

Appendix C3 – Mitigation Plan

Lower Guadalupe Feasibility Study
(Guadalupe and Blanco Rivers), TX
Integrated Draft Feasibility Report and Environmental Assessment

October 2019



**US Army Corps
of Engineers®**
Fort Worth District

BEAR CREEK DETENTION DAM ALTERNATIVE MITIGATION PLAN

Engineering Regulation (ER) 1105-2-100 guides USACE Civil Works programs to demonstrate that damages to all significant ecological resources, which generally includes wetlands, bottomland hardwoods, streams, rivers, and riparian forest, have been avoided and minimized to the extent practicable. Any remaining unavoidable damages must be compensated to the extent justified, as discussed in ER 1105-2-100, paragraph C-3(d)(3)(1). ER 1105-2-100, paragraph C-3(e), requires the use of a habitat function-based methodology, supplemented with other appropriate information to describe and evaluate the impacts of the proposed plan, and to identify the mitigation need of the FWP condition as measured against the FWOP condition. The recommended plan shall contain sufficient mitigation to ensure that the plan selected will not have more than negligible adverse impacts on ecological resources (Section 906(d) of WRDA 1986). Additionally, the WRDA 2007 Implementation Guidance indicates that ecological success criteria for mitigation is based on replacement of lost functions and values of the habitat, including hydrologic and vegetative characteristics.

Mitigation Requirements

Mitigation is applied using policy guidance, which states that mitigation is intended to replace the functional losses of the habitat, not simply a ratio of area lost.

Based on the results in Appendix C2, construction of the Bear Creek Detention Dam (BCDD) would result in a total loss of 24.93 AAHUs. Riverine habitat would decrease by 1.14 AAHUs from the physical replacement of riverine habitat by the BCDD, upland habitat would decrease by 1.96 AAHUs, riparian habitat would decrease by 7.18 AAHUs, and grassland habitat would decrease by 14.65 AAHUs (Table 1). Compensatory mitigation measures for the loss of 7.18 AAHUs of riparian and 1.14 AAHUs of riverine habitat must be implemented to comply with ER 1105-2-100. Although FWOP and FWP for grassland and upland habitats have been discussed, the USACE does not mitigate for these habitat types unless they have been shown to be of significance based on quality or uniqueness. The grasslands within the project area are of low quality and consist of mostly non-native, regularly mowed vegetation. Mitigation for upland habitats is not required for USACE Civil Works projects and will not be recommended as none of the upland habitat in the impacted area was considered unique or of significant value.

Table 1. Differences in Future-Without and Future-With Project AAHUs

Habitat Type	FWOP and FWP AAHU Difference
Riparian	7.18 loss
Upland	1.96 loss**
Grassland	14.65 loss**
Riverine	1.14 loss
Total AAHUs lost	24.93

**Mitigation not required for loss in AAHUs.

Refer to Appendix C2 for information regarding habitat model selection, metrics descriptions, model use, and FWOP and FWP details.

Additionally, 21 acres of existing GCWA habitat would be directly removed with the construction of the dam, while 84 acres of existing GCWA habitat (37 acres of non-GCWA habitat) within the inundation pool would be infrequently inundated upstream of the BCDD. In total, 105 acres of GCWA habitat, assumed to be occupied, would eventually be adversely impacted by the construction and operation of the BCDD.

Mitigation Measures

Traditional mitigation for offsetting riparian forest loss includes replanting native riparian forest near waterways. Preferably, riparian plantings occur in areas with little to no habitat value such as agriculture lands or maintained areas. Mitigation sites along the Guadalupe River suitable for riparian plantings were plentiful within and downstream of New Braunfels, Texas. Native riparian tree species would be planted at a density of 715 bare root trees per acre in order to minimize costs and account for some mortality of trees.

Mitigation for adverse stream habitat impacts traditionally includes the use of mitigation banks or constructing the habitat features lost through the proposed action in adjacent, nearby low quality aquatic habitats to achieve a no net loss of wetland function.

Within the Bear Creek region, no mitigation banks were available within the primary, secondary, or tertiary service areas.

The study PDT coordinated with resource agencies to develop a traditional mitigation plan that included the construction of riffle run complexes (boulder fields, cross veins, etc) and instream cover (logs, root wads, etc) in the Guadalupe River. Other regional water bodies were considered however none were found to have similar hydrologic conditions to Bear Creek that were not already impacted by manmade features such as low water dams.

While conceptually feasible, constructing habitat features in the already high quality habitat of the Guadalupe River poses challenges that are costly to overcome and may inhibit the ability to achieve mitigation success. Few areas lack the type of habitat features that would be constructed, limiting site availability. Additional limitations on site selection include avoid areas impounded by low water dams and not creating safety hazards for recreational users. Lastly, with the Guadalupe River already boasting general high quality habitat, the acreage needed to offset the aquatic impacts of the BCDD in the Guadalupe River were considerable. This is due to the small increase in habitat quality from the FWOP to the FWP condition driving the need for more acreage. With the anticipated hurdles associated with a traditional aquatic mitigation, other options for aquatic mitigation were explored.

Numerous low water dams, several in disrepair, have been built on area streams and rivers for various purposes including power generation and irrigation. However, the impacts of dams on rivers is well known as they disconnect river reaches, trap sediments, alter flow regimes, and create lake environments that promote non-native and/or invasive species while suppressing native communities.

In addition to traditional aquatic mitigation measures, two low water games were assessed for their potential removal in order to meet the aquatic mitigation requirements.

For unavoidable impacts to the GCWA, a 4 to 1 mitigation ratio for impacts to GCWA habitat was assumed. This assumption included no credits would be given for the GCWA habitat within the inundation pool and it counted as lost habitat as well. Opportunities exist to further reduce the acreage of GCWA habitat mitigation needed through onsite conservation work. Had the BCDD alternative been selected, formal coordination under Section 7 of the Endangered

Table 3. Riparian Mitigation Future-Without Project Conditions Total Riparian AAHUs

Evaluation Technique	AAHUs Over 50 Years	Average Total Riparian AAHUs
Fox Squirrel	0.00	0.00
Downy Woodpecker	0.00	

Riparian Mitigation: Future-With the Project

Implementing the riparian mitigation measures will result in a total lift of 7.28 AAHUs. Due to the increase of life requisite values for the two evaluation species beginning in TY 5.

Table 4. Future-With Project Conditions of the Agriculture/Mowed Field after Planting Bare Root Riparian Forest

Evaluation Species	Acre s	Target Year									
		0		1		5		25		50	
		HSI	CH U	HSI	CH U	HSI	CH U	HSI	CHU	HSI	CHU
Fox Squirrel	25.00	0.00	---	0.00	0.00	0.00	0.00	0.40	100.00	0.65	328.13
Downy Woodpecker	25.00	0.00	---	0.00	0.00	0.00	0.00	0.20	50.00	0.60	250.00

Table 5. Riparian Mitigation Future-With Project Conditions Total Riparian AAHUs

Evaluation Technique	AAHUs Over 50 Years	Average Total Riparian AAHUs
Fox Squirrel	8.56	7.28
Downy Woodpecker	6.00	

Alternative 1: Traditional Stream Mitigation

Bear Creek features high quality riverine habitat. To offset riverine impacts from the construction of the BCDD and associated access and construction, 31 acres in either the Guadalupe River and/or Comal River would be enhanced with haphazardly placed cobble/boulders to increase

instream cover, substrate diversity, and riffle/run quality. The actions will increase the riparian buffer along the river, increasing core habitat and connectivity.

Bear Creek Mitigation: Future-Without the Project

It is assumed that the Guadalupe River would maintain high quality in the FWOP. The total FWOP riverine AAHUs is 27.28.

Table 6. Bear Creek Mitigation: Future-Without the Project

Habitat Type	Acres	Target Year									
		0		1		5		25		50	
		HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU
Riverine	31	0.88	---	0.88	27.28	0.88	109.12	0.88	545.60	0.88	682.00

Bear Creek Mitigation: Future-With the Project

Introduction of instream cover, substrate diversity, and increased riparian width and riffle/run quality will slowly increase the riverine habitat quality. The riparian buffer along the rivers must be at least 50 meters wide. It is estimated that this mitigation measure will increase the riverine HSI value from 0.88 to 0.92 over 50 years. The proposed mitigation actions will increase the riparian buffer along the river, increasing core habitat and connectivity. The total FWP riverine AAHU for this Alternative is 28.42. There will be a lift of 1.14 riverine AAHUs after implementation of the FWP mitigation of the Guadalupe and Comal Rivers.

Table 7. Bear Creek Mitigation: Future-With the Project

Habitat Type	Acres	Target Year									
		0		1		5		25		50	
		HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU
Riverine	31	0.88	---	0.91	27.75	0.91	112.84	0.92	567.30	0.92	713.00

Alternative 2: Removal of Cummings Dam

Cummings Dam is located southeast of San Marcos, TX on the San Marcos River. It is approximately 18 miles northeast of the BCDD site. The dam was constructed in 1905 and since then it has altered 34.14 acres of upstream riverine habitat and one acre of downstream riverine habitat. The dam has slowed flows, increased sediment, and decreased the amount of run-riffle habitat for aquatic life. Resource agencies have shown previous interest in removing Cummings Dam as part of a larger effort to reduce the impact of dams on rivers.

Removal of Cummings Dam: Future-Without the Project

There are 34.14 acres of riverine habitat upstream of Cummings Dam that are affected by the pooling. Pools are an integral part of all riverine systems, but the Cummings Dam has had a

negative impact on this reach of the San Marcos River and has increased pooling to abnormal levels, impacting riffle/run series. Compared to other rivers within this region, the 34.14 acres of the San Marcos River have lower riverine quality due to deeper water reducing riffle complex abundance and sediment burying high quality substrates. There will be no change to downstream riverine habitat in the FWOP as shown in Table 8 and Table 9.

Table 8. The Cummings Dam Future-Without Project Conditions: Cummings Dam in Place

Habitat Type	Target Year										
	Acres	0		1		5		25		50	
		HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU
Riverine Upstream	34.14	0.56	---	0.56	19.12	0.56	76.47	0.56	382.37	0.56	477.96
Riverine Downstream	1.00	0.88	---	0.88	0.88	0.88	3.52	0.88	17.60	0.88	22.00

Table 9. The Cummings Dam Future-Without Project Conditions Total Riverine AAHUs: Cummings Dam in Place

Evaluation Technique	AAHUs Over 50 Years	Total Riverine AAHUs
Riverine Upstream	19.12	20.00
Riverine Downstream	0.88	

Removal of Cummings Dam: Future-With the Project

The removal of Cummings Dam will, at first, have negative impacts on the river. Debris and sedimentation will temporarily impact the mitigation project area, but will be pushed further downstream soon after the removal. The positive impacts upstream of the dam will immediately take effect in TY 1 and continue to grow through TY 50. There will be little impact on the riverine habitat downstream of the dam. Areas disturbed during construction will be replanted with native vegetation to prevent runoff and erosion. While this aquatic mitigation measure produces benefits beyond the required quantity, it does so at no extra cost. Dam removal would be considered a total removal effort, USACE would not partially remove a dam to reduce the inundation footprint. USACE would only completely remove a dam for the purpose of mitigation leaving no residual inundation footprint. Tables 10 and 11 show the modeling results for the Cummings Dam removal FWP condition.

Table 10. The Cummings Dam Future-With Project Conditions: Cummings Dam in Place

Habitat Type	Target Year										
	Acres	0		1		5		25		50	
		HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU	HSI	CHU
Riverine Upstream		0.88	---	0.88	20.31	0.88	89.45	0.88	522.34	0.88	738.28
Riverine Downstream		0.88	---	0.88	0.88	0.88	3.52	0.88	17.60	0.88	22.00

Table 11. The Cummings Dam Future-With Project Conditions Total Riverine AAHUs: Cummings Dam in Place

Evaluation Technique	AAHUs Over 50 Years	Total Riverine AAHUs
Riverine Upstream	27.41	28.29
Riverine Downstream	0.88	

Alternative 2: Removal of Textile Mill Dam

The Textile Mill Dam sits on the Guadalupe River, upstream of the I-35 bridge, in New Braunfels, Texas. FWOP and FWP modeling results were assumed to be the same as the Cummings Dam removal. The only difference between the two options considered was costs as the Textile Mill Dam is taller and longer than Cummings Dam.

Recommended Mitigation Plan

Costs for each mitigation plan were developed to include real estate, materials, labor, cultural resource surveys, MAMP, and construction. For plans with low water dam removal measures, associated water right costs were also included. Mitigation plan elements and costs were as follows:

Mitigation Plan 1: Traditional aquatic mitigation, 25 acres of riparian forest plantings, 412 acres of GCWA mitigation.

Mitigation Plan 1 Cost: \$18,454,651.00

Mitigation Plan 2: Cummings Dam removal, 25 acres of riparian forest plantings, 412 acres of GCWA mitigation.

Mitigation Plan 2 Cost: \$9,454,651.00

Mitigation Plan 3: Textile Dam removal, 25 acres of riparian forest plantings, 412 acres of GCWA mitigation.

Mitigation Plan 3 Cost: \$13,554,651.00

The recommended mitigation plan had the BCDD alternative been selected for implementation would be mitigation plan #2: Removal of Cummings Dam, up to 25 acres of riparian forest plantings, cultural resource surveys, up to 412 acres of GCWA habitat, and the monitoring and adaptive management plan. This mitigation plan provides the same or greater aquatic benefits compared to Alternatives 1 and 3, while costing less, and is supported by resource agencies. This plan has a net gain of 8.29 AAHUs, compared to mitigation Alternative 1's net gain of 1.14 AAHUs. Ancillary benefits of the removal of Cummings Dam include: increased public safety and positive impacts on public recreation, fish passage, potential improvement of habitat for the federally endangered Texas wild-rice, and sediment transport.

The implementation sponsor does have the option to select a more expensive option, however, all expense above the least cost alternative would be borne by the implementation sponsor.