

## **APPENDIX F: MONITORING AND ADAPTIVE MANAGEMENT PLAN**

This appendix details the feasibility level monitoring and adaptive management plan for the Brownsville Resacas Ecosystem Restoration Study. This plan identifies and describes the monitoring and adaptive management activities proposed for the project and estimates their cost and duration. This plan will be further developed in the preconstruction, engineering, and design (PED) phase as specific design details are made available.

The Brownsville Resaca adaptive management plan will describe and justify whether adaptive management is needed in relation to the alternatives identified in the Feasibility Study. The plan will outline how the results of the project-specific monitoring program would be used to adaptively manage the project, including specification of conditions that will define project success.

The primary intent of this Monitoring and Adaptive Management Plan is to develop monitoring and adaptive management actions appropriate for the project's restoration goals and objectives. The presently identified management actions permit estimation of the adaptive management program costs and duration for the Brownsville Resaca Ecosystem Restoration. This plan is based on currently available data and information developed during plan formulation as part of the feasibility study. Uncertainties remain regarding the exact project features, monitoring elements, and adaptive management opportunities. Components of the monitoring and adaptive management plan, including costs, were estimated currently available information. Uncertainties will be addressed in PED, and a detailed monitoring and adaptive management plan, including cost breakdown, will be drafted by the project delivery team (PDT) as a component of the design document.

### **AUTHORITY AND PURPOSE**

Ecosystem restoration feasibility studies are required to include a plan for monitoring the success of the restoration (Section 2039, WRDA 2007). Monitoring includes the systematic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management may be needed to attain project benefits. Section 2039 also directs that a Contingency Plan (Adaptive Management Plan) be developed for all ecosystem restoration projects.

### **GOALS AND OBJECTIVES**

During the initial stages of project development, the PDT developed restoration goals and objectives to y the restoration measures. The goal of the Brownsville Resaca Ecosystem Restoration Project is to restore the ecological structure and function of the resacas in the City of Brownsville. The resulting objective focuses on the importance of the resaca habitats for the unique and diverse flora and fauna dependent on these ecosystems.

## **MANAGEMENT AND RESTORATION ACTIONS**

The PDT performed a thorough plan formulation process to identify potential management measures and restoration actions that address the project objective. Numerous alternatives were considered, evaluated, and screened in producing a final array of alternatives. The PDT subsequently identified a tentatively selected plan (TSP). The TSP included the following ecosystem restoration components, all or some of which would be implemented on 46 restoration areas on Resaca del Rancho Viejo and Resaca de la Guerra:

- 205 acres of dredging to restore resaca depths to a minimum average of six feet in depth;
- 31 miles bank sculpting to restore the 1:10 to 1:15 bank slopes along the resaca shoreline;
- 523 acres riparian planting to replace or augment existing vegetation within the riparian habitats of the resaca;
- 57 acres of emergent planting along the shallow aquatic habitats paralleling the newly sculpted shoreline;
- and over 900 acres invasive species management (See resaca figures in the Environmental Appendix of the Feasibility Report).

## **IMPLEMENTATION**

Pre-construction, during construction, and post construction monitoring shall be conducted by utilizing a Monitoring and Adaptive Management Team (MAMT) consisting of the U.S Army Corps of Engineers (USACE) and Brownsville Public Utilities Board (BPUB).

Monitoring will focus on evaluating project success and guiding adaptive management actions by determining if the project has met Performance Standards. Validation monitoring will involve various degrees of quantitative monitoring aimed at verifying that restoration objectives have been achieved for both biological and physical resources. Effectiveness monitoring will be implemented to confirm that project construction elements perform as desired. Monitoring will be carried out until the project has been determined to be successful (performance standards have been met), as required by Section 2039 of WRDA 2007. Monitoring objectives have been tied to original baseline measurements that were performed during the site characterization field visits. Adaptive management measures will be considered upon first instance of failure to meet a performance standard. Metrics and specific adaptive measure triggers will be refined during PED.

**Table 1. Modeling criteria, performance standards, and adaptive management for the Brownsville Resacas Ecosystem Restoration Project**

Measurement	Performance Standard	Adaptive Management
Aquatic Vegetation	80% plant establishment	Replacement of dead plants vegetation; modifying plant species composition or location within the restoration area, modify propagation method, allowing natural succession of native vegetation, remedial planting/seeding, amending soil, modify irrigation, herbicide application, biological control, mechanical control of invasive species
Woody Vegetation	80% plant establishment	
Herbaceous Vegetation	50% canopy cover	
Species diversity	75% of reference site	
Non-native vegetation	<25-percent canopy cover of non-native species with no area >0.25 acres in size with >25-percent non-native species	Chemical, biological, or mechanical control
Invasive Species	<25-percent canopy cover of invasive species with no area >0.25 acres in size with >25-percent invasive species	
Bank Slope	90% of modified slopes <1:10 slope	Regrade slope, identify and mitigate erosion source, utilize green armoring techniques
Resaca Depth	Average depth <6 feet	Re-dredge, identify and mitigate erosion source

## Vegetation

Baseline vegetation metrics were compiled during the initial site assessments throughout the study area. Vegetation metrics included, species composition, percent canopy cover for each species, percent overstory canopy cover, and percent aquatic vegetation canopy cover. These measurements should be able to allow the MAMT to assess the performance standards. Any planted material that has died within the warranty period shall be replaced. Post warranty period, adaptive management could include the replacement of the plants, modifying the propagation method, allow natural selection to augment the habitat. Restoration of the aquatic and riparian vegetation would be considered successful when the site meets the species diversity associated with the target vegetation association and when the site is generally vegetated with 80% success of plantings for aquatic and woody species with a herbaceous canopy cover of at least 50%. Adaptive management could include remedial planting/seeding, modifying species composition, modifying propagation method, amending soil, and/or modify irrigation to ensure successful establishment the vegetation.

The percent canopy cover of non-native and invasive species should be less than 25 percent at each restoration site. On an annual basis, or more frequently if needed, areas greater than or equal to 0.25 acres in size that have more than the 25 percent areal cover of non-native or invasive vegetation shall be treated per the Operations and

Maintenance Manual for the Brownsville Resaca Project. This typically includes the use of chemical and mechanical methods for management of non-native and invasive species.

### **Resaca Shoreline and Depth**

The resiliency of the resaca ecosystems is dependent on the hydraulic influences of the resaca on the adjacent habitats. The proposed dredging and bank sculpting address these hydraulic influences on the habitats. During flood events, deposited sediments and erosion may affect the project areas, particularly in adjacent or upstream of construction areas. Restoration will be considered successful when 90 percent of the modified slopes are greater less than 1:10 and when the average depth of each resaca segment is greater than 6 feet in depth and can be maintained with minimal effort over a five year period.

Although the resaca structural features are designed to function during flood events, excessive flood velocities could damage resaca banks or result in sedimentation. Adaptive management should assess and repair, redesigning if necessary, resaca banks and riparian areas damaged during large flooding events.

### **REPORTING**

The Brownsville Resaca Ecosystem Restoration Project is expected to be constructed as a phased project over a period of fifteen years. Evaluation of the success of the Brownsville Resaca Ecosystem Restoration Project will be assessed annually until all performance standards are met for each phase of the study. Site assessment will be conducted annually by the MAMT and an annual report will be submitted to the U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department, and USACE by January 30 following each monitoring year.

Permanent locations for photographic documentation will be established to provide a visual record of habitat development over time. The locations of photo points will be identified in the pre-construction monitoring report. Photographs taken at each photo point will be included in monitoring reports.

### **MONITORING AND ADAPTIVE MANAGEMENT COSTS**

Costs to be incurred during PED and construction phases include the drafting of the detailed monitoring and adaptive management plan. Cost calculations for post-construction monitoring are displayed for a three year monitoring period for each construction phase.

It is intended that monitoring conducted under the Brownsville Resaca Ecosystem Restoration Project will utilize centralized data management, data analysis, and reporting functions associated file sharing/management software. All data collection activities will follow consistent and standardized processes established in the detailed monitoring and adaptive management plan. Cost estimates include monitoring equipment, photo point establishment, data collection, quality assurance/quality control, data analysis, assessment, and reporting for the proposed monitoring elements (Table

35). Unless otherwise noted, costs will begin at the onset of the PED phase of the first construction phase and will be budgeted as construction costs.

**Table 2. Preliminary Cost Estimates for Implementation of the Monitoring and Adaptive Management Plan for the Brownsville Resacas Ecosystem Restoration Project**

<b>Category</b>	<b>Activities</b>	<b>PED Set-up &amp; Data Acquisition</b>	<b>Construction</b>	<b>3-year Post Construction</b>	<b>Total</b>
Monitoring: Planning and Management	Monitoring workgroup, drafting detailed monitoring plan, working with PDT on performance measures	\$25,000			\$25,000
Monitoring: Data Collection	Data collection		\$50,000	\$450,000	\$500,000
Data Analysis	Assessment of monitoring data and performance standards		\$25,000	\$75,000	\$100,000
Adaptive Management Program	Detailed adaptive management plan and program	\$25,000			\$25,000
	Establishment of adaptive management program			\$600,000	\$600,000
Database Management	Database development, management, and maintenance		\$10,000	\$30,000	\$40,000
<b>Total</b>					<b>\$1,290,000</b>

