TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

March 1, 2021

Ms. Amanda McGuire
Chief, Environmental Branch
Regional Planning and Environmental Center
Room 3A12
819 Taylor Street
Fort Worth, Texas 76102

Attention: Ms. Justyss Watson

Re: River Road Aquatic Ecosystem Restoration

Dear Ms. McGuire:

This letter is in response to the River Road Aquatic Ecosystem Restoration Feasibility Study (ERFS) dated November 2020 for the proposed River Road Ecosystem Restoration project. The United States Army Corps of Engineers in conjunction with San Antonio River Authority propose to restore function and structure to the aquatic ecosystem, provide additional recreational and ecotourism benefits to the community as well as improve water quality in the San Antonio River through ecosystem restoration. The project is located in the River Road area in one of the remaining un-channelized segments of the San Antonio River between Highway 281 and East Mulberry Street in San Antonio, Bexar County, Texas.

The Texas Commission on Environmental Quality (TCEQ) has reviewed the ERFS and related information. On behalf of the Executive Director and based on our evaluation of the information contained in these documents, the TCEQ certifies that there is reasonable assurance that the project will be conducted in a way that will not violate water quality standards. General information regarding this water quality certification, including standard provisions of the certification, is included as an attachment to this letter.

The proposed project will impact 3.1 acres of waters of the U.S with the intended purpose of restoring approximately 22 acres of riparian habitat and 3 acres of aquatic habitat. Project activities include removal of three low water crossings, riparian plantings and complete removal of Avenue A. Benefits of the proposed project include increase in natural nutrient uptake and pollutant filtering, improvement of habitat (riparian and riverine), resilient habitat for migratory birds, creation and restoration of complex stream sequences (riffle, pool, run), improvement of water quality and channel flow, as well as reduced sedimentation and erosion. The nature of the project is restoration and therefore considered to be self-mitigating.

No review of property rights, location of property lines, nor the distinction between public and private ownership has been made, and this certification may not be used in any way with regard to questions of ownership.

If you require additional information or further assistance, please contact Ms. Brittany M. Lee, Water Quality Assessment Section, Water Quality Division-Matrix, 14250 Judson Road, San Antonio, Texas 78233-4480, at (210) 403-4048 or by email at Brittany.Lee@tceq.texas.gov.

Sincerely,

David W Galindo

David W. Galindo, Deputy Director
Water Quality Division
Texas Commission on Environmental Quality

DWG/BL

ccs: Ms. Justyss Watson, Project Manager, Justyss.A.Watson@usace.army.mil

Clean Water Act
Section 404(b)(1) Analysis

River Road Aquatic Ecosystem Restoration
Feasibility Study

Continuing Authorities Program

November 2020

US Army Corps
of Engineers®
Fort Worth District

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1 Project Description

The Integrated Feasibility Report (IFR) and Environmental Assessment (EA) details the planning process undertaken for the Continuing Authorities Program (CAP) Section 206 River Road Aquatic Ecosystem Restoration Feasibility Study and documents the environmental assessment to satisfy the National Environmental Policy Act (NEPA). The San Antonio River Authority (SARA) sent a letter of intent to the U.S. Army Corps of Engineers (USACE) Fort Worth's District's (SWF) District Commander on December 1st, 2015. The letter contained SARA's desire to initiate a study partnership under the USACE Section 206 Program for Aquatic Ecosystem Restoration. A Feasibility Cost Share Agreement (FCSA) was signed between USACE SWF and SARA on September 24th, 2018. The River Road Aquatic Ecosystem Restoration Feasibility Study (River Road)is a single purpose, CAP Section 206 Aquatic Ecosystem Restoration study.

1.1 Location

The study area is located in the River Road area of the San Antonio River in San Antonio, Texas (Figure 1). The project site spans approximately 3700' of the river between East Mulberry Avenue and U.S. Highway 281 and is bound by Avenue A and River Road to the east and west, respectively (Figure 2). The upstream portion of the study area is one of the last remaining unchannelized segments of the upper San Antonio River.

By the request of the Non-Federal Sponsor (NFS), SARA, the project area was extended downstream by approximately 1000' in July 2019. Prior to this change, the project area spanned approximately 2700' from East Mulberry Avenue and East Woodlawn Avenue. The area was extended to include two low water crossings that influence the project area.

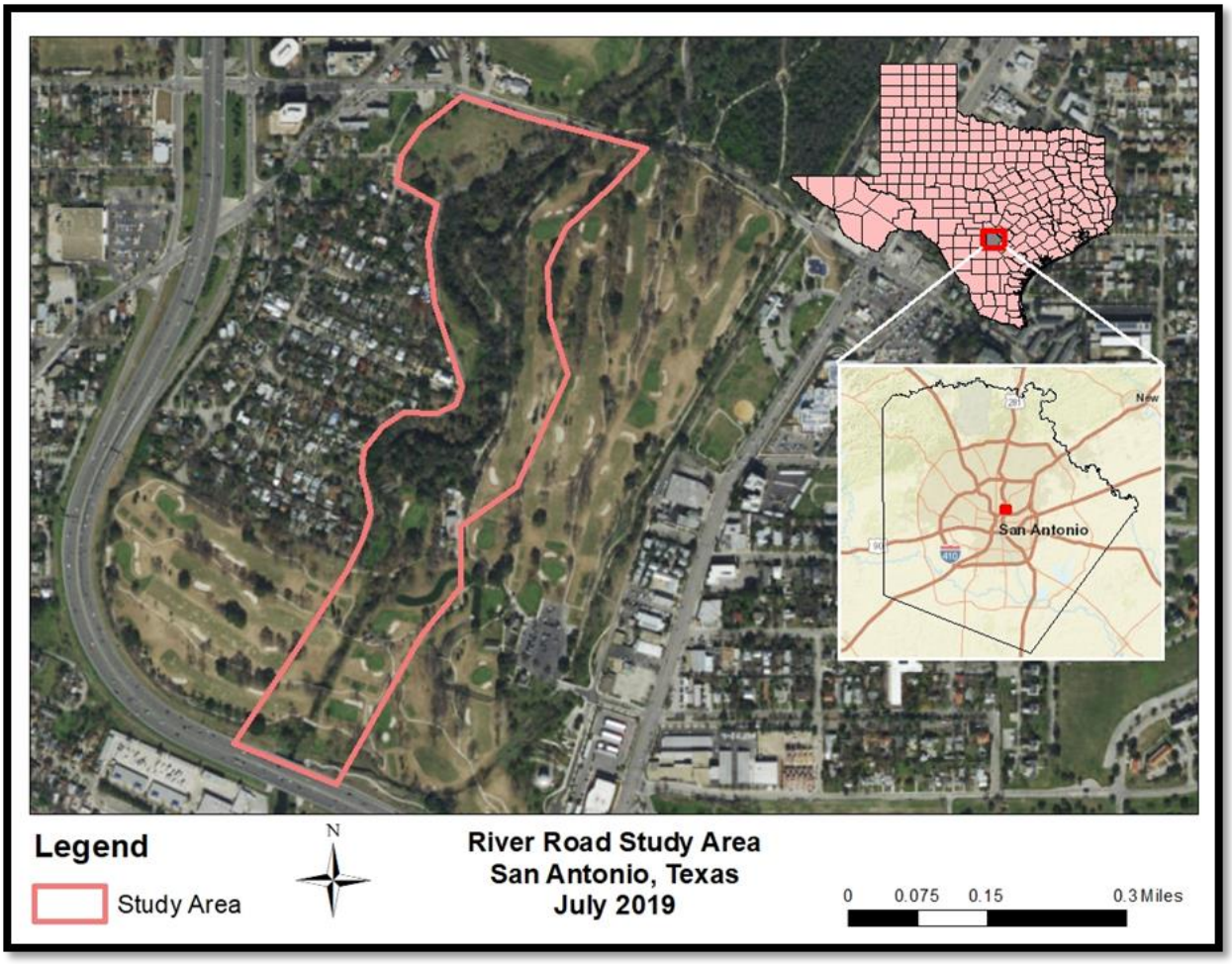

Figure 1. River Road Study Area

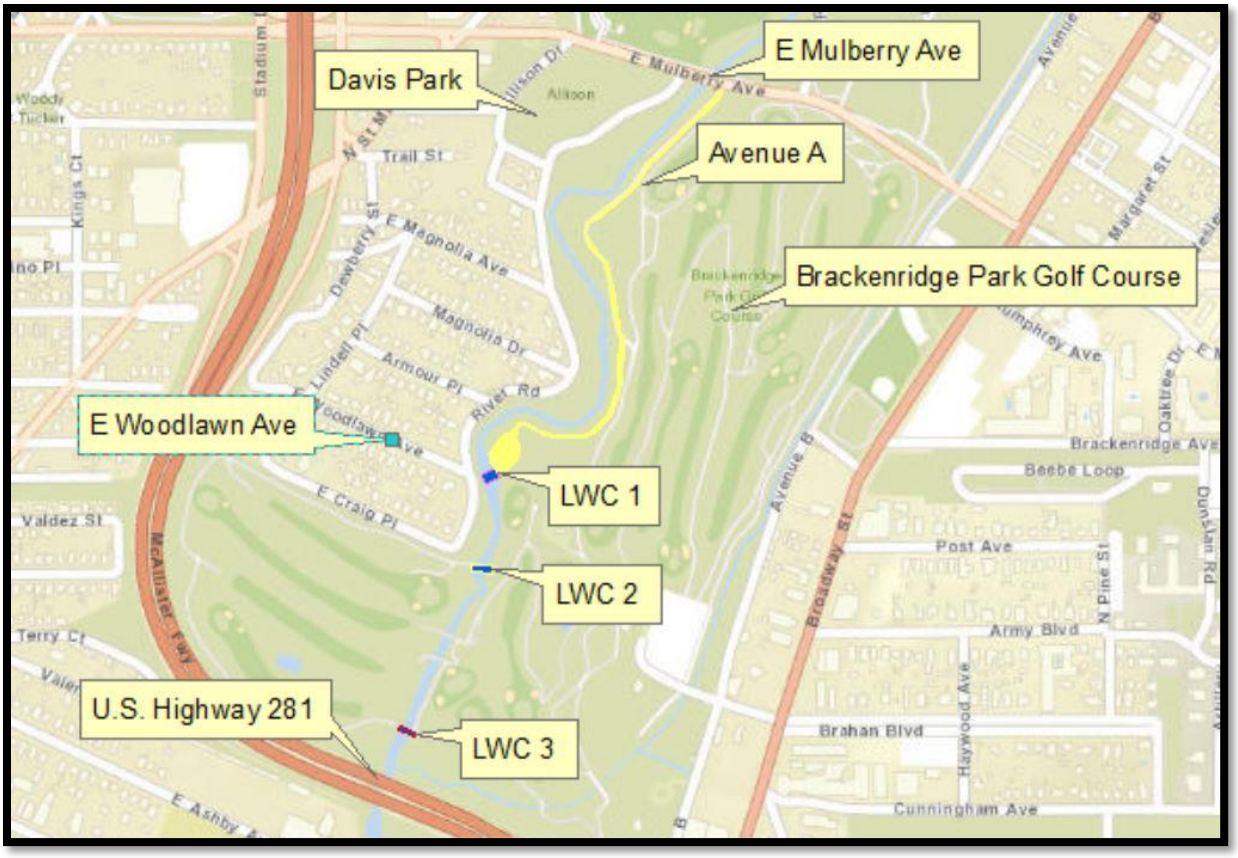

Figure 2. Pertinent Locations within the Study Area

1.2 Study Authority

The study is being performed under the standing authority of the USACE Continuing Authorities Program (CAP), Section 206 of the Water Resources Development Act of 1996, as amended (335 U.S Code 2201):

"*The Secretary may carry out an aquatic ecosystem restoration and protection project if the secretary determines that the project –*

(1) Will improve the quality of the environment and is in the public interest; and

(2) Is cost effective."

Section 206 focuses on water resource related projects of relatively smaller scope, cost and complexity. Unlike traditional USACE civil works projects that are of wider scope and complexity, the CAP is a delegated authority to plan, design, and construct certain types of water resource and environmental restoration projects without specific Congressional authorization.

1.3 Purpose and Need

The primary purpose of the study is to investigate and examine measures that would restore degraded ecological structure and function to aquatic and riparian habitat on the River Road reach of the San Antonio River. This includes assessing opportunities, evaluating alternatives, and selecting a plan from those alternatives. The selected plan must be technically sound, environmentally acceptable, economically feasible, and supported by the local sponsor, SARA,

and the Federal Government. The need is to address current erosion, sedimentation, and altered hydrology in the study area that has caused the degraded ecological structure.

1.4 Planning Objectives and Constraints

An objective is a statement of the intended purposes of the planning process; it is a statement of what a plan should try to achieve. More specific than goals, a set of objectives effectively constitutes the mission statement of the Federal/non-Federal planning partnership.

An essential element of any planning study is the set of constraints confronting the planners. A constraint is a restriction that limits the extent of the planning process. Constraints, like objectives, are unique to each planning study.

The objective of USACE with respect to ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of success would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention. Those restoration opportunities that are associated with wetlands, riparian, and other floodplain and aquatic systems are most appropriate for USACE involvement.

Planning Objectives

Planning objectives reflect an expression of public and professional issues or concerns about the use of water and related land resources resulting from the analysis of existing and future conditions in the study area. These planning objectives were used in guiding the development of alternatives and plans and their evaluation for the period of analysis. The following planning objectives were used in formulation and evaluation of alternatives and plans:

- To restore aquatic ecosystem function and structure to the River Road segment of the San Antonio River for a 50-year period of analysis.
- Restore riparian habitat quality over the 50-year period of analysis.
- Reduce erosive threat to the roads that parallel the river over the 50-year period of analysis.
- Maintain pedestrian access in the project area over the 50-year period of analysis.
- To provide an economically efficient solution.

Planning Constraints

The following are institutional constraints that apply to this study:

- Avoid increasing flooding in the area.
- Plans must be consistent with Federal, State, and local laws such as the NEPA, Endangered Species Act (ESA), Fish and Wildlife Coordination Act (FWCA), Clean Water Act (CWA), and the National Historic Preservation Act (NHPA).
- Minimize impacts to culturally significant landmarks and areas.
- The study will be completed within the CAP scope and cost limitations.

The following planning constraints apply to this study:

- Avoid removing pedestrian access to the study area.
- Maintain vehicular access from East Mulberry Avenue to the Brackenridge Park Golf Course maintenance building.
- Avoid removing access across the San Antonio River.
- Avoid designing project in a way that does not allow for “open” play across the San Antonio River in the Brackenridge Park Golf Course.

1.5 Problems and Opportunities

Water resource projects are planned and implemented to solve problems, meet challenges, and seize opportunities. In the alternative planning setting, a problem can be thought of as an undesirable condition. An opportunity offers a chance for progress or improvement of the situation. The identification of problems and opportunities gives focus to the alternative planning effort and aids in the development of planning objectives. Problems and opportunities can also be viewed as local and regional resource conditions that could be modified in response to expressed public concerns. This section identifies the problems and opportunities in the study area based on the assessment of existing and expected Future Without-Project (FWOP) conditions.

The aquatic ecosystem along the River Road segment of the San Antonio River is severely degraded from excessive erosion and sedimentation and threatens the integrity of the two roads that parallel the river. In addition to hydrological impacts associated with urbanization within the watershed, River Road and Avenue A have constrained the river, resulting in magnified erosion and sedimentation. This has caused a reduction in the area of the riparian corridor adjacent to the river, reducing the natural bank erosion protection of the river.

The opportunities identified include:

- Restoring function and structure to the aquatic ecosystem.
- Provide additional recreational and ecotourism benefits to the community.
- Improve water quality in the San Antonio River through ecosystem restoration.

2 Measures, Alternatives, and Plans

2.1 Management Measures

A measure is defined as a means to an end; an act, step, or procedure designed for the accomplishment of an objective. In other words, a measure is a feature (structure), or an activity, that can be implemented at a specific geographic site to address one or more planning objectives. Measures are the building blocks of alternatives and are categorized as structural and non-structural. Equal consideration was given to these two categories of measures during the planning process while conducting this feasibility study. Measures that were developed, but eliminated from further consideration are documented in the River Road Aquatic Ecosystem Restoration Feasibility Study IFR/EA. The measures listed below were carried throughout the alternative and plan evaluation process.

Structural Measures

- Brackenridge Park Golf Course Golf Cart Path Widening – The Brackenridge Park Golf Course is adjacent to the project area. A golf cart path runs parallel to Avenue A. This path would be expanded by two feet to accommodate vehicular traffic from the golf course maintenance staff.
- Low Water Crossing Modification – This measure would incorporate the removal of existing concrete rip-rap, and fill material from either Low Water Crossing 1, 2, or 3. One 5'W x 4' H concrete box culvert would be placed in the center of a low water crossing. Suitable fill material would be placed, compacted, and shaped accordingly and 6" of concrete rip-rap would be positioned for appropriate slope. This modification will allow for better stream flow, but at a smaller scale compared to a natural channel.
- Low Water Crossing Removal – Existing low water crossings would be demolished and the material removed. Removal of the low water crossings will enable the reestablishment of a natural flow regime, improvement of water quality through regular temperatures, improvement of sedimentation, and improved connectivity of aquatic habitats. The ecosystem restoration objective can be obtained by this measure through the restoration created by restoring natural flows.
- Reestablishment of Allison Drive – A Texas Department of Transportation approved road would be built within the boundary of the past alignment of Allison Drive within the northwestern section of the study area.
- Removal of River Road - Partial removal of River Road beginning at East Mulberry Avenue and ending at Allison Drive. The portion of road removed would be replaced with native soil and vegetation
- Boulder Barrier – A barrier consisting of 3' to 4' diameter boulders with 7' centers would be placed along the boundaries of River Road to protect restoration features from vehicular traffic.
- Gate Installation – This measure would include installation of a gate at the intersection of Avenue A and East Mulberry Avenue to restrict public vehicular access, but allow maintenance staff to access the Brackenridge Park Golf Course maintenance building through the expanded golf cart path. Pedestrian access would still be permitted with this measure.
- Avenue A Partial Removal – This measure would include the removal of 621 cubic yards of road material and replacing that material with native soil. This removal will allow for vegetation to reestablish within bare areas, reducing the erosion and sedimentation impacts from the road.
- Avenue A Full Removal – This would include the complete removal of Avenue A, with the removal of 1,921 cubic yards of road material and replacing it with native soil. This removal will allow for vegetation to reestablish within bare areas, reducing the erosion and sedimentation impacts from the road.
- Instream Structures – Placement of instream structures such as j-hooks or rock vanes to create pool, riffle, and run features within the San Antonio River. This measure would improve aquatic habitat while also reducing the amount of sheer stress on the banks of the river. The features will provide quality auditory benefits for the general public, mimicking the sounds of a small waterfall. This measure would improve the aquatic ecosystem by interacting with the stream banks, bed, and floodplain creating a network

that supports aquatic wildlife habitat, improves oxygen within the water, and maintains stream function and structure. There would be some light channel shaping required for the placement of the structures; however, this would be limited to ensure the structures adequately settle into the channel.

- Geolifts – This measure would be used to compliment the instream structures. They would be used to stabilize the stream bank along the outside of stream meanders and would be placed within an appropriate proximity of the instream structures. Geolifts are basically a series of overlapping soils constructed of erosion control matting and native soils and assist in erosion control.
- Habitat Structures – This measure would include the installation of structural habitat features such as bat boxes, bird boxes, and platforms and creation of brush piles and snags through other management measures. The structures should provide additional nesting sites for wildlife in areas where natural nest sites are lacking (i.e. urban settings). Wildlife can be attracted to these features even if they are not utilized for nesting. While improving wildlife habitat, this measure will also increase wildlife viewing and recreational opportunities.
- Bridges – This measure would be dependent upon the low water crossing removal measure. An ADA compliant pedestrian bridge would be placed in the previous locations for Low Water Crossings (LWC) 1, 2, and 3.

Non-Structural Measures

- Native Species Plantings – Native aquatic and riparian vegetation would be planted within the specified project area. This management measure would support the ecosystem restoration objective by addressing the loss of aquatic and riparian habitat structure and function. The native species planted would include aquatic, herbaceous, and woody. A well developed, age and species diverse aquatic and riparian habitat provides numerous ecological benefits to the components of the riverine system which are requirements for many migratory birds. Bird habits, such as foraging and nesting, can be dependent on vertical and horizontal stratification. A well-developed riparian woodland provides each of these layers and supports the feeding, resting, and defensive requirements for birds. Woody vegetation provides an important source of allochthonous material to the aquatic environment through small and large woody debris. These allochthonous inputs add energy to the aquatic system required by the organisms lowest on the primary producer scale; these organisms are at the true base of the system and are required in large sustained numbers of individuals to ensure there is adequate energy surplus at each trophic level to feed the next higher level through to the primary consumers. Vegetative biodiversity provides protections for food and energy security, and can decrease impacts from large scale disturbances.
- Invasive Species Management – Non-native Invasive species would be eradicated and managed for up to ten years after project implementation. This measure will only be implemented in combination with the native species plantings measure. Invasive species produce negative impacts on areas that they invade, and can lead to the widespread loss of native habitat. Destruction of native habitats can lead some faunal species to extinction and reduce the overall health of riverine and riparian systems. In addition to ecological system impacts, invasive species often times lead to economic losses due to public and private structure destruction. Non-native invasive species can negatively impact biodiversity through disease transfer, predation or parasitism on native species, competition, altering habitat for floral and faunal native species, and hybrid creation. These impacts can create monocultures, which can prove to be unsuitable for sensitive

or rare wildlife species. Invasive species can be controlled through biological, chemical, and mechanical means. Any chemical controls will be certified for aquatic use to avoid any impacts to water quality within the San Antonio River. Mechanical controls indicate a physical removal of a plant through pulling or cutting. Techniques and chemicals utilized during project implementation will depend upon the species.

2.2 Array of Alternatives

The final array of management measures were combined into alternatives that would address ecosystem restoration of the riverine and riparian forest habitats, as well as restore structure and function of the study area. Each of the alternatives listed below could be a standalone plan, or be combined with other alternatives to form a suite of plans. In addition, several scales of the alternatives were developed in order to achieve differing levels of captured and uncaptured benefits. All alternatives will also include recreation features, such as trash cans, signage, fishing access and enforcement.

2.2.1 Instream Modification

The Instream Modification Alternative focuses its efforts upon three low water crossings in the San Antonio River, labeled LWC 1, 2, and 3 (Figures 3-6). Future-With Project condition benefits vary between the scales of the Instream Modification alternative. This alternative can include measures such as native species plantings, invasive species management, habitat features, instream structures, geolifts, low water crossing removal, low water crossing modification, and bridges.

There are four scales evaluated for this alternative: 1A, 1B, 1C, and 1D. All scales would involve native species plantings, invasive species management, instream structures, and geolifts (Figures 7 and 8); however each scale will require either modification or removal to LWCs 1, 2, or 3. A box culvert would allow for some improved water flow; however, it would be assumed to be less impactful than the complete removal of the structure due to erosion and pooling from blockage within the river. Combinations of Low Water Crossing Removal and Modification will yield different results based on the low water crossing it is applied to (upstream vs. downstream of LWC 1).

The vegetation within the vicinity of the river include: pecan (*Carya illinoiensis*), poison ivy (*Toxicodendron radicans*), Chinese privet (*Ligustrum sinense*), Chinaberry (*Melia azedarach*), beggar's lice (*Hackelia virginiana*), greenbriar (*Smilax spp*.), Virginia creeper (*Parthenocissus quinquefolia*), straggler's daisy (*Calyptocarpus vialis*), giant ragweed (*Ambrosia trifida*), Turk's cap (*Lilium superbum*), and giant cane (*Arundinaria gigantea*). As mentioned above, non-native invasive species will be managed with implementation of this project. However, it should be noted that some non-native invasive species may be acting as erosion control. Special care should be taken to ensure that erosion is not increased due to this measure.

Figure 3. Low Water Crossings 1, 2, and 3

Figure 4. Low Water Crossing 1

Figure 5. Low Water Crossing 2

Figure 6. Low Water Crossing 3

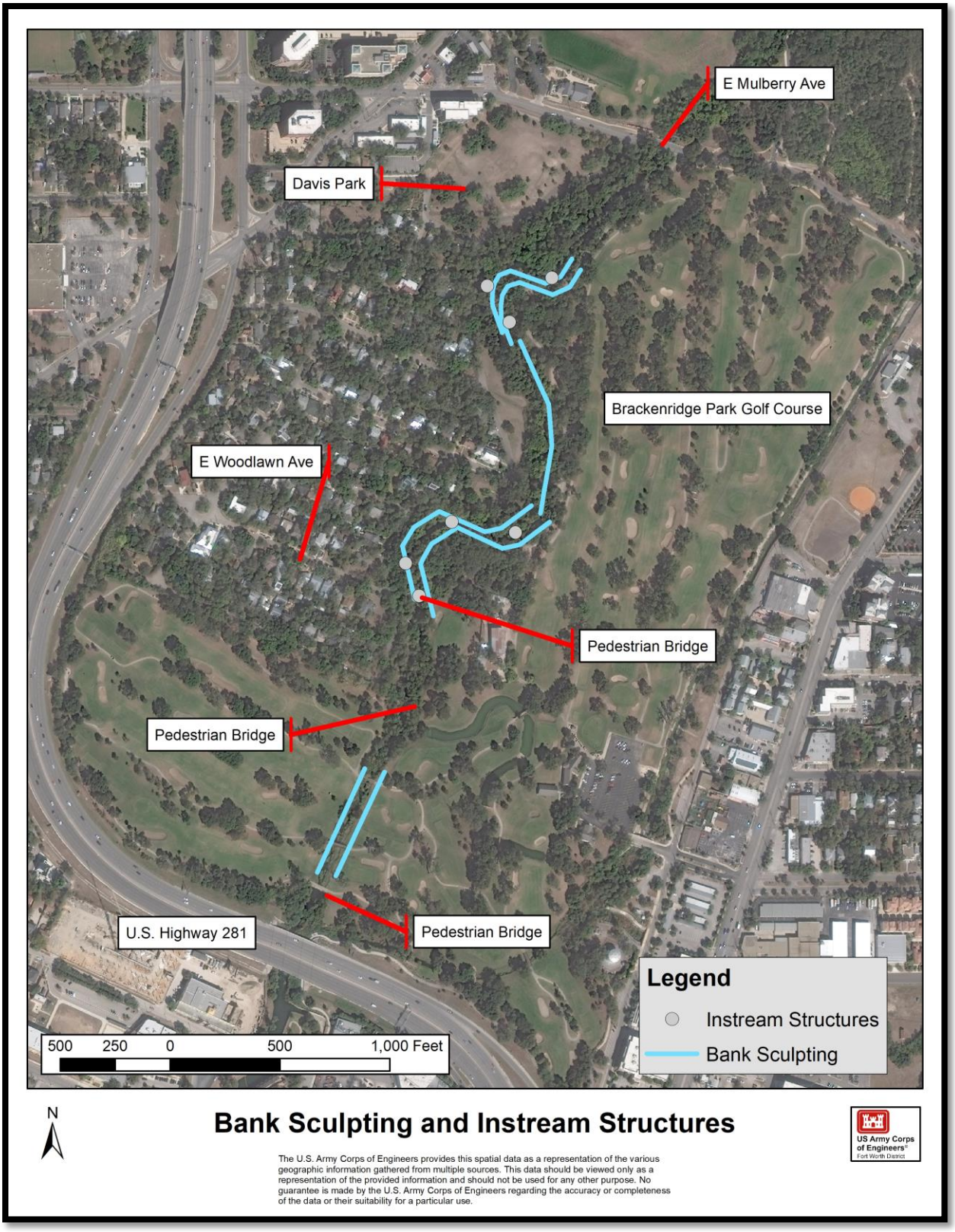

Figure 7. Conceptual Placement of Pool, riffle, and run Features for the Instream Modification Alternative

Figure 8. Native Species Plantings and Invasive Species Management for the Instream Structure Modification Alternative

2.2.1.1 Scale 1A

Scale 1A is the removal of all low water crossings. This will significantly open the stream bed, increase channel flow, and reduce pooling, erosion, and adverse sedimentation. It is assumed that epifaunal substrate, pool substrate, pool variability, sediment deposition, bank stability, and riparian vegetative zone width will dramatically improve within the upstream habitats.

Epifaunal substrate, pool substrate, sediment deposition, bank stability, vegetative protection, and riparian vegetative zone width will dramatically improve within the downstream habitat. This scale would include an additional instream structure underneath the pedestrian bridge in the

existing location for LWC 1 for increased habitat for wildlife and auditory benefits for the general public.

Scale 1A of the Instream Modification Alternative includes the following measures:

- Low Water Crossing Removal,
- Bridges,
- Instream Structures,
- Geolifts,
- Native Species Plantings,
- Invasive Species Removal,
- And Boulder Barrier.

2.2.1.2 Scale 1B

Scale 1B incorporates the modification of LWC 1 and the removal of LWC 2 and 3. LWC 1 does not have consistent flow, installing a box culvert within the center of the structure will reduce some adverse pooling. This reduction will lead to some improved erosion and adverse sedimentation within the upstream portion of the study area. This scale would include the following measures:

- Low Water Crossing Removal,
- Low Water Crossing Modification,
- Bridges,
- Native Species Plantings,
- Invasive Species Removal,
- Instream Structures,
- And Boulder Barrier.

2.2.1.3 Scale 1C

This scale includes the removal of LWC 1 and the modification of LWC 2 and 3. Scale 1 would include an additional instream structure underneath the pedestrian bridge in the existing location for LWC 1 for increased habitat for wildlife and auditory benefits for the general public.

- Low Water Crossing Removal,
- Low Water Crossing Modification,
- Bridges,
- Native Species Plantings,
- Invasive Species Removal,
- Instream Structures,
- Geolifts,
- And Boulder Barrier.

2.2.1.4 Scale 1D

This scale includes the modification of all low water crossings (LWC 1, 2, and 3).This scale includes the following measures:

- Low Water Crossing Modification,
- Instream Structures,
- Geolifts,
- Native Species Plantings,
- Invasive Species Removal,
- And Boulder Barrier.

2.2.2 Avenue A Modification

Avenue A provides public access to the study area and is heavily utilized by the public. Avenue A runs parallel to the San Antonio River beginning at East Mulberry Avenue and ending near LWC 1 (Figure 9). It is a relatively degraded road that does not have curbs or physical boundaries to signal an edge (see Figure 10 and 11). There is constant human disturbance along the boundaries of Avenue A which have led to compaction and a lack of vegetation. Vegetated areas parallel to Avenue A have species such as poison ivy, giant ragweed, beggar's lice, straggler's daisy, giant cane, Chinese privet, peppervine (*Ampelopsis arborea*), lantana (*Lantana camara*), hackberry (*Celtis occidentalis*), dewberry (*Rubus spp*.), and various oaks.

Figure 9. Location of Avenue A

Figure 10. Severely Degraded Road/Non-Existent Habitat at the Avenue A Dead-End

Figure 11. Avenue A Parking Adjacent to the San Antonio River

This alternative will include measures such as native species plantings, invasive species management, habitat features, gate installation, Avenue A full removal, Avenue A partial removal, Brackenridge Park Golf Course golf cart path widening, and an access path. Avenue A Modification will limit the amount of vehicular access to the project area. A gate will be installed for both scales of the project to limit vehicular access to the project area. Brackenridge Park Golf Course maintenance staff will be able to enter the gated area to access their maintenance building and the golf course. Pedestrian access will still be permitted to all areas.

2.2.2.1 Scale 2A

Scale 2A incorporates the complete removal of Avenue A beginning at East Mulberry Avenue until the loop near LWC 1. Upon demolition of this road, native soil would be deposited. Native species would then be established on the former alignment of Avenue A. An ADA compliant asphalt path would be appropriately positioned for recreational use and pedestrian access. The Breckenridge Park Golf Course golf cart path on the east side of the river would be expanded to accommodate maintenance staff equipment. Areas shown in green and yellow (Figure 12) would be managed for invasive species and would be planted with native species. This scale includes the following measures:

- Brackenridge Park Golf Course Golf Cart Path Widening,
- Access Path,
- Habitat Structures,

- Trash Cans,
- Gate Installation,
- Native Species Plantings,
- Invasive Species Management,
- And Avenue A Full Removal.

Figure 12. Areas under Scale 2A of the Avenue A Modification Alternative

2.2.2.2 Scale 2B

Scale 2B of the Avenue A Modification alternative would implement the removal of the lower portion of Avenue A while leaving the rest of the road in place for the maintenance staff to access the maintenance building (Figure 13). The section of road removed would be replaced with native soil, followed by native species plantings and invasive species management. The measures for this scale include:

- Access Path,
- Gate Installation,
- Habitat Structures,
- Trash Cans,
- Native Species Plantings,
- Invasive Species Management,
- And Avenue A Partial Removal.

Figure 13. Areas under Scale 2B of the Avenue A Modification Alternative

2.2.3 River Road Modification

River Road and Davis Park are in the northwestern portion of the study area (Figure 14). Davis Park is located within the floodplain of the San Antonio River and is heavily maintained with mowing and other landscaping controls (Figure 15 and 16). Davis Park lacks suitable vegetation to appropriately filter and slow down stormwater runoff flowing into the river. Davis Park is dominated by bermudagrass (*Cynodon dactylon*) with intermittent green ash (*Fraxinus pennsylvanica*), straggler's daisy, and false mallow (*Malvastrum spp*.). The River Road Modification alternative will incorporate native species plantings in Davis Park, with focus on wildflowers, native grasses, and appropriate riparian vegetation to restore a suitable riparian zone between the river and urban elements.

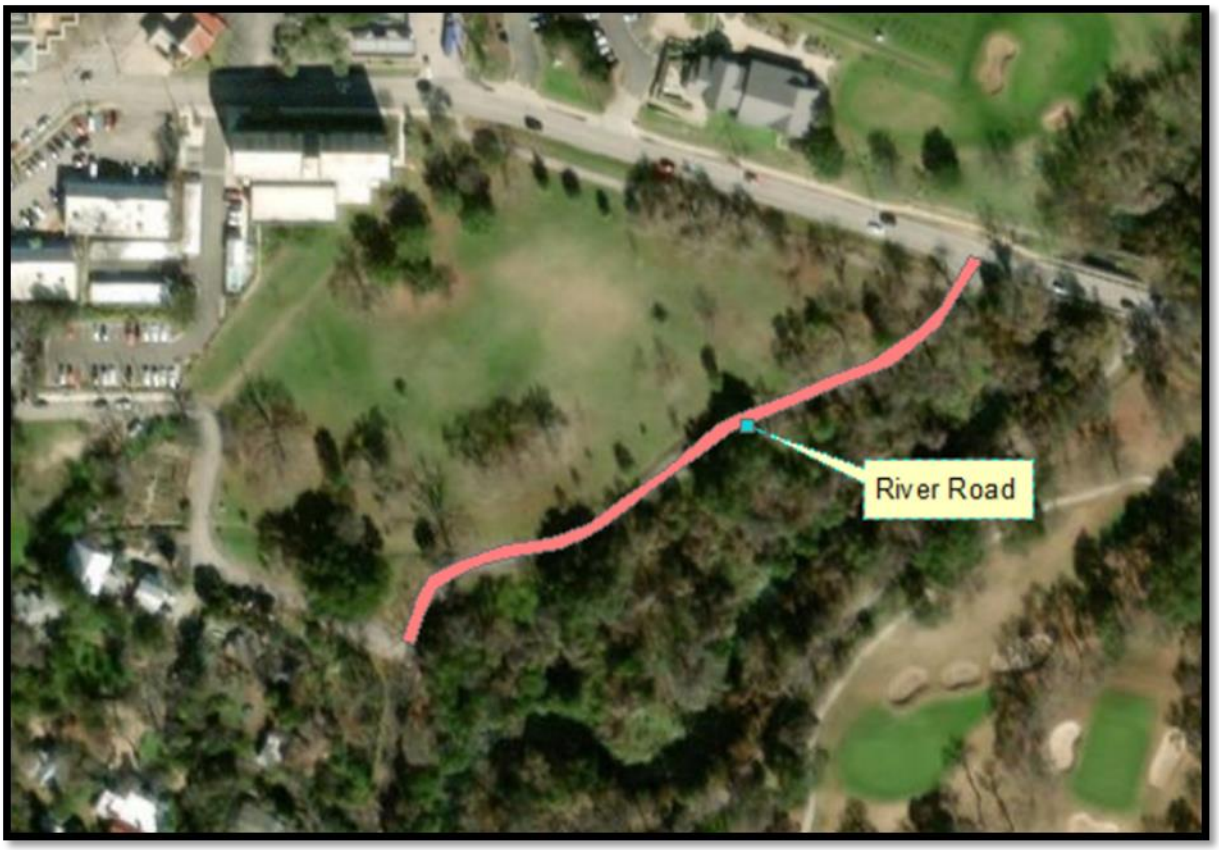

Figure 14. Location of River Road within the Study Area

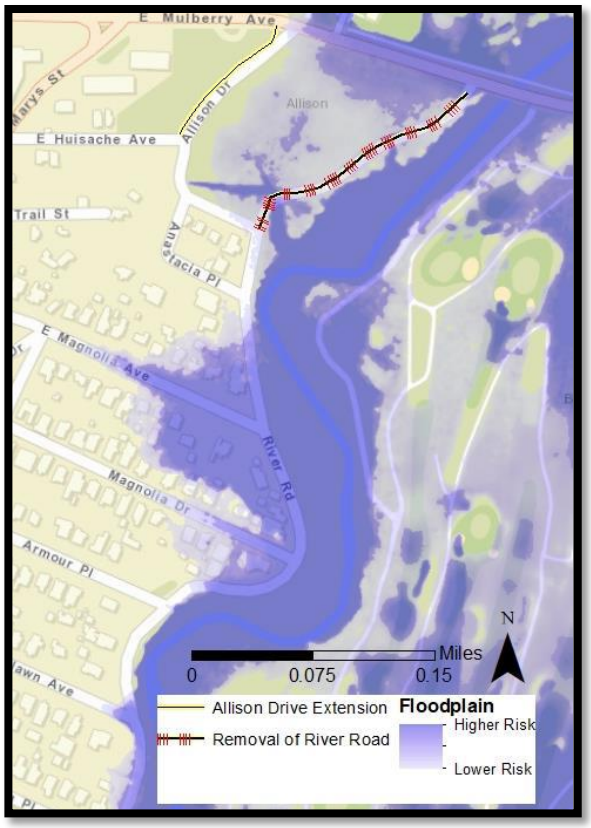

Figure 15. Davis Park and River Road Located within the Floodplain

Figure 16. Davis Park

2.2.3.1 Scale 3A

Scale 3A would incorporate the removal of a portion of River Road and re-establish the original alignment of Allison Drive as another traffic route for the adjacent community (Figure 17 and 18). The River Road section would be replaced with native soil and native vegetative species to expand the riparian zone. The restoration measures included with Scale 3A include:

- River Road Removal,
- Reestablishment of Allison Drive,
- Native Species Plantings,
- Invasive Species Management,
- And Habitat Structures.

Figure 17. Scale 3A of the River Road Modification Alternative

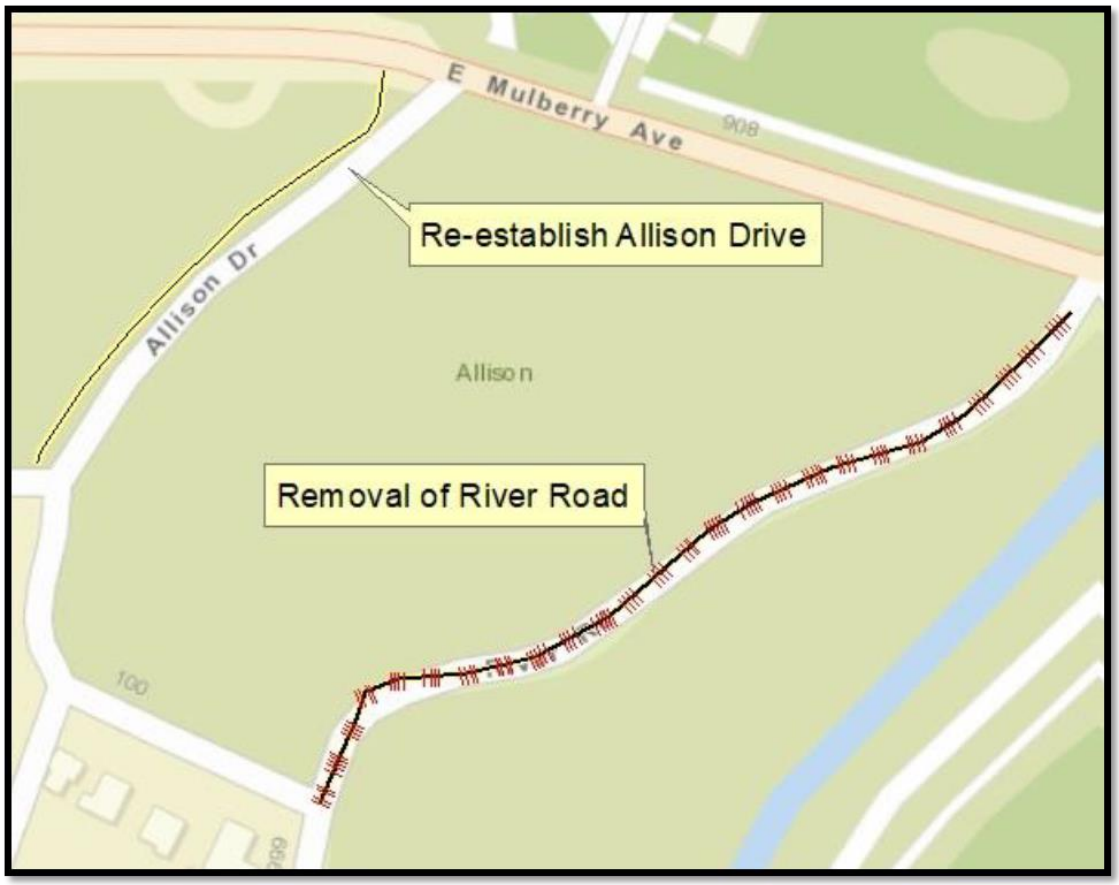

Figure 18. Removal of River Road and the Re-establishment of Allison Drive

2.2.3.1 Scale 3B

Scale 2B is limited to native species plantings and invasive species management. The relocation of River Road is not included in this assessment, therefore, all plantings would be limited to existing open park areas (Figure 19).

Figure 19. Scale 3B of the River Road Modification Alternative

2.3 Array of Plans

2.3.1 No Action

The No Action Plan would leave the River Road study area in its existing condition and would not address the study objectives of restoring habitats that would benefit migratory, breeding, and wintering Neotropical birds, waterbirds, and waterfowl and aquatic organisms. The significant national loss of habitats that is occurring for these species would continue and no efforts to offset the magnitude of these losses would occur for the study area. Migratory birds key in on aquatic habitats such as the San Antonio River when identifying resting and refueling areas during their annual migrations, especially in the more arid regions of the western U.S. This is an evolutionary response for these species as riparian and aquatic habitats generally have higher biodiversity and biomass than upland habitats. These resources are especially important during times of high energy demands such as migration and preparation for the breeding season. Although the River Road study area continues to attract a large number of

migratory birds due to its attractive aquatic environments, the low quality habitat and low habitat diversity cannot adequately support the energy needs of the migratory birds the river attracts. Therefore, migratory birds must expend additional, limited energy resources in search of food elsewhere. In addition to the lack of suitable habitat for a diverse range of migratory birds, the river itself is currently impacted by extreme amounts of pooling leading to an inadequate amount of pool, riffle, and run features for aquatic species prosperity. Under the No Action Plan, the river would continue to be impacted by adverse sedimentation leading to poor water quality and aquatic connectivity. The purpose of the project is to restore the structure and function of the aquatic ecosystem of the San Antonio River; therefore, the No Action Plan is ineffective in addressing the objectives of the feasibility study.

2.3.2 River Road Scale 3B

The change from non-native herbaceous vegetation to a restored native riparian forest would be a hydraulically neutral action. Restoration of Davis Park would partially address the restoration objective for River Road by providing some increased vertical structure diversity in the existing non-native invasive dominated park. Some increased insect biomass production and ancillary water quality benefits will occur with implementation of this alternative. Davis Park is located within the floodplain, so increasing vegetative diversity could allow for additional filtering of storm and runoff drainage before entering the San Antonio River. By increasing the vegetation that can create a buffer between the urban landscape and the river, there will be improved erosion and sedimentation conditions.

2.3.3 River Road Scale 3B + Avenue A Scale 2B

The River Road reach of the San Antonio River is heavily utilized by the general public. Severe erosion and adverse sedimentation on the eastern bank of the river is caused by pooling and the amount of vehicular traffic along Avenue A. By removing a small portion of this road, USACE and the NFS can improve upon the adverse impacts from recreational use.

Although Scale 2B of the Avenue A Modification alternative would only remove the lower loop of Avenue A, it would still be beneficial to the project by reducing erosion and sedimentation in the area. The lower loop of Avenue A acts as supplemental parking and its removal would most likely reduce the amount of nonpoint source pollution occurring due to idling vehicles.

This plan includes the restoration benefits of planting native species in Davis Park as well as planting and maintaining vegetation on the “southern” alignment of Avenue A past the Brackenridge Golf Course maintenance building.

The effects of this restoration alternative will have long-term beneficial impacts on not only the riparian buffer zone of the San Antonio River, but also within the river itself through reduced pollution and sedimentation. The plan addresses the increase of additional riparian habitat along with increased control of vehicular access within a small segment of the study area.

2.3.4 River Road Scale 3B + Avenue A Scale 2B + Instream Modification Scale 1C

River Road Scale 3B + Avenue A Scale 2B + Instream Modification Scale 1C incorporates the full scale removal of LWC 1 and the modification of LWCs 2 and 3 along with native species plantings in Davis Park and the partial removal of Avenue A. Removal of LWC 1 will have a significant impact because it will reduce the extreme pooling that occurs in the river from East Mulberry Avenue to the low water crossing itself. Reduced pooling will encourage stream flow; thereby, improving oxygenation and other abiotic factors within the river. Improved connectivity within this reach of the river will improve aquatic habitat through increased natural pool, riffle, and run and transport of debris. Introduction of manmade instream structures such as j-hooks

and pool, riffle, and run features will provide increased benefits for aquatic wildlife by providing additional areas for foraging and cover.

Increased connectivity within the river will provide better habitat conditions for native fish, such as channel catfish (*Ictalurus punctatus*), yellow bullhead (*Ameiurus natalis*), and largemouth bass (*Micropterus salmoides*) through increased aquatic plant diversity and improved habitat structure. Pool, riffle, and run features will assist ecosystem restoration in a variety of ways. Pools can protect smaller fish or provide shelter during dry conditions and also allow sediment and organic materials to settle within the streambed because the river moves more slowly in those areas. Riffles assist in the protection of smaller species from predators while also acting as a unique location for food sources. Riffles are a good source of habitat for caddisflies, stoneflies, and mayflies; indicator species for river health. Smaller fish, unable to adequately compete in pools, are more likely to utilize runs because of the quick moving water over shallower areas. Due to the complexity of pool, riffle, and run features, each segment acts as its own micro habitat providing protection and forage for a variety of species. This plan will also incorporate the restoration measures described in Section 2.3.2 and 2.3.3.

2.3.5 River Road Scale 3B + Instream Modification Scale 1C + Avenue A Scale 2A

River Road Scale 3B + Instream Modification Scale 2C + Avenue A Scale 2A is similar to the last plan with one exception. Scale 2A of the Avenue A Modification alternative will include the full removal of Avenue A. This plan incorporates expanding the riparian buffer zone along Avenue A from 10’ to 30’ in some of the narrower portions of the river. The expansion will not only increase ancillary water quality benefits from improved runoff filtering but will also provide additional riparian habitat for migratory birds and other wildlife within San Antonio.

Although adding riparian habitat is a significant benefit, removing the road itself will reduce nonpoint source pollution entering the river and decrease the intensity of runoff by removing the impervious surface throughout the entire eastern edge of the project area. Impervious surfaces can create “heat island” effect causing increases in temperatures up to 22ºF (U.S. Environmental Protection Agency 2020). The heat island effect can cause adverse impacts, such as increased energy consumption, elevated air pollutant and greenhouse gas emissions, compromised human health and comfort, and impaired water quality. Impaired water quality due to the heat island effect can increase the temperature of stormwater runoff. Rapid temperature changes in aquatic ecosystems can be stressful and prove fatal to aquatic life. Avenue A Scale 2A will nullify some of the adverse impacts on the eastern boundary of the study area through increased shading, habitat quality, and biodiversity.

In addition to the riparian habitat impacts, the complete removal of Avenue A will also terminate vehicular access to the area. Thereby, improving erosion effects from the eastern bank of the river that have contributed to poor sediment transport and water flow.

2.3.6 River Road Scale 3B + Avenue A Scale 2A + Instream Modification Scale 1A

River Road Scale 3B + Avenue A Scale 2A + Instream Modification Scale 1A incorporates all of the habitat benefits and measures described by the previous plans. Instream Modification Scale 1A; however, removes LWC 1, 2 and 3 and replaces those structures with a pedestrian bridge. The removal of LWCs 2 and 3 significantly improves stream flow and habitat connectivity. The lack of an immovable structure will address the problems of erosion and poor sediment transport within the study area. The section of river impacted by LWCs 2 and 3 has been channelized and focuses distribution of water to the center of the channel. This plan will support the ecosystem restoration objectives of the project by addressing the lack of aquatic shading, reduced allochthonous material inputs, lack of stratification of vertical structure, lack of terrestrial shading, and lack of soft and hard mast diversity.

2.3.7 Avenue A Scale 2A + Instream Modification Scale 1A + River Road Scale 3A

Avenue A Scale 2A + Instream Modification Scale 1A + River Road Scale 3A adds to the previous plan's habitat measures. It incorporates the relocation of River Road to the former alignment of Allison Drive and would implement the native species plantings measure within this area. This plan would increase the riparian buffer on the northwestern edge of the study area; improving habitat quality through increased vegetative diversity, decreasing the velocity of stormwater runoff entering from East Mulberry Avenue and Davis Park, and improving erosion impacts from decreased vehicular traffic on River Road.

2.4 Impacts to Jurisdictional Wetlands, Streams, and Open Water

As part of the alternatives evaluation process, a semi-quantitative assessment of permanent impacts to wetlands, streams, and open water was conducted for the No Action and six best buy or cost-effective alternatives to allow for a relative comparison of impacts. Impacts that were considered include low water crossing modification, low water crossing removal, instream structures, and bridge placement (Table 1). Exact fill will be refined after feasibility has been completed. It is estimated that in a worst-case scenario, there will be an addition cut (cubic yards) as a result of the bank sculpting and geolifts (Table 1).

Table 1. Amount of Material Required for Alternatives

Alternative		Remove Existing Fill Material (Cubic Yards)	New Fill Material (Cubic Yards)	New Fill for Instream Structures (Tons)
Instream Modification	1A: Removal of all low water crossings	468	0	4,556
	1B: Modification of LWC 1 and removal of LWCs 2 and 3	434	120	3,905
	1C: Removal of LWC 1 and modification of LWCs 2 and 3	400	240	4,556
	1D: Modification of all low water crossings	366	360	3,905
	Bank Sculpting & Geolifts	1,800	0	0

The specific type and quality of habitat impacts were evaluated, but are not required for this analysis. Habitat types that would be affected by installation of management measures are expected to be primarily degraded riverine and riparian habitats. Thus, each aquatic resource was estimated to have the same functional value on an aerial basis. Available U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) online mapping data for wetlands in the River Road study area were reviewed and compared with current aerial imagery and field surveys to supplement the analysis (Figure 20).

It is expected that the “freshwater pond” as indicated in Figure 19, will diminish in size with implementation of the Instream Modification alternative. Although this will decrease biological wetlands within the study area, it will improve aquatic habitat and other riverine resources due to the restoration of the historical habitat structure and ecological function created by the proposed natural stream design. This decrease will also be offset by an increase in pool-riffle-run complexes created by the new instream structures, creating the deeper water habitat for temperature and refugia.

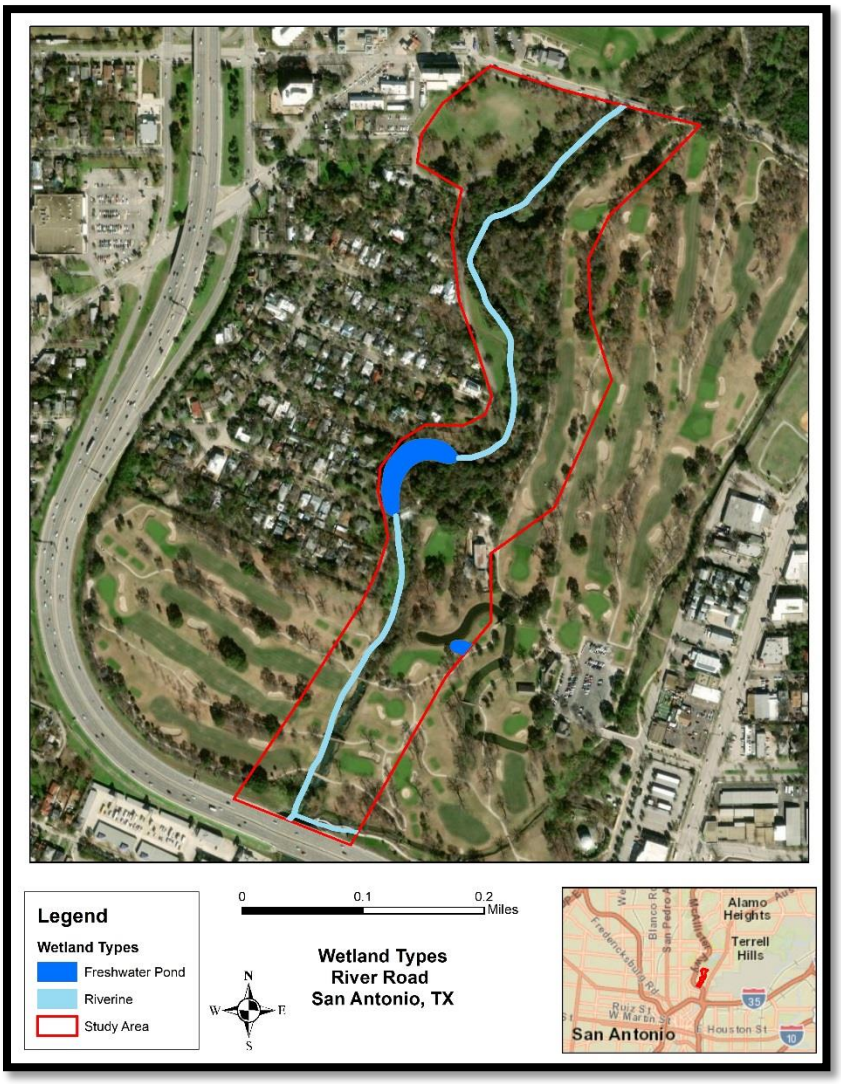

Figure 20. Wetlands Types within the River Road Study Area (USFWS 2019)

2.5 Least Environmentally Damaging Practicable Alternative

All alternatives considered in the final array would have a net benefit to the aquatic environment. However, not all alternatives produced an equal amount of aquatic benefits. Therefore, using a combination of field collected data, habitat modeling, and incremental cost analyses, a Tentatively Selected Plan (TSP) was identified that maximizes net aquatic benefits, while avoiding adverse impacts to outdoor recreation use. As such, the TSP was also identified as the Least Environmentally Damaging Practicable Alternative under the CWA.

3 Tentatively Selected Plan

The TSP is a combination of River Road Modification Scale 3B, Instream Modification Scale 1A, and Avenue A Modification Scale 2A (Figure 21) . This plan provides:

- Two distinct habitat types (riparian and riverine) out of the two targeted habitat types;
- Resilient habitat for migratory birds;
- The creation of a complex of pool, riffle, and run features that can be managed to improve water quality as an ancillary benefit;
- The restoration of the San Antonio River through improved channel flow, sedimentation, and erosion; and
- The restoration of 99.2% of the proposed restoration areas;

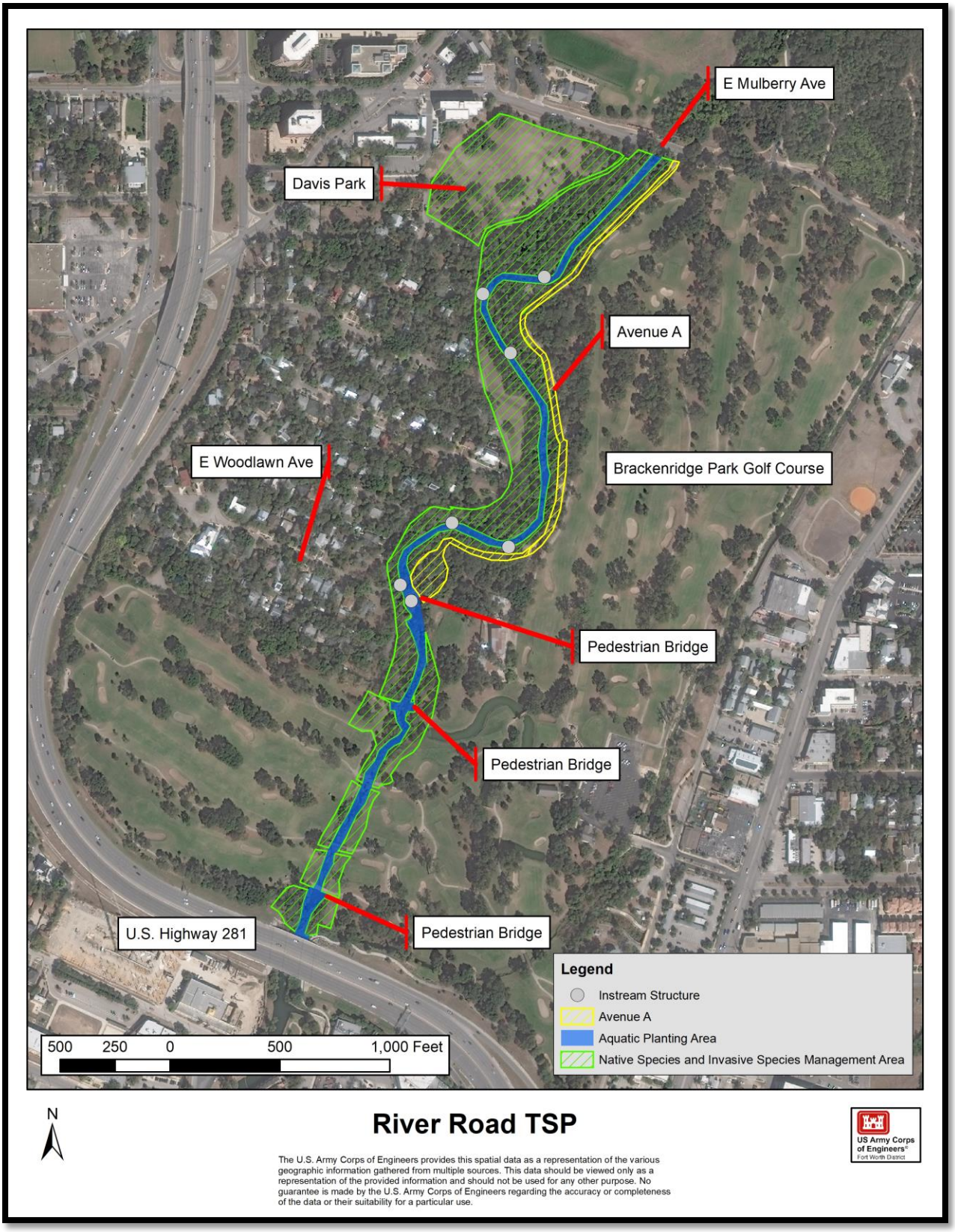

Figure 21. The Tentatively Selected Plan Measure Locations

This plan will incorporate native species plantings and non-native invasive species management throughout the project area. Native species established along the banks of the river will include herbaceous, shrub, and tree species, while plantings within the river will focus on submerged, emergent, and floating-leaved species. Plant candidates are provided in Table 2. Additional species may be added to this list, with approval from SWF USACE and principal partners, as they become available. Propagules will be collected locally for species deemed suitable for restoration. Species used in this project will be collected from and occur naturally within the same level III or level IV Texas ecoregion as the project area, in this case the Texas Blackland Prairies. Species will also be selected based upon tolerance to conditions characteristic of the restoration sites. Seeds and cuttings will be collected from multiple parent trees from multiple sites to reduce genetic limitations. Seeds and cuttings will be collected, processed, stored, and sown following standardized methods.

A major factor in the restoration of the San Antonio River within the study area is the removal of all three low water crossings, particularly the large crossing at E Woodlawn Avenue. Problems identified within this study area can be directly linked to flow constraints attributed to LWC 1. Special attention to this site and public support of continued pedestrian access across the river in this location encouraged the Project Delivery Team to develop measures that would allow the continued public enjoyment of the river while also ensuring the health and quality of the ecosystem. As such, the pedestrian bridges are an important aspect of the TSP.

As described in Section 2.1, Instream features such as pool, riffle, and runs, j-hooks, and rock vanes will be utilized for the purpose of instream habitat with the ancillary benefit of stream bank protection. Additional habitat created by the pool, riffle, and run structures will be essential for different niches of fish and aquatic life. Organisms too small to survive in fast-moving waters can inhabit riffle areas for protection from predators and locate food sources. The structural elements of instream features provide an array of benefits to an assortment of aquatic life, not limiting to their size. Sites with a significant amount of erosion were targeted based on their need for protection and aquatic habitat. The reduction of adverse sedimentation around eroded sites due to the proposed instream structures and geolifts will improve water quality, which in turn improves the aquatic ecosystem. By improving turbidity, aquatic plants and algae will have better a better chance of survival. Heavy sedimentation can pack the stream bed and reduce the availability of protection and cover for aquatic life and also reduce the impacts of natural polishing processes that occur due to microbes removing nutrients and pollution.

The removal of Avenue was not taken lightly. Constraints brought upon the team by the fee property owners, the City of San Antonio, required continued access to the Brackenridge Park Golf Course maintenance building. In response to this request, the team put forth the tactic of expanding the existing Golf Course golf cart path to accommodate the maintenance staff. Avenue A, a bind point for the San Antonio River, is an essential location for restoration efforts. Its removal will facilitate the expansion of the riparian zone, an extremely important factor in aquatic ecosystem health due to its temperature cooling and water polishing effects.

The TSP will not only have benefits for terrestrial wildlife species, but will also have significant beneficial impacts to aquatic habitat and wildlife. This plan will increase and restore riparian habitat within an urban setting, but will also improve the overall water quality of the San Antonio River through a stress point downstream of the San Antonio Zoo.

Migratory birds, riparian and riverine systems, and aquatic wildlife are the resources of national significance identified within the study area. Based on historical descriptions and existing conditions of the San Antonio River outside of urban areas, this portion of the river would have been extremely valuable stopover habitat for migrating birds, provided excellent connectivity between riparian systems, and would have been unobstructed to allow the movement of aquatic

species, sediment, debris, and other natural materials. The recreation of expanded riparian buffers, along with improved riverine habitat are critical to improving habitat for migratory birds, local wildlife, and aquatic species.

Based on the analysis in Section 2.4, the estimated impact to aquatic habitats from the permanent placement of material for pool, riffle, and run structures is 4,556 tons for River Road Scale 3B + Avenue A Scale 2A + Instream Modification Scale 1A.

Table 2. Potential Native Species List for the River Road Project Area

Scientific name	Common name	Growth form
Acer negundo	Box elder	Woody
Acmella oppositifolia	Oppositeleaf spotflower	Herb/wildflower
Aesculus pavia	Red buckeye	Woody
Ampelopsis cordata	Heartleaf peppervine	Vine
Andropogon gerardii	Big bluestem	Graminoid
Andropogon glomeratus	Bushy bluestem	Graminoid
Asclepias sp.	Milkweeds	Herb/wildflower
Bacopa monnieri	Water hyssop	Emergent
Bouteloua curtipendula	Side-oats grama	Graminoid
Bouteloua dactyloides	Buffalo grass	Graminoid
Callicarpa americana	American beautyberry	Woody
Campsis radicans	Trumpet creeper	Vine
Carex sp.	Sedges	Emergent
Carya illinoinensis	Pecan	Woody
Carya texana	Black hickory	Woody
Celtis laevigata	Sugarberry	Woody
Cephalanthus occidentalis	Buttonbush	Woody
Cercis canadensis	Eastern redbud	Woody
Chasmanthium latifolium	Inland sea oats	Graminoid
Cocculus carolinus	Carolina snailseed	Vine

Condalia hookeri	Brazilian bluewood	Woody
Cordia boissieri	Anacahuita	Woody
Cornus drummondii	Roughleaf dogwood	Woody
Crataegus spathulata	Hawthorn	Woody
Dermatophyllum secundiflorum	Texas mountain laurel	Woody
Diospyros texana	Texas persimmon	Woody
Echinodorus berteroi	Tall burhead	Emergent
Echinodorus subcordatum	Creeping burhead	Emergent
Ehretia anacua	Knockaway	Woody
Eleocharis acicularis	Slender spikerush	Emergent
Eleocharis macrostachya	Flatstem spikerush	Emergent
Eleocharis quadrangulata	Squarestem spikerush	Emergent
Equisetum	Horsetail	Emergent
Forestiera pubescens	Stretchberry	Woody
Glandularia bipinnatifida	Dakota mock vervain	Herb/wildflower
Heteranthera dubia	Water stargrass	Submerged
Ilex decidua	Deciduous holly	Woody
Juglans microcarpa	Little walnut	Woody
Juglans nigra	Black walnut	Woody
Justicia americana	Water willow	Emergent
Lantana urticoides	Texas lantana	Herb/wildflower
Lonicera sempervirens	Coral honeysuckle	Vine
Malvaviscus arboreus	Turk’s cap	Herb/wildflower
Morus rubra	Red Mulberry	Woody
Nuphar lutea	Yellow pond-lily	Floating-leaved
Nymphaea mexicana	Mexican water lily	Floating-leaved

Nymphaea odorata	American water lily	Floating-leaved
Panicum virgatum	Switchgrass	Graminoid
Passiflora incarnata	Passion flower	Vine
Phyla lanceolata	Lanceleaf frogfruit	Herb/wildflower
Phyla nodiflora	Texas frogfruit	Herb/wildflower
Platanus occidentalis	American sycamore	Woody
Polygonum hydropiperoides	Swamp smartweed	Emergent
Pontederia cordata	Pickerelweed	Emergent
Potamogeton illinoensis	Illinois pondweed	Submerged
Potamogeton nodosus	American pondweed	Submerged
Prunus mexicana	Mexican plum	Woody
Ptelea trifoliata	Common hoptree	Woody
Quercus buckleyi	Texas red oak	Woody
Quercus fusiformis	Texas live oak	Woody
Quercus macrocarpa	Bur oak	Woody
Quercus muehlenbergii	Chinkapin oak	Woody
Quercus shumardii	Shumard oak	Woody
Sagittaria latifolia	Arrowhead	Emergent
Sagittaria platyphylla	Delta arrowhead	Emergent
Sambucus nigra	Elderberry	Woody
Sapindus saponaria	Western soapberry	Woody
Schizachyrium scoparium	Little bluestem	Graminoid
Schoenoplectus pungens	American bulrush	Emergent
Schoenoplectus tabernaemontani	Softstem bulrush	Emergent
Sideroxylon lanuginosum	Gum bumelia	Woody

Sophora affinis	Eve's necklace	Woody
Sorghastrum nutans	Indiangrass	Graminoid
Symphoricarpos orbiculatus	Coral berry	Woody
Taxodium distichum	Bald cypress	Woody
Tridens albescens	White tridens	Graminoid
Tridens flavus	Purpletop tridens	Graminoid
Tripsacum dactyloides	Eastern gamagrass	Graminoid
Ulmus americana	American elm	Woody
Ulmus crassifolia	Cedar elm	Woody
Ungnadia speciosa	Mexican buckeye	Woody
Vallisneria americana	Wild celery	Submerged
Verbesina virginica	Frostweed	Herb/wildflower
Vitis mustangensis	Mustang grape	Vine
Wedelia texana	Orange zexmenia	Herb/wildflower
Ziziphus obtusifolia	Lotebush	Woody

3.1 Project Description

3.1.1 Completeness

The alternatives fully analyzed will not completely restore the historical ecosystem conditions; however, all of the alternatives included in the TSP would achieve the benefits described below without other projects being completed. For all alternatives, this included determining the likelihood of natural resources that could benefit as part of a project's implementation.

3.1.2 Effectiveness

The River Road study uses a measure of riparian species and riverine response as the ecological metric (criteria) to compare alternatives against their ability to address the ecosystem restoration objective. Riverine structure and function from pre-restoration conditions through completed restoration can be quantified by using an integrated assessment, comparing habitat, water quality, and biological measures to measure the success of the ecosystem restoration objective. Therefore, restoration management measures are largely identified for their ability to restore the physical structures that contribute to food, cover, and nesting sites of the ecosystem.

The Rapid Bioassessment Protocols (RBPs) for Use in Streams and Wadeable Rivers allows for characterization of the existing biotic integrity of the San Antonio River and the future with-project

biotic integrity of the river resulting from the various measures and combinations of measures considered during the study. The Grey Squirrel Habitat Suitability Index (HSI) and Barred Owl HSI were also used to evaluate the conditions of the historically riparian areas on either side of the San Antonio River. The models have been approved for use in the San Antonio River Basin.

Reference conditions within the RBP guide were used to scale the conditions within the San Antonio River and the acceptable expectation for the level of restoration achievable for the river. The product of HSI or RBPs and acres are utilized as a single unit of measure, average annual habitat units (AAHUs), which along with average annual cost (AAC) is used to compare and rank the numerous combinations of management measures. Based on the future without-project and with-project evaluation the following table was developed.

River Road Scale 3B + Avenue A Scale 2A + Instream Modification Scale 1A contributes to the achievement of the planning objectives and avoids all constraints. The TSP, as described in Section 3, is environmentally effective due to the varying measures that can be implemented (Table 3).

Table 3. The Average Annual Habitat Units and Acres associated with the Tentatively Selected Plan

Alternative	Scale	FWOP AAHU	FWP AAHU	AAHU Benefits	Acres
Instream Modification	1A: Removal of Low Water Crossings 1, 2, & 3	7.6	12.9	5.3	16
Avenue A Modification	2A: Complete removal of Avenue A	0.8	1.7	0.9	4.6
River Road Modification	3B: River Road As-Is and Planting in Davis Park	0.0	2.5	2.5	4.9

3.1.3 Acceptability

River Road Scale 3B + Avenue A Scale 2A + Instream Modification Scale 1A is acceptable in terms of all known applicable laws, regulations, and public policies.

3.1.4 Efficiency

River Road Scale 3B + Avenue A Scale 2A + Instream Modification Scale 1A is the most cost effective means of achieving the objectives of all of this study's alternatives, plans, and scales of plans (Table 4).

Table 4. Comparison of the Tentatively Selected Plan's Benefits and Costs

Alternative	Scale	AAHU Benefits	Annual Cost ($1,000) October 2019 Prices
Instream Modification	1A: Removal of Low Water Crossings 1, 3, & 3	5.3	$98.60
Avenue A Modification	2A: Complete removal of Avenue A	0.9	$16.00
River Road Modification	3B: River Road As-Is and Planting in Davis Park	2.5	$7.46

3.2 General Description of Dredged or Fill Material

3.2.1 General Characteristics of Material

The project area will not be dredged; however, there will be some excavation to remove existing fill materials from the low water crossings and prep the site for the pedestrian bridges. Some reshaping and contouring of the channel will be required in the locations associated with the instream structures and geolifts, those areas are indicated in Figure 7. Fill will be required for the use of instream structures, but it will be obtained from a local commercial source for the region. The Tinn and Frio soils located within the project area come from a clayey alluvium of Holocene age derived from mixed sources (Natural Resources Conservation Service [NRCS] 2020).

3.2.2 Quantity of Material

Based on conceptual designs approximately 4,556 tons of crushed stones, rip rap, and boulders would be placed within the San Antonio River for aquatic habitat with ancillary benefits for bank protection and erosion control. The Instream Modification alternative would require 468 CYs of concrete to be demolished and removed from the river.

3.2.3 Source of Material

All fill materials would be acquired from an existing commercial source in the region. Materials would be tested by USACE field construction engineers to verify it meets the specifications as required by the design and specifications in the construction contract prior to it being used in the construction of the various features. Therefore, it is anticipated that the materials would be free of any contaminants.

3.3 Description of the Proposed Discharge Site(s)

3.3.1 Location

Discharge into waters of the United States would occur along the banks and bottom of the San Antonio River. Surplus material would be removed from the project area and deposited into a disposal site that would not impact waters of the United States. It is anticipated that during construction, existing flows would be diverted and construction would occur under dry conditions.

3.3.2 Size

The area of the riparian zone restoration area is approximately 22 acres in size and 0.8 miles of stream channel would be restored or approximately 3.1 acres.

3.3.3 Type(s) of Sites

In the case of the TSP and associated construction activities, land cover in the project area includes riverine and riparian habitat, residential areas, and park settings.

3.3.4 Type(s) of Habitat

The habitat types existing within the study area are riparian and riverine. Riparian habitat, which exists along rivers and other water bodies, are unique because of their soil characteristics and existing vegetation. Most riparian habitat consists of vegetation that is frequently flooded and inundated. The riparian habitat along the San Antonio River is heavily degraded and has been impacted by soil erosion, human disturbance, and non-native invasive species. Invasive species make up approximately 80% of the total vegetation, including bermudagrass, chinaberry, bastard cabbage (*Rapistrum spp*.), Chinese privet, elephant ear (*Alocasia spec*.) and giant cane.

The riverine habitat within the upstream portion of the study area is heavily degraded due to adverse sedimentation and pooling. This portion lacks suitable pool, riffle, and run habitat and instead consists almost entirely of pool habitat from East Mulberry Avenue to E Woodlawn Avenue. The downstream portion, E Woodlawn Avenue to U.S. Highway 281, has less degradation within the stream bed but the banks do not have appropriate slopes and are mostly drop-off points with little to no vegetation.

3.3.5 Waters and Wetlands

All of the waters within the footprint of the TSP construction elements are considered jurisdictional. Because of the severe degradation of the riverine habitat types, i.e. sandbars and riparian vegetation, all 3.1 acres of impacted jurisdictional waters are considered riverine habitat.

3.3.6 Timing and Duration of Discharge

Construction of each of the restoration measures would be timed to occur during low flow periods to minimize impacts to the wetland system. A more detailed schedule would be developed during design and bid stages of implementation.

3.4 Description of Disposal Method

Heavy construction vehicles and equipment would be needed to construct the project components described above, including demolishing low water crossings, placement and shaping of instream structures, and placement of pedestrian bridges. The vehicles and equipment would operate outside of existing river and drainages to the extent possible.

An assortment of wheeled and tracked equipment necessary to handle large loads of material, such as backhoes, track hoes, bulldozers, dump trucks, and front end loaders, would be used for construction. Excess materials would be hauled to an appropriate disposal site. Project work would take place during safe and low flow conditions.

The temporary staging and storage of construction materials and vehicles would be situated in areas that are currently disturbed or are recommended to be cleared from the construction of the project components described above. All staging and storage areas would be outside of wetlands. Best management practices (BMPs) in staging areas would include erosion control and spill prevention measures.

3.5 Factual Determinations

3.5.1 Physical Substrate Determinations

3.5.1.1 Substrate Elevation and Slope

The existing substrate elevation for River Road study area is approximately 661’ to 670’ at mean sea level (msl) with an approximate slope of 14%. The elevation and slope of the constructed project areas would be impacted in very minor amounts due to light excavation that may be necessary for the construction of pedestrian bridges.

3.5.1.2 Sediment Type

The soil within the stream bed and area most applicable to the Clean Water Act Section 404(b)(1) Analysis is Tf, Tinn and Frio soils, 0 to 1 percent slopes, frequently flooded (NRCS 2020). The Frio soil series occurs mainly on the flood plains of the Medina River and the San Antonio River. It is limy throughout and a fairly productive soil well suited to native grasses and pecan orchards.

3.5.1.3 Dredge/Fill Material Movement

Material placed in the channel bottom and side slopes would be sized and/or anchored to withstand high flow events. Only minor movement of fill material (instream structures) would occur after stabilization.

3.5.1.4 Physical Effects on Benthos

The existing benthos would be temporarily impacted within the proposed 3.1 miles of restoration; however, the natural instream design of the proposed improvements would restore the aquatic function and benthic habitats to the system. The proposed instream structures would create pool, riffle, run, and glide habitats that would sustain a diverse and abundant benthic community. These diverse aquatic structural habitats are severely lacking in this reach of the San Antonio River. During construction, erosion and sedimentation BMPs would be utilized to minimize impacts to benthos downstream of the proposed project area.

3.5.1.5 Other Effects

Temporary impacts to aquatic organisms and fish are expected to occur during construction from earthmoving and demolition activities with the potential for temporary sedimentation and water quality degradation within the river during construction. However, the aquatic organisms would be expected to return upon completion of the restoration.

3.5.1.6 Actions Taken to Minimize Impacts

Actions would be minimized to the extent possible by scheduling construction to coincide with low flow periods. Silt fences and geotextile filters would be placed to minimize sediment transport downstream. Staging and construction access areas would avoid wetlands and aquatic habitats to the extent possible to minimize temporary disturbances and provide distance between aquatic habitats and exposed sediments. BMPs would be detailed as designs for the different elements of the TSP are prepared. Thus, the existing aquatic organisms and fish found at the construction sites would be temporarily affected during construction and expected to recover and improve post construction.

3.5.2 Water Circulation, Fluctuation, and Salinity Determinations

3.5.2.1 Salinity

No changes in salinity are expected to occur.

3.5.2.2 Water Chemistry

The project would not negatively impact water chemistry of the San Antonio River; however, positive impacts from improved oxygenation and sedimentation are expected to occur. These secondary benefits will be due to the construction of the instream features, removal of low water crossings, establishment of native species, and shading from the restored riparian habitat. The aquatic habitat features will increase mixing and turbulence, thereby increasing dissolved oxygen levels. Native aquatic vegetation plantings will also have a similar effect through photosynthesis.

3.5.2.3 Clarity

Temporary disruption to water clarity is expected during construction. After the low water crossings are demolished and pedestrian bridges and instream structures are placed and settled, water clarity would return to pre-construction conditions. Water clarity is expected to improve over the 50-year period of analysis due to the removal of the low water crossings and Avenue A. Erosion will be decreased, leading to a decrease in adverse sedimentation. Normal sedimentation will result in higher water clarity and more natural conditions within the river.

3.5.2.4 Color

The improvement of water quality within the San Antonio River will yield low positive changes in water color over the next 50 years.

3.5.2.5 Odor

No changes in odor are expected to occur.

3.5.2.6 Taste

The stream is not used as a potable water source within any portion of the area that would be impacted by the project.

3.5.2.7 Dissolved Gas Levels

The shading provided by the introduction of woody vegetation into the riparian habitat is anticipated to improve water chemistry by maintaining cooler water temperatures supporting higher concentrations of dissolved oxygen in the water column.

3.5.2.8 Nutrients

The proposed ecosystem restoration project would include the restoration of woody vegetation to expand the riparian corridor within the study area. In addition, herbaceous vegetation would be allowed to mature and reach natural height. The increase in organic material within the floodway would provide allochthonous input into the San Antonio River to support the lower trophic levels of the aquatic ecosystem. The widening of the riparian habitat corridor also improve nutrient loading as the riparian vegetation would filter excessive nutrient loads from the turf maintenance on the adjacent golf course.

3.5.2.9 Eutrophication

Eutrophication is not evident in the project reach and there would be no factors changed that would impact eutrophication of the aquatic system of the San Antonio River.

3.5.3 Current Patterns and Circulation

3.5.3.1 Current Patterns and Flow

The San Antonio River flows through urban environments and is heavily influenced by stormwater runoff magnified by the relatively high impervious cover in the watershed. Patterns of flow are dependent on the distribution and intensity of rainfall over this area. The normal patterns of precipitation result in minor fluctuations of flow intensity through the system. Heavy thunderstorms can induce large flows and higher water surface elevations. The removal of the low water crossings will restore historic flow conditions, as best as possible, in this section of the river. As a result pooling in the upstream portions of the study area will be greatly reduced; the NFS is required to maintain a flow of 10 cubic feet per second (cfs) within this reach – ensuring sustainability of aquatic and riparian habitats with normal water elevations.

3.5.3.2 Velocity

Water velocities will be controlled utilizing natural channel design principles. Scouring would be controlled by the placement of the instream structures designed to dissipate energy while creating pool and riffle habitats. Where required, the channel and banks would be protected with suitable erosion control techniques.

3.5.3.3 Stratification

Stratification does not occur within the project area nor would it occur with implementation of the TSP.

3.5.3.4 Hydrologic Regime

The TSP would restore natural flows to the river. The natural stream design would not increase the water surface elevation or increase the flood risk to residential structures.

3.5.3.5 Normal Water Level Fluctuations

The TSP would restore the natural river function, including allowing normal water level fluctuations associated with seasonal rain patterns. Base flows to the river are will continue to be supplemented with reuse water from the City of San Antonio.

3.5.3.6 Salinity Gradients

The project area waters only contain freshwater components. There would be no impacts to salinity gradients.

3.5.3.7 Actions Taken to Minimize Impacts

Appropriate BMPs would be utilized to minimize erosion and sedimentation during construction. Instream sediment trapping devices can include the use of floating materials and collection mats that run along the bottom of the river. These materials can limit the transport of sediments, decreasing adverse impacts within the water. Native vegetation would be reestablished to help stabilize the stream disturbed by construction activities.

Additional, shoreline stabilization methods to be considered to be incorporated with native vegetation installation include:

I. Encourage “soft” or natural shoreline protection over “hard” structural methods
   a. Easier on the environment, imitate natural systems
II. Basic Principles of Shoreline Protection
   a. Imitate nature
      i. Native vegetation
   b. Keep slopes gentle
   c. Employ “soft armoring” whenever possible
      i. Live plants, logs, vegetative mats
      ii. Alternative to hard armoring
         1. Stone blocks, sheet-pile
III. Recommended Shoreline Protection Methods
   a. Soft approach
   b. Re-vegetation
   c. Live staking
      i. For slopes with high erosion – good in conjunction with other methods
      ii. Drive woody plant cuttings deep into substrate – sprouts roots and grows
   d. Live fascines (bundles)
      i. For slopes with light erosion
      ii. Similar to staking. Plant live stems and branches in trenches, cover with soil and vegetation
   e. Brush layering
      i. For badly eroded slopes
      ii. Plant cuttings inserted at an angle into holes dug into side of slope
   f. Brush matting
      i. For badly eroded slopes
      ii. Full layer or mat of live plant cuttings that will root and grow

g. Erosion control matting
    i. For moderate slopes along roadways or waterways
    ii. Biodegradable mat planted with grass and covered with soil

3.5.4 Suspended Particulate and Turbidity Determinations

3.5.4.1 Expected Changes in Suspended Particulates/Turbidity Levels in Vicinity of Disposal Site

Only minor temporary increases in suspended particulates and turbidity levels would likely occur during construction of the TSP. A Stormwater Pollution Prevention Plan (SWPPP) would be prepared, which would outline site-specific BMPs to minimize erosion and the potential for sediment to enter receiving waters during construction activities. BMPs, such as silt curtains could be used to reduce impacts. Surplus material that cannot be used for restoration activities would be disposed of appropriately. Over the long-term, reduced nutrient and sediment loading would decrease the associated suspended particles that enter the San Antonio River after large rainfall events due to the nature of the TSP.

3.5.4.2 Effects (degree and duration) on Chemical and Physical Properties of the Water Column

Light Penetration: Changes to light penetration would occur during construction associated with minor turbidity increases. Appropriate erosion and sedimentation controls would be implemented to reduce impacts to downstream waters. After project completion and stabilization, the clarity of the river would improve upon preconstruction levels due to the removal of the low water crossings, installation of instream structures, and establishment of native species. It is expected that improved sedimentation conditions will enhance water clarity, which will result in higher light penetration.

Dissolved Oxygen: Temporary lowering of dissolved oxygen could occur during construction; however, in the long-term dissolved oxygen may increase as a result of aeration over the instream structures placed within the channel as part of the natural instream design. Woody riparian vegetation planted along the stream channel would shade the stream further benefitting the dissolved oxygen levels of the stream.

Toxic Metals and Organics: No water testing was conducted in the immediate proposed project area and no data was identified to provide information on water quality measures. The proposed project would not result in the introduction of toxicants into the San Antonio River. The watershed is primarily urban with most of the run-off coming from industrial, commercial, and residential areas. The project sponsor would be responsible to ensure the site is not contaminated prior to construction and would be responsible for reclamation, if necessary.

Pathogens: No pathogens would be added to the water column as a result of this project.

Others as Appropriate: No other effects to the water column are anticipated.

3.5.4.3 Effects on Biota

Displacement of local biota would occur during construction as mobile species would immigrate to adjacent habitats. Indirect impacts to biota would occur in the vicinity of the construction areas as emigrating species move into areas already at carrying capacity. This would result in stressors to the existing populations as the emigrating species would compete for food and other resources. Although sessile species would be impacted during construction activities, the TSP would result in the elimination of the larger pool created by the low water crossing, the biotic community would shift from a pool dependent community to a more diverse community associated with the pool, riffle, run/glide habitats of the restored river.

Primary Production, Photosynthesis: Aquatic and riparian vegetation would be removed from the project site during the modification of the San Antonio River. Once the low water crossings are removed and instream structures are constructed, primary producers would be restored to the aquatic and riparian ecosystem through native species plantings. No net loss of primary production is anticipated as the result of the proposed action.

Suspension/Filter Feeders: Suspension and filter feeders would be temporarily displaced during construction activities. BMPs would be established to control erosion and sedimentation downstream that may otherwise impact filter feeders. Once the proposed channel is constructed, suspension and filter feeders would repopulate the riffle and pool habitats created through the restoration project. No net loss of suspension or filter feeders is anticipated as the result of the TSP.

Sight Feeders: Sight feeders would be temporarily displaced during construction activities. BMPs would be established to control erosion and sedimentation downstream that may otherwise impact sight feeders. Once the proposed low water crossings are demolished and instream structures are constructed, sight feeders would repopulate the riffle and pool habitats created through the construction. No net loss of sight feeders is anticipated as the result of the TSP.

3.5.4.4 Actions Taken to Minimize Impacts

BMPs will be established to control erosion and sedimentation to minimize impacts to biota downstream. By utilizing instream structures and restoring native riparian vegetation, long term impacts to the aquatic biota would be beneficial.

3.5.5 Contaminant Determinations

The proposed project would not result in the exposure of toxicants to the biota of the San Antonio River. As previously stated, the project sponsor would be responsible for site reclamation and providing an uncontaminated site prior to construction of the project.

3.5.6 Aquatic Ecosystem and Organism Determinations

As described in Section 2, the TSP was selected after an extensive review of possible environmental restoration alternatives to meet the Project's purpose and need, as well as to be the most practicable implementable project. The alternatives resulted in best buy plans with beneficial effects. Accordingly, long-term impacts associated with the TSP were determined to have moderate to significantly positive effects on water resources, hydrology, biological resources, land use, and recreation.

3.5.6.1 Effects on Plankton and Nekton

Temporary impacts to plankton and nekton would occur during construction of the TSP. However, the instream structures included in the Instream Modification alternative would result in a series of riffle and pool complexes throughout the project reach. The habitat diversity provided by the created pools and riffles would provide habitat to a diverse community of plankton and nekton once the channel and vegetation is restored. Therefore, no net loss of plankton and nekton is anticipated.

Nekton passage, will be significantly improved due to the removal of the low water crossings. The low water crossing at E Woodlawn Avenue allows very little natural flow. The lack of river flow severely impacts fish passage. The removal of the low water crossing will completely open this section of the river, allowing fish passage and the movement of essential organic matter, sediment, and debris.

3.5.6.2 Effects on Benthos

No additional effects other than those previously discussed were identified.

3.5.6.3 Effects on Aquatic Food Web

Temporary disruptions to the food web would occur during construction. However, the instream structures of the proposed TSP would result in a series of riffle and pool complexes throughout the project reach. This diversity would provide habitat to an assorted community of organisms at all trophic levels. Therefore, no net loss of species or negative impacts to trophic levels are anticipated as the result of the TSP.

3.5.6.4 Effects on Special Aquatic Sites

Sanctuaries and Refuges: No USFWS sanctuaries or refuges occur within the project area.

Wetlands: The pooling caused by LWC 1 will be significantly reduced; however, this will improve the overall health of the riverine system. Therefore, the project would significantly increase the conditions of wetland systems in the project area.

Mudflats: There are no mudflats that occur within the project area.

Vegetated Shallows: No vegetated shallows are anticipated to be impacted by the project.

Coral Reefs: No coral reefs occur within the project area.

Riffle and Pool Complexes: The instream structures of the proposed TSP would result in a series of riffle and pool complexes throughout the project reach. Therefore, riffle and pool complexes would significantly increase as a result of the proposed action.

Threatened and Endangered Species: The project would not impact any federally listed threatened or endangered species.

Other Wildlife: Wildlife inhabiting the aquatic and riparian habitats within the project would be temporarily displaced during construction. Mobile species would immigrate to adjacent habitats. Although sessile species would be impacted during construction activities, they would be expected to return to suitable habitat areas following construction. Native vegetation, instream structures, and removal of the low water crossings are expected to have positive impacts on aquatic and riparian species.

3.5.6.5 Other Effects

Land Use: The TSP would not change land use within the immediate or adjacent areas.

Transportation: Although the removal of Avenue A is expected, there would be no significant impacts to transportation because the road does not lead to residential, commercial, or industrial sites. Transportation for the Brackenridge Golf Course maintenance staff will be mitigated through the expansion of the golf cart path.

Utilities: There would be no effects to utilities.

Cultural Resources: The TSP requires the removal of the low water crossings, the removal of Avenue A, the installation of pool, riffle, and run features, the mechanical management of invasive species, the installation/creation of habitat structures, as well as the construction and/or use of access routes, and the construction of any laydown areas. Significant cultural resources could, therefore, be adversely affected by these activities.

Continued coordination with the Texas State Historic Preservation Office will ensure compliance with Section 106 of the NHPA.

3.5.7 Recommended Disposal Site Determinations

3.5.7.1 Mixing Zone Determination

Most fill would occur within areas of the channel while in a dry state and only minimal mixing would occur, primarily due to churning of shallow waters by equipment traversing the channel bottom. BMPs will be implemented, such as silt curtains to lower impacts. Disposal of surplus material would occur at an offsite location that is not within waters of the United States.

3.5.7.2 Determination of Compliance with Applicable Water Quality Standards

The State of Texas List of Impaired Water Bodies, also known as the CWA Section 303(d) List, identifies: 1) water bodies that do not meet the standards set for their use; 2) which pollutants are responsible for the failure of the water body to meet standards; and 3) water bodies that are targeted for clean-up activities within the next two state fiscal years. According to the Draft 2020 Texas Commission on Environmental Quality (TCEQ) Section 303(d) list (TCEQ 2020), the TCEQ has not designated the segment 1911-01 of the San Antonio River Basin as an impaired water body. However, the San Antonio River lists total phosphorus and nitrate as potential sources of impairment and concern.

The development and use of the SWPPP for construction and post-construction operation will bring this project into compliance with standards set by the CWA by identifying the potential stormwater pollution sources, which could include: demolition operations, grading operations, material storage areas, and staging areas, and reduce the potential of those pollutants entering nearby waterways. Potential pollutants contributed to this project could include: sediments, fuels, trash, and chemicals. The proposed ecosystem restoration project would result in water quality benefits by increasing dissolved oxygen concentrations and providing a more efficient vegetative buffer to filter nutrients from adjacent land uses before entering the creeks.

3.5.7.3 Potential Effects on Human Use Characteristics

Municipal and Private Water Supply: Municipal and private water supplies in the action area rely on groundwater associated with the Edwards Aquifer. The project area is not located in the recharge or contributing zone of the Edwards Aquifer and the San Antonio River is not utilized as a local water supply; therefore, the TSP would not impact the local water supply.

Recreational and Commercial Fisheries: Recreational fishing is a popular activity within this reach of the San Antonio River. Fishing will be temporarily impacted during construction due the presence of heavy machinery and construction boundaries. However, improvements to aquatic habitat and the presence of pool, riffle, and run features should improve the diversity of fish and fishing opportunities in the project area.

No commercial fisheries were identified in the project area.

Water Related Recreation: There will be temporary impacts to water related recreation during construction, but recreation is expected to improve upon the removal of the low water crossings in the study area.

Aesthetics: Implementation of the TSP will have short-term, temporary impacts on aesthetics during construction. While visual and aesthetic preferences are unique to each individual, implementation of the TSP could have a significant positive effect on the visual aesthetics. As native species become established, they will produce a variety of colors and visual effects. Depending upon the individual, the instream structures and pedestrian bridges will be more aesthetically pleasing than pooling and low water crossings.

Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Areas, and Similar Preserves: The TSP will have a permanent effect on Davis Park due to the implementation of native species plantings, areas previously utilized by the public for picnicking will be no longer available for those types of recreational activities. However, the opportunity for environmental outreach and birding will be available and will be beneficial for the

general public. The incorporation of Davis Park into the project area will deter some recreationalists, but attract new recreationalists. The study area is a part of the greater Brackenridge Park, which can still be utilized as an alternative recreation site.

4 Determination of Cumulative Effects of the Aquatic Ecosystem

Because the TSP would utilize natural instream design and would entail the restoration of native riparian habitat, the beneficial cumulative impacts of the project are major. The temporary effects of construction activities that may result at the project site and areas downstream would be relatively minor. However, with proper BMPs in place, these minor adverse impacts would be inconsequential to the beneficial cumulative impacts on water quality and the aquatic and riparian habitats.

The conservation of water resources in Bexar County continues to be a priority and initiatives by the City of San Antonio (CoSA), SAR, San Antonio Water Systems, Bexar County, Texas Parks and Wildlife Department, and non-profit organizations are making progress in increasing the extent of restored and protected aquatic habitats. Although future restoration and conservation initiatives will undoubtedly continue, the CoSA and Bexar County are one of the top ten growth centers in the U.S. As a result, urban pressures would continue to encroach on the county's suburban and rural aquatic ecosystems. Because of projected future population growth and subsequent urbanization, the sustainability and ecological viability of aquatic habitats for fish and wildlife as well as human uses, highlights one of the greatest ecological needs of the county.

The TSP would effectively provide up to 3.1 acres of enhanced or created riverine habitat and 22 acres of riparian habitat with essential connectivity for aquatic species within the river and critical stop-over habitat for the birds utilizing the Central Flyway. Therefore; the cumulative effects of the TSP will have long-term beneficial impacts.

5 Determination of Secondary Effects on the Aquatic Ecosystem

BMPs to minimize impacts associated with construction activities have been identified and would be refined during design activities, as would construction timing considerations. BMPs are expected to include schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control construction site runoff, spills or leaks, waste disposal, or drainage from raw material storage areas. Additional erosion control and stabilization practices may include but are not limited to: establishment of temporary or permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of existing vegetation, temporary velocity dissipation devices, flow diversion mechanisms, silt fencing, sediment traps, and the prompt vegetation establishment of disturbed areas. These measures would reduce potential impacts to water quality. Implementation of sediment and erosion controls during construction activities would maintain runoff water quality at levels comparable to existing conditions.

A Monitoring and Adaptive Management Plan has been developed to monitor and assess functionality of components of the recommended ecosystem restoration project informing monitoring and adaptive management strategies to ensure success in meeting goals of the project.

An Operation, Maintenance, Repair, Replacement, Rehabilitation (OMRR&R) plan would be developed to ensure the structural integrity of the structural restoration features are maintained and that excess sediment and debris is removed and dislodged from water control structures.

6 Summary of 404(b)(1) Analysis

While implementation of the TSP would involve the placement of fill material within the project footprint and would impact 3.1 acres of waters of the U.S., this disposal would not violate established State water quality standards or the Toxic Effluent Standards of Section 307 of the Clean Water Act of 1977, as amended, nor harm any endangered species or their critical habitat. Implementation of the TSP would not result in adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Appropriate steps to minimize potential adverse temporary impacts of discharge in aquatic systems include use of suitable erosion control technologies together with the implementation of procedures to protect against erosion and sedimentation during and after construction.

Impacts to the San Antonio River, following implementation of the TSP would have major beneficial impacts on water quality. The restoration of approximately 22 acres of riparian habitat and 3 acres of aquatic habitat associated with the project increase the natural nutrient and pollutant filtering functions of the river and riparian zone. Although the scale of the benefits may be relatively small, the TSP will improve the conditions of the San Antonio River after removing all three of the low water crossings due to reduced sedimentation from improved erosion conditions. Reduced sedimentation will improve water temperatures, water clarity, and dissolved oxygen levels over time. The placement of instream structures will also contribute to the effect above, adding to natural oxygenation and providing habitat for aquatic wildlife. The features will assist with energy dissipation, reducing the effects of erosion along the river banks. The benefits of the TSP will improve the overall conditions with improved water and habitat quality for aquatic species.

Adverse impacts of the TSP are minor and comparable to the conditions covered by the Nationwide Permit (NWP) 27- Aquatic Habitat Restoration, Enhancement, and Establishment Activities. Compensatory mitigation for impacts to 3.1 acres of waters of the U.S. and wetlands is not required, in line with NWP 27, because there is a net increase of aquatic resource functions and services. In addition, the restoration of 3.1 acres of riverine and 22 acres of riparian habitat with ecosystem restoration measures outweigh any minor adverse impacts to existing wetlands as the result of pool, riffle, and run feature placement.

7 References

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8 List of Preparers

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Findings Declaration

The proposed project will impact 3.1 acres of waters of the U.S with the intended purpose of restoring approximately 22 acres of riparian habitat and 3 acres of aquatic habitat. Project activities include removal of three low water crossings, riparian plantings and complete removal of Avenue A. Benefits of the proposed project include increase in natural nutrient uptake and pollutant filtering, improvement of habitat (riparian and riverine), resilient habitat for migratory birds, creation and restoration of complex stream sequences (riffle, pool, run), improvement of water quality and channel flow, as well as reduced sedimentation and erosion. The nature of the project is restoration and therefore considered to be self-mitigating.

The proposed placement site for discharge of or fill material complies with Section 404(b)(1) Guidelines.

July, 29 2021
Date

Amanda McGuire

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Chief, Environmental Branch