includes 38 acres of property in and around the Visitor Center, which is within the 167 acres of Candelaria Farms purchased by the City in 1977. The Management Plan also includes the "100-acre wood" within the Bosque, located west of the Visitor Center on the west side of the Riverside Drain. The RGNC and Preserve were originally established in 1979 with a guiding "Master Plan." A 25-year lease agreement with the City was established in 1980.

The Management Plan was developed in 2010 as an update/addition to the Master Plan. Recommendations for Education and Interpretation, Park Resources, Management and Facilities were provided to meet the RGNCSP's mission statement: To preserve and protect the Bosque, educate the public about the Rio Grande ecosystems, and to foster positive human interactions with those systems (New Mexico State Parks 2010).

1.3.10 San Antonio Oxbow Biological Management Plan

The San Antonio Oxbow Biological Management Plan (1997) provides a summary of how the unique marsh habitat came to exist and its importance to wildlife, particularly migratory birds. The plan presents a project at the San Antonio outfall, and issues with sedimentation and erosion were addressed.

The goal of Oxbow marsh management includes maintenance and enhancement of the native marsh and wetland habitat value, biological diversity, biological productivity, and natural aesthetic beauty of the Oxbow and its surroundings. The plan presents management constraints, including land ownership, water supply, and siltation, and includes policies developed and management strategies proposed to implement the goal and policies. These goals and policies addressed:

Ondrea's Oxbow by Barbara Coleman

- Developing and maintaining an Oxbow ecological database
- Integrating Oxbow management with other Bosque management programs and plans
- Establishing an Oxbow Advisory Committee
- Securing a reliable water source and providing flow control measures
- Restricting access to the marsh and the adjacent buffer zone
- Identifying and implementing appropriate measures to maintain and increase wildlife habitat value
- Fostering environmental research and education consistent with City OSD policies
- Providing opportunities for low-impact passive recreation consistent with City OSD policies
- Assessing the potential impact of exotic vegetation on the Oxbow and implementing control measures as necessary and appropriate

Three phases were proposed for implementation of the plan, including 1) addressing land ownership and management, 2) installing habitat features, and 3) installing visitor use facilities. Management strategies included the following:

- **Baseline and on-going data gathering**
- **Access control**, both within the Oxbow marsh and within the buffer zone above the bluff
- **Water management** to include partial drawdowns, flooding, periodic high flows, and managing beaver dams
- **Vegetation management** to include manipulating water to maintain marsh vegetation, sandbar and alluvial fan vegetation, and invasive species management
- **Wildlife management** to include protecting native woody vegetation from beavers and providing nest boxes for birds
- **Erosion control** to include drainage flows, and storm water management both on-site and nearby
- **Maintenance of various project elements**
- **Developing management agreements with landowners or acquiring lands**
- **Fire management**

1.4 BOSQUE ACTION PLAN PROJECT STATUS

The BAP (1993) outlined 22 Project Areas in the Bosque and identified priority projects for each, as well as overarching priorities relevant to all locations. Reviewing the status of these projects as well as additional work implemented by both the OSD, and others aids in the planning and prioritization process for future Bosque management needs. Numerous federal, state, tribal, and municipal entities have authorities within and adjacent to this area. These entities conduct habitat restoration projects, build infrastructure, and take care of maintenance activities. Table 3 presents the status of site-specific projects. Additional restoration work is summarized in the following section.

Table 3. Status of Location-Specific BAP Projects

Project Area	Proposed (1993)	Current Status
Alameda Bridge NE	Parking, Trails, Picnic area, Signs, Planting	Parking moved to Alameda SE due to bridge construction; all other components implemented
Alameda Bridge SE	Parking, Trails, Picnic area, Signs, Planting	These items were implemented along with additional amenities such as: Americans with Disabilities Act (ADA) access, restrooms, equestrian parking, habitat improvements (Alameda Wetland)
Alameda Bridge SW	Trail, Signage, Environmental Education Area	These amenities have been implemented though the Environmental Education Area has not been formalized (a BEMP site exists).
Calabacillas Arroyo	Parking, Trails, Signs	These amenities have been implemented as well as picnic table installation, interpretive kiosk and planting.
La Orilla Road Access	Parking, Trails, Gated Access, Riverside Drain bridge	These amenities have been implemented in coordination with other landowner and agency projects (e.g., parking at the Sagebrush Church; gated access with AMAFCA), and access across the Corrales Main Canal (though not a formal bridge).
Candelaria Farms	Wildlife observation blind, interpretive signage, Ranger residence, Interpretive Center, Riverside Drain bridge	These amenities, and others, have been implemented at the Candelaria Nature Preserve (CNP) and at or in coordination with the RGNCSP.
Campbell Road Access	Sidewalk for ADA access, Trailhead, Signage	A formal access points exists though there is not separate designated ADA access.
Atrisco NW Access	Trailhead parking, Atrisco Drive access, Trails	These amenities have been implemented.
Central Bridge NW	Trailhead parking, Atrisco Drive access, Trails, Osage-LaMedia wetlands	While access exists, more formal access and other amenities being planned through the Atrisco Acequia Madre project.
Central Bridge NE	Parking, Trails, ADA access, Picnic area, Signs, Planting, Interpretive Signage, Wetland	All recreational amenities have been implemented; plantings and jetty jack removal have occurred; wetland enhancements are provided to the south along Tingley.
Central Bridge SE	Parking, Trails, ADA access, Picnic area, Signs, Planting, Interpretive Signage	All amenities have been implemented, as part of and in coordination with BioPark access and improvements
Central Bridge SW	Parking, Trails, Environmental Education Area	Parking and trails exist, and river access have been implemented. The Environmental Education (EE) area is present at Tingley and will be formalized on the NW side.

Project Area	Proposed (1993)	Current Status
Barelas Bridge NW	Trailhead, Trail, Environmental Education Area	Informal parking exists. Natural surface trails exist. A crusher fine trail was constructed for a distance from the Bridge access point. An EE area was not implemented at this site but is more evident on the SE site at the National Hispanic Cultural Center (NHCC).
Barelas Bridge NE	Parking, Trails, Picnic grounds, Bicycle Rack, ADA access, Wetlands, Interpretive Signs	A parking lot and bicycle rack were constructed at Marquez Lane. A wetland is proposed at the Barelas outfall area. ADA access does not exist (though is present on the paved trail along Tingley).
Barelas Bridge SE	Bridge connection to Paseo del Bosque (PdB) Trail, Trails, Environmental Education Area	Parking is available at the NHCC, with a bridge drain crossing to the PdB trail which exists along the east side of the drain in this area; trails exist within the Bosque. An Environmental Education Area is available at the NHCC.
Barelas Bridge SW	Parking, Trails	Informal parking and trails exist.
Rio Bravo Bridge NW	Parking, Trails, Picnic Grounds, land acquisition (Blake Road)	Informal parking and trails exist. Access is along Kelsey Road. With limited access, other amenities have not been implemented due to the proposed bridge expansion.
Rio Bravo Bridge NE	Parking, Trails, Picnic Grounds, ADA access, Boat launch	Formal parking, trails (crusher fine, ADA accessible), and picnic grounds exist. While a boat launch has not been constructed, a fishing pier has along the riverside drain.
Rio Bravo Bridge SE	Expand parking, Trails, Picnic Grounds, ADA access, Wheelchair access fishing pier, emergency launch site	Informal parking and trails exist; ADA trail and fishing pier access exist at Rio Bravo NE; emergency launch site is located at the NW site.
Rio Bravo Bridge SW	Parking, Trails, Environmental Education Area, bridge crossing to Rio Bravo State Park	Informal parking and trails exist, a drain crossing, and informal education area exist across from Harrison Middle School
Property North of I-25	On the east side of the river, acquisition of the agricultural land was proposed	This property was not purchased, but Price's Dairy was – resulting in Valle de Oro National Wildlife Refuge
Paseo del Bosque Trail		All PdB corridors were constructed: From Alameda to RGNC on the levee; from RGNC south to South Diversion Channel (SDC) along the east side of the Riverside Drain

1.5 ADDITIONAL RESTORATION EFFORTS IMPLEMENTED SINCE THE BAP ADOPTION

Habitat restoration work by other entities, such as treatment of non-native species, has been ongoing in the MRG since at least the mid-1980s. Several of these agency projects intersect with the OSD's projects listed in Table 3, as well as the updated priorities described in this BAUP. New Mexico Interstate Stream Commission (NMISC), USACE, MRGCD, Reclamation, Albuquerque Bernalillo County Water Utility Authority (ABCWUA), U.S. Fish and Wildlife Service (USFWS), and New Mexico State Land Office (NMSLO) have implemented restoration projects within the Bosque. From 2005 to 2016, many of these agencies, including the City, have contributed to work in the river and the Bosque from the Corrales

Bosque Preserve and the Pueblo of Sandia's Bosque on the north down to the Pueblo of Isleta, as well as north and south beyond Albuquerque.

Middle Rio Grande Endangered Species Collaborative Program

A large number of projects were completed with Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) support and in collaboration with federal and state agencies such as NMISC, especially roughly from 2000 to 2010. The MRGESCP is composed of a partnership of 16 federal, state, tribal, municipal, and non-governmental organizations working toward the recovery of threatened and endangered species within the MRG. The MRGESCP supports programs and projects to protect and/or benefit in this reach of the river the following listed species: the Southwestern willow flycatcher *(Empidonax traillii extimus;* flycatcher), Rio Grande silvery minnow (*Hybognathus amarus;* silvery minnow), and two additional species that were added to the MRGESCP in 2021: Yellow-billed cuckoo (*Coccyzus americanus*; cuckoo) and New Mexico meadow jumping mouse (*Zapus hudsonius luteus*). At the time that these restoration projects were implemented, potential habitat for species was part of the focus. The MRGESCP is currently approaching restoration projects with a larger ecosystem approach. This management approach matches the current approach by COA OSD as noted in this BAUP document.

USACE Bosque Restoration Projects

The USACE, in coordination with City OSD and MRGCD, constructed a number of habitat restoration projects in the Albuquerque Reach from 2005 to 2019 including Albuquerque Biological Park Habitat Restoration Project, Bosque Wildfire Project, Ecosystem Restoration @ RT66, and the MRG Restoration Project, totaling over 1500 acres of restoration work in the Project Area.

Under the Bosque Wildfire Project, USACE led the development of the All-Hazards Bosque Runbook, which was finished after over 300 acres of the Albuquerque Bosque burned in 2003 and 2004. The Runbook identified existing hazards, such as jetty jack locations blocking Bosque access and information about other Bosque features, pertinent to fire-related activity. In addition, the Runbooks were used as a method of public outreach and education about the MRG's listed species and their habitat requirements.

Other Stakeholder Projects

Several other state and federal agency partners have contributed to other efforts in the Bosque. Figure 2 provides an overview of those projects that have been completed since approximately 2000. A more detailed map book is provided in Appendix A, Habitat Restoration Projects.

In addition, potential future projects within the Project Area include the *Middle Rio Grande Flood Protection Bernalillo to Belen* project of which a portion within the Bosque from Mountain View Road south to the Isleta Pueblo on the east side of the river (USACE 2017) is proposed. The Albuquerque Levees have also been evaluated by USACE in the recent past and have the potential to be explored further for rehabilitation needs.

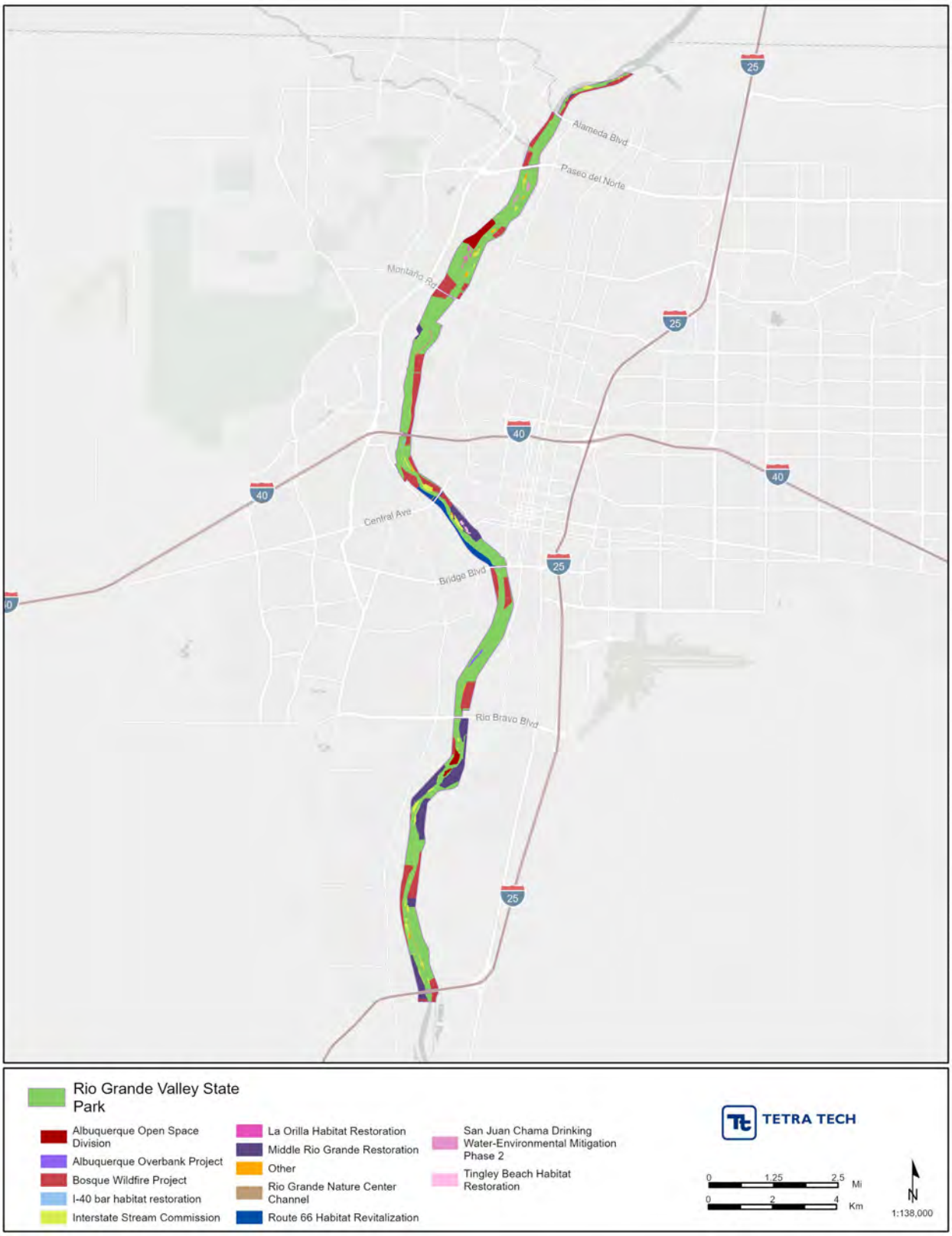


Figure 2. Projects completed in the Bosque and adjacent to MPOS in the past 20 years

Exotic species control was proposed and is ongoing at all locations throughout the Bosque. Additional information can be found in Section 4 regarding these projects, as well as Operations & Maintenance in Section 5.

2.0 RESOURCE CONDITIONS – HISTORIC, RECENT PAST AND CURRENT

This section includes an overview of resources and changes since the adoption of the BAP.

BAP Policies affiliated with this section:

- Policy 3: The Rio Grande Valley State Park shall be managed to preserve and enhance its ecological diversity.
- Policy 6: All submittals for development located in the RGVSP shall include completed extraordinary facilities form to be submitted to the Open Space Advisory Board for their action.
- Policy 7: Any disturbance within the Rio Grande Valley State Park not approved by Open Space Division shall be mitigated by the party responsible for the disturbance.
- Policy 8: Improvements shall be located in non-sensitive areas that are appropriate for such development, considering the ecological sensitivity as well as the user satisfaction.
- Policy 20: Construction methods and materials used shall be compatible with the preservation of the natural character of the Rio Grande Valley State Park.
- Policy 21: Construction methods and materials used shall preserve the cultural character of the park.
- Policy 23: The principal use of the area within the Rio Grande levee roads shall be recognized for conveyance of water for beneficial uses and as a floodway and storm water outlet.

2.1 WATER RESOURCES MANAGEMENT AND INFRASTRUCTURE

Infrastructure in the Project Area includes a number of water resource, transportation, utility, and other facilities. This infrastructure influences water supply and availability, protects property, provides municipal services and urban connections, and offers recreational access and habitat for wildlife. Whether within or near the Project Area, this infrastructure impacts the OSD's operations and maintenance and influences the planning and implementation of projects. The OSD engages with its federal, state, and local partners frequently to ensure that Open Space project planning is compatible with and adaptable to changes in infrastructure operations as well as new development.

Water management infrastructure in the area includes flood control levees, riverside drains, stormwater facilities, the ABCWUA Drinking Water Project (DWP), and the City's Wastewater Treatment Plant (WWTP) (Figure 3). This infrastructure influences water supply, impacts flow alignment, protects property, and provides recreational access and habitat for wildlife. The existing infrastructure needs to be considered in restoration plans as it affects surface and groundwater movement at the site, restoration site access, and plant community recommendations.

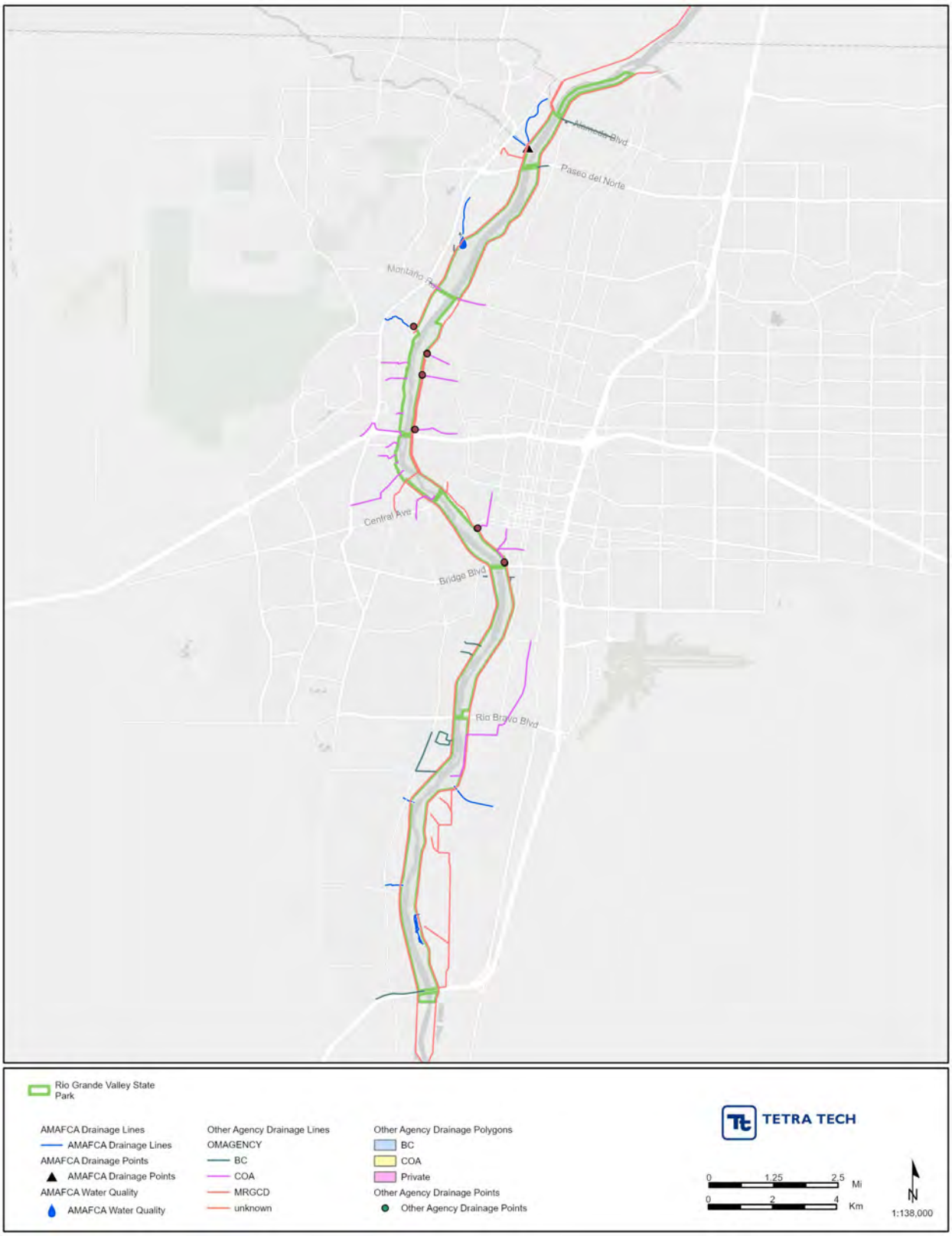


Figure 3. Water Infrastructure Facilities in the Project Area

2.1.1 Water Resources Infrastructure

The channel over the last several hundred years has moved across or flooded in its entirety what is now the 500-year flood zone. Flooding increased in frequency and magnitude due to changes in watershed runoff characteristics (Scurlock 1998). Changes in channel alignment and rapid bank erosion occurred during flood stage because of the aggraded channel and lack of riparian vegetation, which rendered stream banks susceptible to accelerated rates of erosion (Scurlock 1998).

Flood control projects, such as levees, dams, riverside drains, and jetty jacks, altered historical annual peak discharges, and resulting changes in channel morphology affecting Bosque and riverine habitat. These features are constructed and maintained by a variety of agencies including AMAFCA, ABCWUA, DMD, and MRGCD. The change in infrastructure since 1900 is illustrated below.

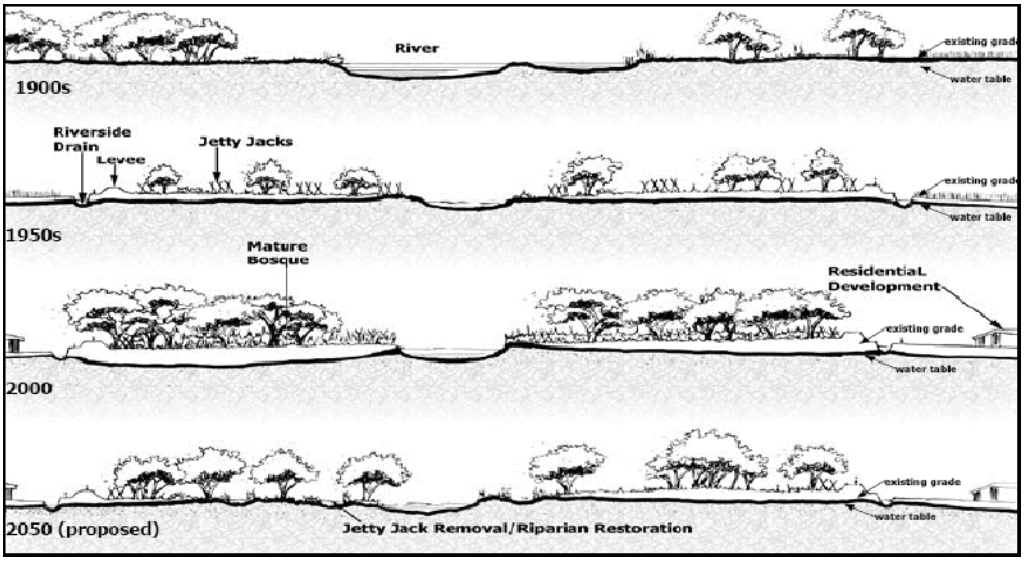


Figure 4. Flood protection projects (USACE 2003a)

Water resource-related infrastructure includes jetty jacks, flood control levees, riverside drains, stormwater facilities, water treatment facilities, and the DWP (see Figures 3, 4, and 5). Water is a critical component to the health of the Bosque ecosystem. Habitat restoration projects are impacted by water resource facility operations as vegetation communities and wildlife populations in the riparian forest rely on the availability of both surface and ground water. Operation of these facilities also impacts project priorities as some offer recreational opportunities, and some of them affect water availability and river access.

Approximately 30,000 jetty jacks were deployed (Figure 6) in the Albuquerque Reach within the Bosque for bank stabilization and to reduce flooding. Within various restoration projects, approximately 10,000 jetty jacks have been removed. Jetty jacks reduce water flow velocity which causes suspended sediment to settle-out of the water column resulting in deposition (see Figure 5). This results in a well-defined river channel, raises the floodplain, increases the river channel capacity, reduces river meandering, and disconnects the river from the floodplain. Over time, as the depositional process continues, the vegetation armors the bankline and thus provides the same role as the jetty jacks. Since the construction of Cochiti Dam in the 1970s, sediment loads have dropped in the Rio Grande by up to 70

percent. The decrease in the Rio Grande's sediment load, combined with the armoring of the bankline by the vegetation has greatly reduced the usefulness of jetty jacks. Additionally, these structures are hazardous to first responders during wildfires and make it difficult to maintain vegetation, including the removal of invasive and non-native species. Removing jetty jacks from the floodplain would alleviate these issues and allow for more natural floodplain processes and natural recruitment and establishment of native riparian vegetation.

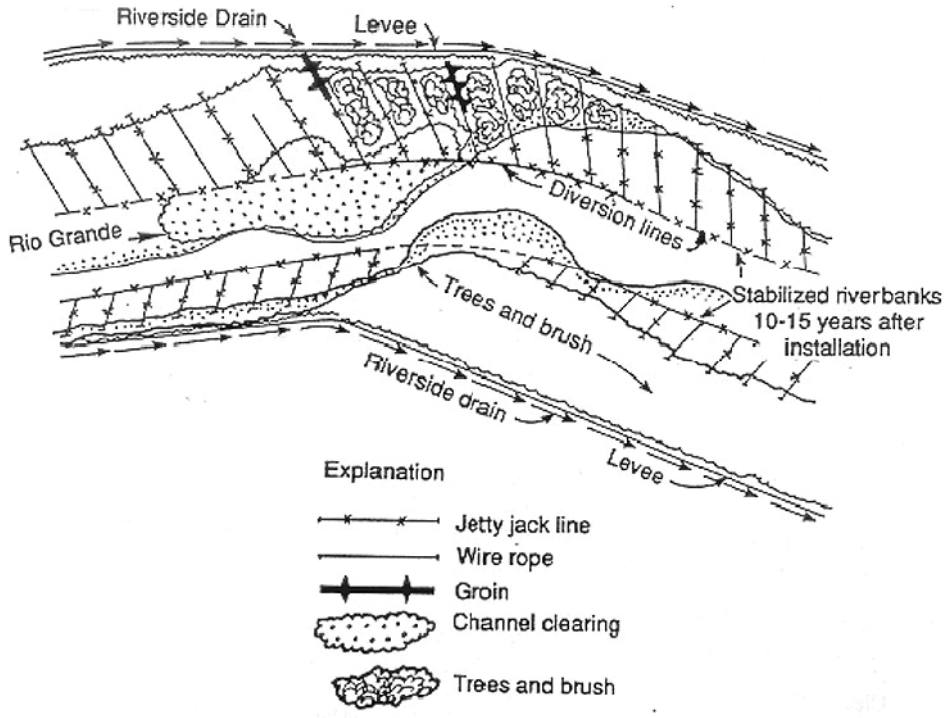


Figure 5. Jetty Jack alterations in the MRG Channel and Bosque

Levees and irrigation drains within the Project Area are over 60 years old and were engineered to meet the needs of their time: water delivery and flood control. While modifications have been necessary to accommodate changing environmental conditions and an increasing population, some remaining structures continue to pose a threat to the riverine and Bosque ecosystem, resulting in a narrower and deeper river channel, sedimentation issues, decreased overbank flooding, and reduced groundwater levels.

Irrigation drains and water treatment facilities in the Albuquerque area divert water from the river for agricultural and municipal use, thereby decreasing floodplain and groundwater connectivity. While this influences the composition of the Bosque ecosystem and reduces recreational use of the river, the irrigation ditches do offer opportunities for recreation.

Stormwater facilities protect property and funnel stormwater runoff to the Rio Grande. Many stormwater facilities are concrete-lined, creating fast-moving water and a disconnect between surface water and groundwater. City DMD and AMAFCA maintain these facilities to deal with sediment and debris issues.

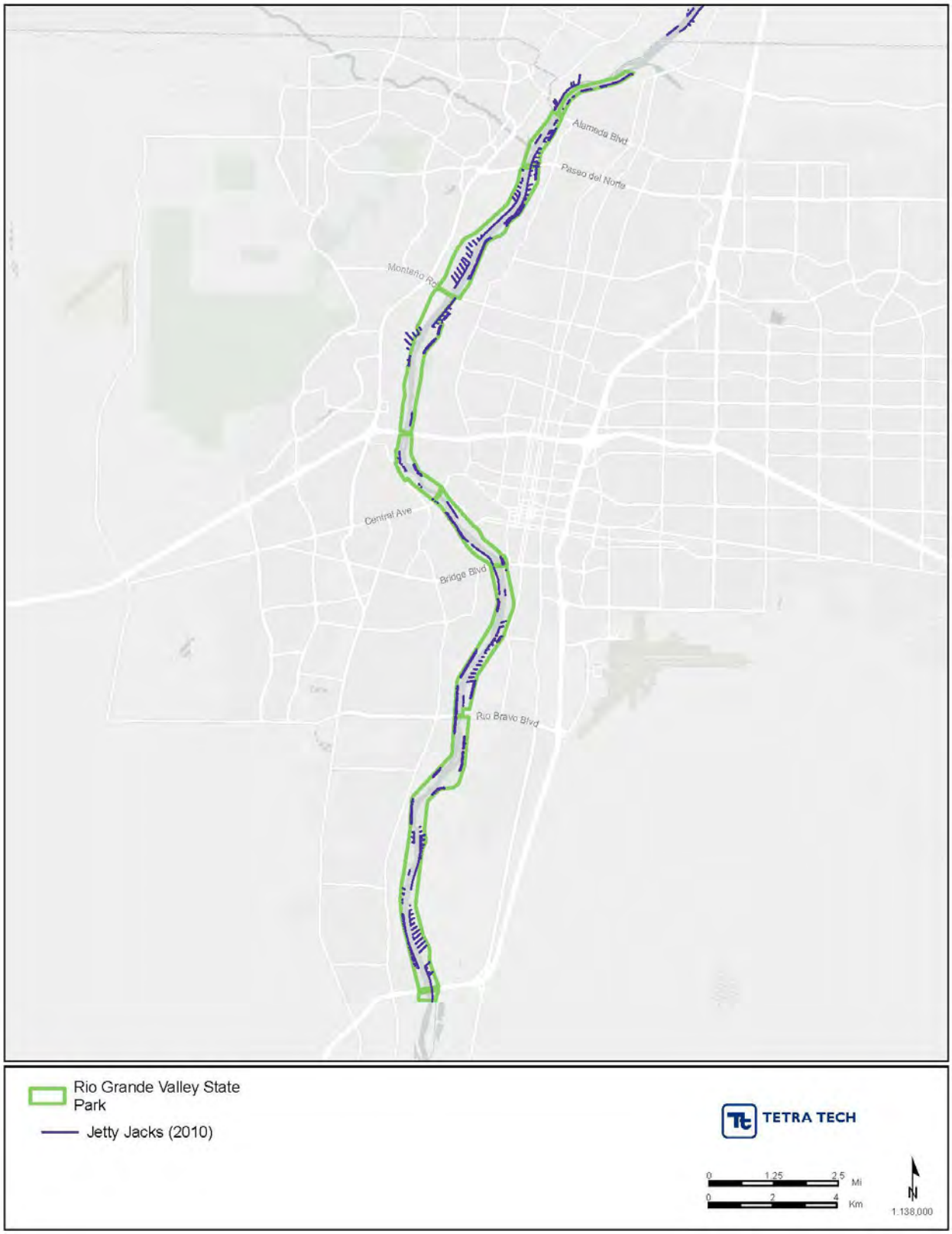


Figure 6. Jetty Jacks within the Albuquerque Reach Bosque

The combined effects of flow management, engineering interventions, and various anthropogenic modifications to the land have dramatically altered the quantities, distribution, and quality of vegetation communities in the MRG. Additionally, the pattern and distribution of existing riparian vegetation communities are a result of floodplain and site-specific variability related to soils, landform position, and shallow groundwater conditions (Finch et al. 1995).

Alteration of the Rio Grande hydrology has caused a decline in vegetation and wildlife species. Several species, including the minnow, flycatcher, cuckoo, and the New Mexico meadow jumping mouse, which were once abundant in the Albuquerque Reach are now listed as threatened or endangered.

2.1.2 Other Community Infrastructure

Ongoing development of new and maintenance of old transportation facilities (e.g., roads and bridges) and existing utility infrastructure (such as electric lines) (Figure 7) influence OSD's management decisions and project priorities. Continued urban growth near the Bosque leads to the need for continuous updates to existing infrastructure and development of new infrastructure. Some of these structures occur within and adjacent to the Bosque areas managed by the City OSD and the MRGCD.

Central Outfall Wasteway

Additional municipal infrastructure includes parks and other Open Space facilities throughout the City. The City's Comprehensive Plan and the Climate Action Plan contend that connections and access among these facilities be prioritized.

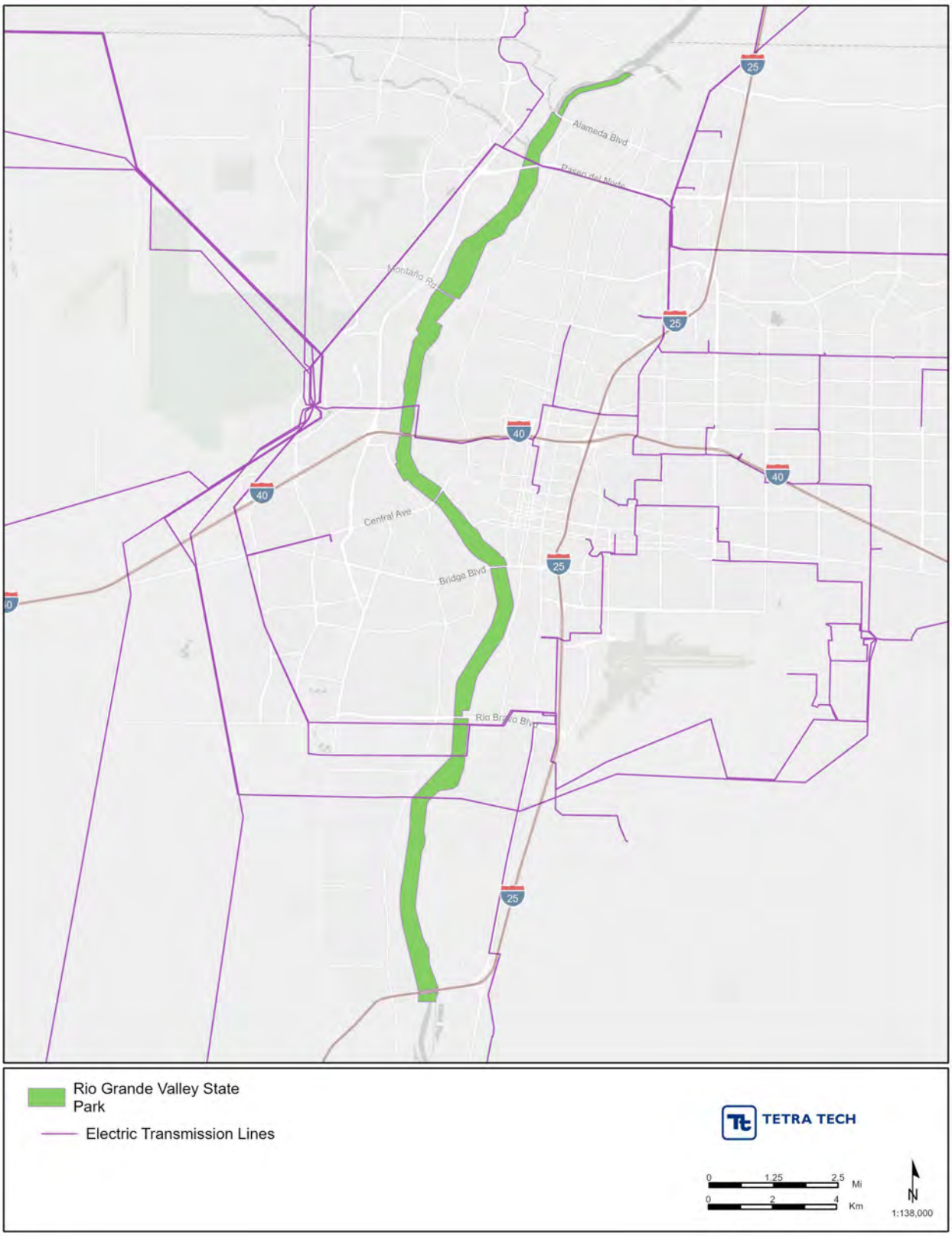


Figure 7. Utility Infrastructure

2.1.3 Hydrology and Water Management

2.1.3.1 Introduction

River channel dynamics include the hydrology, geomorphology, and hydraulic characteristics of the Rio Grande in the Albuquerque reach. Since the 1800s, land use, especially in the form of urbanization, and population growth drove many changes in the hydrology and geomorphology of the Rio Grande, as described above.

Flow regulation alone substantially impacts the hydrology of the Rio Grande. In the Albuquerque reach, flows are regulated by the Cochiti dam. A comparison of flood frequency analyses pre- and post-Cochiti through 2000 at the USGS Rio Grande at Albuquerque gage (Gage No. 08330000) shows a decrease in flood event magnitudes ranging from 30 to 70 percent (MEI 2002).

Hydrologic changes drive geomorphic and channel hydraulic changes. But flood protection and channel stabilization measures, including levees, jetty jacks, bendway weirs, and bank armoring also contribute to geomorphic and hydraulic changes. These combined factors have contributed channel narrowing, straightening, bed material coarsening, and bed incision since the 1930s.

These big picture changes and other localized changes have been well documented in the Albuquerque reach. The long-term changes have set the stage for more recent changes over the last 20 years, which will be discussed here. The hydrologic, geomorphic, and hydraulic changes since 2000 will be discussed. These changes will be compared to changes prior to 2000 as reported by several studies. In addition, hydrologic, hydraulic, and sediment transport model development in the reach will be discussed in terms of how these tools were used to identify viable restoration sites and to inform decisions about restoration projects.

2.1.3.2 Hydrology 2000-2020

Mussetter Engineering Inc (MEI) (2002) obtained flood-frequency curves using a log Pearson Type III distribution for the Albuquerque Rio Grande at Albuquerque gage (Gage No. 08330000) from 1942 to 1999. Their results, shown in Table 3, are differentiated based on the pre-Cochiti period (1942 to 1973) and the post-Cochiti period (after 1973). Using the same method, the analysis was extended to include peak flow data from 2000 to 2020 (see Table 4). The peak flows in the post-Cochiti period decreased with the inclusion of peak flow data from 2000 to 2020. The analysis was also performed for only 2000 to 2020 to illustrate the substantial decrease in peak flood flow magnitude in the last 20 years compared to both the pre- and post-Cochiti periods.

Table 4. Peak Flow Hydrology (cubic feet per second (cfs)), adapted from MEI 2002

	Return Period (years)					
	2	**5**	**10**	**20**	**50**	**100**
1942-1973 (Pre-Cochiti)	7090	10800	13400	16000	19500	22200
1973 to 1999	5410	7600	8940	10100	11600	12600
1973 to 2020	4923	6654	7746	NC	10020	10950
2000 to 2020	*3781*	*5136*	*6021*	*NC*	*7847*	*8582*

NC = not calculated – calculations were performed using PeakFQ and the 20-year return period was not included in that estimate

It is unclear what role drought may have on the decrease in peak flood flow magnitudes compared to other factors such as changes to water use or land use practices. The hydrologic changes occurred with the re-opening of the Jemez Canyon Dam, which was intended to reintroduce flow and sediment from one of the Rio Grande's largest tributaries, and the ABCWUA diversion, which began diverting water in 2009 for the San Juan Chama project. What is clear is that the magnitude of each flood event continued to decrease over the last 20 years, which alone would cause a reduction in floodplain inundation and geomorphic changes to the river compared to historical observations (see Table 5).

Table 5. Peak Streamflow at Rio Grande at Albuquerque (USGS 08330000) 1993-2021

Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1993	1993-06-07	6.49	7,210
1994	1994-05-11	6.65	7,050
1995	1995-05-25	6.35	6,570
1996	1996-06-27	4.48	2,690
1997	1997-06-08	6.21	6,270
1998	1998-05-09	5.32	4,060
1999	1999-05-28	5.79	4,920
2000	2000-08-20	3.92	2,040
2001	2001-05-22	5.83	4,970
2002	2002-09-10	3.94	1,770
2003	2003-03-21	4.04	1,880
2004	2004-04-03	5.14	3,590
2005	2005-06-03	6.51	6,780
2006	2006-07-09	5.42	4,030
2007	2007-05-21	5.32	3,810
2008	2008-05-25	6.31	5,400
2009	2009-04-14	5.91	4,940
2010	2010-05-22	6.17	5,140
2011	2010-12-17	4.71	2,710
2012	2012-08-17	4.91	2,510
2013	2013-09-13	5.74	4,350
2014	2014-08-02	5.50	3,770
2015	2015-05-27	5.54	3,070
2016	2016-06-07	5.96	3,950
2017	2017-05-10	6.59	5,660
2019	2019-06-18	6.73	5,720
2020	2019-22-21	4.86	2,630
2021	2021-05-31	4.81	2,250

(USGS 08330000 Rio Grande at Albuquerque, NM surface-water: peak streamflow)

2.1.3.3 Geomorphology 2000-2020

The geomorphic changes in the Albuquerque reach over the last 20 years are driven by the hydrologic changes discussed in the previous section, as well as other historical activities including dredging and channel stabilization (levee construction and jetty jack installation). Decreases in sediment supply from flow regulation alone would result in channel narrowing, and combined with channel stabilization, the overall geomorphic response of the channel was narrowing an incision, which includes a narrower top width and less floodplain inundation. To address some of these issues, USACE re-opened Jemez Canyon Dam in 2001 to allow more flow and more sediment into the Rio Grande.

Geomorphic Parameters: Planform, Width, Slope, Bed Elevation

Historically, prior to the 1800s, the Rio Grande was an aggrading system with a relatively wide, braided channel. Since then, it transitioned to a mostly single thread channel and continues to adjust to continuous and fluctuating anthropogenic forces. However, the degree of transition still varies from upstream to downstream in the Albuquerque reach. Downstream of Montaño, the river is relatively wide with more islands and braided, mobile sand bars. Planform trends in the last 20 years are that sand bars deposit on one bank creating a narrower channel that tends to flow on the other bank (USBR, 2018). The planform change is caused, in part, by increased presence of vegetated islands and bars which force flow into a distinct channel (USBR 2013). Observations from 1996 to 2018 are that bars deposit in the area between islands and banks, which pushes flow into one side (except when flows are high), effectively narrowing the river. However, from Montaño downstream, sand bars are still more mobile, and the channel is wider than north of Montaño (USBR 2018).

The active channel width continued to decrease from 2000 to 2018 (Table 6). The active channel is defined as the area of the channel that remains dynamic (i.e., includes mobile bars, but not vegetated islands).

Table 6. Channel Width (Values Combined from MEI 2002 and USBR 2018)

Year	1918	1972	1992	2001	2011	2014	2018
Width (feet)	1338	577	519	506	465	349	267

Sediment

In general, bed material coarsened because of incision, narrowing, and reduction in upstream sediment supply. The upstream parts of the Albuquerque reach are more gravel-cobble dominant than sand, and that trend is propagating downstream (USBR 2018). Ortiz (2004) estimated that the transition from sand to gravel-cobble is propagating at approximately one mile per year in the downstream direction. Tetra Tech (2019a) showed that as of 2016, the downstream most extent of the coarsening was near Corrales, New Mexico, and sediment sampling indicated the coarsening reversed between 2012 and 2016, showing a fining of bed material.

Historically, suspended sediment concentration (measured as daily averages of suspended sediment in tons/day and discharge in cfs) increased during higher magnitude flows, but since the completion of Cochiti Dam, suspended sediment did not increase in high water years. This indicates a sediment limited reach. The suspended sediment concentration is consistent throughout the year, but the highest suspended sediment concentrations tend to occur during summer monsoons between July and

September (USBR 2018). The average suspended sediment concentration decreased by an order of magnitude after closure of Cochiti Dam in the 1970s (Table 7) (USBR 2018). It increased from 1976 to 1990, and then decreased slightly from 2006 to 2014.

Table 7. Average Suspended Sediment Concentration 1955 to 2014 (from USBR 2018)

	1955-1975	1976-1990	1991-2005	2006-2014
Average concentration (mg/L)	3377	499	831	760

Future Geomorphic Predictions

Future geomorphic trends include bed incision, continued bed material coarsening, increased meandering, and decreased slope (USBR 2018). These future trends were predicted by the Schumm (1977) and Massong et al. (2010) models, and the processes are described by Reclamation (2018) as follows:

> *As the peak discharge decreases, so will the channel width. As vegetation encroaches on the narrowing channel and on sand bars, average channel depth will increase, indicating incision. The incised channel will support increased bend migration, as the incised conditions and more concentrated flows will undermine the roots of surrounding vegetation. Given this process, the encroaching vegetation may not necessarily stabilize the banks in place. The lateral migration will also be exacerbated by the trends of river bed coarsening, as the sediment starved reach will uptake sediment from the river banks if the bed material is too coarse. The reach will experience decreasing slope as sinuosity increases. The sinuosity (channel length: valley length) is affected by changes in belt width and meander wavelengths, which affects the river length.*

Trends indicate that lateral migration may threaten current floodplain habitat as bend curvatures increase and the bed incises. Typically, however, new floodplain habitat forms where deposition occurs across from migrating bends on point bars (USBR 2018).

2.1.4 Models – Hydrologic, Hydraulic, Sediment Transport, Upper Rio Grande Water Operations Model

The Albuquerque Reach is included in several hydrologic, hydraulic, and sediment transport models. Some of these models are used to inform the design of restoration projects and others were developed to predict, more broadly, the hydraulic parameters and sediment transport outcomes that could result from different hydrologic conditions, including the removal of dams (Tetra Tech 2019b). The models provide hydraulic parameters including channel capacity, flow area, velocity, slope, depth, width, and predicted water surface elevations and extents, as well as sediment transport outcomes such as aggradational or degradational reaches. This information can be used to identify potential restoration areas and to help inform decisions about restoration projects, such as what design will best reduce erosion.

By modeling hydrologic scenarios such as average, wet, and dry years (USBR 2018), hydraulic and sediment transport models can be used to predict locations where bank erosion is likely to lead to loss of endangered species habitat or where aggradation may increase floodplain connectivity and potential

habitat area. In these ways, hydraulic modeling is a valuable tool to assess the potential for areas to gain or lose habitat based on the most likely hydrologic conditions or a range of hydrologic conditions.

Most recently, in the Albuquerque reach, hydraulic models indicated that between 2004 and 2017 channel top width decreased, hydraulic depth increased, width to depth ratio decreased, energy grade slope increased, wetted perimeter decreased, flow area decreased, and channel velocity increased (USBR 2018). Additionally, Reclamation observed that incisional reaches had decreases in top width, increases in hydraulic depth, and increased velocity (USBR, 2018). While aggradational reaches had minor changes in top width, decreased in hydraulic depth, but still increased in velocity from 2004 to 2017 (USBR 2018).

High flow inundation south of Central on the west side in the Ecosystem Restoration @ RT66 Project, 2010

Other modeling tools include the Upper Rio Grande Water Operations Model (URGWOM). URGWOM was developed to provide a reliable tool to account for the complex water supply and demand in the Rio Grande and reliably forecast the hydrology for water managers (URGWOM Technical Team 2020). Water uses include flood control, irrigation, Native American water rights, Endangered Species Act compliance, municipal and industrial uses, recreational uses, transmountain diversions, and the Rio Grande Compact (URGWOM Technical Team 2020). URGWOM is useful for environmental and impact assessments that may be necessary for certain restoration projects.

Existing Data

The following data is available for the Albuquerque reach to perform more in-depth analyses as needed:

- Cross sections
- Thalweg profiles
- Bed material, bed load, suspended sampling
- LiDAR
- Aerial photography
- Hydraulic models
- Sediment transport models
- URGWOM modelling

Based upon this information, OSD management considerations for this area are as follows:

OSD Management Considerations Related to Infrastructure and Hydrology

- Work with Reclamation, USACE, and the Albuquerque Fire Rescue to further assess and remove Jetty Jacks throughout the Bosque.
- Continue to maintain swales and construct new swales when feasible to better access a lower groundwater table and provide a higher chance of survival for cottonwood and willow plantings.
- Maintain vegetation along bridges and other infrastructure within the OSD's jurisdiction.
- Work with the City's Department of Municipal Development and Bernalillo County Public Works to assess and improve storm drain outfalls.

2.2 ECOLOGICAL RESOURCES

Establishing current baseline environmental conditions within the Project Area provides a basis for comparison with historical conditions. This effort allows an evaluation of changes since the 1993 BAP was written, which aids in planning for future projects as outlined in this framework. This section analyzes current conditions with regard to ecological resources.

The following BAP policies are specific to ecological resources throughout the Bosque:

- Policy 1: Land use decisions shall be compatible with the ecological opportunities and constraint characteristics of the identified biophysical land units.
- Policy 2: Comprehensive programs shall be established for monitoring environmental ecological systems.
- Policy 3: The Rio Grande Valley State Park shall be managed to preserve and enhance its ecological diversity.
- Policy 4: Regeneration of cottonwood trees shall be emphasized to perpetuate their existence.
- Policy 5: Habitat for rare and endangered plant and animal species shall be protected.
- Policy 7: Any disturbance within the Rio Grande Valley State Park not approved by the Open Space Division shall be mitigated by the party responsible for the disturbance.
- Policy 8: Improvement shall be located in non-sensitive areas that are appropriate for such developments, considering ecological sensitivity as well as user satisfaction.
- Policy 25: Fire suppression shall utilize wildland fire techniques that minimize the impacts of fire suppression in the RGVSP ecosystem wherever possible.

2.2.1 Soils

The properties of various soil types can affect recreational uses, vegetation types, and construction capabilities. Project planning includes soil analysis to evaluate project-specific needs and challenges. This section describes the dominant soil types present within the Project Area as well as soil quality within the Project Area, and how soil quality affects management.

2.2.1.1 Data Sources

- Results of Soil Sampling along the MRG, 2006 Report (Reclamation 2007)
- Natural Resources Conservation Service (NRCS) Web Soil Survey Online Map Viewer (2021)
- Bosque Wildfire and MRG Restoration USACE project data (2003 and 2016)

2.2.1.2 Existing Conditions

Soils within the Project Area are comprised of 15 diverse types that are dominated by a range of poorly drained to well-drained soils with depths greater than 80 inches. The two most dominant soil types are Torrifluvient and Vinton and Brazito (NRCS 2021). All soil types found within the Project Area are listed in Table 8.

Torrifluvients are derived from alluvium generated from igneous and sedimentary rock. This soil type covers approximately 2,250 acres within the Project Area and is characterized by well-drained sandy loam soils (found in floodplain areas with frequent flooding). Vinton and Brazito soils are composed of weathered igneous and sedimentary rock and cover approximately 1,773 acres within the Project Area. This fine loamy sand soil type is also found within floodplain areas that receive occasional flooding. Neither soil type is classified as Prime and Unique Farmland (NRCS 2021).

Table 8. Soil Types Found Within the Project Area

Soil Type	Parent Material	Drainage Class	Flooding Frequency	Acreage in Project Area
Torrifluvents, frequently flooded	Alluvium from igneous and sedimentary rock	Somewhat poorly drained	Occasional	2,250
Vinton and Brazito Soils, occasionally flooded	Recent alluvium from igneous and sedimentary rock	Well drained	Occasional	1,773
Bluepoint-kokan association, hilly	Sandy Alluvium or Eolian Sands	Somewhat excessively drained	None	36.9
Brazito Fine Sandy Loam MLRA 42	Residuum weathered from igneous and sedimentary rock	Poorly drained	None	2.8
Brazito Silty Clay Loam MLRA 42	Residuum weathered from igneous and sedimentary rock	Well drained	None	7
Brazito Complex	Residuum weathered from igneous and sedimentary rock	Well drained	None	3.8
Gila Loam, 0 to 1 percent slopes MLRA 42-1	Coarse loamy alluvium from igneous, metamorphic and sedimentary rock	Well drained	None	<1
Gila Clay Loam MLRA 42	Alluvium from igneous and sedimentary rock	Well drained	None	<1
Gila Complex, Moderately Alkali	Alluvium from igneous and sedimentary rock	Well drained	None	2.8
Glendale Clay Loam, 0 to 1 percent slopes MLRA 42.1	Alluvium from igneous and sedimentary rock	Well drained	None	<1
Vinton Loamy Sand	Recent alluvium from igneous and sedimentary rock	Well drained	None	<1
Vinton Sandy Loam, 0 to 1 percent slopes	Recent alluvium from igneous and sedimentary rock	Somewhat excessively drained	None	2.6

Soil Type	Parent Material	Drainage Class	Flooding Frequency	Acreage in Project Area
Agua Loam MLRA 42	Recent alluvium from igneous and sedimentary rock	Well drained	None	4.3
Anapra Silt Loam MLRA 42	Recent alluvium from igneous and sedimentary rock	Well drained	None	<1
Bluepoint Loamy Fine Sand, 1 to 9 percent slopes	Alluvium or eolian deposits	Somewhat excessively drained	None	<1

Soil salinity varies widely across the Project Area, ranging from levels of one milli-Siemen per meter (mS/m) in the surface and subsurface profiles of the Montaño Southeast, Rio Bravo Southeast and Bridge Southeast Project Areas to 199 mS/m in the upper profile and 232 mS/m in the lower profile at the Interstate 25 East Project Area (Caplan and McKenna 2005a, Caplan and McKenna 2005b, Caplan and McKenna 2005c, Parametrix 2005b). Average salinity ranges from 15 mS/m in the surface profile and 14 mS/m in the Montaño Southeast site to 62.43 mS/m in the surface profile and 62.23 mS/m in the lower profile of the Interstate 25 East Site (Parametrix 2005b, Caplan and McKenna 2005a). See Table 9 for average salinity levels across the seven project sites in the Bosque.

Table 9. Average Soil Salinity in Project Sites Located Within the Bosque and Adjacent MPOS

Project Area	Average Surface Soil Salinity (mS/m)	Average Subsurface Soil Salinity (mS/m)
Rio Bravo Southwest Burn Area	39.17	36.28
Montaño Southeast Burn Area	15	14
Montaño West Burn Area	47.57	51.09
Interstate 40 East Burn Area	40.54	39.24
Interstate 25 Fuels Reduction Area	62.43	62.23
Rio Bravo Southeast Burn Area	24.82	23.54
Bridge Southeast Burn Area	27.92	25.88

2.2.1.3 Soil Quality in the Project Area

When combined with the groundwater trends discussed in Section 2.3.6, soil texture and salinity are not limiting factors for revegetation of sites regarding habitat restoration projects. Although there are many small areas in each former Project Area that exceeded the cottonwood pole's salinity stress tolerance of 80 mS/m, average soil salinity throughout the sites is much lower and should not be a limiting factor for native plant revegetation (Caplan and McKenna 2005c).

As noted in the discussion of Goals (Section 3.1.1), erosion is an issue throughout the Bosque. There are two main types of *erosion* issues:

a) erosion along bluff areas on the west side of the river where stormwater flows from adjacent neighborhoods and roads hit the high bluff areas, especially along Namaste Road at the San Antonio Oxbow, and at Pat Baca Open Space along Atrisco Drive.

b) erosion along natural surface trails also occurs from stormwater flow events as well as general use and overuse of the trail system.

Addressing erosion issues within these Project Areas is a priority.

2.2.2 Fire History

Since 1996, several fires have burned approximately 799 acres in the Bosque (Figure 8 and Table 10). The two largest fires both occurred in 2003: the Atrisco Fire started on June 24 near the Interstate 40 (I-40) bridge, burning approximately 150 acres, and the Montaño Fire started two days later on June 26 near the Montaño Bridge, burning approximately 113 acres. Combined, the two fires burned approximately 263 acres within the Bosque. This spurred the USACE to become involved in the restoration of burned areas and other work required to prevent future fires (USACE 2004a). Following the fires, the City of Albuquerque removed the invasive species understories throughout the Bosque. This eliminated most understory canopies within the Albuquerque reach of the MRG, which eliminated substantial amounts of bird habitat. As a result, it created a need for new revegetation work to replace bird habitat and additional invasive species treatments.

Table 10. List of fires that have occurred in the Bosque since 1996

Fire Name	Year of Occurrence	Acres Burned
Tingley	1996	98
Baxmac	1998	5
Poco Loco	2002	6
Montaño	2003	113
Atrisco	2003	352
Lavega	2003	0.1
Brown Burn	2004	63
Tree House	2005	1
Squirrel	2005	0.1
Barcelona	2006	0.2
South Valley	2006	95
Marcelino	2006	2.9
Rio Grande	2008	0.5
Louise	2008	5
Marcelino	2008	5.2
Sage	2010	5.3
Riverside	2012	4
Poco Loco	2013	2.9
Paseo Fire	2013	2.09
mm 4.5 Fire	2016	0.25
Alameda Fire	2017	2.7
Goff Fire	2018	0.5
I-40	2018	3

Fire Name	Year of Occurrence	Acres Burned
Durand	2020	0.5
Shelly	2020	0.1
Rio Bosque	2021	0.25
Stadium	2021	0
Valley High	2021	0.1
Montaño	2022	30
Total		798.69

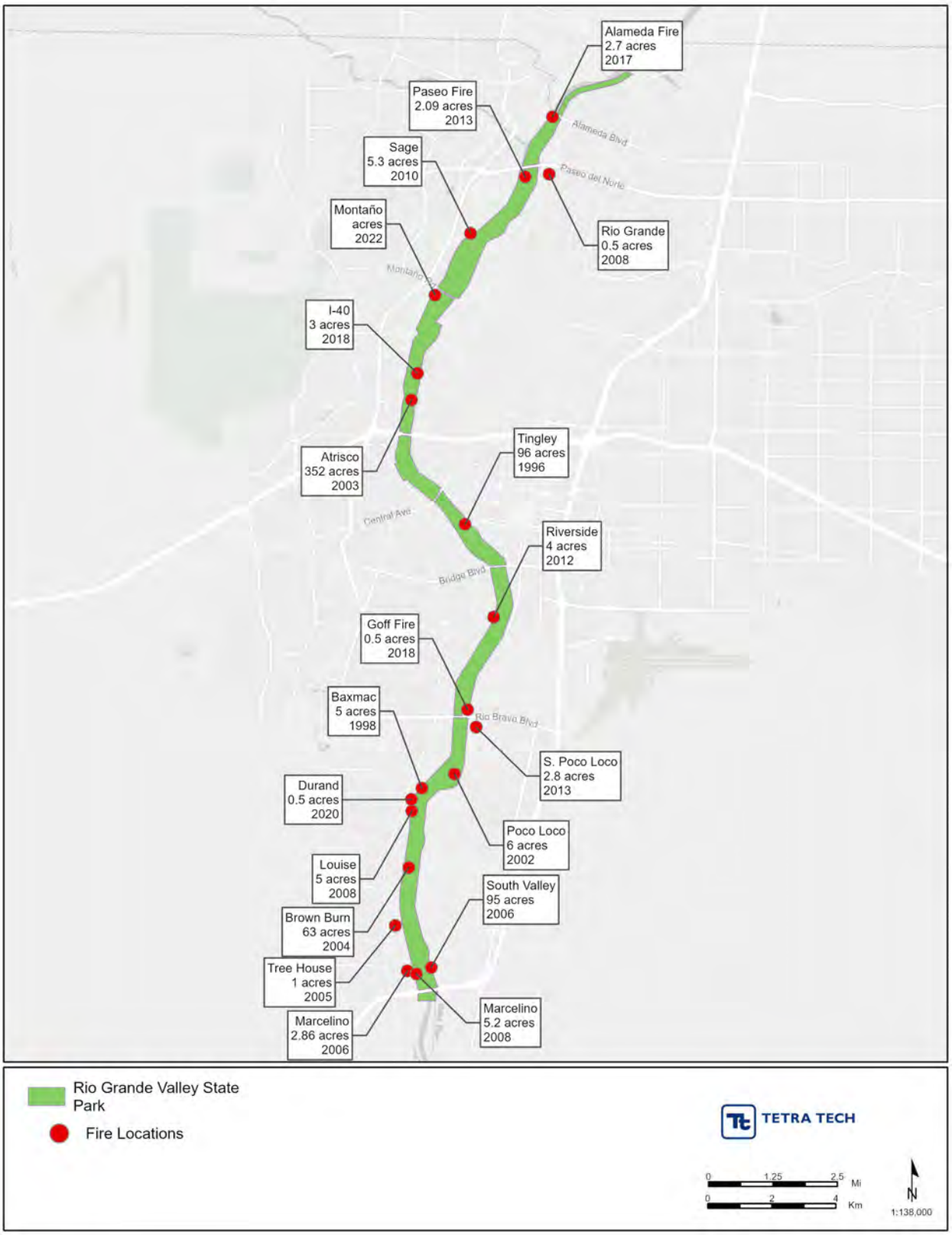


Figure 8. Recent Fire History in the Bosque (2003-2022)

2.2.2.1 2022 Montaño Fire

On May 25, 2022, a wildfire was reported in the Albuquerque Bosque on the west side of the Rio Grande south of the Montaño bridge. This fire, in total burned approximately 30 acres including portions of an island and a small area on the east bank of the Rio Grande (Chaves and Shaw 2022).

The fire's epicenter was in an area known colloquially as the "Deep Dark Woods," but also burned within the southeast portion of the Bosque Ecosystem Monitoring Program (BEMP)'s Savannah site. Both sites are in areas classified by recent Hink and Ohmart mapping (see section 2.3) as C/SC-RO1 (Cottonwood overstory over a well-developed understory co-dominated by salt cedar and Russian olive), C/MB2 (cottonwood overstory over a sparse mulberry understory), and C-SC/SC-RO1 (mixed cottonwood-salt cedar overstory with a well-developed understory co-dominated by salt cedar and Russian olive). While the Savannah site has been historically known as a relatively open cottonwood overstory forest (the C/MB2 portion of the fire area), with some ladder fuels in the form of piles of forest debris, which lie outside of its monitored section, the Deep Dark Woods has been known to carry extremely high fuel loads. For example, Bosque School monitoring in 2015 concluded that the Deep Dark Woods' fuel loads were 100 tons per acre, 300 percent more than any of the BEMP sites. These fuel loads accumulated over time in the aging cottonwood Bosque, which has had relatively few flooding events in recent history due to drought and water management practices. The ever-increasing intrusion of exotic woody species has also contributed greatly to the rising fuel loads throughout the Bosque. On May 25, these fuel loads combined with favorable fire conditions to produce a high intensity fire. Preliminary monitoring, which took place approximately two weeks after the fire, estimated that the fire killed approximately 62 percent of the cottonwood trees within the fire area (Chaves and Shaw 2022).

While recent fires that have occurred in the Bosque have been human caused, an increase in the growth of ladder fuels in the form of non-native vegetation, such as kochia (*Bassia scoparia*), salt cedar (*Tamarix* spp.*)*, Siberian elm (*Ulmus pumila*), tree of heaven (*Ailanthus altissima*), and many other species have caused an increase in fuel loads within the riparian forest understory. Historically, fuel loads within the MRG system have been periodically reduced by the flooding of the Rio Grande, which carried away dead woody materials and excess forest debris. However, over the last 70 years, there has been a drastic reduction in flooding of the MRG due to the construction of dams upstream, disconnects between the Bosque and the river (due to channelization), and an increase in drought patterns due to climate change. The combination of an increased prevalence of invasive species and the distinct absence of flooding over the past 70 years has resulted in the heavy buildup of forest fuel loads and ladder fuels that has greatly increased the risk of catastrophic wildfires in the Bosque. Fuel reduction treatments, such as the processing and removal of dead woody material and ladder fuels, is and will be crucial in preventing future, high intensity wildfires.

BEMP Monitoring of the Montaño Fire

As mentioned above, BEMP conducted four monitoring efforts in June 2022 to assess tree and vegetation condition, ash depth, and woody debris remaining to ascertain the effects of the Montaño fire on the Bosque north of the Deep Dark Woods.

Tree and vegetation monitoring was conducted utilizing eight 30 x 15 meters Hink and Ohmart plots within the fire area north of the Deep Dark Woods. Native species identified within the plots accounted for 15 percent of trees and shrubs observed while non-native accounted for 38 percent, and

unidentifiable woody species accounted for 47 percent of trees and shrubs observed within the plots. As a result of the fire, 88 percent mortality among trees and shrubs present within all plots was noted with only 12 percent showing signs of re-sprout. Among native species, 14 percent of fire-damaged plants showed signs of re-sprout, while 22 percent of non-native species and 2 percent of unidentifiable woody species showed signs of re-sprout.

Two ash monitoring efforts were conducted on June 10 and June 24, 2022. Monitoring was conducted by measuring ash depth in millimeters (mm) at ten-foot intervals along eight 50-meter transects. Ash depth was found to range from as little as 2 mm up to 125 mm, with average ash depths of 38 mm across the site. The monitoring effort conducted on June 24 noted the presence of ash concretions because of recent rains. These concretions will limit water penetration into the soil profile while present. While ash may temporarily result in such concretions during periods immediately following precipitation, if incorporated into the soil profile, ash can temporarily increase soil pH and available soil nutrient pools, potentially aiding in post-fire recovery efforts (Bodi et al. 2014).

Remaining fuel loads were assessed on June 24, 2022. Monitoring was conducted by measuring depth of litter and fuels along four 30-foot transects. Measurements of litter were taken at the one foot (ft.) and 5 ft. mark, wood chips at the 2 ft. and 6 ft. mark and fuel depths at 10-foot intervals. Remaining leaf litter was only found on one transect, measuring .25 inches in depth. This distinct lack of leaf litter can be expected immediately post-fire as leaves and litter often have the lowest ignition temperatures of available fuels and as a result, burn first. Fuel load monitoring concluded that fuel loads have been drastically reduced by this fire when compared to the fuel load levels. Half of the points monitored lacked any forest fuel accumulation, while the monitoring points that still contained fuel loads ranged from .1 inches of fuel to 41 inches of fuel accumulation. Remaining fuels were noted to be from Rio Grande cottonwood, Russian olive, and salt cedar trees. No wood chips were detected.

2.2.3 Vegetation

2.2.3.1 Data Sources

Tetra Tech staff performed a field characterization of vegetation conditions and the general patterns of habitat and associated plant community types within the Albuquerque Bosque. Tetra Tech then performed a desktop analysis. The field characterization was done by conducting Hink and Ohmart classification and mapping of the Bosque. The Hink and Ohmart vegetation classification system identifies six community structure types and is used extensively in the MRG to characterize major riparian habitat types and dominant vegetation (Hink and Ohmart 1984). Field visits were conducted from September 14, 2021, to February 14, 2022. Hink and Ohmart vegetation codes were assigned to areas based on structure type and dominant vegetation. Non-dominant woody species, exotic weeds, and management species of interest were also documented. A desktop analysis was then performed comparing the results of the 2021 Hink and Ohmart mapping to the results of Hink and Ohmart mapping conducted in 2005 by USACE.

While the 1993 BAP (COA 1993) used biophysical land units to characterize the vegetation communities within the Bosque, Hink and Ohmart classification and mapping was used to ensure continuity of this practice.

2.2.3.2 Vegetation Communities

Historically, the Rio Grande consisted of a relativity wide and braided channel with a Bosque, which was composed of a mosaic of woody riparian vegetation of varying age classes and ephemeral wetland communities (Crawford et al. 1993). This mosaic was less prone to catastrophic wildfires and provided diverse habitat supporting an abundance of wildlife.

The Project Area contains extensive stands of Rio Grande cottonwood (*Populus deltoides ssp. wislizeni*) intermixed with other native species such as Gooding's willow (*Salix goodingii*), seep willow (*Baccharis spp.)*, New Mexico olive (*Forestiera neomexicana*), and three-leaved sumac (*Rhus trilobata)* and non-native species such as Siberian elm (*Ulmus pumila*), salt cedar (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*). These stands provided extensive canopy cover and significant vegetation volumes and are associated with high use by obligate riparian bird species (Ellis 1995).

The dominant vegetation communities were assessed and mapped in the field utilizing the methods devised by Hink and Ohmart. The Hink and Ohmart vegetation classification system identifies six community structure types (see Table 11) and is used extensively in the MRG to characterize major riparian habitat types and dominant vegetation (Hink and Ohmart 1984). Field maps were then digitized utilizing Environmental Systems Research Institute (ESRI) ArcGIS software for further analysis.

Table 11. Hink and Ohmart Vegetation Community Structure Types

Vegetation Community Structure Type	Description
1	Mature Riparian Forests with tall trees exceeding 40 feet in height, closed canopies, and relatively dense understories composed of saplings and shrubs
2	Mature Riparian Forests with tall trees exceeding 40 feet in height and closed canopies, but with little to no understory
3	Intermediate-aged Riparian Woodlands comprised of mid-sized trees 20-40 feet in height and dense understories
4	Intermediate-aged Riparian Woodland/Savannahs comprised of open stands of mid-sized trees 20-40 feet in height with widely scattered shrubs and sparse herbaceous growth
5	Riparian Shrublands comprised of dense vegetation (shrubs and saplings) up to 15 ft in height and lacking tall trees. They often have dense herbaceous growth underneath
6	Sparse herbaceous or shrubby vegetation with heights of five feet or less

Hink and Ohmart Type 1: Mature Riparian Forest

The dominant woody vegetation species noted by Hink and Ohmart classification in 2005 and 2021 were Rio Grande cottonwood, coyote willow, Gooding's willow (tree willow), four-wing saltbush (*Atriplex canescens*), sand sagebrush (*Artimisia filifolia*), salt cedar, Russian olive, Siberian elm, and tree of heaven (*Ailanthus altissima*). Other stand types mapped included wet meadows and open areas. Of those dominant species noted, the most significant changes in acreage documented from 2005 to 2021 were four-wing saltbush (dominant acreage increased by 2260.8% from 2005 to 2021), sand sagebrush (dominant acreage increased by 173.23%), Siberian elm (dominant acreage increased by 105.34%), coyote willow (dominant acreage increased by 93.48%), and tree willow (dominant acreage decreased by 85.45%). The increase in dominant acreage of four-wing saltbush and sand sagebrush can be attributed to plant succession in areas formerly classified as open areas of the Bosque. Increases in native species, such as coyote willow, seep willow, and Rio Grande cottonwood, can be attributed to the construction of willow swales and cottonwood pole plantings. While Siberian elm dominance was not documented in areas that were formerly treated for non-native plant infestations, the species increased in areas that have not been treated. See Table 12 for dominant species compositional changes.

Table 12. Dominant Species and Compositional Changes

Dominant Species	2005 Acres	2021 Acres	Change (acres)	Change (%)
Coyote Willow	251.2	486	+234.8	+93.5
Rio Grande Cottonwood	2048.7	2123.8	+75.2	+3.7
Tree Willow	212.5	30.9	-181.6	-85.5
Four-winged Saltbush	3.2	76.5	+73.3	+2260.8
Sand Sagebrush	6.5	17.8	+11.3	+173.2
Salt Cedar	409.7	348.9	-60.8	-14.9
Russian Olive	435.2	396.9	-38.3	-8.8
Siberian Elm	254.7	522.9	+268.3	+105.3
Tree of Heaven	40.2	34.6	-5.6	-13.9
Wet Meadow	37.4	39.1	+1.7	+4.6
Open Area	180.7	84.6	-96.1	-53.2

The most significant changes in structure type between 2005 and 2021 occurred in Structure Types 1 (which increased by 83.84%), 3 (which increased by 141.2%) and 4 (which increased by 50.05%). Changes in structure type can be attributed to the maturation of the riparian forest of the Bosque. As the forest matures, open spaces fill in, leading to increases in vegetation Structure Types 5 and 6; trees

grow larger, leading to increases in vegetation Structure Types 2, 3 and 4; and understories become denser, leading to deceases in vegetation Structure Type 2 and increases in vegetation Structure Type 1. See Table 13 for changes in all vegetation structure types from 2005 to 2021. Appendix B, Hink and Ohmart Vegetation Maps, provides a map book of the 2021 Hink and Ohmart mapping results.

Table 13. Hink and Ohmart Structural Type Coverage

Structure Type	2005 Acres	2021 Acres	Change (acres)	Change (%)
1	323.3	594.3	271.1	+83.8
2	1172.5	828.1	-344.5	-29.4
3	162.2	391.2	228.0	+141.2
4	273.2	409.9	136.7	+50.1
5	443.7	458.1	14.4	+3.2
6	104.8	124.3	19.5	+18.6

Exotic, weedy herbaceous, and herbaceous species of interest for management were documented when found within Hink and Ohmart polygons utilizing Fulcrum mobile data collection software. These species of interest within the Bosque included the following: Bermuda grass (*Cynodon dactylon),* Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis)*, giant reed (*Arundo donax*), Johnson grass (*Sorghum halpense*), kochia (*Bassia scoparia*), ravenna grass (*Saccharum ravennae*), tumbleweed (*Kali tragus*), and Russian knapweed (*Rhaponticum repens*). Management species of interest documented included alkali sacaton (*Sporobolus airoides*), Indian grass (*Sorghastrum nutans*), and yerba mansa (*Anemopsis californica*).

2.2.3.3 MRG-CAP Habitat Targets

The MRG-CAP (discussed in Section 1.3.7 above) provides targets for riparian and wetland communities, while taking an ecosystem approach. Per the 2019 version of the document and current working updates, targets for native versus non-native components as well as habitat types have been developed. These can serve as targets for riparian enhancement, treatment, and restoration projects.

For a key attribute of *percent cover of aggressive invasive herbaceous species*, a target score for *very good* equates to less than 1 percent cover of aggressive invasive herbaceous species, and *good* = less than 5 percent cover (Muldavin et al 2019). These include New Mexico Class A noxious weeds but also other species of concern such as kochia (*Kochia scoparius*), Russian thistle (*Salsola tragus*), camelthorn (*Alhagi maurorum*), giant cane (*Arundo donax*), perennial pepperweed (*Lepidium latifolium*), and Russian knapweed (*Acroptilon repens*).

For the key attribute of *percent exotic woody cover*, a *very good* rating is proposed at less than 10 percent of woody cover being non-native; *good* is at 10-25 percent.

The *dynamic patch mosaic (DPM) relative abundance of riparian vegetation type* key attribute is intended to evaluate the degree of complexity of the riparian vegetation patch mosaic as a measure of functional riparian and wetland ecosystems (Latterell et al. 2006; Muldavin et al. 2017). A patch mosaic of different vegetation types (riparian forest, shrubland, meadows, and marshes) suggests intact hydrological regimes with associated ecological processes. In contrast, riparian wetlands dominated by

one community type likely reflect highly altered hydrological regimes or other impacts to ecosystem function and processes. The following DPM scores for a reach are proposed in the 2022 MRG-CAP update (Table 14) (Muldavin, Hummel, Draft 2022).

Table 14. Dynamic Patch Mosaic Scoring

Poor	Fair	Good	Very Good
DPM balance critically departed i.e., around 90% forest, 10% shrubland, 5% meadow, 0% marshes (excludes channel).	DPM balance significantly departed, i.e., around 75% forest, 15% shrubland, 5% meadow, 1% marshes.	DPM balance somewhat departed, i.e., around 50% forest, 25% shrubland, 10% meadow, 5% marshes	DPM well-balanced, i.e., around 35% forest, 35% shrubland, 20% meadow, 10% marshes (excludes channel)

2.2.4 Sensitive Species

A review of the Service Information for Planning and Consulting database, the Biota Information System of New Mexico (BISON-M), and the New Mexico Rare Plants website identified federally and state-listed species for Bernalillo County (Service 2022, BISON-M 2022, NMRPTC 1999). Avian use documented in annual reporting by Hawks Aloft was also reviewed. Table 15 contains federally and state-listed species with the potential to occur in the Project Area.

Table 15. Federally- and State-Listed Species for Bernalillo County, NM (2022)

Common name	Scientific name	Federally-listed	State-listed	Potential to occur
Birds				
Aplomado Falcon	*Falco femoralis*	E	E	
Baird's Sparrow	*Centronyx bairdii*		T	
Bald Eagle	*Haliaeetus leucocephalus*		T	X
Bell's Vireo	*Vireo bellii*		T	X
Broad-billed Hummingbird	*Cynanthus latirostris*		E	X
Common Black Hawk	*Buteogallus anthracinus*		T	X
Gray Vireo	*Vireo vicinior*		T	
Least Tern	*Sternula antillarum*		E	
Mexican Spotted Owl	*Strix occidentalis lucida*	T		X
Neotropic Cormorant	*Phalacrocorax brasilianus*		T	X
Peregrine Falcon	*Falco peregrinus*		T	X
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E	E	X
Yellow-Billed Cuckoo (western pop)	*Coccyzus americanus occidentalis*	T		X
Mammals				
Meadow Jumping Mouse	*Zapus luteus*	E	E	X
Spotted Bat	*Euderma maculatum*		T	
Fish				
Rio Grande Silvery Minnow	*Hybognathus amarus*	E (CH)	E	X

Common name	Scientific name	Federally-listed	State-listed	Potential to occur
Invertebrates				
Monarch Butterfly	*Danaus plexippus*	C		X
Plants				
Great Plains Lady's Tresses	*Spiranthes magnicamporum*		E	X

Notes: C = candidate, CH = designated critical habitat within Project Area, E = endangered, T = threatened.

2.2.4.1 Rio Grande Silvery Minnow

Data sources

Since its federal endangered listing in 1994, Reclamation, USFWS, USACE, state agencies, and others have cooperated on numerous studies and projects targeting conservation and recovery of the minnow. The initial Rio Grande Silvery Minnow Recovery Plan was issued in 1999, with the most recent version released in 2010 (USFWS 2010). Recovery goals include the following: the prevention of extinction, recovery sufficient to down-list to threatened status, and ultimate recovery toward federal delisting.

Population data on the silvery minnow and the associated ichthyofaunal community in the MRG have been gathered since 1987. Platania (1993) conducted the first studies (1987–1992) to determine spatial and temporal changes in the MRG ichthyofaunal community and to provide resolution of species-specific habitat use patterns. Sampling efforts during 1989 and 1990 revealed that silvery minnow population numbers had declined markedly since 1987 (Platania 1993). Since those preliminary studies, the Population Monitoring Program has conducted long-term systematic data collection at numerous sites between Angostura Diversion Dam and Elephant Butte Reservoir. These data provide information on the conservation status of the silvery minnow and the MRG fish community.

In 2001 the USFWS developed the Rio Grande Silvery Minnow Augmentation Plan (updated in 2018) to aid in preventing extinction by augmenting wild populations with hatchery-raised minnows (Archdeacon 2021, USFWS 2018). Since that time, approximately 3,000,000 minnows have been released into three reaches of the Rio Grande: San Acacia Reach, Isleta Reach, and Angostura Reach (also known as the Albuquerque Reach; Archdeacon 2021). Minnow release occurrence is based on fall season population monitoring numbers (Archdeacon 2021).

Life history

The silvery minnow is the only federally listed fish species occupying habitat within the Albuquerque area. Silvery minnow are pelagic spawners, producing numerous semi-buoyant, non-adhesive eggs that develop while drifting (Platania and Altenbach 1998). Spawning is typically observed in the spring, from late April through June, accompanying the period of snowmelt runoff (Reclamation 2012), as well as during some runoff events following summer monsoons. Both juvenile and adult minnow primarily use mesohabitats with moderate depths between 5.9 to 15.7 inches throughout the year, low water velocities between 0.13 to 0.29 ft per second, and silt/sand substrates. During winter months, these minnows become less active and seek habitat with cover such as debris piles and other areas with low water velocities. During spring sampling, large concentrations of reproductively mature minnow are often collected on inundated lateral overbank habitats (Hatch and Gonzales 2008). Further study is needed to determine whether minnow exhibit preferential use of lateral habitat (including overbank) for

spawning. Surveys of inundated overbank habitats have often captured large numbers of gravid females and ripe male minnows (Gonzales and Hatch 2009).

Threats

The original listing of the species as endangered (USFWS 1994) cited the presence of mainstream dams; growth of agriculture and urban areas in the Rio Grande Valley; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation, particularly during periods of low or no flow; inadequacy of existing regulatory mechanisms, including the lack of recognition that instream flows are a beneficial use of state waters; and dewatering of a large percentage of its habitat.

Persistence of the minnow population remains a serious present-day risk in the Rio Grande due to (a) channel drying and the lack of suitable perennial refugia habitat during the irrigation season and during periods of drought, leading to drying of potential habitat for minnows; (b) lack of abundant feeding habitat consisting of channel flows less than 0.5 cfs, and high flow velocities suspending and scouring away potential benthic and other attached food supplies for minnows, decreasing survival rates; and (c) floodplain habitats that fail to connect and inundate during spawn-stimulating flows, stranding minnow eggs and developing fry within high-velocity channel flows. High-velocity channel flows have long been known to produce very high-to-total mortality of eggs and developing fry in small-bodied fish species (Harvey 1987).

Critical habitat

The USFWS designated 157 miles of critical habitat for the minnow from Cochiti Dam to the full pool elevation of Elephant Butte Reservoir at river mile (RM) 62 in Socorro County (USFWS 2003). This also included areas bounded by existing levees or, in areas without levees, 300 ft of riparian zone outward from each side of the river during bankfull stage (USFWS 2003). The designation encompasses the stretch of the Rio Grande in the Albuquerque area.

Presence

Historically, silvery minnows were distributed throughout most of the Rio Grande from near the Gulf of Mexico to the upper reaches of both the Pecos River and the Rio Grande, reaching into the Rio Chama. They currently occupy approximately seven percent of their former range in three Rio Grande reaches: Angostura Reach (40.4 mi), Isleta Reach (53.1 mi), and San Acacia Reach (58.2 mi) (USFWS 2010).

Population monitoring data confirm the presence of the minnow within the Angostura Reach, including at monitoring sites within the Albuquerque area. This reach sees lower survival rates for minnow young than the other reaches (Dudley et al. 2021; Mortensen et al. 2019). Each year since 2002, large numbers of hatchery fish are released at several sites to increase population numbers, especially prior to spring runoff and fish recruitment periods (Archdeacon 2020).

2.2.4.2 Southwestern Willow Flycatcher

Data sources

USACE, Reclamation, MRGCD, and the City have conducted flycatcher presence/absence surveys during the May-to-July survey season within the Albuquerque Reach in relation to various projects since the early 2000s.

Life history

The flycatcher is a state- and federally endangered insectivorous neotropical migrant songbird species whose nesting habitat consists of dense riparian and wetland vegetation. The breeding range includes New Mexico, Arizona, California, southwest Colorado, and west Texas (Sogge et al. 2003). Flycatchers arrive in their breeding range from mid-May through early June and remain there until departing for their wintering grounds in northern South America, Central America, and Mexico in July through mid-August (Moore 2020). Populations in New Mexico are concentrated in the riparian forests of the Gila River and the Rio Grande. Flycatchers prefer forests of cottonwood or Russian olive overstory with a dense understory comprised of coyote willow near standing water in soils with a high moisture content (Sogge et al. 2003).

Threats

Threats facing the flycatcher include brood parasitism from brown-headed cowbirds (*Molothrus ater)*, loss and fragmentation of riparian habitat, and predation. Brown-headed cowbirds have been known to cause between 5.3 to 10.1 percent of juvenile nest mortalities. It is speculated that brood parasitism is a larger threat at lower elevations, although brown-headed cowbirds have been documented in the Albuquerque Bosque (NMDGF 2022, Tetra Tech 2020). Urbanization, agricultural development, water diversion, livestock grazing, recreation, and river channelization have led to nesting habitat loss throughout the flycatcher's range. The flycatcher is also suspected to be vulnerable to predation from great-tailed grackles (*Quiscalus mexicanus*), as great-tailed grackle numbers have been increasing in areas where flycatcher numbers are decreasing. Predation may also be tied to habitat loss and fragmentation as nest predation decreases and distance from the edge of nesting habitat increases (NMDGF 2022).

Critical habitat

Final critical habitat for the flycatcher was designated by the USFWS in 2013. No critical habitat has been designated within the Project Area. The nearest designated critical habitat for the species can be found approximately six miles south of the Interstate 25 East site near Los Lunas (Table 16). Critical habitat also lies approximately 60 miles north of the Project Area.

Presence in Project Area

Surveys in the Project Area have been conducted since approximately 2003 with long-term surveys occurring at the Oxbow and Tingley. From approximately 2005 to 2015, USACE conducted surveys at these locations and at additional locations starting in approximately 2010 (related to specific project locations). An overview of more recent survey results and use by migrant flycatchers is shown in Table 16.

Table 16. Flycatcher Detections per Survey Year Within the Bosque and Adjacent MPOS

Southwestern Willow Flycatcher Observations per Survey Year				
Survey Site	**2021**	**2018**	**2017**	**2016**
Oxbow	8	5	10	3
Central NW/Tingley	5	0	3	N/A
Interstate 25 East	2	1	1	N/A
Route 66	N/A	2	1	2
Rio Bravo NE	N/A	1	1	N/A

Southwestern Willow Flycatcher Observations per Survey Year				
Survey Site	**2021**	**2018**	**2017**	**2016**
SDC	N/A	N/A	N/A	3
Rio Bravo SE	N/A	N/A	N/A	1

2.2.4.3 Yellow-Billed Cuckoo

Data sources

Reclamation personnel have conducted presence/absence surveys for the cuckoo during the June to August survey season within the Rio Grande Basin since 2006 from Isleta Pueblo south to Elephant Butte Reservoir. Presence/absence surveys in the Albuquerque Reach have been conducted since the protocol was implemented in 2016.

Life history

The cuckoo is a neotropical migrant, obligate riparian species and was listed as a threatened species under the ESA by the USFWS effective November 3, 2014. Its western population can be found from southern British Columbia to Montana to southern Sinaloa, Mexico, during the breeding season (which occurs late April through August) and in Central and South America during the non-breeding season (NatureServe 2021, Tetra Tech 2020). Breeding habitat in the southwest is highly variable, including riparian woodlands, desert scrublands, desert grassland drainages, and Madrean evergreen woodlands with oak-dominated drainages (USFWS 2020). In the middle of the Rio Grande Valley, they can be found nesting in large patches of mature cottonwood and Gooding's willow forests, which have dense understories comprised of early successional staged willow species (*Salix spp.*), saltcedar, and Russian olive, which support a large insect prey base comprised of cicadas, katydids, and other invertebrates from mid-June to late August. They prefer patches of forest that are 50 acres or larger and are at least 350-feet wide. Cuckoos also favor areas that contain standing water or are near water features, such as ponds or streams. Cuckoo's typically have one brood with a clutch size of two to three eggs, but during years of increased food availability they can have up to three broods (Laymon et al. 1997).

Threats

The chief threat facing the cuckoo today is habitat loss and degradation of riparian habitat. Factors that have been contributing to the degradation and loss of cuckoo habitat include the following: agricultural conversion of habitat, river management practices that alter stream flow and channelize streams, agricultural grazing, destruction of cottonwood gallery forests by wildfire, and the replacement of native understory plants by non-native species, such as salt cedar.

In many regions where cuckoos currently exist, restored or naturally generated forests do not have the young tree recruitment or forb cover that they once did have due to changes in the hydrology in those areas because of stream channelization and damming, which has greatly reduced or eliminated flooding frequency. These actions, along with the pumping of groundwater and increases in drought severity, have also led to lowered groundwater tables that inhibit native early understory successional growth and serves as vital habitat for the cuckoo (Wohner et al. 2021). This, in combination with the increase in wildfire frequency, has also contributed to increased growth of non-native species, such as Russian olive and saltcedar. While an understory comprised of non-native species can serve as habitat for the cuckoo,

it has been observed that as the proportion of saltcedar on the landscape increases, cuckoo numbers decrease (White et al. 2020).

Critical Habitat

Final critical habitat for the cuckoo was designated by the USFWS in 2021. The Project Area is not in an area designated as critical habitat for the yellow-billed cuckoo. The closest critical habitat can be found approximately six miles south of the Project Area, near Los Lunas, and extends from there to Elephant Butte Reservoir in Socorro County (USFWS 2021).

Presence in Project Area

Each year from 2017 to 2019, Tetra Tech conducted detection surveys for the cuckoo across 10 different sites in the Albuquerque Bosque. Only one cuckoo was detected from 2017 to 2019. The cuckoo was detected on July 27, 2019, at the Rio Bravo northeast site (Tetra Tech 2018).

2.2.5 Climate Conditions

The southwest region has experienced periods of drought for centuries, and most modeled future climate projections in the Rio Grande are characterized by persistent drought (Gutzler 2013, USACE 2016; Moeser et al. 2020). Additionally, recent literature shows increasing temperatures and drought and predicts the continuation of a less predictable climate, with fluctuations in storms and drier conditions (Gutzler 2013; Llewellyn and Vaddey 2013). Mountainous snowpack in northern regions is decreasing, and evaporative losses are enhanced, resulting in warmer and drier conditions. Changing climate impacts the Bosque in several ways, including its infrastructure, management needed, water supply, and the timing and duration of river flows, which in turn impact the vegetation and wildlife communities.

The Project Area is situated in a semiarid climate region typified by dry conditions and limited precipitation. Summer maximum temperatures are generally in the 90s (Fahrenheit) and often exceed 100 degrees, and winter minimum temperatures are typically in the 20s and 30s with occasional dips into the teens. Precipitation is divided between summer thunderstorms associated with the southwest monsoons and runoff from winter storms as weather systems drop south into New Mexico. Table 17 shows climate averages for a 34-year period from 1982 to 2016 at the northern end of the Bosque area (Albuquerque Valley COOP Station).

Table 17. Climate Averages for the Albuquerque Valley COOP from 1982-2016

Month	Average Temperature (°F)	Average Maximum Temperature (°F)	Average Minimum Temperature (°F)	Average Precipitation (inches)
January	34.7	49.3	20.0	0.41
February	39.5	55.1	23.9	0.44
March	46.3	63.5	29.1	0.67
April	53.6	71.8	35.3	0.65
May	61.8	80.8	42.7	0.53
June	70.5	89.9	51.1	1.65
July	75.1	91.7	58.5	1.42
August	73.5	89.0	57.9	1.87

Month	Average Temperature (°F)	Average Maximum Temperature (°F)	Average Minimum Temperature (°F)	Average Precipitation (inches)
September	66.0	83.0	49.0	1.05
October	54.1	71.5	36.7	1.00
November	42.5	58.5	26.5	0.60
December	34.0	48.2	19.8	0.62

Source: Western Regional Climate Center (292100; https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm2100)

Prolonged drought has led to decreased spring runoff flows in both magnitude and duration during most years since 2000. This has led to a less dynamic river channel in which overbank flooding occurs less frequently and the river becomes increasingly disconnected from the floodplain. These challenges, decreased spring runoff and the river becoming disconnected from the floodplain, threaten the ecological functions within the MRG Bosque for the future. Habitat restoration within the Bosque is essential to reestablish important floodplain connectivity and maintain a healthy Bosque ecosystem for generations to come.

2.2.6 Groundwater

2.2.6.1 Data Sources

- Bosque Ecosystem Monitoring Program (BEMP) Well Data (1997-2021)
- MRG Bosque Restoration Project Access Database (2007-2020)

2.2.6.2 Existing Conditions

Existing well data from wells within the Project Area were reviewed to determine groundwater status throughout the Project Area (see Figure 9). Average groundwater levels throughout the proposed Project Areas varied greatly, with the shallowest of 0.19 feet above ground level occurring at the Oxbow N Scallop well in 2019, and the deepest of 11.88 feet occurring at the Alameda well in 2020 (see Table 18 below for the average groundwater depth of each well site in the proposed Project Area). Also, a trend of decreased depth to groundwater occurred in the late spring and summer months, which correlates with seasonal precipitation patterns.

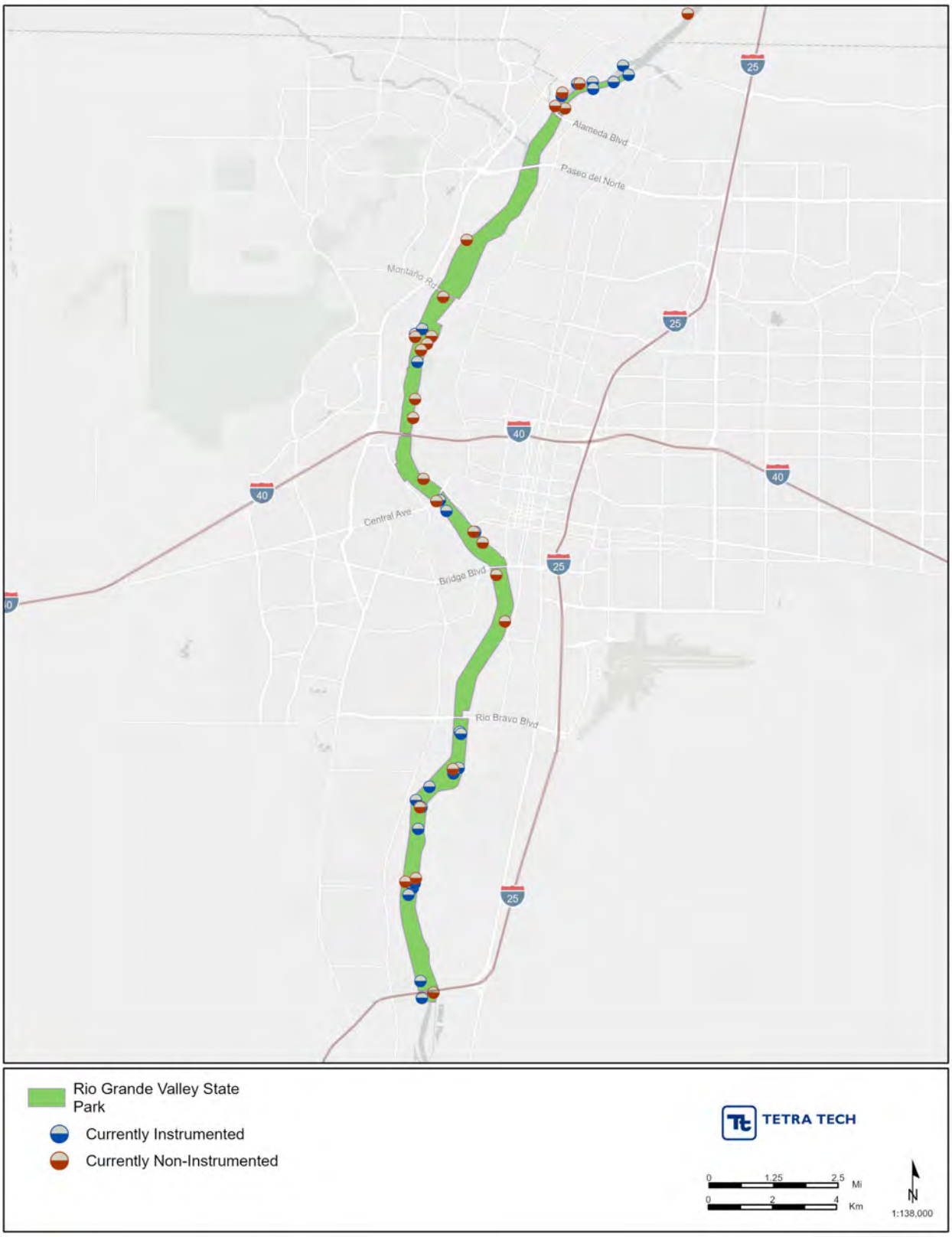


Figure 9. Groundwater Wells Within the Bosque and Adjacent MPOS

Table 18. Average Depth to Groundwater in Wells Within the Bosque and Adjacent MPOS

Project Area	Well Name	2021	2020	2019	2018	2017
Alameda NE	1F Terrace	No Data	No Data	No Data	No Data	1.92
	1F Swale	No Data	6.41	4.91	5.43	4.43
	1H Terrace	No Data	7.36	6.05	6.29	5.41
Alameda SE	Diversion	10.75	10.56	9.47	10.72	9.59
	Badger	9.25	9.19	8.19	9.66	8.90
	Alameda	11.87	11.88	10.87	12.10	11.18
Calabacillas Arroyo	Calabacillas	6.60	7.30	6.33	7.85	6.10
	Minnow	6.35	6.77	5.87	7.54	6.02
	Bobcat	4.90	5.00	4.07	4.72	4.20
	Montaño	6.96	7.28	6.41	7.33	6.65
	Savannah	4.87	5.02	4.12	5.03	4.35
	Oxbow N Scallop	No Data	0.62	-0.19	0.64	-0.11
	Oxbow 2	N/A	1.61	1.59	2.16	1.85
	Route 66	6.96	7.28	6.49	7.33	6.67
Central SW	Route 66 Inlet	N/A	1.89	0.57	1.36	0.62
	Route 66 Outlet	N/A	N/A	0.47	1.51	0.64
Central SE	Bio Park	5.77	5.51	4.68	5.42	4.89
	4A New	N/A	3.68	3.11	3.68	3.35
Bridge SE	Hispanic Cultural Center	5.58	6.42	4.61	6.23	4.73
	5C North	N/A	N/A	0.20	1.81	0.55
	5C South	N/A	N/A	N/A	2.02	0.94

Water table depths across all sites would be favorable to the establishment of native riparian vegetation, such as Rio Grande cottonwood and willow species, but sites with water table depths greater than eight feet would limit establishment of other natives, such as coyote willow and seepwillow.

OSD Management Considerations

- Conduct regular surveys of forest fuels and non-native plant densities to aid in management decisions and fire prevention.
- Inventory, assess, and close off user-made trails to minimize negative effects of recreation on the RGVSP ecosystem.
- Conduct management and planning activities with habitat succession, climate change considerations and future restoration opportunities in mind.
- Conduct habitat improvement activities for ESA and state-listed species.
- Reduce hazardous fuel loads. Identify best practices regarding mulching/chipping/masticating, migratory bird season, hazardous tree felling, etc.
- Develop post-fire protocols that include assessments, treatment, monitoring and retreatment.
- Reduce and manage invasive species with community support, including youth crews, staff, volunteers through Invasive Plant Patrol, etc. Focus on woody species, herbaceous, and Ravenna grass.
- Stabilize soils and reduce erosion along bluffs.
- Include ongoing monitoring with BEMP and UNM Biology classes.

2.3 PUBLIC USE

Ever-increasing use of the Rio Grande Bosque for public recreation over the past two decades has resulted in the need for an updated management framework that helps enhance and ensure its protection as a valuable ecosystem and community resource for educational, cultural, and recreational use.

The Bosque is also a hub for educational and conservation programs. A number of educational programs have been developed over the years. These efforts have resulted in a population who is invested in the health and sustainability of this vital ecosystem. These programs need to be assessed through an access and equity lens ensuring the whole community can engage in these experiences, and they need to be enhanced when possible due to the enormous benefits the programs have to people and the environment.

2.3.1 BAP Policies

The following BAP policies are specific to Recreation and Education throughout the Bosque:

- Policy 9: Access points shall be developed in appropriate areas.
- Policy 11: An ecologically compatible, multi-use trail system shall be enhanced.
- Policy 13: Appropriate fishing areas shall be developed.
- Policy 14: Non-motorized boating areas shall be developed.
- Policy 15: Special use permits shall be required for all organized events.
- Policy 16: Trails shall be re-routed in areas where emergency vehicles cannot access the levee roads.
- Policy 17: Educational opportunities and improvements shall be identified in appropriate areas.
- Policy 18: Educational programs and materials shall be developed and implemented.
- Policy 19: Use of Environmental Education Areas shall be coordinated with Open Space Division prior to their use.
- Policy 24: A volunteer patrol shall be formed and coordinated by the Open Space Division to provide a safe environment for the park users and protection of the natural resources.

2.3.2 Trails and Recreational Facilities

The Bosque trail system offers vast recreational opportunities for the community. The trails also serve as connectors from the northern to the southern parts of the City, to other City Parks and Open Spaces, and to the neighboring communities. The OSD manages over 38 miles of natural surface multi-use trails in the Bosque on the east and west sides of the river.

Additionally, the City constructed a major paved trail on the east side of the river, the Paseo del Bosque trail, which runs 17 miles from Alameda Blvd. to 2nd Street south of Rio Bravo. The Paseo del Bosque Trail is managed by three different entities, including the OSD, City Park Management, and Bernalillo County Parks and Recreation. In 2020, the OSD also constructed 4.25 miles of crusher fine trail to create an ADA trail around the Tingley area from Central Ave. to Montaño Blvd. Allowable trail uses on the natural surface trails include walkers, hikers, bikers, and equestrians. Off-road vehicles of any sort are not allowed except for emergency and official maintenance vehicles. An exception has also been made along the paved trails where e-bikes, scooters, and other e-devices are also allowed but must maintain a maximum speed of 18 miles per hour.

In addition to this extensive trail system, the OSD has established a number of major trailheads with various amenities. No major trailhead is the same, but most offer an official parking area with dedicated ADA and equestrian parking. These areas include trash receptacles, mutt mitt stations, and bike racks.

Some areas also include picnic areas, tables, benches, and restrooms. Trailhead locations and major trails are shown in Table 19 and Figure 10.

Table 19. Bosque Trails and Access Sites

Trail/Access Site Name	Description
Paseo del Bosque Trail	A 17-mile multi-use paved trail that runs south from Alameda Blvd. on the north end to the AMAFCA Diversion Channel south of Rio Grande Blvd on the eastern levee.
Rio del Norte Trail	A multi-use, stabilized crusher fine trail that winds through the Bosque on the east side of the Rio Grande from Montaño Rd. to Central Ave.
Alameda	A parking and picnic area off of Alameda Blvd. that provides access to the Paseo del Bosque trail and an unpaved trail that runs on the east side of the Rio Grande from Alameda Blvd. to Sandia Pueblo.
Calabacillas Arroyo	A parking, picnic and trailhead located at the Calabacillas Arroyo that provides access to the northern extent of an unpaved trail network from Alameda Blvd. to the San Antonio Oxbow on the west side of the Rio Grande.
Shining River	A parking area adjacent to Paseo Del Norte that provides access to the Paseo del Bosque Trial and a network of unpaved trails that run parallel to it on the east side of the Rio Grande.
Alamo Farm	An Open Space farm and parking area that provides access to an unpaved trail network on the west side of the Rio Grande from Alameda Blvd. to the San Antonio Oxbow.
Open Space Visitors Center	A parking and picnic area that provides access to an unpaved trail network on the west side of the Rio Grande from Alameda Blvd. to the San Antonio Oxbow.
Pueblo Montaño	A multi-use recreation facility, parking area, and picnic area that provides access to an unpaved trail network on the west side of the Rio Grande from Alameda Blvd. to the San Antonio Oxbow.
San Antonio Oxbow	A parking area that provides access to an unpaved trail network on the west side of the Rio Grande from Alameda Blvd. to the San Antonio Oxbow.
Rio Grande Nature Center	A NM State Park and paid parking area that provides access to the Paseo del Bosque Trail, the Rio del Norte Trail, and an unpaved network of trails on the east side of the Rio Grande.
Gabaldon	A parking area that provides access to the Paseo del Bosque Trail and the Rio del Norte Trail on the east side of the Rio Grande and a trail connection to the paved trails on the west side.
Rio del Norte	A parking and picnic area on Central Ave. that provides access to the Paseo del Bosque Trail and the Rio del Norte Trail on the east side of the Rio Grande.
Tingley Beach	A multi-use recreation facility with fishing, parking and picnic area that provides access to the Paseo del Bosque Trail and a network of unpaved multi-use trails on the east side of the Rio Grande.
Valle del Bosque	A Bernalillo County park that provides access to an unpaved trail network on the west side of the Rio Grande, southwest of Central Ave.
Marquez	Parking areas that provide access to the Paseo del Bosque Trail and a network of unpaved trails on the east and west sides of the Rio Grande off of Avenida de Dolores Huerta.
Rio Bravo Riverside Picnic Area/Poco Loco	A set of parking areas that provide access to an unpaved network of trails on the east and west sides of the Rio Grande and to the Paseo del Bosque Trail. A picnic area and a wheel chair accessible fishing pier is also located on the east side of the Rio Grande off of Rio Bravo Blvd.
Durand	A Bernalillo County Open Space with a parking and picnic area that provides access to an unpaved trail network on the west side of the Rio Grande, south of Rio Bravo Blvd.
Valle de Oro Urban National Wildlife Refuge	An Urban National Wildlife Refuge managed by the USFWS that provides public access to Bosque and a network of unpaved trails on the west side of the Rio Grande during open hours.

Figure 10. Recreational Amenities in the Bosque

2.3.3 Education and Outreach

The OSD and its partners have been offering educational programs in the Bosque since the inception of the Division and the designation of the State Park.

One of the longest running programs in the Bosque includes the BEMP whose mission is *Community Science, Education and Stewardship: equitable and inclusive hands-on student research essential to the management of the Rio Grande ecosystem*. BEMP was established in 1996 and now has 33 active sites across 270 miles of the MRG and over one million data points that are collected annually by K-12th grade students and their teachers. The data they collect is further analyzed and interpreted by professors and students at UNM. Over time, this valuable information, about the status and changes of the Bosque, has helped inform management decision.

The New Mexico Museum of Natural History and Science along with numerous partners has also developed a comprehensive curriculum, the Bosque Education Guide, on the MRG and Bosque, and offers annual trainings to educators. Most recently, the curriculum has been aligned with Next Generation Science Standards and now includes a Spanish version.

The OSD has directly engaged numerous school groups to plant about a thousand cottonwood trees every year in the Bosque, and now works closely with the RiverXChange program both in the classroom and Bosque. Additionally, Albuquerque Public Schools (APS) and Charter School classes, Boy and Girl Scouts, and other youth and adult groups volunteer each year to learn about and help steward the lands through clean-up, planting, and trail events.

Youth Conservation Crews, including the Rocky Mountain Youth Corps and Ancestral Lands Conservation Corps, have become an essential part of the stewardship efforts by assisting the hazardous fuel load mitigation, invasive species removal, trail rehabilitation, and construction and other management projects in the Bosque. Managing and educating about this complex ecosystem takes many people, and the OSD relies extensively on partners and volunteers. Despite these efforts, there are still many residents who know little about this vital ecosystem, its importance and history. The OSD is dedicated to continuing and expanding these efforts with the hope that every student in Albuquerque has experienced and is knowledgeable about the Bosque.

2.3.3.1 Equitable Access to the Outdoors

The City of Albuquerque has an excellent local open space and park system. With almost 25 percent of the City devoted to parks, trails, and open space, the extensive parks and recreation system frames and shapes the City and its quality of life. Albuquerque ranks high in park- and outdoor recreation-related criteria.

Overall, as of 2022, 91 percent of Albuquerque residents live within a 10-minute walk of a park, open space, or trail, according to the most recent Trust for Public Land (TPL) ParkScore Index data. This is much higher than the national average of 55 percent calculated by TPL. Albuquerque is committed to raising its Park Access Score to the mid-90s, with a longer-term goal of 100 percent. The Bosque is key to this goal as it runs through the center of the City and provides ideal access for the public's enjoyment of nature and the outdoors.

The City is also assessing equitable access to the outdoors knowing the immense benefits this plays in people's lives. Spending time in nature has proven to support overall health and wellbeing physically, mentally, and socially. Students' academic performance increases while stress levels decrease. It is imperative we provide these opportunities to all children, especially to communities who are experiencing increased financial disparity knowing nature is one key element in managing equity challenges.

Data from The Wilderness Society's 2020 report *Next Stop: Equitable Access A Transit to Parks Analysis* provided a wide range of information around systemic barriers to public land access that in addition to Environmental Education of New Mexico's report *Every Kid, Every Day, Every Way: A multi-shared vision and strategy to provide daily equitable access to the outdoors and environmental learning for all New Mexico kids,* guided the development of new educational programs and restructuring of existing programs to support equitable access goals.

Montaño Parking Lot Picnic Area

The Open Space education program was developed following a comprehensive model used within social and environmental justice work that includes actions and strategies at the individual, interpersonal, institutional, and structural/systemic realms. The education program's multitude of projects are distributed equitability across the City and are culturally, socially, and economically relevant. The OSD leverages internal and external partners' goals and resources and follows an urban-to-wild scaffolded approach where program projects meet our City's residents where they are and bridge those experiences to creating pathways to MPOS lands and programs. While the OSD and partners are making great strides to ensure every kid and family can get out in nature and public lands, there is still a lot of work to be done, and the OSD is committed to these efforts.

2.3.3.2 Volunteer Programs

The OSD had developed an extensive volunteer program. The primary program is Trail Watch, which was established in 1995 as well as an extended Fire Watch that was established in coordination with Albuquerque Fire Rescue due to increase fire activity.

Trail Watch Volunteers (TWV) are the foundation of the OSD's volunteer program and are often referred to as Open Space "eyes and ears." These volunteers patrol areas of their choice and record observations,

report problems and needs, and educate the public on proper resource use. Specifically, TWVs help with the following:

- Report observations such as flora and wildlife sightings and visitor activities
- Notify OSD of maintenance needs and law enforcement issues
- Educate and guide the public to be stewards of the environment
- Assist with conservation projects

As an extension of the TWV program, the Adopt-an-Open Space program was formed to concentrate stewardship in a targeted area. TWV duties are applied, but adopters also agree to organize at least one group project per year. In the Bosque, groups of 10 or more can adopt restoration areas, help with non-native plant control, and trail maintenance. At the City's expense, a sign is installed in the adopted area recognizing the adopters' efforts. One of the more successful of these programs, the Yerba Mansa Project, which has adopted the pond area behind Tingley Beach, has involved hundreds of volunteers, provided studies and current statistics about Ravenna Grass removal, and planted native shrubs, trees, and grasses over many years.

The OSD recently developed the Invasive Plant Patrol program that trains volunteers to recognize and remove a number of common herbaceous invasive plants. This program that has a lot of potential for weed management throughout the Bosque, but needs to be further developed.

All of these programs are essential to the OSD's ability to manage the Bosque and can be further enhanced through boosting volunteer numbers, developing information and education materials specific to the Bosque and enabling more self-directed volunteer events that follow OSD protocols and ordinances.

2.3.3.3 Wayfinding and Regulatory Signage

Currently, a number of signs exist throughout the Bosque; however, the signs are not all consistent. Many are outdated or faded and lack good wayfinding information. Most of the existing signs are located at major trailheads. Strategically located signs help prevent public use of private property, inform visitors of what they can expect or what is allowed regarding the different trail uses (e.g., biking, walking, equestrian), provide information about trail distances and levels of difficulty, and aid visitors in wayfinding. Wayfinding signage may include trail maps, pertinent safety information, property boundaries, and the location of other nearby public access points. Signs may also be used to encourage stewardship, outdoor ethics, and trail etiquette. Signage should be placed in key locations along the Bosque corridor and at river access points and should contain quick response (QR) codes providing access to further information online and in different languages. Signs throughout the Bosque need to be updated, consistent, and installed at all trailheads, major intersections, and official boating launch sites.

2.3.3.4 Interpretive Signage

The OSD has collaborated with partners to incorporate interpretive signage at some key locations such as the Aldo Leopold Trail, west of the RGNC State Park, the San Antonio Oxbow Overlook, and the Calabacillas Arroyo trailhead. The dynamic ecosystem of the river and Bosque along with the rich history and cultural traditions tied to the Bosque cannot be understated. This greenbelt running through the heart of the City is one of the most visited areas by residents and visitors and provides an ideal venue for education. Interpretive signage is a key strategy for educating the public and helping with OSD efforts, such as highlighting the importance of the area, teaching people to respect wildlife, tread lightly on (reduce impacts to) and help care for the Bosque. Interpretive signage is self-directed, and people can get basic information or delve deeper if so desired, which is made easier by incorporating technology such as QR codes and smart phones. Enhancing signage throughout the Bosque helps to describe the character of that area as well as provide the public with opportunities to get more information.

2.3.4 Small Watercraft

The Rio Grande in the Albuquerque area offers unparalleled opportunities to see wildlife, escape the urban environment, and enjoy water-based outdoor recreation. It is legal for boaters to recreate on the Rio Grande. Kayaks, canoes, rafts, and other small, non-motorized watercraft are all permitted in the Rio Grande. Boaters must follow all New Mexico Boating Safety Regulations. There are a number of access points along the Bosque, including at the following: Alameda, Calabacillas Arroyo, Central Avenue Bridge, Avenida Cesar Chavez/Dolores Huerta Bridge, and the Rio Bravo Bridge. To provide safe evacuation off the river, the Albuquerque Fire Rescue (AFR) and the OSD installed rive mile markers at each mile on the river. Today there are 17-mile markers on each side of the river for a total of 34. In addition to these efforts, the City is considering additional boating and emergency access points strategically located throughout the Bosque. Wayfinding signage is also needed at all of these locations to help address navigation, boat regulation, and safety issues.

OSD Management Considerations

- Improve and install wayfinding signage at all trailheads, river access locations, and major junctions.
- Work with partners to develop interpretive signage, especially identifying the ancestral and historic sites along the river and emphasizing the unique environment, functions, ecosystem services, and stewardship.
- Continue to support and grow volunteer programs, especially the Invasive Plant Patrol Program.
- Work with youth crews for job skills training in conservation and to support OSD management including trails, invasive species removal, restoration projects, and fuel thinning projects.
- Establish full-time city positions, such as Bosque Park Attendants, to assist with interacting and informing visitors and general trail and facility management. This would include a minimum of 1 person per 1,000 acres for 7-days a week coverage.
- Continue to support and enhance educational experiences for Albuquerque's youth through BEMP, RiverXChange, and other related programs.
- Promote equitable access to the Bosque while emphasizing trail etiquette and land stewardship.

3.0 PLANNING PROCESS

The following components and steps were used for the planning process of the BAP to BAUP update.

3.1 BOSQUE GEODATABASE

Prior to a detailed review of the BAP, a file geodatabase (FGDB) of all data for the RGVSP for the past 20 years was compiled. To promote efficiency and consistency, the FGDB rules followed the Collaborative Program Database Management System (DBMS) naming conventions. All of the geodatabase feature datasets and associated feature classes were named intuitively, and a reference guide was provided with detailed descriptions of each feature dataset and feature class, including a description of the contents of each feature dataset, date of origin, date of acquisition; and point of origin. The Bosque FGDB will continue to be updated as new data is developed.

3.2 BOSQUE ASSESSMENT AND UPDATE PRIORITIZATION GOALS

The planning process began with a review of the original BAP goals with OSD:

A. Environment and Wildlife - The goal is to protect and enhance the natural resources of the RGVSP

B. Recreation and other Public Uses - The goal is to protect and enhance the natural character of the RGVSP by facilitating appropriate management practices and public uses

C. Education - The goal is to enhance environmental education within the RGSVP

D. Administration - The goal is to protect and enhance the natural character by facilitating appropriate management practices and public uses of the RGVSP

The goals were reviewed and updated by OSD as follows:

- Protect and Enhance
  - Protect Natural Resources
  - Enhance Natural Resources
  - Provide Erosion Control
  - Provide Invasive and Non-native Species Management
- Fire Prevention
- Managed Public Use
  - River access
  - Interpretive signage
  - Safety

3.3 BAUP LOCATIONS

Of special note, some areas were not initially included in the BAP and are not considered as part of the Bosque, either due to land ownership or other management restrictions (e.g., San Antonio Oxbow). Therefore, a full list of areas and quadrants was developed building upon the initial BAP list. Table 20 lists the Bosque and adjacent MPOS locations in geographic order from north to south, and a detailed spreadsheet was developed in order to evaluate which of the following amenities exists and/or have been proposed: parking, trailheads, boat launch sites, signage, picnic grounds, bicycle racks or horse tie-ups, accessibility, restrooms, drain crossings, paved trails, natural surface trails, interpretive signs, exotic species control, fuel reduction, and native plantings.

Table 20. Bosque and Adjacent MPOS locations

Location
Site 1: Alameda Bridge NE
Site 2: Alameda Bridge SE
Site 3: Alameda Bridge SW
Site 4: Calabacillas Arroyo
New Site: Paseo SE
New Site: Paseo SW
New Site: Open Space Visitor Center
Site 5: La Orilla Road Access
New Site: Montaño NE
New Site: Montaño NW
New Site: Montaño SW
New Site: Montaño SE
Site 6: Candelaria Farms
New Site: RGNC
New Site: San Antonio Oxbow
Site 7: Campbell Road Access
New Site: I-40 NE
New Site: I-40 NW
New Site: I-40 SE
Site 8: Atrisco NW Access (Riverview Heights)
Site 9: Central Bridge NW
Site 10: Central Bridge NE
Site 11: Central Bridge SE (Tingley)
Site 12: Central Bridge SW
Site 13: Barelas Bridge NW
Site 14: Barelas Bridge NE
Site 15: Barelas Bridge SE
Site 16: Barelas Bridge SW
New Site: 2nd St/Glass Gardens
Site 17: Rio Bravo Bridge NW
Site 18: Rio Bravo Bridge NE

Location
Site 19: Rio Bravo Bridge SE
Site 20: Rio Bravo Bridge SW
New Site: Durand Open Space
New Site: Shirk Lane Access
New Site: Valle del Oro
Site 21: Property North of I-25
New Site: I-25 NW
New Site: I-25 SW
New Site: I-25 SE
Site 22: Paseo del Bosque Trail

As noted in Table 20, every bridge crossing quadrant within the City of Albuquerque is included in the Bosque. There is ongoing annual operations and maintenance as well as overarching project planning that is being conducted for the entire 4,300 acres within the Bosque in addition to the proposed priority projects. The focus of work throughout the Bosque varies depending on Project Area needs but is related to the following goals: protection and enhancement, fire prevention, and recreational and educational use.

3.4 E-TEAM DEVELOPMENT

As part of the planning process for this BAUP document, an E-Team of stakeholders was developed. The E-Team met bi-monthly from August 2021 through April 2022 to explore needs, define goals, develop management solutions, and collaboratively plan and prioritize the projects detailed in this management framework. The E-Team group was composed of representatives from the following agencies:

- ABCWUA
- AMAFCA
- Bernalillo County (County)
- BEMP
- City Department of Municipal Development (DMD)
- MRGCD
- New Mexico Department of Game and Fish (NMDGF)
- NMISC
- NMSLO
- New Mexico Energy, Minerals, and Natural Resources Department (EMNRD, Forestry Division
- USACE
- Reclamation
- USFWS

Meetings were held on August 25, 2021; October 14, 2021; December 15, 2021; February 16, 2022; April 19, 2022; and November 18, 2022. Stakeholders provided input and review to project goals and objectives, potential projects, and priority project evaluation. Stakeholders also provided information on their activities within the Project Area which are discussed in the priority project evaluation.

3.4.1 Goals and Objectives

During initial meetings with the E-Team, BAP goals were discussed and updated with the main goals being **Protect and Enhance, Fire Prevention,** and **Managed Public Use**. Over-arching objectives that were highlighted included the following:

- *Use of the river in a safe and responsible manner*
- *Balance of habitat protection and recreational use*
- *Creating a healthy vibrant ecosystem under future climate change scenarios*

Sub-goals discussed included the following:

Protect and Enhance	Fire Prevention	Managed Public Use
Protect natural and cultural resources	Reduce hazardous fuel loads including invasive species	Foster education and stewardship
Enhance natural resources and ecological health	Work with other entities on fire preparedness	Develop interpretive and wayfinding signage
Provide erosion control and stabilization along bluffs	Deter and remove encampments	Address safety issues and access
Manage invasive and non-native species coupled with planting native and climate ready trees	Work with AFR on educational outreach efforts including the Fire Watch program	Provide accessible river access and signage

These initial goals and objectives were used to evaluate potential priority projects. Further discussion and input on goals occurred at the August and October 2021 meetings with the E-Team. Additional goal and topic discussion highlights are described below.

3.4.1.1 Protect and Enhance

Group discussion of this goal included more detailed discussion as follows:

- Areas to protect and restrict access to
- Coordination with adjacent managing agencies – Corrales Bosque Preserve, Pueblo of Sandia, Pueblo of Isleta
- Non-native understory
- Siberian elm management – full eradication versus having some trees
- Evaluate location and develop site-specific goals
- Use a phased approach
- Managing current restoration sites

3.4.1.2 Fire Prevention

Group discussion of this goal included more detailed discussion as follows:

- Fire causes and prevention
- Education and outreach to deter fires
- Fire treatments implemented by NM State Forestry
- Post-fire Rehabilitation and Restoration

- Funding for post-fire response

3.4.1.3 Managed Public Use

Group discussion of this goal included more detailed discussion as follows:

- Environmental Education and Wildlife Preservation Areas
- Volunteer clean-up projects
- Trails etiquette – bicycles, equestrians; paved, crusher fine, and dirt trails
- Areas to protect and have less access
- Student projects
- Coordination with existing volunteer groups
- ORV-use access restrictions
- Agency management and maintenance – MRGCD, AMAFCA
  - Need for buffers around river maintenance
- Balanced access throughout the Bosque

3.4.2 Ongoing E-Team Coordination

Additional E-Team meetings focused on the refinement and update of information related to potential projects, stakeholder activities, and priority project evaluation.

The Draft BAUP and project priorities was presented to the E-Team in November 2022 and Team Members provided comments in December of 2022. Comments were incorporated prior to OSD, Parks and Recreation, and other City department review.

3.5 PRIORITY PROJECT EVALUATION AND SELECTION

With the goals and objectives for the Bosque in mind, the following potential projects listed in Table 21 (and Figure 11) was developed with the E-Team and were evaluated as detailed in Section 3.6:

Table 21. Proposed Projects for Evaluation

Project Number/Name	Open Space Proposed Project Components	Other Agencies/Projects Included
Project 1: Alameda NE	Fuel reduction/exotic species management, recreation improvements, revegetation	NM Forestry Division (NMFD) on fuel reduction.
Project 2: Alameda SE	Parking, solar project, trails, revegetation, improved signage, improved access for special needs, revegetation, site plan	ABCWUA solar project, Parks and Recreation Department site plan, BernCo on Alameda storm drain outfall, USACE Rio Grande Environmental Management Program (RGEMP), and interpretive signs.
Project 3: Alameda SW/Calabacillas Arroyo	Fuel reduction, Calabacillas Arroyo parking lot, AMAFCA maintenance, revegetation	Parks and Recreation Department on the Calabacillas Trails Plan.
Project 4: Montaño SW (Pueblo Montaño/Bosque School)	Habitat restoration, recreation and boating access, fuels reduction, post-fire remediation, revegetation	Bosque School and NMFD on post-fire remediation, ABCWUA on Bosque Non-Potable Reuse project

Project Number/Name	Open Space Proposed Project Components	Other Agencies/Projects Included
Project 5: San Antonio Oxbow and Oxbow Bluffs	Oxbow Bluffs site plan and public access – trail connection, overlook Oxbow – invasive species, beaver, and wetland management; erosion control	MRGCD and AMAFCA on Oxbow wetland improvements
Project 6: Atrisco Acequia Madre (Central NW-SW)	Atrisco Acequia Madre Project site plan and major improvement, Rio Grande Bosque Wildfire Mitigation Project	MRGCD, BernCo, and ABCWUA, on site plan. DHSEM and CSWCD on fuels reduction. City's DMD on potential outfall improvements
Project 7: Pat Baca Open Space	Pat Baca Open Space storm drainage outfall project that will include overall property enhancements and erosion control	City of Albuquerque DMD - outfall improvements. MRGCD on erosion at Pat Baca
Project 8: Bridge SE to Glass Gardens	Post-fire management, invasive species management, address transient use	Coordination with Hispanic Cultural Center.
Project 9: Rio Bravo/Poco Loco NE	Parking lot and trail area improvements, possible boating access, invasive species management	NMDOT on bridge expansion
Project 10: State Land Office (SLO) Bosque Adjacent to Valle de Oro (VdO)	Coordination and management of SLO land for interpretation and restoration projects. Possible bridge over the Riverside Drain for boating access	NMSLO – Rio Grande Returns project
Project 11: Southside Water Reclamation Plant (SWRP) Outfall Restoration Project	Coordination and management of Bosque land adjacent to the Treatment Plant outfall and trail route and construction	ABCWUA restoration project

Additional description of some of the components noted include the following:

- USACE Rio Grande Environmental Management Program (RGEMP) – this project addresses ecosystem restoration opportunities and feasibility along the Bosque between Sandia and Isleta Pueblo (USACE 2019). Project alternatives are included in the Alameda SE Project Area.
- Rio Grande Bosque Wildfire Mitigation Project – this project is anticipated to use funding from the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP) to implement wildfire prevention measures across 470 acres of Bosque between Central and Bridge Boulevards on both sides of the river (FEMA July 2022).

Figure 11. Potential Projects Evaluated

3.6 EVALUATION CRITERIA DEVELOPMENT

Using the goals listed in Section 3.4.1, the E-Team developed criteria for evaluating the potential projects. Table 22 specifies these evaluation criteria. The group also considered the following:

- Overlap with other projects
- Finishing what was not completed in the BAP
- Evaluation of projects in lower use geographic areas
- How to balance managed public use and habitat protection

Therefore, levels of use and other criteria were developed to give specific points under each evaluation criteria (Table 22) with a total possible maximum score of 50 points.

Table 22. Evaluation Criteria

Goals/Evaluation Criteria	Definition/Points	Max Points/ Category
	TOTAL CATEGORY RANKING FOR PROJECTS	**50**
MANAGED PUBLIC USE		
Desired Level of Use at Location	1 - requires initial management to achieve desired level of use	1
	1 - requires O&M for level of use	1
Level of Use	1 - least use	5
	2 - medium use	
	3 - heavily trafficked	
	3 - wildlife preserve	
Education & Outreach	0 - no	3
	1 - informational signs	
	2 - interpretive area	
Recreational infrastructure (trails, picnic areas, etc.)	1 - improve/add infrastructure where desired/needed	1
	2 - O&M of existing	2
	Total Managed Public Use Ranking	**13**
PROTECT & ENHANCE	***Highest ranked category***	
Restoration Project (new, existing)	0 - no	0
	1 - new	1
	2 - meet existing restoration project O&M obligations	2
Protect existing Wildlife Preserve Area	0 - no	1
	1 - yes	
Benefits threatened, endangered or sensitive species	0 - no	2
	1 - possibly	
	2 - yes	
Protect habitat (not currently preserve, but good habitat)	0 - no	0
	1 - high avian use OR multiple species habitat	1
	1 - predominately native species in H&O code	1
	1 - increases mosaic dynamic OR fuel break	1
Acres-max/min	0 - no	0

Goals/Evaluation Criteria	Definition/Points	Max Points/ Category
	1 - adjacent to existing restoration project	1
Water Quality (protects or enhances stormwater quality)	0 - no	0
	1 - includes trash/debris catchment OR opportunities to disconnect from impervious surfaces	1
	1 - includes pollutant control	1
Sediment Management	0 - no	0
	1 - project removes sediment with pollutant issues	1
	1 - project improves sediment quantity to river	1
	2 - reduces erosion	2
	Total Protect & Enhance Ranking	**16**
FIRE PREVENTION		
Fuels/Exotic management	0 - no	0
	1 - protects adjacent habitat or residential area	1
	1 - protects Bosque habitat	1
	1 - protects critical infrastructure	1
Fire Risk	0 - no	0
	1 - reduces risk in high-risk areas	1
	1 - reduces risk in areas with repeated fires	1
	1 - treatment of increased weeds/exotics; hazardous trees that could be safety issue	1
Fire Mgmt Plan to be implemented within next 5 years	0 - no	0
	1 - yes	1
	Total Fire Prevention Ranking	**7**
EXISTING FUNDING AND/OR RESOURCES		
	0 - no	0
	1 - community engagement	1
	2 - multiple partners	2
	2 - partner support	2
	3 - funding	3
	Total Existing Funding and/or Resources Ranking	**8**
ENVIRONMENTAL JUSTICE		
Can incorporate into project design	0 - no	0
	1 - improve ADA accessibility	1
	1 - improves public health (improved air or water quality)	1
	2 - improves access to natural green space in underserved areas	2
	2 - improves educational and engagement opportunities	2
	Total Environmental Justice Ranking	**6**

Based upon the evaluation and rankings (by score), the following projects were selected as the top nine projects (Table 23). Conceptual designs for each project have also been provided in the next section.

Table 23. Priority Projects Resulting from Evaluation

Priority Projects
Priority Group 1 (40 -50 points)
Project 5: San Antonio Oxbow and Oxbow Bluffs (44)
Project 6: Atrisco Acequia Madre (Central NW-SW) (40)
Priority Group 2 (30 -39 points)
Project 2: Alameda SE (36)
Project 4: Montaño SW (Pueblo Montaño/Bosque School) (34)
Project 7: Pat Baca (32)
Project 11: SWRP Outfall Restoration Project (30)
Priority Group 3 (20-29 points)
Project 12: SLO Bosque adjacent to VdO (28)
Project 3: Alameda SW/Calabacillas Arroyo (20)
Project 9: Rio Bravo/Poco Loco NE (20)

3.7 PRIORITY PROJECT DESCRIPTIONS AND PLAN FOR IMPLEMENTATION

3.7.1 San Antonio Oxbow and Oxbow Bluffs

The San Antonio Oxbow is located along the west side of the Rio Grande and accessed off Coors Blvd. and Namaste Road. It is a significant wetland that provides critical habitat to diverse wildlife. Irrigation water from the Corrales Drain managed by MRGCD is the main water source for the San Antonio Oxbow.

The City acquired an additional 23-acres above the Oxbow in March 2021, now designated as MPOS. The property makes up a larger complex of natural habitat that includes the adjacent San Antonio Oxbow Overlook south of Namaste Road with the wetlands below. This newly acquired property along with the previously owned Overlook is now referred to as the San Antonio Oxbow Bluffs (SAOB). The OSD aims to conserve the natural characteristic and ecology of the area while implementing a site plan that supports public access and low-impact recreation including a trail corridor.

This was the highest-ranking project based upon the evaluation criteria. It received the highest points under most criteria, receiving a total of 45 out of 50 points. Project components are shown in Figure 12.

3.7.1.1 Managed Public Use

Managed public use currently exists through an informal parking area at the end of Namaste Road and natural surface trails to stunning viewsheds that overlook the wetland area and Rio Grande. Pueblo Montaño to the north also provides access to a trail along the levee to the San Antonio Oxbow, but not to the SAOB. The City completed a community planning effort to develop a site plan for the SAOB that was approved by the Environmental Planning Commission in 2023. The plan identifies a number of new outdoor amenities such as wayfinding and interpretive signage, restrooms, benches and an informal gathering space, rain and pollinator gardens, and dedicated art celebrating the biodiversity of the site.

Additionally, the plan identifies a trail throughout the SAOB and bridge crossing at the Corrales Drain that connects this area all the way from Coors Blvd. to Pueblo Montaño. Trails will discourage public access into sensitive areas including wetland habitats. Additional ADA trail connections are identified between the current San Antonio Oxbow Overlook south of Namaste Road and the Oxbow Bluffs north of Namaste Road.

3.7.1.2 Protect and Enhance

Excavation of the open water area at the San Antonio Oxbow, March 2016

Within the Oxbow, previous restoration work under the MRG Restoration Project was conducted including invasive species management, wetland management, restoration of backwater channels and bank terracing, and revegetation. The OSD is developing a Wetlands Action Plan for management of all wetland properties, which includes the Oxbow. Ongoing wetland management, including mitigating beaver activity that prevents water flowing into the Oxbow, supporting plant diversity through reducing cattails, as well as providing invasive species treatment and jetty jack removal, is needed within the Oxbow. Wetland management includes an evaluation of current and future water inputs and needs. This is especially important considering persistent drought and limited irrigation flows from the Corrales Drain that support Oxbow. Implementation of these projects will also aid in fire prevention.

Figure 12. San Antonio Oxbow and Oxbow Bluffs

Additionally, the SAOB site design may include strategies to improve the biodiversity of this upland area through seeding and direct plantings of native species. Large eroded headcuts on the bluff are a major problem especially evident at the end of Namaste Road. The site plan calls for passive ways to disperse and capture water to support plantings and reduce soil erosion.

3.7.1.3 Existing Funding and Resources

Considerable community engagement and interest for this project exists. There are also multiple partners and partner support including MRGCD, AMAFCA, Native Plant Society, Saint Pius Catholic High School, and Bosque School. Additionally, the public who advocated for the protection of the property as MPOS rather than a subdivision is very dedicated to the ongoing planning and management of this area. The OSD will work with these groups to support management of this area through organized volunteer events, monitoring, and educational activities. Additionally, the City has secured funding to implement the site plan; however, it has not been determined if the available funding is enough to implement the full plan or if it will need to be implemented in phases. There is no dedicated funding for the management of the San Antonio Oxbow aside from the general budget for the Bosque.

3.7.2 Atrisco Acequia Madre (Central NW - SW)

The Atrisco Acequia Madre project located mainly at Central NW (Figure 13) also scored high as it has various components related to recreation and restoration. The City is collaborating with numerous partners to develop the Atrisco Acequia Madre site plan, which is the headwaters for the irrigation channels going to the South Valley and is also an important access point for the Bosque.

Most of the improvements around the Central Blvd. area that currently support outdoor recreation have been on the east side of the river. The OSD and ABQ BioPark were able to create a state-of-the-art recreation area at Tingley Beach that features fishing ponds, native and pollinator plantings, interpretive signage, and access to crusher fine trails that lead to an overlook and wetlands in the Bosque. Likewise at Central NE, there is a large picnic area and easy access to the river and trails. The Atrisco Acequia Madre project will complement these sites to the east but provide access to users who live on the west side and additional context regarding the historical and cultural importance of this area. This project may also address access south of Central Blvd. across the road and under the bridge as well as potentially improving boating access in this area. The plan will also connect this major trailhead further north to Pat Baca Open Space.

3.7.2.1 Managed Public Use

Managed public use currently exists through a formal parking lot at the southwest corner of Central Blvd. and the river that was constructed under the MRG Restoration Project. There are additional access points where return drains meet the levee and parking and an ADA accessible drain crossing at the Los Vecinos del Bosque Park. A crusher fine trail starts at Central NW and goes approximately one mile south.

The goal of the Atrisco Acequia Madre project is to develop a plan for an educational, outdoor site to celebrate the acequia culture and to protect and preserve the agricultural traditions of the Rio Grande Valley. Planning efforts started in 2021 to discuss the possible use of the space through a series of public

meetings. The site plan is still being finalized; however, a number of major themes surfaced during public engagement and partner meetings including the need to provide interpretive signage, seating and shade, a gathering area, ADA parking and trail connectivity, and gardens and native vegetative landscaping. The existing trails entering the Bosque from this site also need to be re-established in some areas with better wayfinding signage, accessible trail systems, and river access for people with disabilities and for small watercrafts. This project would provide access and amenities to an underserved segment of the City.

3.7.2.2 Protect and Enhance

A number of issues in this area include herbaceous and woody invasive plants and a storm drain outfall that deposits trash into the Bosque and river. Additionally, the Central area has had frequent wildfires due to unauthorized encampments. Previous restoration projects completed in this area include fuel reduction, invasive species management, high flow channel, and swale construction and revegetation.

The City has secured a large FEMA grant (the Rio Grande Bosque Wildfire Mitigation Project) to treat up to 470 acres in this area that will focus on removing and treating invasive woody plants and thinning areas under large canopy trees to reduce ladder fuels. Additionally, this area receives a lot of trash coming off Central Blvd and from the outfall. A low decorative seating wall has been proposed to help keep trash from the road, and the OSD is in conversations with the City's DMD to address the storm drain outfall, which they manage. This area has also been a major site for the annual Dia del Rio and National River Clean-up events along with other volunteer events throughout the year.

3.7.2.3 Existing Funding and Resources

The City of Albuquerque (represented by the OSD and BioPark), Bernalillo County, MRGCD and ABCWUA entered into a Memorandum of Agreement to work cooperatively together to support the Atrisco Acequia Madre Project in 2021. Through this partnership, each entity provided $25,000 and a commitment to continue to support the project with staff time, planning, and funding to implement the plan. Additionally, major partners include the South Valley Regional Association of Acequias and the Center for Social Sustainable Systems who are bringing their in-depth knowledge of the historical and cultural importance of the Atrisco Acequia. Additionally, the City has been awarded a FEMA grant for nearly $1,000,000 for fuel reduction and invasive species treatment on up to 470 acres in the Bosque along each quadrant of Central and the river.

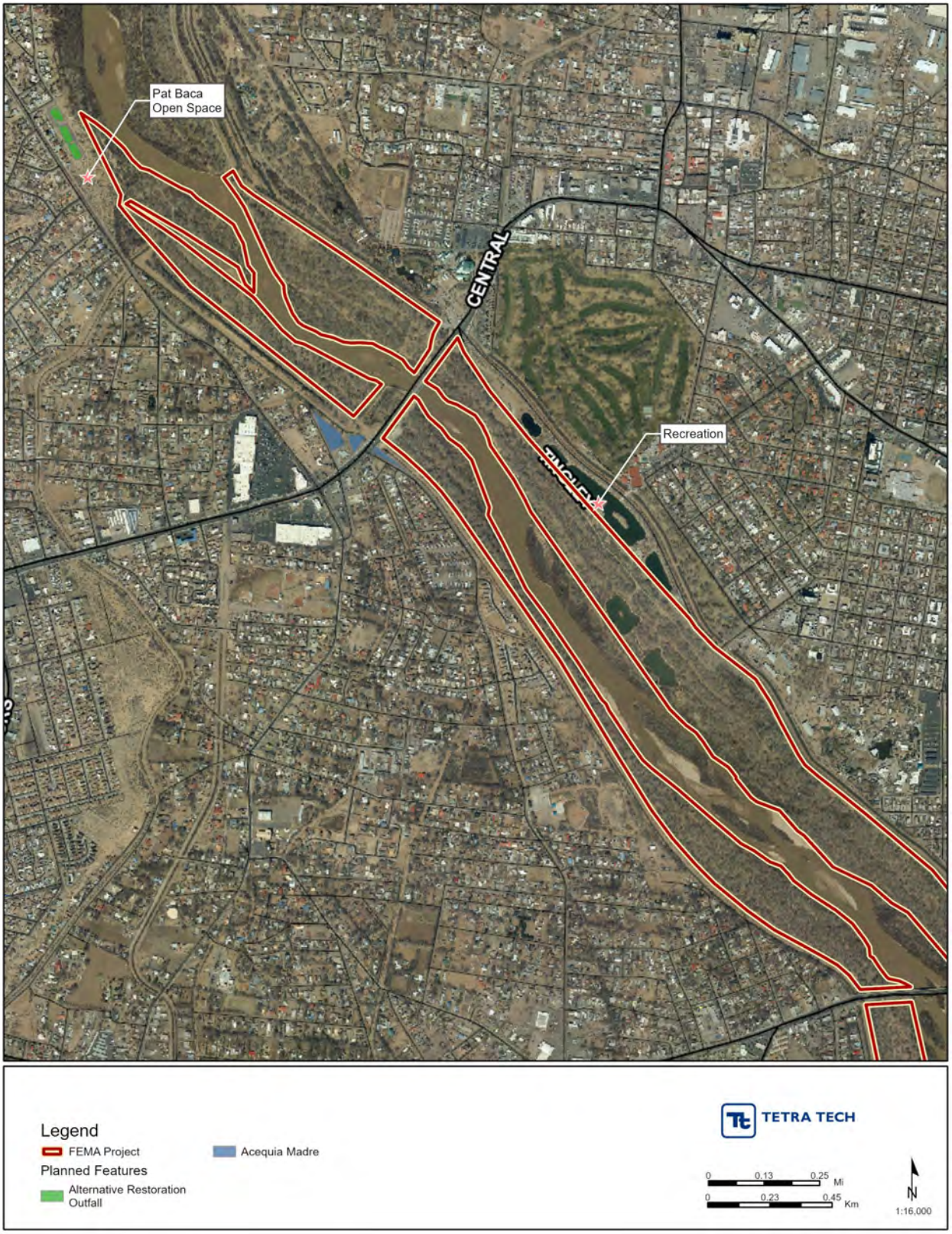


Figure 13. Atrisco Acequia Madre

3.7.3 Alameda Open Space

Alameda Open Space, located on the southeast corner of Alameda Blvd., is a major destination for outdoor recreators and bike commuters accessing the Paseo del Bosque trail and Bosque. It is also adjacent to Bachechi Open Space, which features an Environmental Education Center managed by Bernalillo County Open Space, as well as the ABCWUA San Juan Chama Drinking Water Project and pump station that supports the City's drinking water. The pump station is one of the largest users of electricity in Albuquerque. To offset electricity needs, the ABCWUA plans to install solar covered parking with electric car charging stations (Figure 14). The OSD worked closely with the ABCWUA to review the plans and develop a Memorandum of Understanding that ensures the project will compensate for lost trees and shrubs, and make overall improvements to the surrounding area. Treatment of invasive species will continue to aid in fire prevention.

Additionally, Bernalillo County Public Works and Natural Resource Services manages the Alameda storm drain outfall. The County developed a plan to improve the facility with three different alternatives. The preferred alternative is to construct a high-flow bypass, bioswale, and infiltration basin in the Bosque (Figure 15). This alternative has the potential to aid in water filtration, sediment reduction, and support wet soils habitat. The County is currently seeking funding to make these improvements and will work with the OSD to implement the project pending funding.

3.7.3.1 Managed Public Use

Alameda Open Space is a high-managed public use area with existing parking, restrooms, bike racks, picnic benches, and trail access. It is a major trailhead for the Paseo del Bosque Trail that is used by bike commuters and the public. Often there are conflicts between bikes traveling at high speeds and other user groups such as walkers and equestrians. There are also issues with sign clutter and lack of wayfinding and interpretive information.

To ensure better traffic flow between user groups, the Parks and Recreation Department developed a site plan that is compatible with the ABCWUA solar project. Both the solar project and site plan were approved by the Environmental Planning Commission in 2022. The site plan calls for a realignment of the trails to slow and separate bikes from other users, new native plant landscaping, picnic tables with shade, additional interpretive signs including an entry plaza featuring a Smart Solar Flower, and a secondary entry plaza with a kiosk. The Parks and Recreation Department and OSD will work to implement the site plan. The OSD also plans to assess and upgrade the outdoor furnishings including benches and picnic tables at the northeast side of Alameda.

3.7.3.2 Enhance and Protect

Project components will include fuel reduction, invasive species management, and native plantings. The OSD also plans to assess whether the jetty jacks in the area can be removed as well as work with the ABCWUA on additional interpretive signage for the dam and fish passage connected to the San Juan Chama Drinking Water Project. The OSD is developing a Wetlands Action Plan for management of all wetland properties, which includes the Alameda Wetland.

Figure 14. Alameda SE

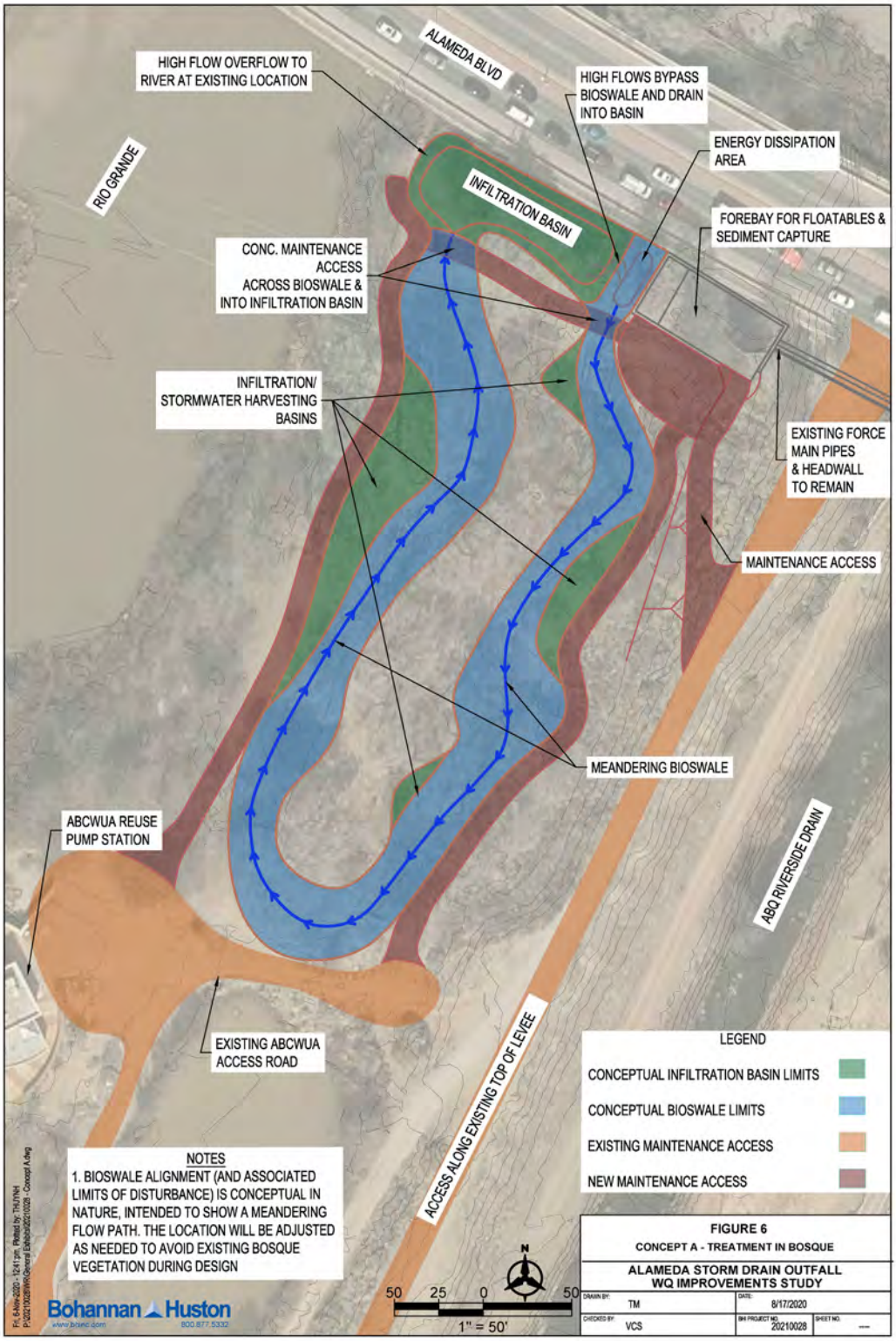

ALAMEDA BLVD
HIGH FLOW OVERFLOW TO RIVER AT EXISTING LOCATION
HIGH FLOWS BYPASS BIOSWALE AND DRAIN INTO BASIN
ENERGY DISSIPATION AREA
RIO GRANDE
INFILTRATION BASIN
FOREBAY FOR FLOATABLES & SEDIMENT CAPTURE
CONC. MAINTENANCE ACCESS ACROSS BIOSWALE & INTO INFILTRATION BASIN
INFILTRATION/ STORMWATER HARVESTING BASINS
EXISTING FORCE MAIN PIPES & HEADWALL TO REMAIN
MAINTENANCE ACCESS
MEANDERING BIOSWALE
ABCWUA REUSE PUMP STATION
ABQ RIVERSIDE DRAIN
EXISTING ABCWUA ACCESS ROAD
ACCESS ALONG EXISTING TOP OF LEVEE
LEGEND
CONCEPTUAL INFILTRATION BASIN LIMITS
CONCEPTUAL BIOSWALE LIMITS
EXISTING MAINTENANCE ACCESS
NEW MAINTENANCE ACCESS
NOTES
1. BIOSWALE ALIGNMENT (AND ASSOCIATED LIMITS OF DISTURBANCE) IS CONCEPTUAL IN NATURE, INTENDED TO SHOW A MEANDERING FLOW PATH. THE LOCATION WILL BE ADJUSTED AS NEEDED TO AVOID EXISTING BOSQUE VEGETATION DURING DESIGN
N
50 25 0 50
1" = 50'
Bohannan Huston
FIGURE 6
CONCEPT A - TREATMENT IN BOSQUE
ALAMEDA STORM DRAIN OUTFALL
WQ IMPROVEMENTS STUDY
DRAWN BY: TM
DATE: 8/17/2020
CHECKED BY: VCS
BH PROJECT NO. 20210028
SHEET NO. ---

Figure 15. Alameda Storm Drain Outfall

3.7.3.3 Existing Funding and Resources

The Water Authority will support native plantings to offset trees and shrubs that will be removed due to the solar covered structure at a 4:1 ratio. Additionally, they are providing $75,000 to help fund interpretive signs and $100,000 for restoration projects in the Bosque. The Parks and Recreation Department also received an Endowment and funding from the State of New Mexico to further support the site plan implementation.

The OSD will pursue ongoing coordination with Bernalillo County in relation to the adjacent Open Space property, especially related to the outfall project, and provide for an ongoing partnership at this location. The USACE RGEMP project will also help with invasive species management, fuel reduction, and revegetation. And finally, Parks and Recreation will work with MRGCD on the site plan to ensure operations and maintenance access for the riverside drain and levee.

3.7.4 Montaño SW

Pueblo Montaño is a popular access point and gathering area for the Bosque from the west side of the Rio Grande and the southwest corner of Montaño (Figure 16). The name Pueblo Montaño honors the ancient pueblo known to have existed there from about AD 1300 to mid-1400. To the south of the parking area and immediately east of Bosque School, the OSD has an agreement with the school regarding the management of 126 acres that dates from the City's purchase of that land from Ray Graham in April 2004. That purchase included the transfer of an easement for Bosque School to use the land in perpetuity for, "...education, research, recreation, and agricultural uses consistent with the conservation of the Bosque while maintaining it in its natural state." OSD projects in this area must be developed and managed in partnership with Bosque School.

3.7.4.1 Managed Public Use

Access to this site is accommodated at a formal parking lot and gathering area that features a number of amenities including restrooms, shade structures, picnic tables, trashcans and mutt mitt stations. Additionally, wood sculptures depict animals of the Bosque as well as a fire fighter who represents the people who fought the large fire in 2003 that burned 100 acres at this site. Trails from this site go along the levee towards Bosque School and beyond and into the Bosque. Also, a concrete trail goes to the picnic area and adjacent levee road.

While this site does support public access and outdoor recreation, it could be enhanced with better wayfinding and interpretive signage. The Parks and Recreation Department is also considering small watercraft access for boaters at this site.

Additionally, the parking area could be greatly improved for bikers and walkers traveling from the Montaño bridge to the parking area and going south along Mirandela Street. Further trail improvements should also be assessed.

Levee trail along drain south of Montaño SW looking south

3.7.4.2 Enhance and Protect

This area provides unique opportunities due to the partnership with Bosque School and BEMP. There has been ongoing student-led research in this area since 2004 that provides baseline data on a number of issues from specific species such as porcupines and cottonwoods to larger complex habitats. Aside from this area being an outdoor learning lab through the partnership with the school and UNM, there is interest in developing model restoration projects that may be considered throughout the Bosque. Most recently, the NM Forestry Division working with the OSD, AFR, and Bosque School reduced hazardous fuel loads on 4.33-acres in 2018. The Bosque School in collaboration with the BEMP also proposed a 1-1.5-acre swale. The purpose of the project would be to provide habitat complexity and wetland habitat within the Bosque. Due to the lack of connection between the Rio Grande and the floodplain, this type of habitat is increasingly rare but vital to many plant, amphibian, bird, and even small mammal species. BEMP staff intend to study and monitor passive revegetation versus active revegetation post swale excavation. The OSD attempted to implement this project in 2020 but was unsuccessful due to cost and resources required to remove large quantities of dirt. Since that time, the idea of developing smaller pocket swales has been discussed and will be further investigated.

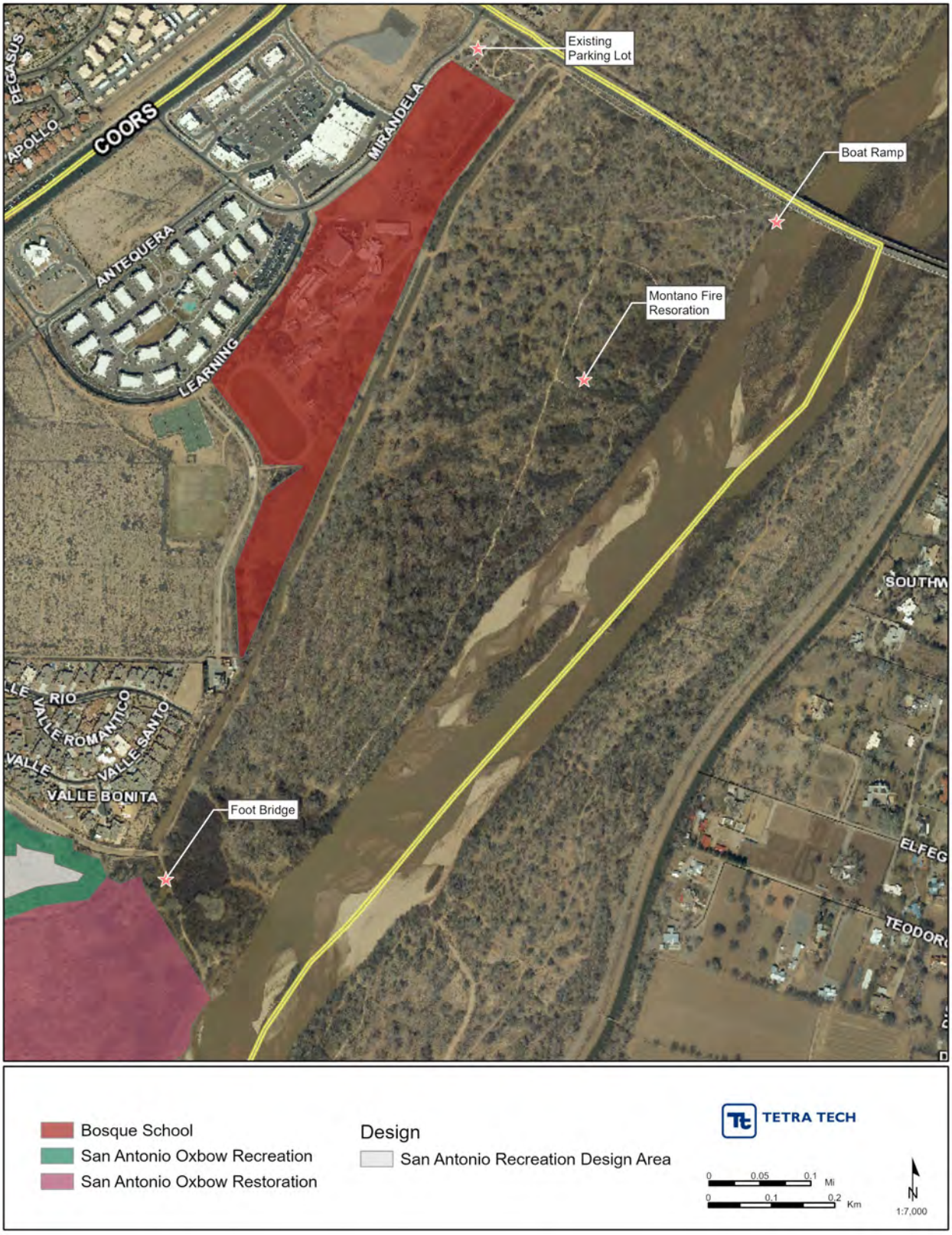


Figure 16. Montaño SW

Additionally, this area has a history of wildfires including the large 100 acres that burned in 2003 and most recently the fire in 2022 that burned 30 acres. The NMFD working with OSD and Bosque School is developing a post-fire remediation project to remove the hazardous dead trees and consider other restoration efforts in 2023. The MRG Endangered Species Collaborative also facilitated site visits after the fire to assess the situation and provide guidance on restoration strategies that are being considered in the project plan.

The ABCWUA is in the process of developing a Bosque Non-Potable Reuse Project in the area, which would release treated water directly to the Rio Grande south of Pueblo Montaño. The project has the potential to increase flow rates to the Rio Grande to support aquatic animals including the Silvery Minnow. However, the water would not flow into the Bosque. The OSD and Bosque School are working with the ABCWUA to review and provide comments on the project.

3.7.4.3 Existing Funding and Resources

The OSD has a Memorandum of Agreement with the EMNRD to support hazardous fuels reduction projects within the Bosque. Through their funding and contracts, they can support the post-fire remediation project planning and implementation. Since there is no other dedicated funding for this specific site, the OSD must rely on the general funds dedicated for the entire Bosque.

3.7.5 Pat Baca Open Space

Pat Baca Open Space, also known as Dog Biscuit Hill, is a bluff that provides stunning views of the Bosque, City, and Sandia Mountains. The property was designated as an official Open Space Unit of the RGSVP on April 2015 by the MRGCD. It is located along Atrisco Blvd. through a residential area (Figure 17). This area supports the neighboring community as a stand-alone property with trails and provides access to the Bosque. Currently a large storm drain outfall goes through this property in the form of an underground pipe that extends out from the bluff. The City's DMD is planning to increase the capacity of the Loma Hermosa outfall and make improvements to the overall system, which has the potential to greatly impact this property and provide some opportunities for overall enhancements.

3.7.5.1 Managed Public Use

Pat Baca Open Space has a trail system that runs along the bluff of the property and extends down into the riparian area of the Bosque. There is currently on-street parking, a mutt mitt station, one bench, and an interpretive sign at an overlook dedicated to Pat Baca. Due to the erosion along the bluff, OSD has had to reroute the trail to the west. As the storm drain outfall project takes shape, the OSD will identify necessary trail reroutes and improvements. An opportunity to include additional wayfinding and interpretive signage may also exist.

3.7.5.2 Enhance and Protect

Currently substantial major erosion compromises the property through numerous major headcuts. The erosion is exacerbated by adjacent residences and the impervious surface sheeting water from driveways and houses, old storm drain outfall infrastructure, and the road where water breaches a curb. The area is also often littered with weeds and dog waste. Additionally, the current outfall goes directly into the Bosque and provides no way for DMD to remove the trash due to inaccessibility. Consequently, the outfall is responsible for directing litter from stormwater into the Bosque, impacting wildlife, water quality, and esthetics of the area.

The DMD is redesigning and constructing new storm drain outfalls (see Figure 18) to better serve the capacity of storm water today and into the future. This as an opportunity to address several the issues from erosion and weed management at Pat Baca to reduce trash and capture water for restoring projects in the Bosque. DMD had developed three potential concepts to be presented to the public.

Within this area under the Ecosystem Restoration @ RT66 Project, USACE completed previous restoration work including invasive species management, high flow channel construction, and revegetation; a backwater channel was also constructed by NMISC. The stormwater captured from the outfall has the potential to be directed into the high flow channel to further clean the water before going into the river and support riparian vegetation.

The OSD is also responsible for maintenance of the Ecosystem Restoration site through ongoing invasive species management and treatment. Additionally, this area will include the Hazardous Fuels Mitigation project using FEMA funding. Implementation of this project will also aid in the removal and treatment of invasive plants and support fire prevention.

DMD also plans to make improvements to an outfall to the north of Pat Baca. These upgrades will directly reduce the trash input into the Bosque.

3.7.5.3 Existing Funding and Resources

The DMD is working with the OSD, MRGCD, BOR, and other entities on the stormwater outfall project at Pat Baca Open Space. DMD has dedicated funding to make these needed improvements.

Components of the RGEMP (USACE) are planned at this location including invasive species treatment as well as a swale and other water features. Bernalillo County is also rehabilitating a stormwater drain outfall and this project may provide some benefits to the Bosque through developing swales and native plantings that will help clean the stormwater.

Figure 17. Pat Baca Open Space

Figure 18. Outfall Restoration Alternatives

3.7.6 Southside Water Reclamation Plant Outfall Restoration Project Area

The ABCWUA operates and treats approximately 55 million gallons per day of wastewater at the Southside Water Reclamation Plant (SWRP). The plant's treated effluent is continuously released to the Rio Grande via an outfall channel located on the east bank of the Rio Grande. Public access to this area is through trails in the Bosque or the Chris Chavez Trail from the southeast side of Rio Bravo Blvd. The SWRP Outfall Restoration Project (Figure 19) is being designed by ABCWUA in coordination with regional partners including the Office of Natural Resources Trustee (ONRT), NMISC, MRGCD, USACE, Reclamation and OSD.

3.7.6.1 Managed Public Use

Currently there is not a formal access area or trail system along this stretch of the Bosque. One goal of the SWRP Outfall Restoration Project is to create a network of new trails that provide increased access in this under-resourced community. Additional interpretive and wayfinding signage is being considered. This will create a new formalized trail system to better serve the Mountain View community and other residences and visitors.

3.7.6.2 Enhance and Protect

A major goal of the SWRP Outfall Restoration Project is to support habitat for endangered species. The SWRP project is adjacent to another restoration site previously constructed under the MRG Restoration Project. This section of the river has yielded higher populations of silvery minnow following construction. The project will aim to extend habitat upstream and downstream of the Treatment Plant outfall and will tie into these existing restoration projects. Habitat restoration components include the following: habitat enhancement through floodplain reconnection and woody debris structures to benefit the silvery minnow, improvement to riparian vegetation through invasive species management and revegetation with native species types to match mosaic habitat goals, and habitat features to benefit both the minnow and flycatcher.

3.7.6.3 Existing Funding and Resources

This project is funded by the ABCWUA and supported by a diversity of stakeholders including ONRT, NMISC, MRGCD, and USACE. The OSD is contributing staff time and expertise for this project rather than direct funding.

Figure 19. SWRP Restoration Project Area

3.7.7 State Land Office Bosque

The New Mexico SLO owns 212.53 acres on the south end of the Bosque. Based on State Legislation, this area is also part of the Bosque but was not being managed by the OSD. In 2020, to avoid confusion regarding regulations and oversight of this area, the OSD entered into a lease agreement with the SLO to officially manage this area (Figure 20). It is also adjacent to Valle de Oro Urban National Refuge (VdO), which provides the main access point into the Bosque in this area.

3.7.7.1 Managed Public Use

This section of the Bosque is teeming with wildlife including wild turkeys, the occasional deer, and numerous bird species. The habitat of the area is further enhanced by the Valle de Oro National Wildlife Refuge, which is 500 acres of traditional farmed land that is being restored to native habitat. The OSD is working closely with VdO and SLO to collaborate on educational and conservation- related activities into the Bosque including working with youth crews on restoration projects. Additionally, VdO provides free access to the Bosque through a permit. The trails from the Refuge connect across the Riverside Drain to the levee and adjacent Bosque. Preliminary discussions are also underway to consider a boating take-out that would be the last official boat ramp prior to the Pueblo of Isleta where the general public is not allowed to access without a permit from the Pueblo.

3.7.7.2 Enhance and Protect

Previous restoration work was completed on the SLO site through the VdO project and supported by AMAFCA. This included the creation of swales and removal of invasive species with the replacement of native vegetation. Current restoration work is also underway through the Rio Grande Returns project. Ongoing management of the area and these projects is needed and would be performed under this project. Project components and maintenance will also aid in fire prevention.

3.7.7.3 Existing Funding and Resources

Several agencies and resources are participating in this Project Area including USFWS, AMAFCA, and NMSLO. Currently no dedicated funding exists for this area outside of the general budget.

Figure 20. State Land Office Bosque

3.7.8 Calabacillas Arroyo (Alameda SW)

The Calabacillas Arroyo Open Space is another major access point to the Bosque on the westside, accessed off Coors Blvd. and Westside drive, southwest of Alameda Blvd. The Calabacillas Arroyo is nearly 17 miles and delivers stormwater to the Rio Grande. As with many major arroyos throughout the City, it provides connectivity for wildlife and recreation and supports the City's stormwater infrastructure. AMAFCA and the City of Albuquerque cooperatively manage this important area. The entire Arroyo east of Unser Blvd. is designated as MPOS and has a scattering of City Parks along its edges as well as trail access from residential areas for equestrians, bikers, and hikers.

3.7.8.1 Managed Public Use

The Calabacillas Arroyo trailhead includes a large parking lot, picnic tables and benches, shade structures, a kiosk with interpretive signs, trashcans, and a mutt mitt station (Figure 21). The trails lead directly to the Rio Grande along the sandy Arroyo as well as throughout the Bosque. In 1998, AMAFCA completed the Calabacillas Arroyo Channel Stabilization Project. This project included a community effort to incorporate a large-scale art installation along the concrete arroyo depicting buried fossils in New Mexico from the Precambrian era to current times. The artist, Michael Wallace, worked with 300 volunteers to construct the artificial fossils, which corresponds to a scavenger hunt where people can identify "artifacts" from a trilobite and mammoth to a conquistador helmet and radio. The installation is further enhanced by interpretive information at the kiosk and online resources. An opportunity to reinvigorate the interpretive project through additional online materials and connecting schools to the site exists.

The City also developed a Calabacillas Trail Master Plan in 2004. While parts of the plan have been implemented, many elements were not realized and are now out-of-date. Consequently, the City's Parks and Recreation Department is updating the plan to provide better trail connections and access throughout the Arroyo and to the Bosque. Through this planning process, the OSD will identify several additional improvements it can make from this site to the larger trail system.

3.7.8.2 Enhance and Protect

Previous invasive species management and planting of native species has been completed between Alameda and Paseo by OSD and under the Bosque Wildfire project. The OSD is currently working with NMSF to develop a treatment prescription and implement fuel load thinning in this area. Several resprouted invasive plants and thickets will benefit from being retreated and thinned. The OSD will also continue to work with AMAFCA on assessing sediment loads into the Rio Grande from the Arroyo.

3.7.8.3 Existing Funding and Resources

The Parks and Recreation Department has dedicated funding for trails that may be used to support the updated Calabacillas Trails Plan. Coordination with AMAFCA is ongoing.

Figure 21. Calabacillas Arroyo (Alameda SW)

3.7.9 Rio Bravo Riverside Picnic Area

This site, commonly known as Poco Loco, is accessed on the northeast side of Rio Bravo from Broadway. The area includes a fully accessible quarter-mile loop trail that winds under a canopy of cottonwoods, passing by the quiet flow of the Rio Grande. The NMDOT is planning to widen and shift the Rio Bravo bridge north, which will greatly impact this site.

3.7.9.1 Managed Public Use

This area features a large parking lot, picnic tables, trashcans, and a mutt mitt station. From the parking area, visitors can access a trail and picnic at one of three sites or fish for rainbow trout from the fully accessible fishing pier along the drain on the north side of Rio Bravo (Figure 22). The Paseo del Bosque trail may also be accessed from the parking area. The site could benefit from better wayfinding and interpretive signage.

The OSD is working with MRGCD and the NMDOT to understand the full impacts of the bridge expansion and how to retain the recreational amenities at Poco Loco. The Parks and Recreation Department has also identified this as an ideal site to provide better small watercraft access for boaters as well as emergency river access for the Bernalillo County Fire Department. The northwest side is being considered due to easy access to the river; however, it is undetermined how the DOT bridge project may affect this area.

3.7.9.2 Enhance and Protect

Previous restoration projects have been completed in this area including fuel reduction and invasive species management. A number of resprouting invasive plants exist including Siberian elms and *Ailanthus*. The City is working with the Ancestral Lands Conservation Corps (ALCC) to treat this area by removing smaller caliber trees by hand. This will be an ongoing effort over the next couple of years.

3.7.9.3 Existing Funding and Resources

The OSD does not currently have any dedicated funding for this area aside from the general funds for the Bosque. Through a contract with the ALCC, the OSD will continue to work on restoration efforts as well as work with the NMDOT on future improvements due to the Rio Bravo bridge project.

Figure 22. Rio Bravo NE

4.0 MANAGEMENT, OPERATIONS & MAINTENANCE

When managing the Bosque, OSD has three over-arching goals: restoration, recreation, and education.

4.1 RESTORATION

New Mexico legislation states the RGVSP 'shall be administered in such a manner as to protect and enhance the scenic and natural values of the Rio Grande.' The first priority in the management of the Bosque as outlined in the 1987 RGVSP Management Plan is to conserve, protect, enhance and diversify existing ecosystems based on the RGVSP Management Plan. The BAP includes numerous policies related to restoration and ecology including Policy 3 that states 'the RGVSP shall be managed to preserve and enhance its ecological diversity.' Every management consideration needs to include the ecological health of the Bosque today and into the future, with an understanding that the Bosque is a dynamic and changing landscape.

Based on scientific projections, the Bosque will change significantly in the future due to several issues previously outlined in this document including climate change. It is essential that the OSD collaborate with partners and use the best science available in the overall management of the Bosque as well as in maintaining existing and establishing new restoration projects. For example, while the BAP heavily favors planting cottonwood trees; other native trees, drought resistant trees, and tested genotype trees should be included in the planting palette.

Inundation of the Middle Rio Grande Restoration Project at Sites 5D and 5E, September 2013

The OSD also needs to use river hydrology, climate and groundwater models to evaluate ongoing changes in vegetation due to restoration, drought, and fire. Ongoing monitoring (by OSD and others) should also be used to best identify areas to establish pole plantings and swales that address the lowering groundwater table (tied to river flows and inputs) projected into the future. Wherever feasible, jetty jacks should also be removed as part of restoration as well as for access to trails and for fire management. Taking a holistic ecosystem approach that supports a mosaic of habitat types, including promoting riparian forest, grasslands, and wetland and open water areas as well as shrublands and uplands, as discussed in the MRG-CAP, should also be considered as the Bosque changes. Addressing fuel loads needs to continue to be a management priority considering persistent drought conditions and aging of continuous cottonwood stands nearing the end of their life cycle.

4.2 RECREATION

The RGVSP was established with the ideal of creating public lands that would allow for and promote appropriate low-impact recreation with regulations on more impactful uses such as off-road vehicles, hunting, and golf courses. According to State Legislation, the designation of the RGVSP as a State Park enables people to enjoy the recreational, environmental, educational and wildlife benefits of the river. The BAP outlines numerous policies that both support and provide for recreation while specifically outlining restrictions and the need to balance recreation with the ecological integrity of the Bosque.

The OSD is facing new challenges with an increase of visitors to the Bosque and new electric individual vehicles such as e-scooters and e-bikes. Managing access and outdoor recreation is a primary responsibility of the OSD. The OSD will focus on working with law enforcement to patrol and enforce ordinances and regulations to limit negative impacts to the Bosque, while enhancing current recreational amenities. The OSD will work to upgrade existing outdoor furnishings, parking areas, picnic areas, and signage. Additionally, the OSD will focus on providing equitable access to the Bosque and improving safety so that the wild and natural character of the Bosque can stay intact. Small watercraft access and safety can also be greatly improved through appropriate signage. These efforts and others will be a major part of managing and enhancing recreational offerings in the Bosque over the next five to ten years.

4.3 EDUCATION

Education is key for the current and future management of the Bosque and is a focal point for the OSD due to the immense benefits it plays in the community's understanding, respect, and connection to this critical area. Education has been central to the establishment of the Bosque as outlined in the RGVSP Management Plan (1987) which states that education shall be provided to visitors of the Bosque through a program of public education, interpretive programs, preventative law enforcement, and publication of informational brochures. The BAP further outlines several policies specific to education and providing/establishing educational material, programs, and designated areas. The OSD's educational programs are also focused on reducing or eliminating (closing the gap to) any barriers to accessing public lands and addressing any issues of equitable access to Open Space for all residents. The OSD is committed to offering direct programs and furthering efforts through partnerships with other environmental educational organizations, engaging Albuquerque Public School children and families, and providing cradle to career opportunities in the Bosque. Education will also be a priority over the next five to ten years and pursued through education programs and interpretation and aligned with the OSD's Community Engagement Plan.

4.4 OPERATIONS & MAINTENANCE

OSD oversees all Bosque lands within the designated RGVSP. Ongoing maintenance of fuel loads, exotic species management, recreational amenities, and trash removal and clean-up, ensuring that signage is in place and other maintenance is conducted on a rotational basis. Maintenance components are described in Table 24. Table 25 shows annual operations and maintenance (O&M) components by area and tasks to be completed in each Project Area.

In addition to these regularly scheduled O&M tasks, the OSD has spends considerable time cleaning up illegal encampments. The City's ordinance clearly states that no camping is allowed in the Bosque. It is essential to enforce no camping due to the issues that result from encampments such as wildland fires and pollution, which impact wildlife and water quality in the Bosque and river. Most fires are believed to be started by people in the encampments, especially around Central Blvd. Clean-up efforts can also be very extensive at times requiring the removal of raw sewage, drug paraphernalia, and dump trucks of trash. This problem has increased over the years as it has throughout the City and Nation. The OSD staff spend a considerable amount of time cleaning these encampments, which has taken time away for other restoration and operation activities. Detecting camps before they get too large is one major strategy the OSD would like to pursue in the future and can hopefully be accomplished with dedicated Park Attendants who will be an active presence in the Bosque to address ongoing issues described above. The OSD follows City policies regarding the removal of encampments by working with APD to provide notice prior to removal and Family and Community Services to aid when people are amenable.

Table 24. Maintenance Descriptions

Maintenance Item	Description
Trash	Manage 20 locations with trash receptacles at parking areas and trailheads in the Bosque and staff services them on weekly basis M, W, and F. See map for locations
Mutt Mitt Stations	Manage and services mutt mitt or pet waste stations at trail heads and parking areas along the Bosque. Maintain supply of bags and ensure stations are in working order.
Transient camp clean-up	Follow the city's protocol for removing and cleaning encampments that includes coordination with APD and Albuquerque Community Safety (ACS).
Mow along trails	Mow quarterly 2-3 ft into the trail along Paso del Bosque.
Wetland irrigation season and vegetation management	Manage major wetlands along with Bosque, including Alameda, OSVC, and San Antonio Oxbow that rely on surface irrigation is coordination with MRGCD. Following the surface water availability with MRGCD's schedule, staff will coordinate with ditch rider and open and close gates to ensure water delivery.
Trail maintenance	Work with volunteers, youth crews and partners to maintains trails throughout the Bosque. This includes through organized annual events like National River Cleanup Day and Dia del Rio. The OSD also managed the Paseo del Bosque trail from Campbell Rd. to Alameda Blvd.
Clean vault toilet	Service vault toilet facilities at Alameda and Pueblo Montaño, regularly scheduled maintenance every 3 months.
Signage and parking assessment	Replacement and repair of signs are implemented as needed, typically due to graffiti, vandalism or natural deterioration. Fence repair is also ongoing.
Assess bridges	Manage removal (by mowing) of vegetation encroaching within 50-100 ft buffer zone under and around major bridge crossings over the Rio Grande.
Hazardous trees assessment	Remove and prune hazard trees as needed along trails and parking areas to maintain clearance for safety of visitors. Trees are not actively pruned aside from these areas.
Wetland management	Monitor for health of wetlands, remove invasive species, conduct surveys, promote wildlife habitat, and ensure water delivery through seasonal irrigation.
Hazardous fuels/Fuels thinning	Work with partners to implement fuels reduction projects to reduce wildfires by removing dead and down woody materials. Focus on removing invasive trees and weedy ladder fuels such as Kochia and Ravenna Grass. Due to the extent of the Bosque, this work is ongoing, however, much of the natural material including potential nesting trees and woody debris is left intact.

Maintenance Item	Description
Plantings	Organize cottonwood pole plantings and willow swales projects throughout the winter with volunteer groups and RiverxChange students. Additionally, annual projects include seeding native grasses, wildflowers, and forbs.

Table 25. Rio Grande Valley State Park Annual Operations and Management Plan

Area	Q3 January - March.	Q4 April-June	Q1 July-September	Q2 October-December
Alameda Open Space	• Assess bridges - water seal and make repairs • Wetlands – invasive removal prior to irrigation season • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Mow along trails • Wetland irrigation season • Trail maintenance, invasive species assessment and outdoor furnishings in the Bosque. Develop a plan for the fall. • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Wetland irrigation season • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Wetlands – assess liner • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet
Shining River	• Signage and parking assessment. • Signage replacement • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Mow along trails • Hazardous trees assessment • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Mow trailhead • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Assess ABCWUA Restoration Site – treat invasives and review tree mortality/survival rates. • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet
Rio Grande Nature Center/Candelaria	• Signage assessment and replacement • Non-authorized camp assessment and clean-up	• Mow along trails • Hazardous trees assessment • Non-authorized camp assessment and clean-up	• Mow along trails • Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up
I-40 NE/Gabaldon	• Signage assessment and replacement • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Mow • Trash – 3 days a week • Hazardous trees assessment • Non-authorized camp assessment and clean-up	• Mow • Hazardous trees assessment • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Mow • Trash – 3 days a week • Non-authorized camp assessment and clean-up
Central NE	• Signage assessment and replacement • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Mow • Trash – 3 days a week • Hazardous trees assessment • Non-authorized camp assessment and clean-up	• Mow • Hazardous trees assessment • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Mow • Trash – 3 days a week • Non-authorized camp assessment and clean-up
Central NW/Tingley	• Signage assessment and replacement • Wetland Management • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Mow • Wetland Management • Trash – 3 days a week • Hazardous trees assessment • Non-authorized camp assessment and clean-up	• Weed mitigation and seeding – goats • Wetland Management • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Wetland Management • Non-authorized camp assessment and clean-up
NHCC	• Trail event (VS and volunteers) • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Volunteer Event (USFWS and MRGCD) • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up
Poco Loco	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Signage and furnishing assessment and replacement	• Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Invasive management	• Trash – 3 days a week • Non-authorized camp assessment and clean-up
SLO	• Annual planning	• Youth crew project support	• Youth crew project support	
Alamo	• Signage Assessment and replacement • Irrigation ditch improvements		• Invasive Tree Removal	
Calabacillas	• Signage and furnishing assessment and replacement • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet

Area	Q3 January - March.	Q4 April-June	Q1 July-September	Q2 October-December
Pueblo Montaño	• Signage and furnishing assessment and replacement • Assess and treat statues • Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet • Weed mitigation (goats)	• Trash – 3 days a week • Non-authorized camp assessment and clean-up • Clean vault toilet
San Antonio Oxbow and Bluffs	• Trash – 3 days a week	• Trash – 3 days a week • Community Clean-ups • Invasive Plant Removal	• Trash – 3 days a week • Community Clean-ups • Invasive Plant Removal	• Trash – 3 days a week
Pat Baca Open Space	• Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up
Central NW/Atrisco	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up • Weed management (goats)	• Non-authorized camp assessment and clean-up
Central SW	• Signage and furnishing assessment and replacement • Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up	• Trash – 3 days a week • Non-authorized camp assessment and clean-up
Dolores Huerta/ Bridge SW	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up
Rio Bravo SW	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up	• Non-authorized camp assessment and clean-up

5.0 MONITORING AND ADAPTIVE MANAGEMENT STRATEGIES

5.1 BAP POLICIES

Adaptive management is defined as a rigorous approach for designing and implementing management actions to learn about critical uncertainties that affect decisions (Murray et al. 2011) and adjust in response to new information or changes. Science-based monitoring of project components is recommended to see if actual outcomes match those predicted and using those results to learn and adjust future management. Criteria for monitoring and adaptive management are used to evaluate the degree to which the project goals are met.

Management strategies and guidelines are provided in lieu of a specific Monitoring and Adaptive Management Plan. Success criteria can be developed and measured through specific, on the ground monitoring of project components, and linking them back to project goals. The potential need for adaptive management where success criteria may not be met is also discussed.

The OSD has limited staff resources to implement annual monitoring. Consequently, the OSD will rely on monitoring and research from other organizations including UNM, BEMP, MRGESCP and citizen scientists. The OSD may contract with other entities if monitoring is not currently being conducted by a partnering agency but is needed to inform OSD management decisions. Additionally, the OSD will take on specific monitoring duties that are outlined in this document.

The following BAP policies are specific to Monitoring throughout the Bosque:

- Policy 2: Comprehensive programs shall be established for monitoring environmental ecological systems.
- Policy 3: The Rio Grande Valley State Park shall be managed to preserve and enhance its ecological diversity.
- Policy 11 C: An ecologically compatible, multi-use trail system shall be enhanced.
- Policy 20 D: Continuously monitor construction projects for compliance with this plan.
- Policy 21 D: Monitor all surface disturbance for archaeological deposits or artifacts.
- Policy 24: A volunteer patrol shall be formed and coordinated by the Open Space Division to provide a safe environment for the park users and protection of the natural resources.

5.2 VEGETATION MANAGEMENT

The goal of vegetation monitoring is to track and quantify changes in vegetation conditions over time. Specific revegetation goals for the Bosque as a whole or on a project by project basis can be defined, such as determining if there is an increase in the abundance and mosaic-like distribution of native plant communities and complex vegetation structure, fuel loads, post-fire restoration and other potential goals. Measurement goals can also include the quantification of woody and herbaceous non-native species. Objectives include diverse cover types and structure in a Project Area. Additionally, vegetation monitoring will determine if restoration measures are promoting improved biodiversity, improved habitat for threatened and endangered species, and reducing the risk of catastrophic fire which can relate back to the goals and objectives for this project.

Methods of monitoring could include continued comparison and assessment of vegetation communities (comparison of Hink and Ohmart vegetation polygons as described in Section 2.3.2) and those mapped and described in a Project Area in the future. Continued collection of data by BEMP and comparison with previous data (as described in Section 2.3.2.1) could also be taken forward in the future.

Alternatively, to provide information on community composition, structure, and density for a known area, a variation of the point-line intercept method which measures established vegetation strata in 5-meter sampling increments along a 50-meter transect could be used (Jamison and Johnson 2019). This methodology was also initially used in 2005 and 2010 under the MRG Restoration Project and comparison data from those years exists.

Based on the results of the vegetation monitoring, various calculations can be performed such as percent cover, density, diversity, species richness, and dominant community composition (upland, riparian, wetland). These values can be compared across years to determine the trajectory of the area and any need for adaptive management. Adaptive management could include changes to infrastructure or the river channel to increase water availability, treatment of non-native vegetation, or revegetation. The results of these assessments can provide information on fuel loads and non-native vegetation densities for management actions.

Additionally, wildlife monitoring can provide information on the quality and type of habitat provided by the vegetation. Vegetation can also be assessed as potential habitat for flycatcher utilizing the USFWS potential habitat form (which is a variation on the Hink and Ohmart methodology). Other data sources, including Audubon Southwest or the MRGESCP studies, may be used to provide input to vegetation monitoring within the Bosque. The OSD will also work with contractors to conduct Hink and Ohmart vegetative studies every 5 years to compare this information overtime. Other partner agency data (Audubon, BEMP, USFWS) will also be used to inform management actions.

5.2.1 Non-Native Vegetation Management

Specific goals related to vegetation management can be developed and evaluated. For example, if non-native vegetation (woody and herbaceous) management and revegetation efforts are successful, non-native vegetation should be less than 25 percent of the vegetation cover. If non-native vegetation exceeds the 25 percent threshold, resprouts can be retreated according to methods described for non-native/exotic vegetation including herbicide treatments and manual and mechanical removal. After an initial establishment period for native vegetation and retreatment of non-native vegetation, the community should be self-sustaining and naturally suppress non-native vegetation.

The OSD will work with the BEMP UNM class to conduct seasonal monitoring of high priority areas where invasive species have been identified. The OSD will also develop a matrix for assessing and prioritizing areas for treatment based on UNM's data. Citizen science and volunteer efforts can also be used to monitor and document the presence of invasive species to help identify areas that may need further monitoring or treatment.

5.2.2 Revegetation

Similarly, revegetation and sustenance of native vegetation can be evaluated. Ideally 75 percent survival of planted trees, shrubs, forbs, and grasses is desired. Initially, in areas that did not have any prior native

vegetation, vegetation survival can be determined by simple counts of plants versus the known number of trees or shrubs planted. However, in areas with existing native vegetation, or after implementation of restoration actions when natural vegetation recruitment occurs, it is difficult to distinguish natural recruitment versus planted material.

Monitoring of revegetated areas would provide information on percent cover and community composition which could be compared to a predefined criterion for native vegetation cover and composition. The success criteria as noted in the MRG-CAP (Table 14) could be used for comparison and evaluation of relative success. The community composition goal would be different for areas intended to be wetlands, riparian forests, or upland areas.

Additionally, the OSD will collaborate with partner agencies to assess the most appropriate locations and species for plantings based on groundwater monitoring and desired vegetation community composition.

5.2.3 Post-Fire Restoration

As noted above, specific initial post-fire data has been collected for the Montaño Fire area by BEMP. Post-fire restoration goals can be developed, and monitoring implemented to evaluate if restoration efforts are meeting success criteria. The OSD will also continue to monitor these and additional post-fire areas for hazard trees, invasive species succession and resprouting, erosion, and native plant establishment and survivability. This will be conducted every six months for the first 2-3 years after the fire occurred with the possibility of extending monitoring as needed. Additionally, the OSD will develop standard post-fire restoration protocols in coordination with the AFR and BCFD.

5.3 RESTORATION FEATURE ASSESSMENT

Several water-related restoration features and components are described in the nine priority projects described in Section 3 including wetland enhancement, river bankline manipulation, and willow swales. The methods for evaluating these types of features is described below.

5.3.1 Wetland Enhancement

Enhancement and management of existing wetland habitats at Alameda SE, the Oxbow, and Tingley are one of the goals for the Bosque. The assessment of water quantity and quality provided to these habitats is key to mimicking natural periods of water flow and drying within wetland habitats. Hydrology inputs and outputs to these areas as well as any blocking by beavers or overgrown vegetation should be evaluated monthly.

The evaluation of desired plant community and composition should be monitored and would also indicate if the hydrology is sufficient to support the desired wetland plant community. Vegetation monitoring would also inform the need for non-native vegetation retreatment or additional native vegetation planting. The overall size and composition of the wetland area can be compared from year to year to determine any expansion of wetland areas and/or changes in community composition.

OSD is developing strategies to enhance the existing wetland habitats throughout the City with both water cycling/flow regimes and vegetation community compositions being a key point in this process. Monitoring by OSD, or an appropriate partner, will be conducted to better inform these decisions.

5.3.2 Bankline Manipulation

Bank destabilization, bank lowering, and/or the creation of high-flow or backwater channels increases the potential for overbank flooding, which could help riparian vegetation subsequently establish in these areas.

River cross section surveys could be conducted annually upon completion of initial construction. The surveyed cross sections could then be compared to the original as-built surveys, and to each annual survey, to monitor the elevation and features of the floodplain at the bankline.

Site visits at low river flows following spring runoff and any major high flow events could also be performed to visually inspect the integrity of restoration features.

Vegetation monitoring of the floodplain, particularly those areas intended to have increased inundation, could be used to evaluate any increase in wet habitat or native riparian vegetation, informing the availability of habitat preferred by native wildlife species. Monitoring could occur bi-annually and be compared to the pre-construction condition and evaluated for changes in vegetation composition. Increases in upland vegetation or non-native species would inform the need for adaptive management, such as channel maintenance, non-native vegetation treatment, or native vegetation planting.

If floodplain connection is lost, management of bankline manipulation measures may be needed.

5.3.3 Willow Swales

Willow swales are proposed within the RGEMP project at Alameda SE and potentially in other Project Areas. Several swales have been constructed in previous restoration projects (MRG Restoration, Ecosystem Restoration @ RT66). These features can be monitored for percent coyote willow cover of a predetermined area and the presence of non-native vegetation. If coyote willow can be established and continues to expand in cover it should preclude non-native vegetation. A decrease in cover of coyote willow could indicate changes in hydrology that increase the depth to water table. Additionally, the presence of non-native vegetation could require non-native vegetation treatment.

5.4 WILDLIFE USE

The use by wildlife, especially threatened and endangered species, is being evaluated by several agencies and stakeholders in the Project Area. This information can be used in comparison with habitat and restoration goals and potential adaptive management needs. OSD will use data gathered by partner agencies to inform restoration and management actions that are conducive to threatened and endangered species habitat creation or in an adaptive management capacity.

5.5 OUTDOOR AMENITIES

OSD will inventory outdoor amenities within the park including signage, trails, picnic tables, benches, bridges, and other amenities and annually assess for any replacement or repairs needed. Trail use, development, and especially user-made trails shall also be assessed annually to provide recommendations for ongoing use management.

OSD Management Considerations

- Develop an annual report specific to OSD's management of the RGVSP that includes a monitoring summary, major projects, plantings and trail projects, unique factors (fires, drought, floods), adaptive management changes, and recommendations for the next year.
- Work with BEMP/UNM Biology Dept. to assist with ongoing monitoring focused on post-fire recovery and remediation efforts as well as invasive species encroachment.

6.0 REQUIRED RESOURCES

The City of Albuquerque is mandated by state legislation and through management agreements with the State of New Mexico and the MRGCD to manage the Bosque. This is a tremendous responsibility, and the OSD has been efficient with existing resources. However, to effectively manage this complex, dynamic ecosystem for recreational purposes and ecological health, the OSD simply needs a lot more resources. Since the City took on management responsibility of the Bosque, the OSD has not had adequate resources, yet has been innovative and has heavily relied on partners and volunteers. However, combining small resource and volunteer contributions only goes so far, and it is more dire than ever that the OSD is adequately resourced due to increased visitation numbers by the public, issues around encampments, and drought spurring on wildland fires. This is the most critical habitat with immense recreational value for the City, yet it is under resourced. For the City to fully meet its obligations and support the Bosque, obtaining the resources outlined below is a top priority for the Open Space Division.

6.1 CURRENT RESOURCES

The OSD currently manages over 30,000 acres in Albuquerque and the surrounding area. The OSD has 43 fulltime employees. Seven employees are dedicated to the Bosque and are listed below in Table 26. Six equipment operators are specifically dedicated to Bosque management as well as a Project Coordinator. Additional staff provide limited support. They include an OSD Biologist who oversees wetland management and Visitor Services and Natural Resource Section personnel who primarily support public events such as major clean-ups and tree planting events with youth and volunteer groups. The current budget for the Bosque is $1,225,285 in General Funds, which is broken down by the following: $556,026 in personnel; $618,786 in operating funds; and $50,473 for fleet.

Table 26. OSD Current Resources for the Bosque

Resources	People and Funds
Staff	6 Equipment Operators and 1 Project Coordinator
Volunteers (Trail Watch, Fire Watch and Bosque Wild volunteers)	In 2022 over 2,350 volunteers have participated in projects to support the entire MPOS system, including the Bosque.
General Funds (annual budget that covers staff, operations, and fleet)	$1,225,285
One-time general fund increase for FY23	$335,000
GO Bonds for the Bosque	$300,000
San Antonio Oxbow Bluffs (SAOB) GO Bond funds	$1,000,000
Alameda Open Space from the ABCWUA	$175,000
Endowment for the Bosque	$450,000

6.2 ADDITIONAL RESOURCE NEEDS

Based on the MPOS Facility Plan, the OSD should have a minimum of one full-time employee per 1,000 acres. With this conservative estimate, the OSD would need six fulltime Open Space Park Attendants to cover the area throughout the week. Currently, the OSD does not have any dedicated Park Attendants for the Bosque. The role of the Park Attendants would be to do the following:

- Maintain trails
- Maintain recreation areas including trailheads and restrooms
- Inventory and maintain outdoor furnishings
- Report and maintain fences, gates, and other access points
- Manage invasive plants such as the Siberian elm, Russian olive, tamarisk, tree of heaven, Ravenna grass, kochia, tumbleweeds, and goathead
- Plant and maintain newly planted trees and shrubs when needed
- Manage areas of erosion
- Maintain swales and other past restoration efforts
- Pick up trash and unnatural debris
- Report issues and ordinance violations
- Interface with the public on a regular basis to inform them about rules and regulations, trail etiquette, boater safety, public events, and educational offerings, and respond to general questions and concerns
- Work alongside volunteers and partners on restoration projects
- Work alongside youth crews on restoration projects
- Work with students and partners on citizen science, monitoring, and research projects

In addition to the six Open Space Park Attendants, the OSD would greatly benefit from having two additional technical staff including an Open Space Technician who would support the complexities of natural resource management as well as a dedicated Education Supervisor who would be able to greatly increase educational programs, interpretive signage, publications, and media for the Bosque.

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Table 27. OSD Staff Needs

Department	Position	Base Cost (with Benefits)
Open Space Division (OSD)	6 Park Attendants	$322,800
OSD	1 Open Space Technician	$64,500
OSD	1 Education Coordinator	$66,000
Total for OSD		**$453,300**

7.0 BAUP IMPLEMENTATION BUDGET NEEDS

This BAUP document contains projects at specific locations that correlate to the priority projects as well as general budget needs. An estimate of in-house (OSD) requirements for those projects as well as ongoing annual operations and maintenance estimated for 5 years is provided in Table 28 below. Regarding the capital projects related to the priority projects and boat access, the numbers provided are conservative estimates and will be further refined through the site planning process for each location.

Table 28. BAUP 5-Year Budget

Description	5 yr. Estimate	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.
OPERATIONS AND MAINTENANCE						
Hazardous Fuels Mitigation (Treating 150 acres per year)	$1,500,000	$300,000	$300,000	$300,000	$300,000	$300,000
Invasive Species Removal and Mitigation (youth crews, volunteer coordination, inmates, herbicides, and tools)	$400,000	$80,000	$80,000	$80,000	$80,000	$80,000
Post-fire Remediation (plantings/seeding, hazardous tree removal, swales and berms, surveys) - 10 acres per year based on average fires per acre over the last 5 years	$500,000	$100,000	$100,000	$100,000	$100,000	$100,000
Construction Debris Removal and Disposal (meet w/102 excavate to look at site – area and 102 excavate)	$300,000			$150,000	$150,000	
Jetty Jack Removal and Repurposing (2006 costs - per jack removal, is $240 below ground, $140 above ground, $100 for tiebacks)	$60,000			$30,000		$30,000
Restoration Plantings and Species Propagation (genotype research)	$50,000	$10,000	$10,000	$10,000	$10,000	$10,000
Trail Rehabilitation and Construction (asphalt and crusher fine)	$60,000		$30,000		$30,000	
Outdoor Furnishings	$150,000	$30,000	$30,000	$30,000	$30,000	$30,000
Wayfinding and Interpretive Signage	$300,000		$150,000	$150,000		
Large Equipment (dump truck, burner, trucks, marsh buggy, 102 excavator)	$700,000	$350,000	$350,000			
Monitoring and Research	$75,000					$75,000
BEMP Education Programs	$375,000	$75,000	$75,000	$75,000	$75,000	$75,000
Bosque Technician	$322,500	$64,500	$64,500	$64,500	$64,500	$64,500
Bosque Education Coordinator	$330,000	$66,000	$66,000	$66,000	$66,000	$66,000
Bosque Park Attendants (6)	$1,614,085	$322,800	$322,800	$322,800	$322,800	$322,800
Total	**$6,736,500**	**$1,398,300**	**$1,578,300**	**$1,378,300**	**$1,228,300**	**$1,153,300**

8.0 BAP POLICY EVALUATION

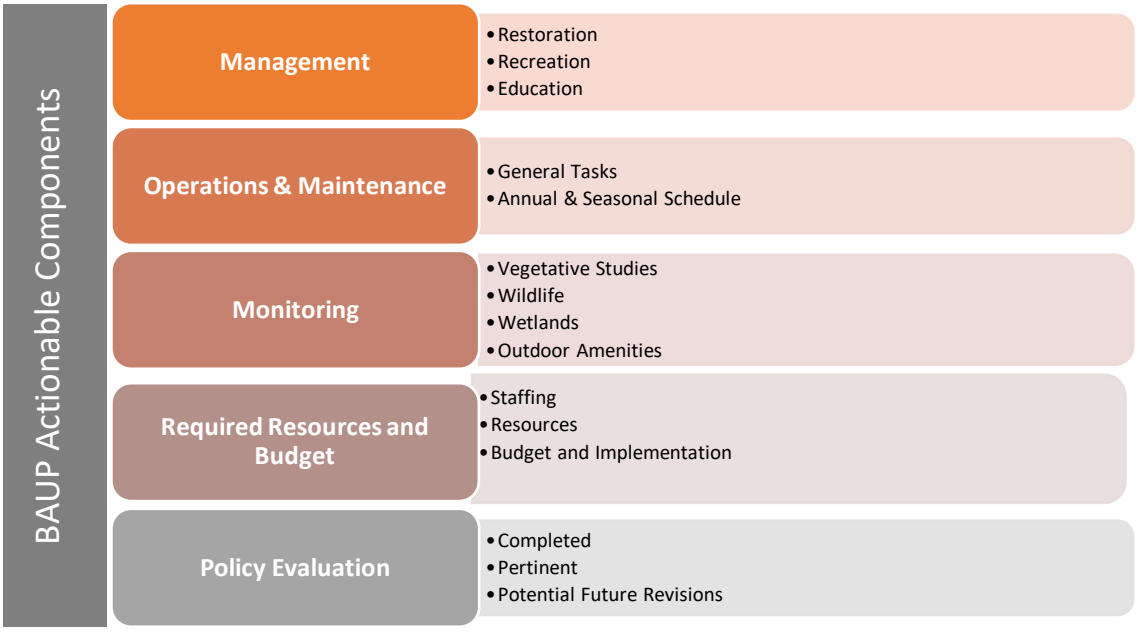
The BAP outlined a number of policies intended to guide decision-making in management and project selection in the Bosque. Based on environmental and usage changes as well as project implementation since adoption, the following (see Table 29) is an assessment of the BAP policies and recommended updates or additions.

Table 29. BAP Policies Evaluation

Policy	Status	Recommended Updates
A.1	Ongoing	Should base new decisions on updated vegetation survey rather than old biophysical land units (BLUs) E. Remove – unlikely to create new wetlands except in outfall areas, which are addressed in a later policy H. IDO supersedes these policies; should be changed for next official update
A.2	Incomplete	This intensity of monitoring is not feasible for OSD to complete alone; should cut down on internal studies and identify what other entities are doing to share data A chart of monitoring that is necessary for OSD to complete would be helpful
A.3	Ongoing	E. Remove I. Remove second sentence – providing new trails interrupts habitat
A.4	Ongoing	Need to expand this policy to include genetically adapted cottonwoods and other drought-adaptive plants and mosaics Add action for monitoring and mapping pole plantings
A.5	Ongoing	Add action to collaborate with plethora of other entities also doing this work
A.6	Ongoing	No longer the policy for development or extraordinary facilities; needs to be updated to current policy in MPOS Facility Plan and IDO Policy: All submittals for development, both on private and public property located on or adjacent to the Bosque, shall be reviewed to determine potential impacts and compliance with IDO protections. Action: Open Space and Parks & Recreations staff will review development applications for compliance Action: OSAB will review and make recommendations to the EPC on extraordinary facilities on OS and adjacent major developments
A.7	Ongoing	Remove “not approved by the Open Space Division” Should also include other plants and grasses
B.8	Ongoing/complete	B. No more Bosque educational facilities are necessary – we now have OSVC, RGNC and Bachechi.
B.9	Complete	With the exception of creating an info booth, this is complete. Currently, a more appropriate location for an info booth in the area would be Tingley but it could be unnecessary. Update policy to maintain existing features and continue to coordinate with BioPark on projects and trail connections instead of developing more.

Policy	Status	Recommended Updates
B.10	Ongoing/complete	C. Each access point should have rules and regulations but limit interpretive signs to major access points. E. Work with APD/Open Space police to increase patrols; hire Bosque Park Attendants to provide more support. G. Remove; no additional parking recommended near the RGNC
B.11	Complete/ongoing	Multi-use trail system exists throughout the Bosque--there are too many trails in some places. This policy can be redirected to focus more on improving and maintaining existing trails and closing the ones that are unsustainable or inappropriate.
B.12	A, B and C complete	D. Mile markers exist in Open Space section north of Campbell but still need them south of Campbell on the paved trail (Park Management and County sections); need to replace bridge crossing signs in several locations indicating which road it is. Remove E and F
B.13	Complete	Add action: Prohibit fishing where inappropriate, including San Antonio Oxbow and wildlife management area ponds south of Central Ave.?
B.14	In progress	Add action: Improve regulatory and informational signage specific to boating at put-in and take-out areas
B.15	Ongoing	No changes
B.16	Ongoing	Add action: Work with other relevant agencies to identify jetty jacks that can be removed to improve emergency vehicle access
C.17	A – E complete	F. Minor edit – change “database” to “StoryMap” H. Add BioPark as education partner
C.18	Complete/ongoing	C. Prioritize major trailheads rather than secondary access points for interpretation G. Include all OSD staff, not just Visitor Services
C. 19	Incomplete	Some of the identified areas are not appropriate due to access issues – no parking, long hike in, etc. – while other areas are now much more accessible. Locations must be reassessed with the goal of providing equitable access around Albuquerque without impacting sensitive areas. Work with the Office of Equity & Inclusion.
D.20	Ongoing	E and G: Construction projects must also be coordinated with other responsible entities including MRGCD
D.21	Ongoing	B and C: Current staff are unaware of these documents/the locations of archaeological zones E. Open Space will work with relevant entities to identify historical sites that are appropriate for interpretation and identification to the general public
D.22	Incomplete	Open Space will work with emergency response entities on training guidelines
D.23	Ongoing	Open Space continues to work with DMD to assess stormwater outfalls and implement appropriate improvements
D.24	Complete	While Trail Watch Volunteers are invaluable, they can’t enforce regulations. In order to deal with increased use, trail etiquette, and natural resource impacts, there must be dedicated staff working closely with APD officers to meet this goal.
New		Fire management/fuel reduction policy
New		Climate change policy

9.0 SUMMARY



The BAUP Actionable Components above provide an overview of the previous sections and summarized actions that will be focused on in this Plan. Over the next five years, the OSD will focus on several initiatives including 1) daily operations and maintenance, 2) projects throughout the entire Bosque, and 3) site-specific priority projects. Additional management considerations have been included.

This planning effort and document provide clear direction for the OSD and partners over a specific period of time. Through an adaptive management approach, this plan also allows for flexibility to modify projects and approaches based on research and monitoring when needed. These efforts will create a healthier, more resilient ecosystem that will allow for greater public access and education and responsible low-impact recreational opportunities for City residents and visitors.

9.1 Operations and Management

The OSD will follow the annual O&M plan set forth in this document while reviewing and modifying it on an annual basis.

9.2 System-wide Projects

The OSD will evaluate project areas throughout the Bosque including the following:

- Improve wayfinding signage at all primary and secondary trailheads including updating regulation signs, maps, and additional information provided in English and Spanish.
- Plan, design, and install interpretive signs that focus on historic Pueblo and Spanish Land Grant sites along with other themes on the cultural and natural history and ecology of the Bosque.
- Update online and print publications that correspond with the interpretive signs, access points, and trails.

9.3 Site-Specific Projects

The nine project areas that have selected for priority implementation are summarized in Table 30.

- Continue to assess and maintain restorations sites and post-fire remediation sites.
- Assess and enhance wetland health including water cycling and vegetation community.
- Improve existing and identify new, small watercraft boat launch sites.
- Create new signage with maps that correspond to the RM markers and boating regulations and safety tips.

Table 30. Priority Area Implementation

Priority Project 1 San Antonio Oxbow Bluffs	Implement the site plan for the Oxbow Bluffs as well as ongoing management of the San Antonio Oxbow to improve flows and diversity of vegetation.
Priority Project 2 Atrisco Acequia Madre	Develop a multi-agency site plan and implement Phase I of the plan. Implement a hazardous fuels reduction project funded by FEMA, treating up to 470 acres in the Bosque.
Priority Project 3 Alameda Open Space	Implement a site plan for additional public recreation amenities and assist with the ABCWUA's solar project. Develop and implement an interpretive signage plan for the area. Additionally, work with Bernalillo County on improving the Alameda storm water outfall.
Priority Project 4 Pueblo Montaño	Work with Bosque School on ongoing monitoring and restoration projects. Coordinate with partners on post-wildfire recovery efforts. Review and provide input on the ABCWUA's Bosque Non-Potable Reuse project.
Priority Project 5 Pat Baca Open Space	Review and provide input on the City's DMD Loma Hermosa Outfall project. Work with partners to address major erosion and headcuts along the bluff and necessary trail reroutes.
Priority Project 6 SWRP Outfall Restoration Project	Review and provide input on the ABCWUA's Southside Water Reclamation Plant Outfall Restoration Project. Oversee trail reroute and construction.
Priority Project 7 SLO Parcel	Coordinate management of the SLO Bosque area with VdO and the SLO on restoration projects and possible interpretive signage.
Priority Project 8 Calabacillas Arroyo	Implement a fuels reduction in the area and support trail enhancements and connections in the Calabacillas Arroyo.
Priority Project 9 Rio Bravo Riverside Picnic Area/Poco Loco	Review and provide input on the Department of Transportation's Rio Bravo Bride Expansion project. Plan and oversee restoration projects in the area and new recreation area related to the bridge expansion.

9.4 Additional Management Considerations

Additional management tasks for consideration are as follows: Bosque infrastructure, public use projects, natural resource management and fire prevention, and research and monitoring:

Bosque Infrastructure:

- Work with Reclamation, the USACE, and the Albuquerque Fire Department to further assess and remove Jetty Jacks throughout the Bosque.
- Continue to maintain swales and construct new swales when feasible to better access groundwater for cottonwood and willow plantings.

- Maintain bridges and other infrastructure (identify what is OSD's responsibility and reference in the O&M plan).
- Work with the City's DMD and Bernalillo County Public works to assess and improve storm drain outfalls.
- Conduct an inventory of outdoor amenities within the park including signage, trails, picnic tables, benches, bridges, and other outdoor amenities and assess annually for any replacement or repairs needed.

Public Use:

- Improve and install wayfinding signage at all trailheads, river access locations, and major junctions.
- Work with partners to develop interpretive signage, especially identifying the ancestral and historic sites along the river, and emphasizing the unique environment, ecosystem services, and stewardship.
- Continue to support and enhance educational experiences for Albuquerque's youth through BEMP, RiverXChange, and other related programs.
- Promote equitable access to the Bosque while emphasizing trail etiquette and land stewardship.
- Continue to support and grow volunteer programs, especially the Invasive Plant Patrol Program.
- Work with youth crews for job skills training in conservation and to support OSD management of trails, invasive species removal, restoration projects, and fuel thinning projects.
- Establish full-time city positions for Bosque Park Attendants to assist with interacting and informing visitors and general trail and facility management. This would be a minimum of one person per 1,000 acres for 7-days a week coverage.

Natural Resource Management and Fire Prevention:

- Mitigate hazardous fuel loads: make notes for certain protocols regarding mulching/chipping/masticating, migratory bird season, hazardous tree felling etc.
- Develop post-fire protocols that include assessments, treatment, monitoring, and retreatment.
- Manage invasive species (may include youth crews, staff, volunteers through Invasive Plant Patrol, etc.) Focus on woody species, herbaceous, and Ravenna grass.
- Conduct soil mitigation and stabilization, especially along bluffs.
- Include monitoring with BEMP and UNM Biology class.

Research and Monitoring:

- Develop an annual report specific to OSD's management of the Bosque that includes a monitoring summary, major projects, plantings and trail projects, unique factors (fires, drought, floods), adaptive management changes, and recommendations for the next year.
- Work with UNM Biology Department to assist with ongoing monitoring focused on post-fire recovery and remediation efforts as well as monitoring of invasive species expansion

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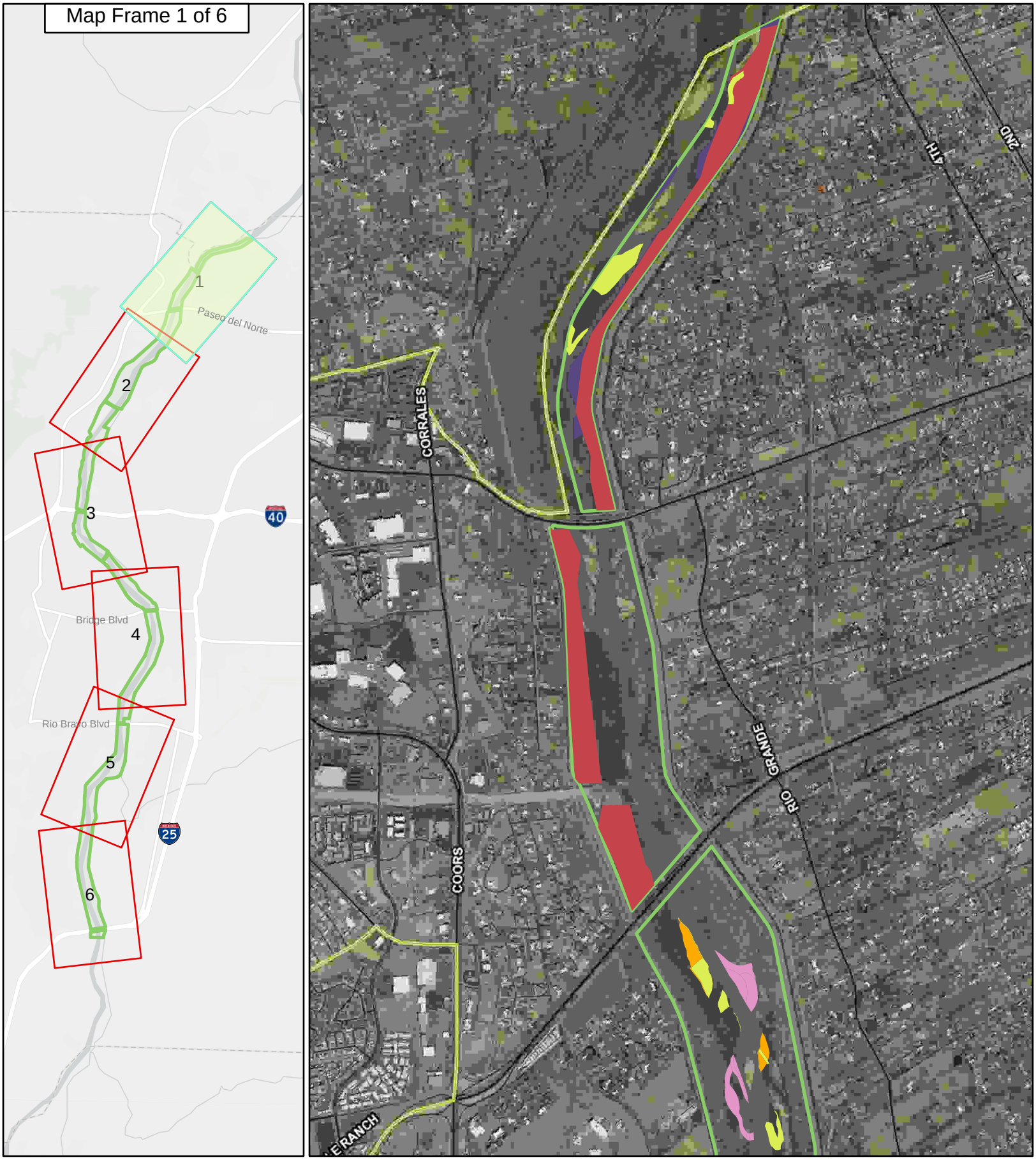
APPENDIX A. HABITAT RESTORATION PROJECTS



Rio Grande Valley State Park

Habitat Restoration

- Bosque Wildfire Project
- Interstate Stream Commission
- Middle Rio Grande Restoration
- Other
- San Juan Chama Drinking Water-Environmental Mitigation Phase 2

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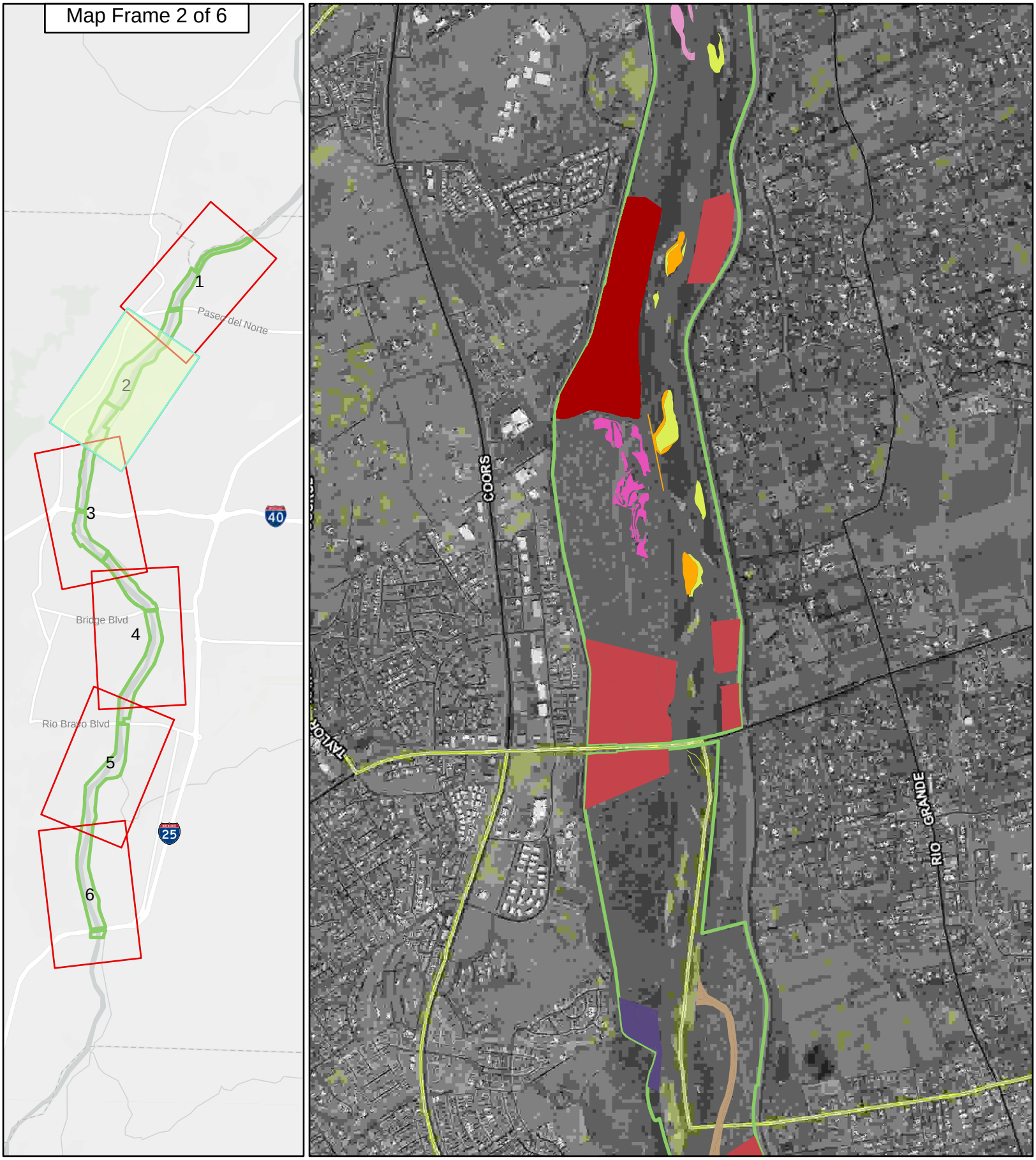

Rio Grande Valley State Park

Habitat Restoration

- Albuquerque Open Space Division
- Bosque Wildfire Project
- Interstate Stream Commission
- La Orilla Habitat Restoration
- Middle Rio Grande Restoration
- Other
- Rio Grande Nature Center Channel
- San Juan Chama Drinking Water-Environmental Mitigation Phase 2

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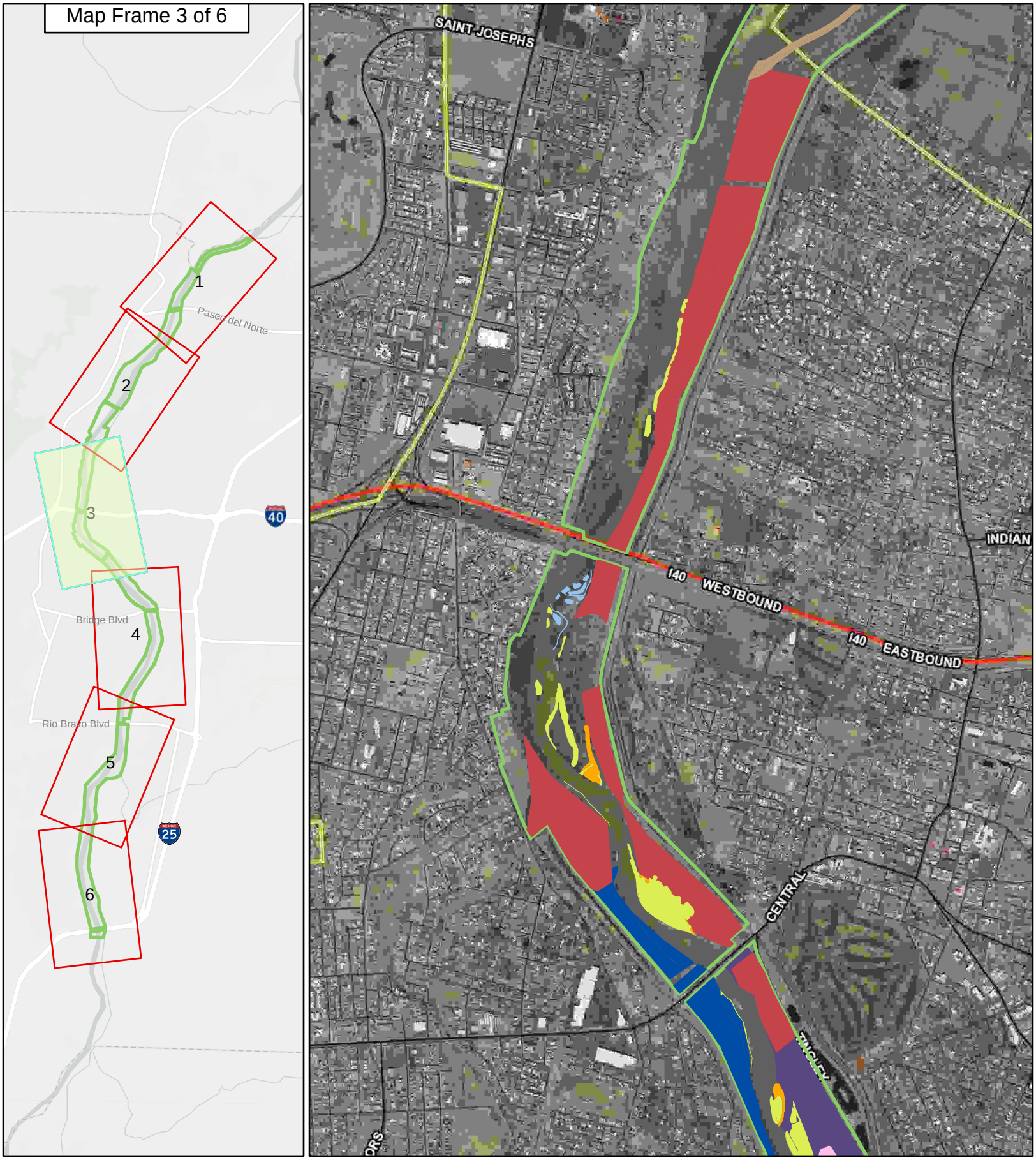

Rio Grande Valley State Park

Habitat Restoration

- Bosque Wildfire Project
- I-40 bar habitat restoration
- Interstate Stream Commission
- Middle Rio Grande Restoration
- Other
- Rio Grande Nature Center Channel
- Route 66 Habitat Revitalization
- Tingley Beach Habitat Restoration

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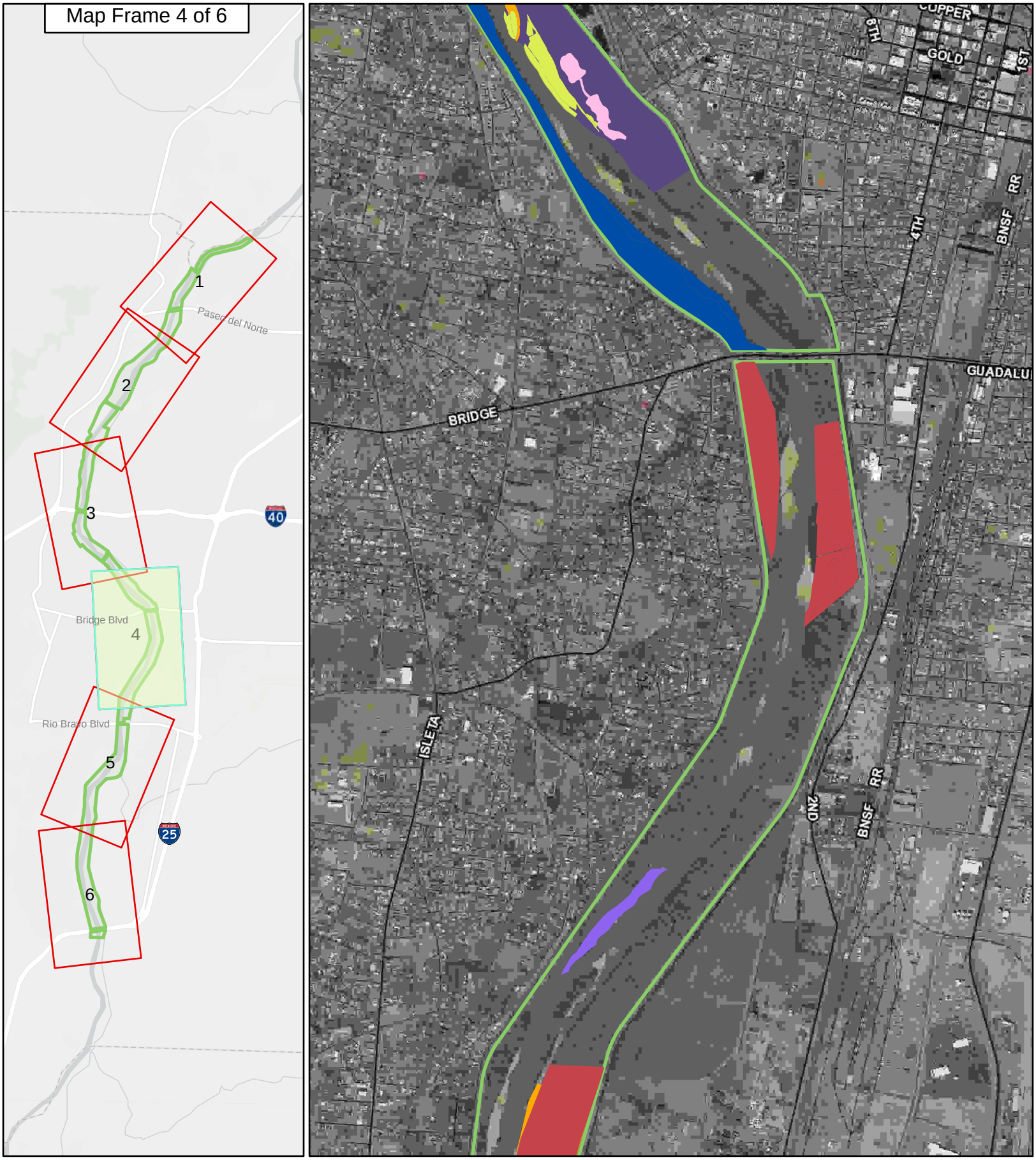

Rio Grande Valley State Park

Habitat Restoration

- Albuquerque Overbank Project
- Bosque Wildfire Project
- Interstate Stream Commission
- Middle Rio Grande Restoration
- Other
- Route 66 Habitat Revitalization
- Tingley Beach Habitat Restoration

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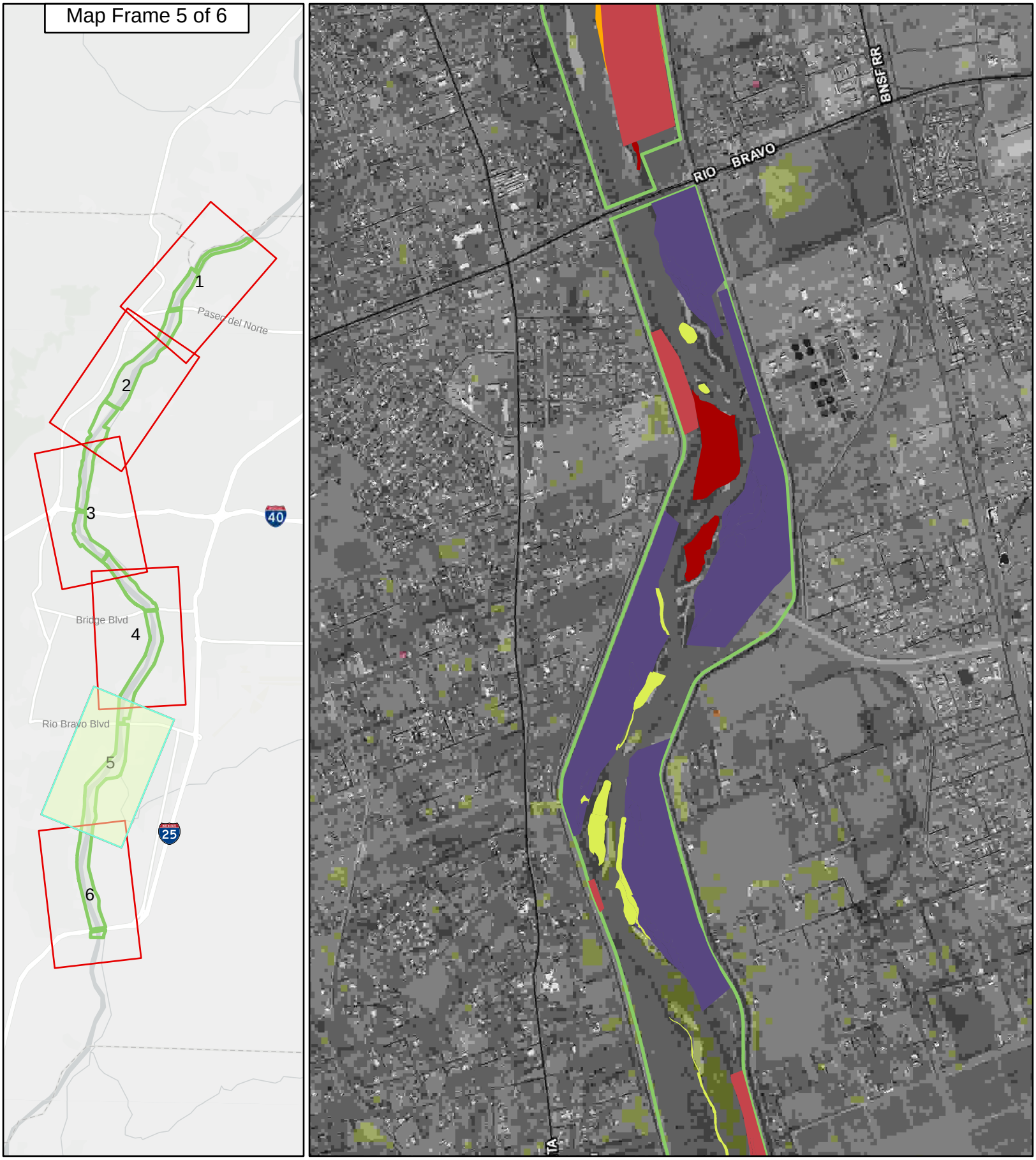

Rio Grande Valley State Park

Habitat Restoration

- Albuquerque Open Space Division
- Bosque Wildfire Project
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- Middle Rio Grande Restoration
- Other

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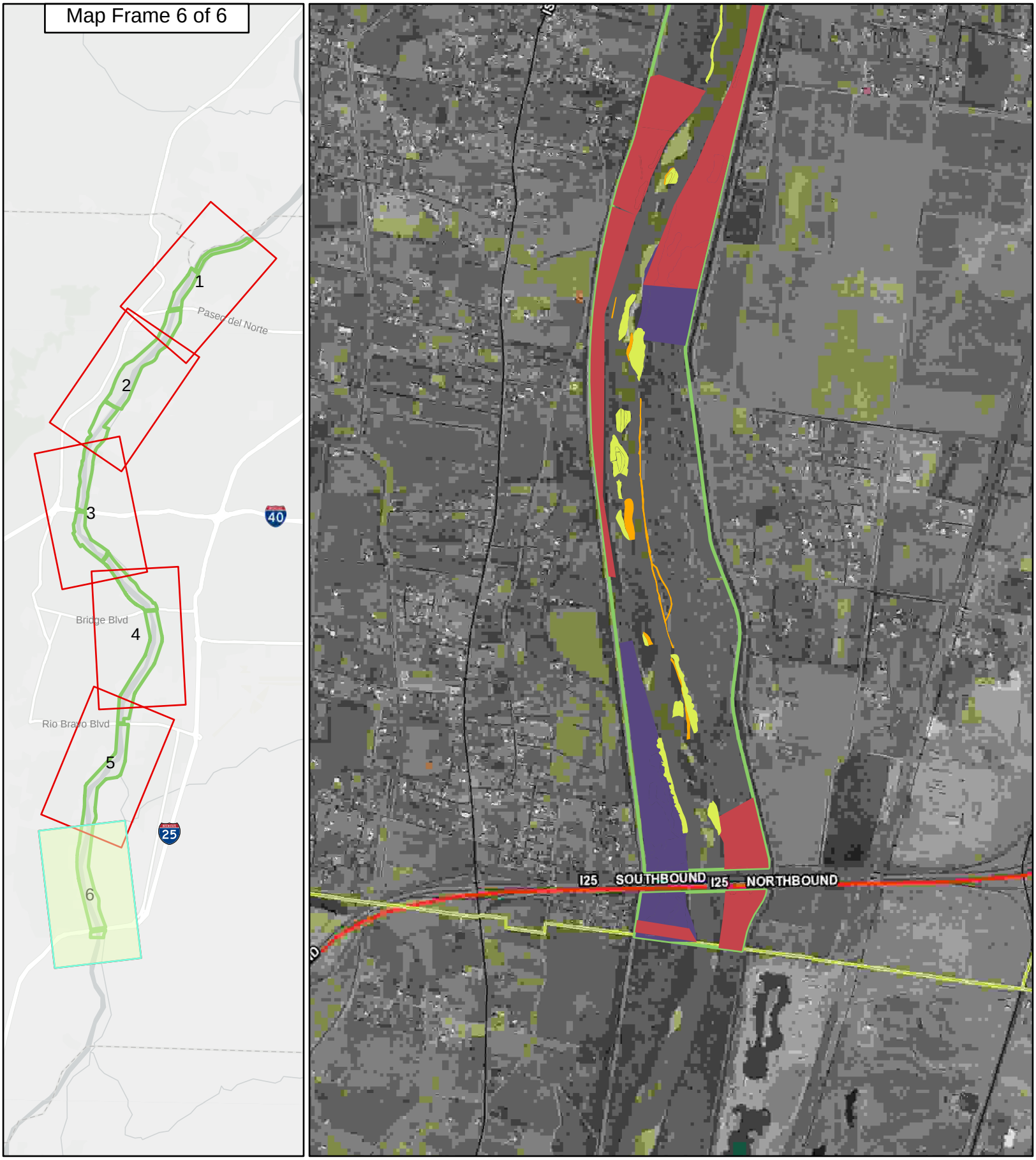

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Habitat Restoration

- Bosque Wildfire Project
- Interstate Stream Commission
- Middle Rio Grande Restoration
- Other

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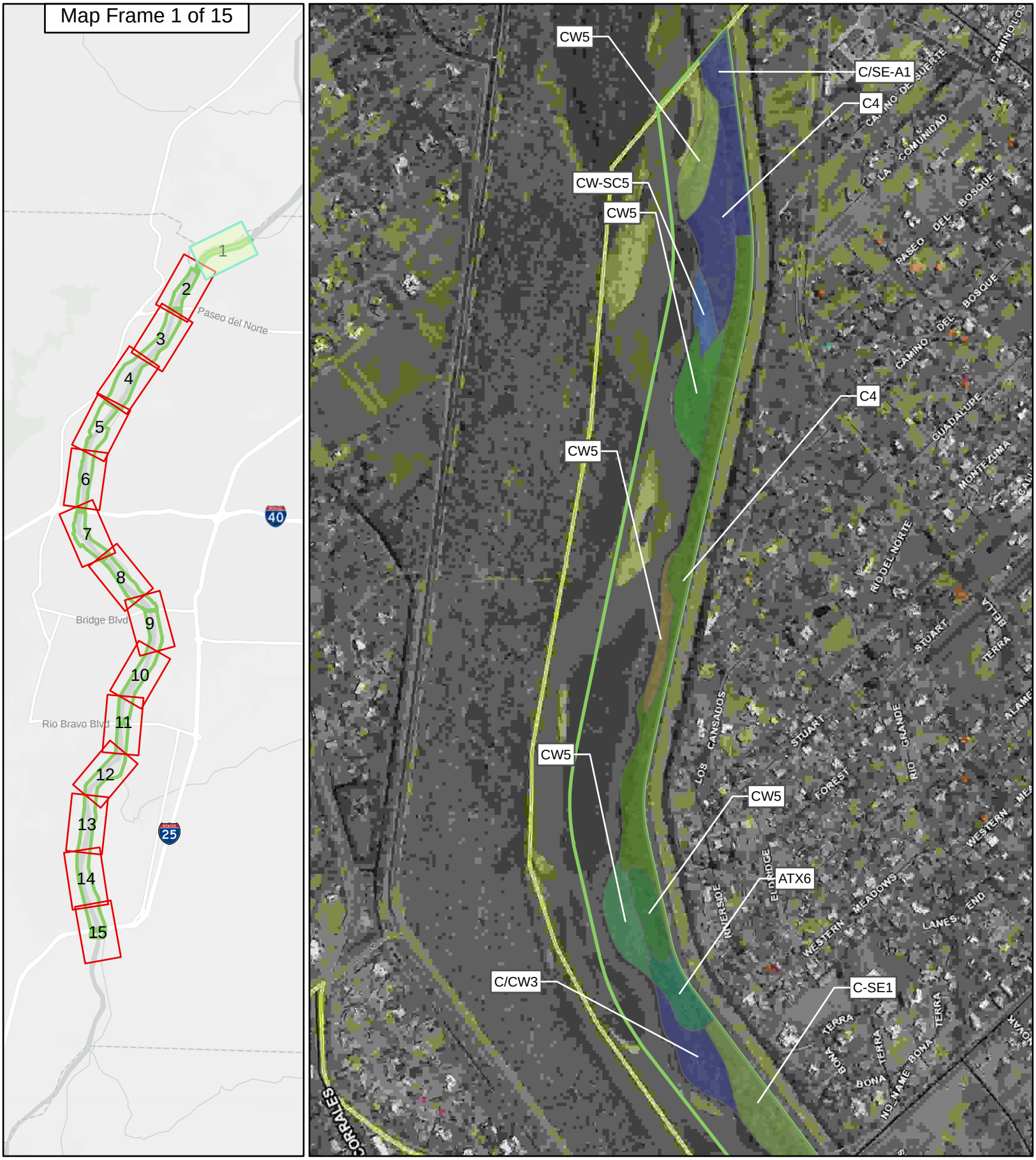
APPENDIX B. HINK AND OHMART VEGETATION MAPS (2021)



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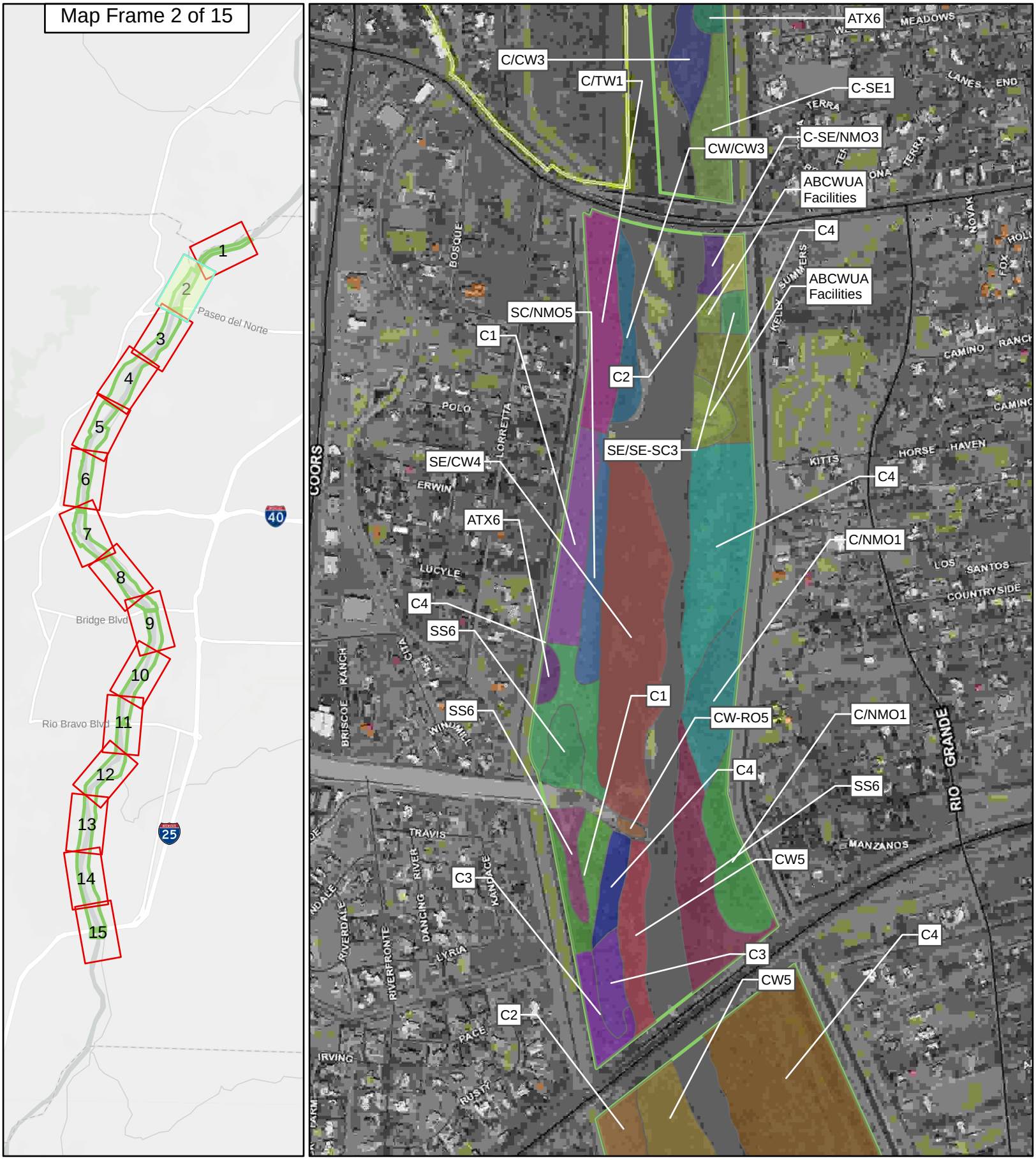
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LYRIA
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MANZANOS
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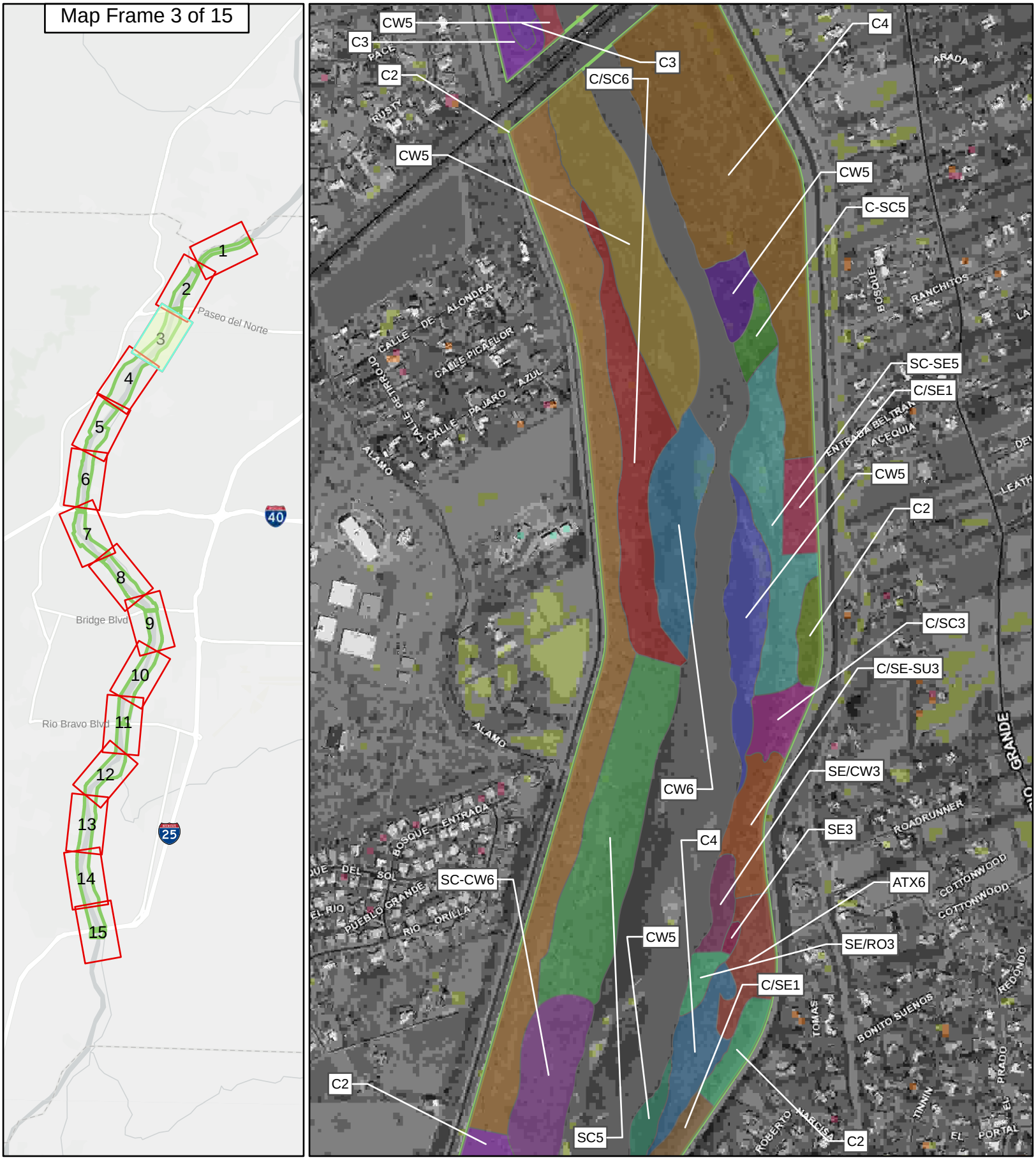

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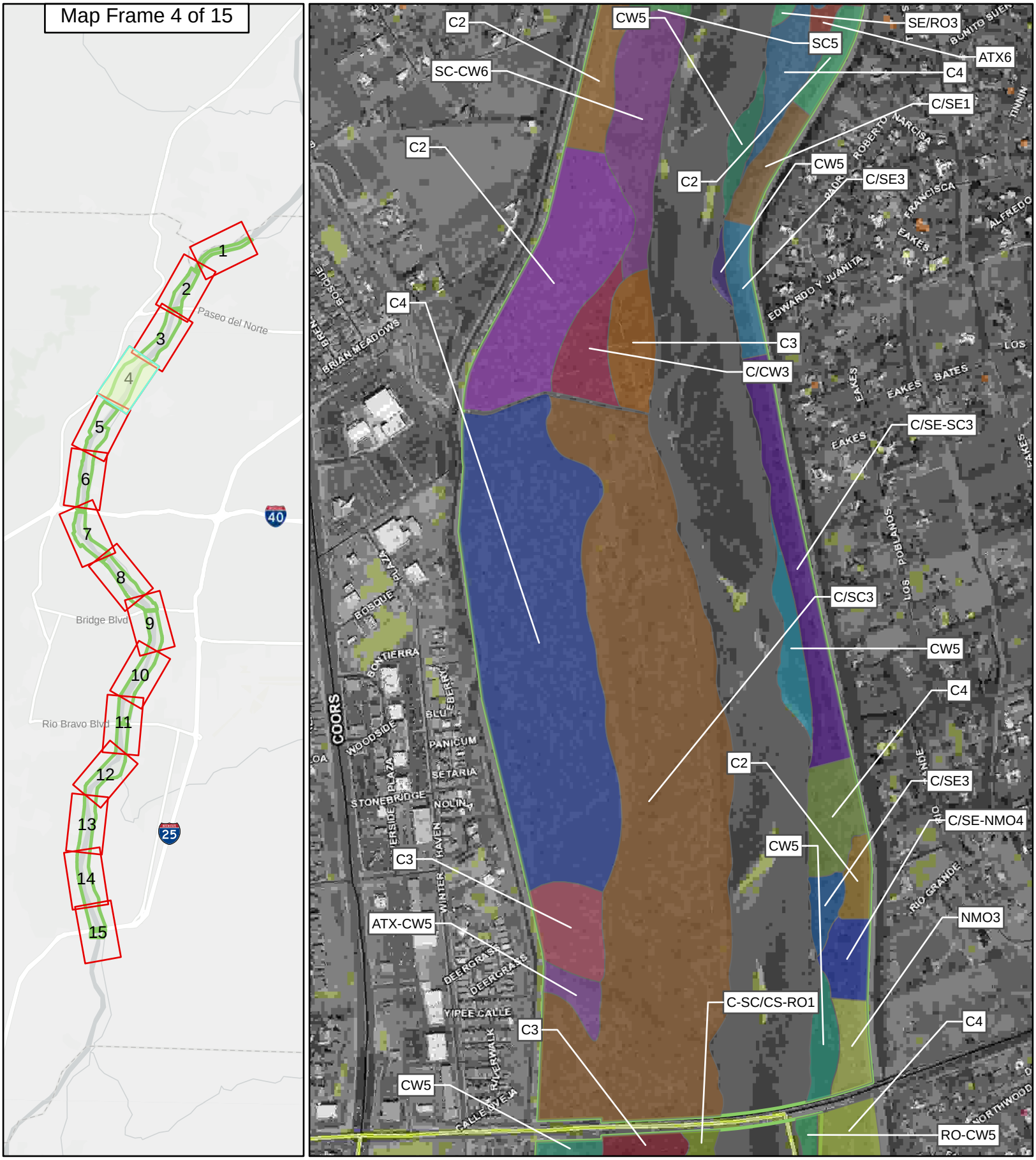

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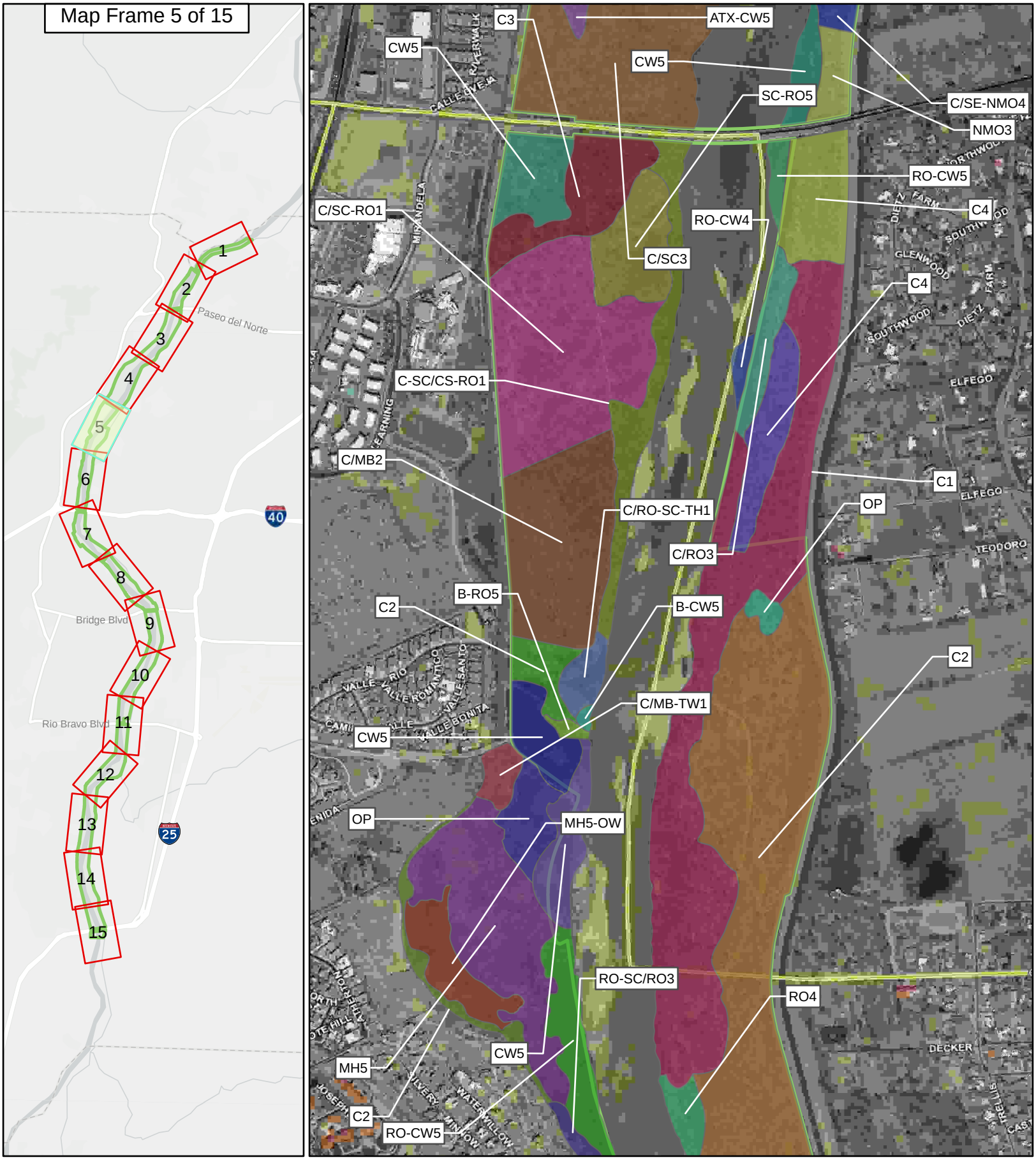

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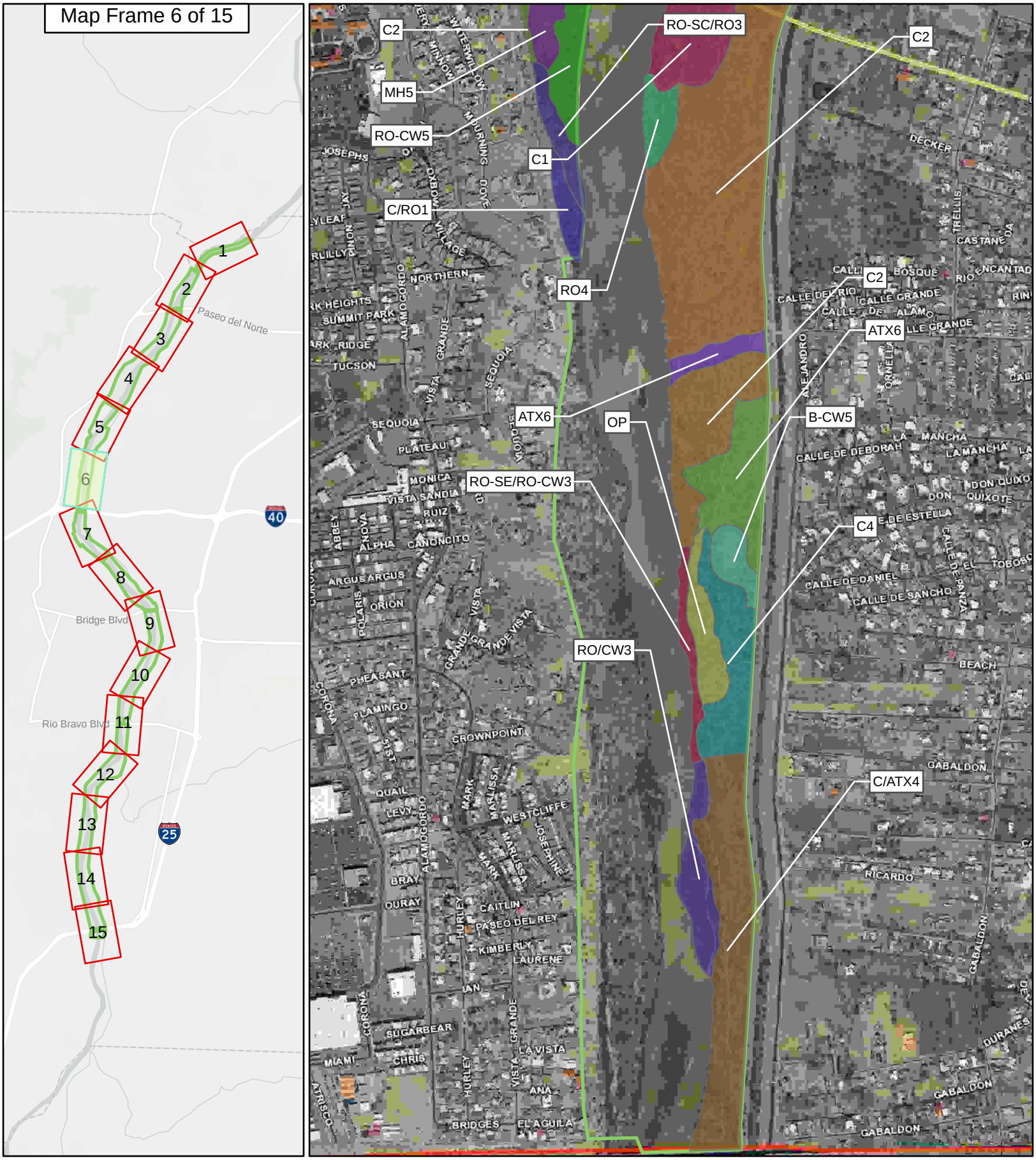

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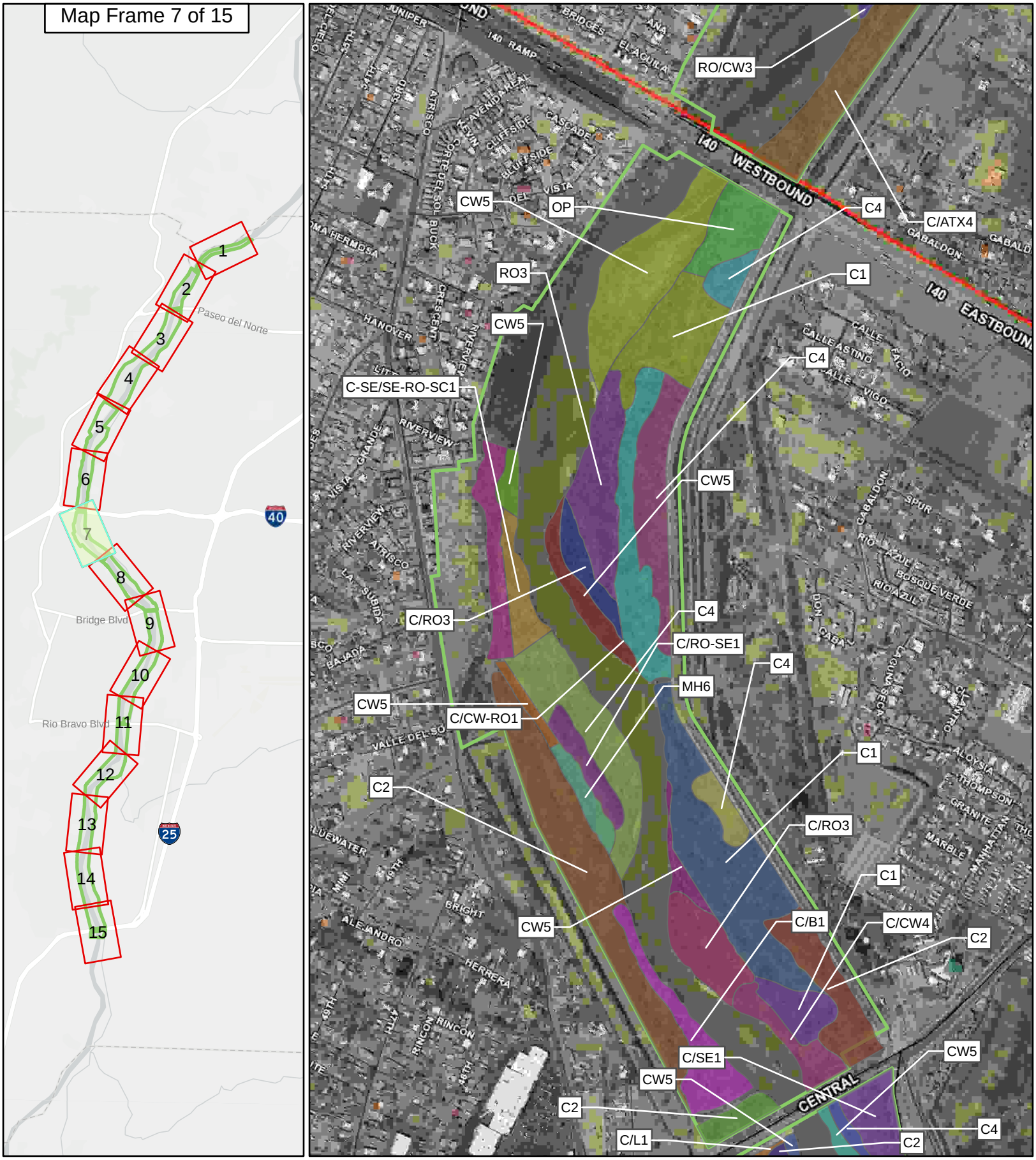
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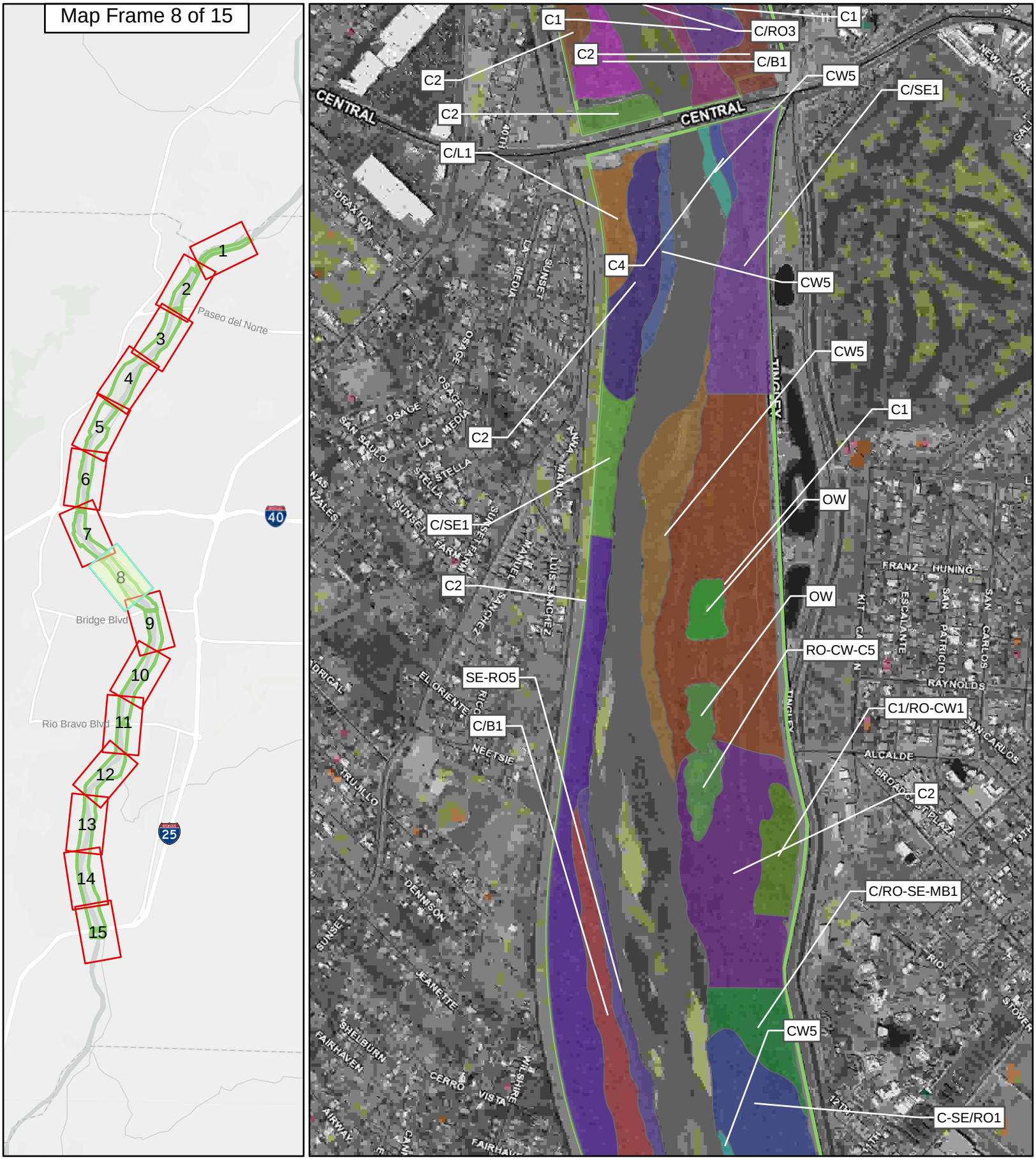

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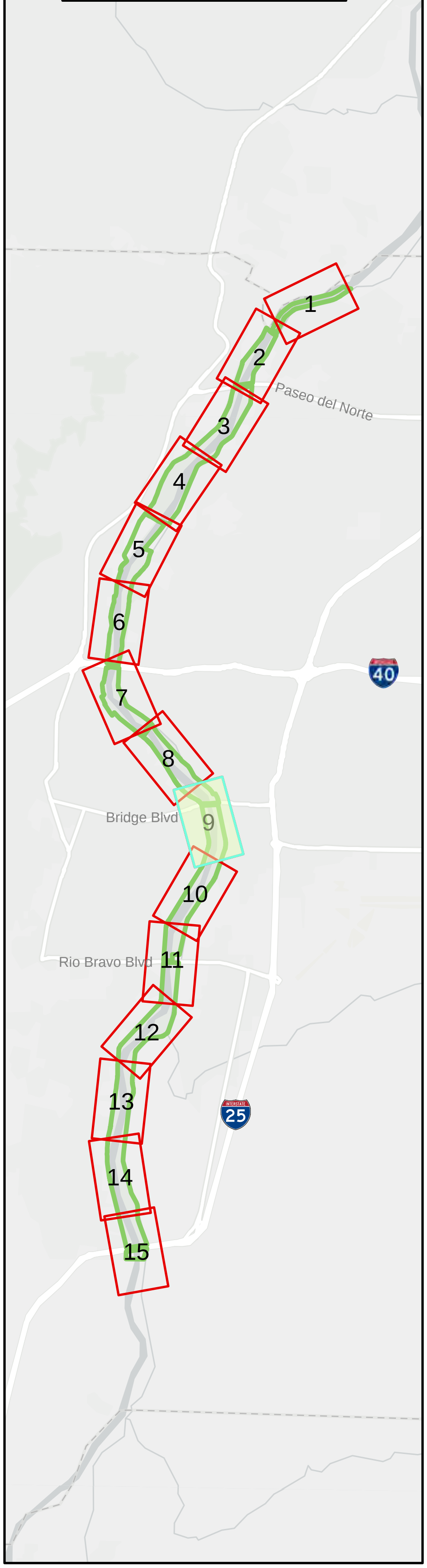

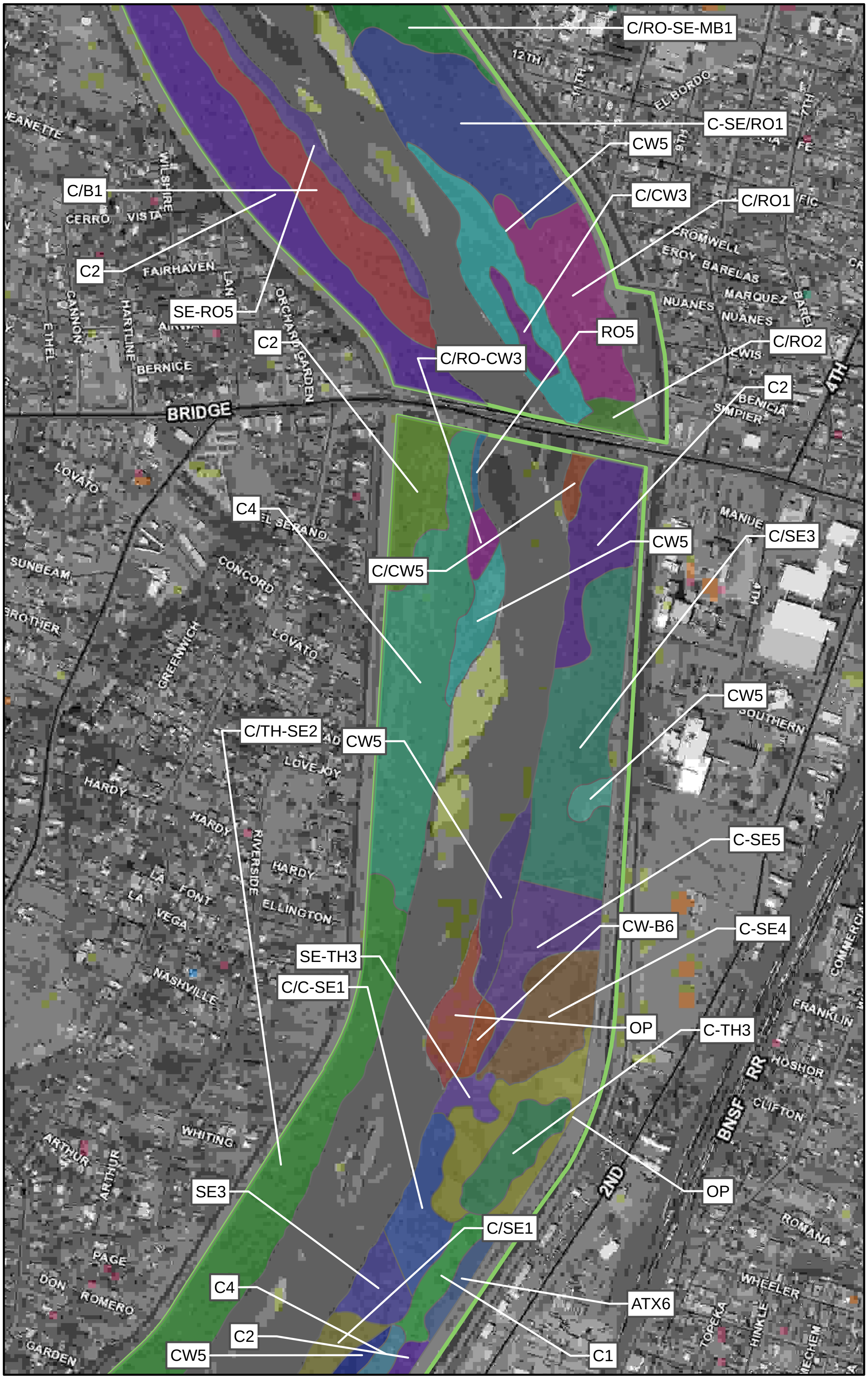

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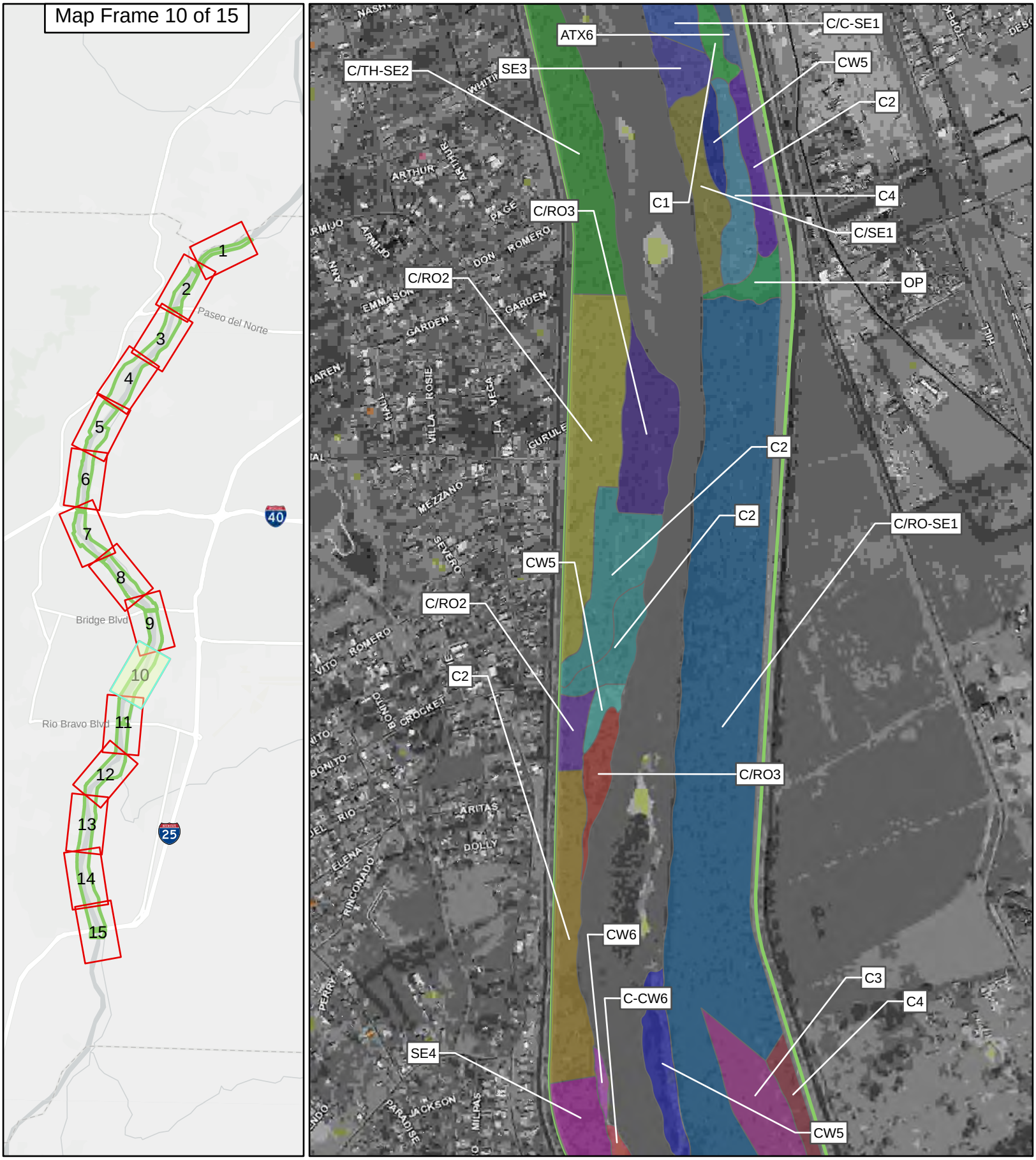

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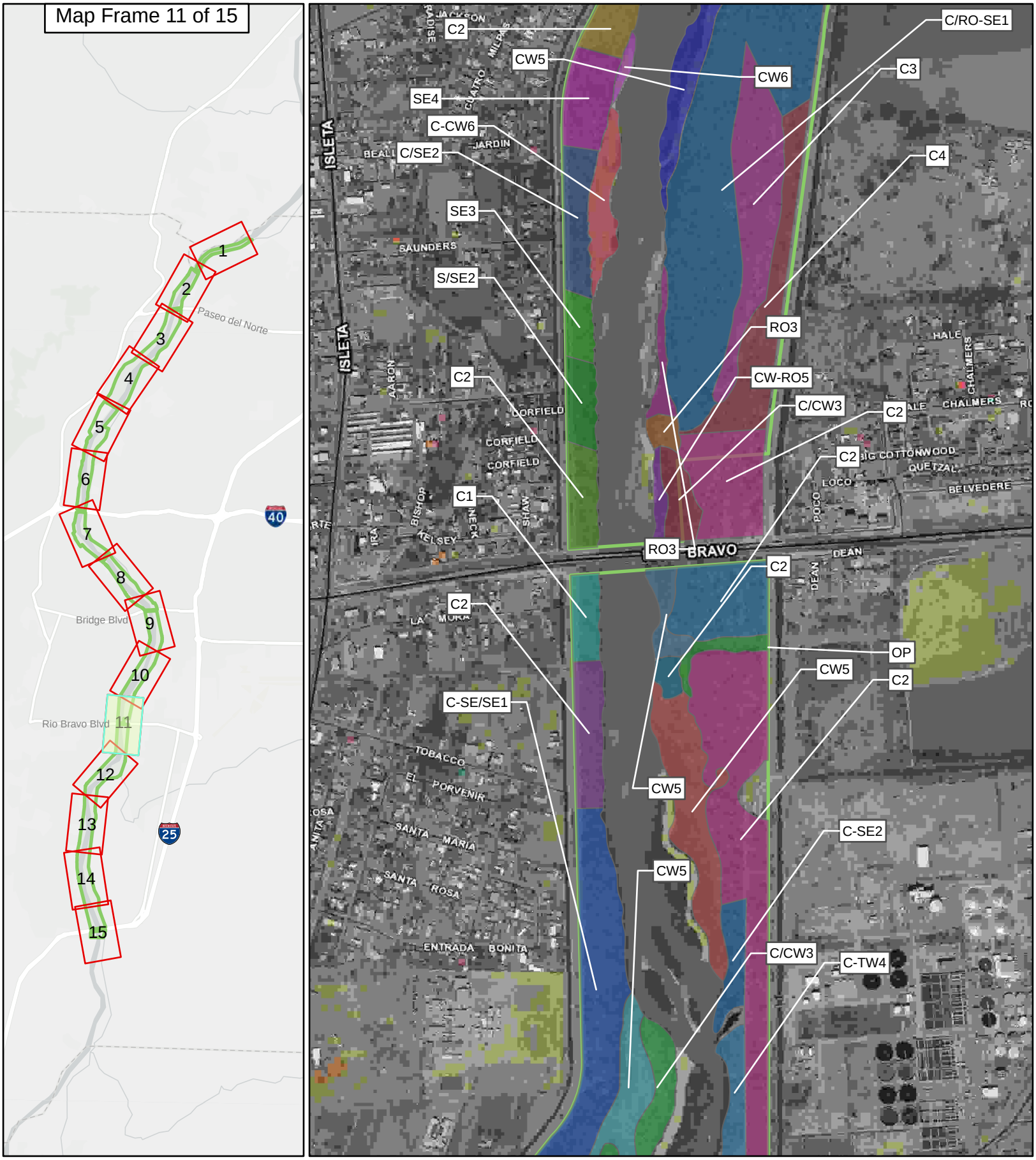

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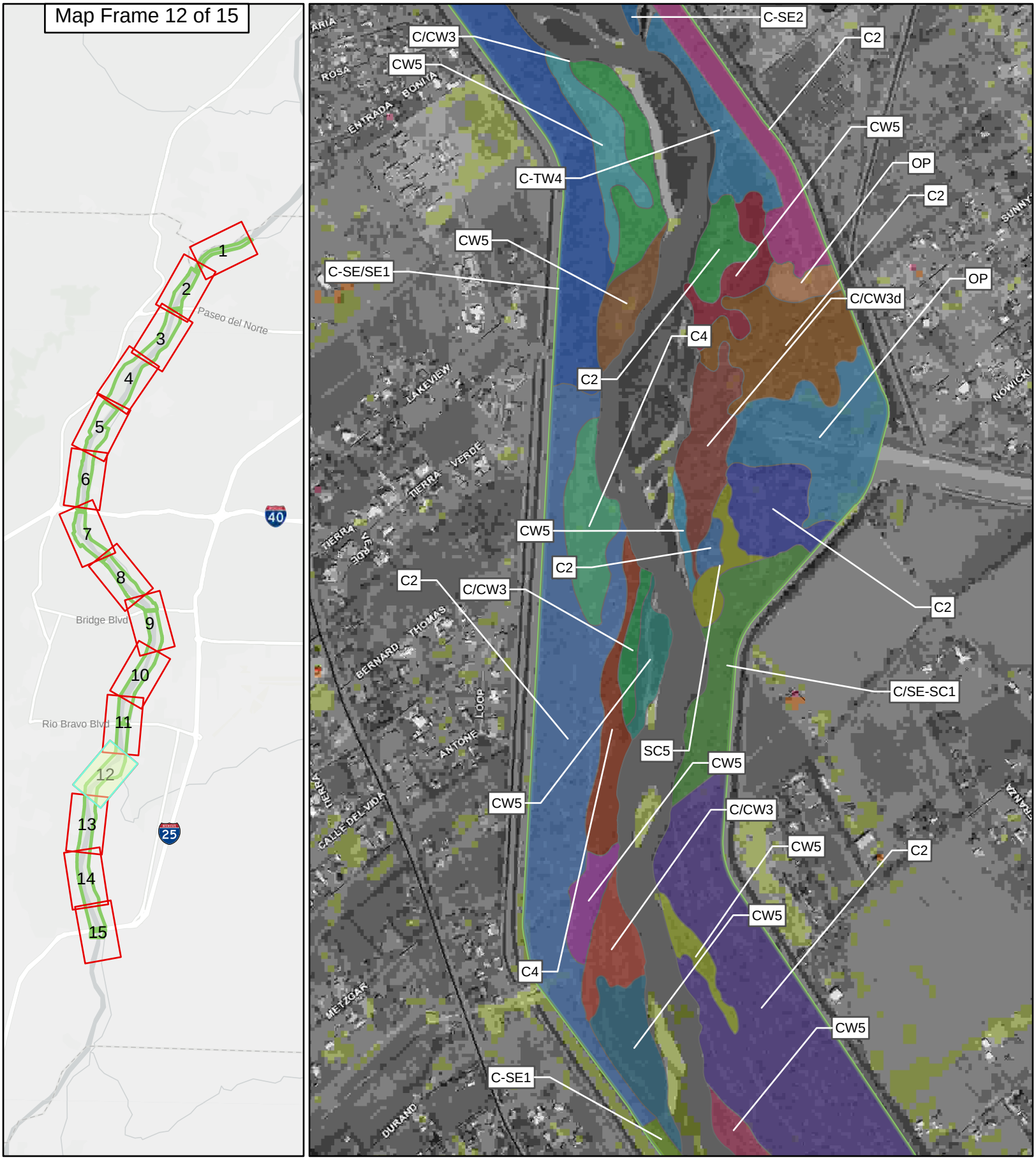

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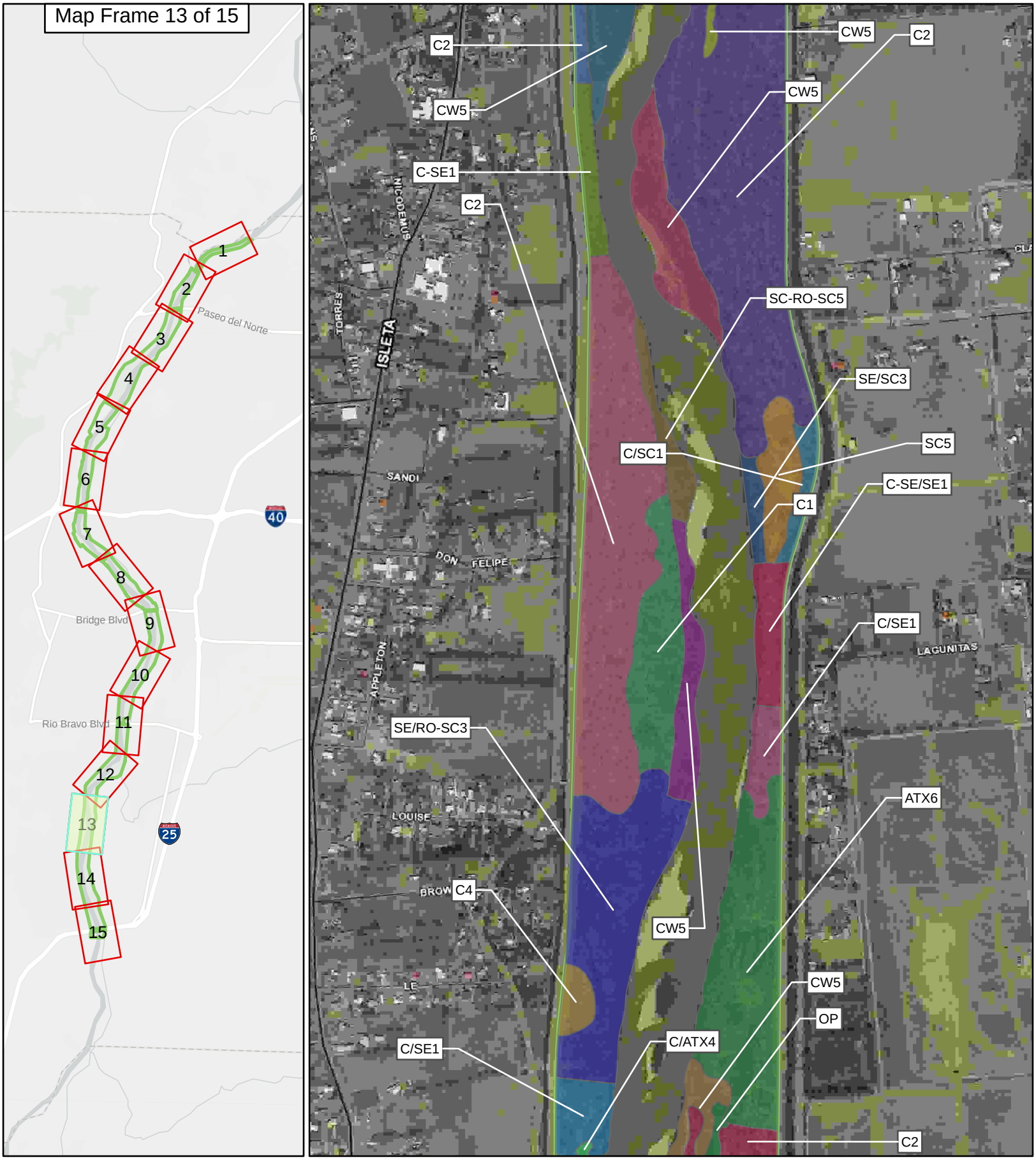

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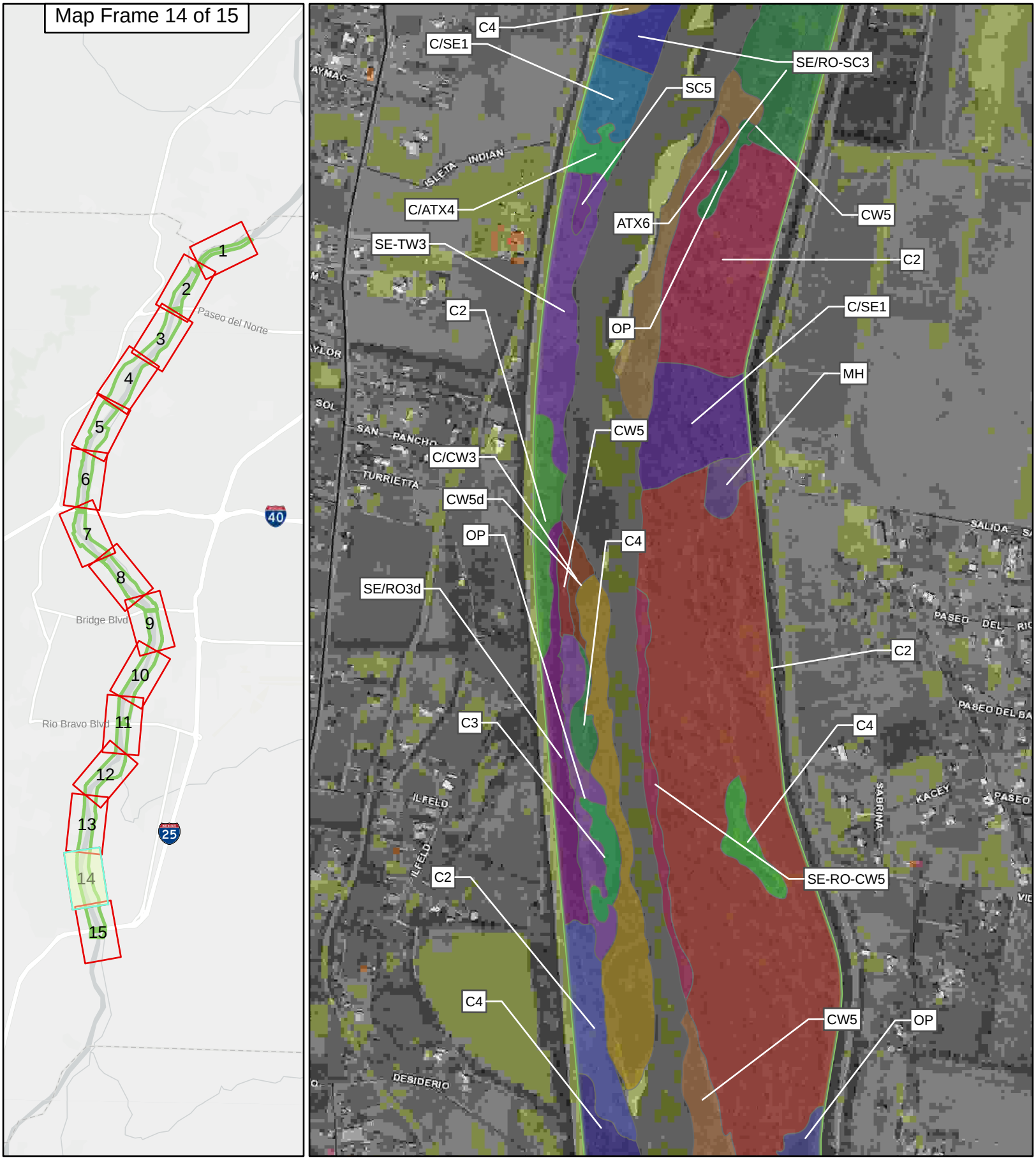

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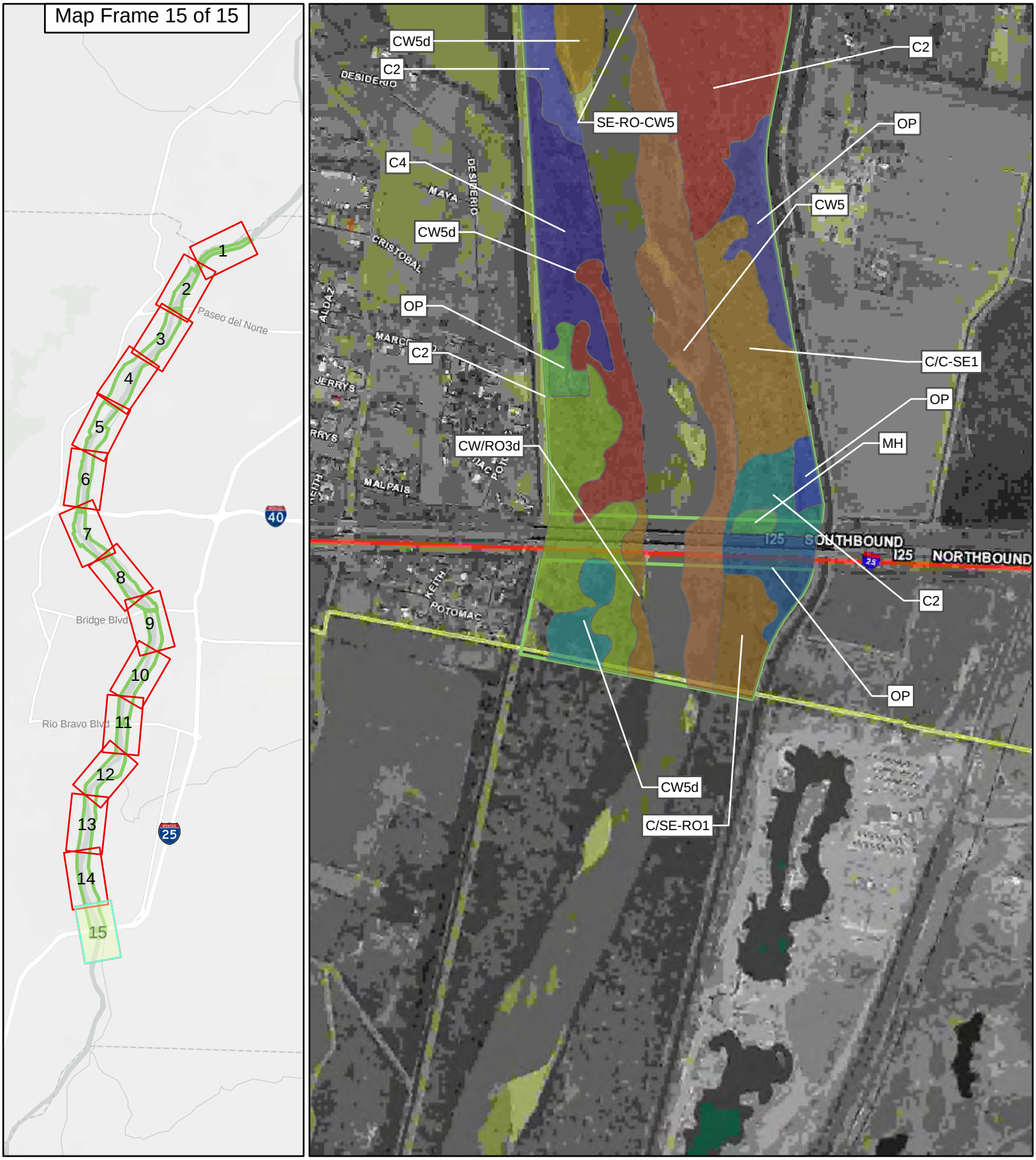
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