DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT CORPS OF ENGINEERS
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

16 March 2018

Reply to:
Regional Planning and Environmental Division North
Environmental Compliance Section (PD-C)

Dear Reviewer:

The St. Louis District of the U.S. Army Corps of Engineers has prepared a Supplemental Environmental Assessment (SEA) with an unsigned Finding of No Significant Impact (FONSI) for construction activities implemented under the District's Regulating Works Project while the Regulating Works Project Supplemental Environmental Impact Statement (SEIS) was prepared. This document serves to notify the public of the Supplemental EA, in which the District updated the EAs associated with this work by assessing impacts to main channel border habitat in the Middle Mississippi River resulting from the construction activities pursuant to commitments made in those EAs as well as the SEIS. You are receiving this letter because you may be interested in the assessment. The Supplemental EA with unsigned FONSI are available for public review. The electronic version of these documents is available through the link below, or you may request a copy of the Supplemental EA and FONSI be mailed to you.

http://www.mvs.usace.army.mil/Portals/54/docs/pm/Reports/EA/DraftSupplementalEA.pdf

We invite your comments related to the content of the attached document. Please note that the Draft FONSI is unsigned. This document will be signed into effect only after having carefully considered comments received as a result of this 30-day public review. The 30-day public review period is open March 16, 2018 through April 14, 2018.

Please address your written comments to:
Shane Simmons
U.S. Army Corps of Engineers (CEMVP-PD-P)
1222 Spruce Street
St. Louis, MO 63103
Email: Shane.M.Simmons@usace.army.mil

Sincerely,

Brian Johnson

Brian Johnson
Chief, Environmental Compliance Branch

U.S. Army Corps
Of Engineers
St. Louis District

March 2018

DRAFT SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT WITH UNSIGNED FINDING OF NO SIGNIFICANT IMPACT

Mosenthein-Ivory Landing Phase 4
Eliza Point-Greenfield Bend Phase 3
Dogtooth Bend Phase 5
Mosenthein-Ivory Landing Phase 5
Grand Tower Phase 5

Regulating Works Project

U.S. Army Corps of Engineers, St. Louis District
Regional Planning & Environmental Division North (CEMVS-PD-P)

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Chapter 1. Introduction

1.1 Overview

The St. Louis District (District) of the U.S. Army Corps of Engineers (Corps) recently completed a Supplemental Environmental Impact Statement (SEIS) entitled: *Final Supplement I to the Final Environmental Statement, Mississippi River between the Ohio and Missouri Rivers (Regulating Works)* (USACE 2017). The purpose of that document was to provide an update to the Project's 1976 Environmental Impact Statement by analyzing the impacts of the Project in the context of new circumstances and information that currently exist, in order to remain in compliance with the National Environmental Policy Act of 1969. Based on the new information uncovered through the process, the Project's Congressional authority, and the continued benefit of the remaining construction to be completed, the selected alternative was to continue with new construction of the Project with the future potential addition of compensatory mitigation for unavoidable adverse effects to main channel border (MCB) habitat.

When the District began the process to consider supplementing the 1976 EIS in 2013, a decision was made to complete site specific Environmental Assessments (SSEAs) for all new Regulating Works Project construction prior to completion of the SEIS. These SSEAs made a commitment that should the analyses undertaken as part of the SEIS process reveal any new impacts on the resources, ecosystem, and human environment not accounted for in the SSEAs, measures would be taken within the Corps' authority to avoid, minimize, and/or compensate for the impacts during the SEIS process as appropriate.

Ultimately, analyses completed as part of the SEIS process revealed that the continue construction alternative would likely have a significant adverse effect on shallow to moderate-depth, moderate-to high-velocity habitat along the main channel border. As indicated in the SEIS, a habitat model has been developed and certified to further evaluate the quantity and quality of this particular habitat impacted by new construction. Therefore, the District has re-evaluated the recent construction activities of the Regulating Works Project outlined in the SSEAs for impacts to main channel border habitat using the certified habitat model, given that the significant adverse impact to this habitat type was not known at the time the SSEAs were completed.

The purpose of this document is to supplement the completed SSEAs with site specific quantification of impacts to main channel border habitat, for the purposes of assessing whether compensatory mitigation should be considered, as well as provide the details of development, implementation, and monitoring of potential mitigation actions going forward. Further, there is no new information or analyses that would suggest impacts to other resources would be different than those discussed in the SSEAs. As such, the other resources and impacts assessed in the SSEAs have not been re-evaluated and are not discussed in this report. The Final SEIS, the SSEAs, and all other applicable background information and documentation can be found here and are all incorporated by reference:

http://www.mvs.usace.army.mil/Missions/Navigation/SEIS/Library.aspx

1.2 Authorization

The St. Louis District of the U.S. Army Corps of Engineers is charged with obtaining and maintaining a navigation channel on the Middle Mississippi River (MMR) that is nine feet deep, 300 feet wide with additional width in bends as necessary[1]. The MMR is defined as that portion of the Mississippi River that lies between its confluence with the Ohio and the Missouri Rivers (Figure 1). This ongoing Project is also commonly referred to as the Regulating Works Project. As authorized by Congress, the Regulating Works Project utilizes bank stabilization, rock removal, and sediment management to maintain bank stability and ensure adequate navigation depth and width. Bank stabilization is achieved by revetment and river training structures, while sediment management is achieved by river training structures. The Regulating Works Project is maintained through dredging and any needed maintenance to already constructed features. The long-term goal of the Project, as authorized by Congress, is to obtain and maintain a navigation channel and reduce federal expenditures by alleviating the amount of annual maintenance dredging through the construction of regulating works. Therefore, pursuant to the Congressionally authorized purpose of the Project, the District continually identifies and monitors areas of the MMR that require frequent and costly dredging to determine if a long-term sustainable solution through regulating works is reasonable. The District also monitors bank stabilization areas to determine if additional work or re-enforcement of existing work is needed to ensure the dependability of the navigation channel.

1.3 Loss of Main Channel Border Habitat

In the Water Resources Development Act of 1986 (WRDA 1986), Section 906(b), Congress gave the Corps the discretionary authority to mitigate for fish and wildlife damages for any water

[1] Congress originally authorized the project of improving navigation of the Mississippi River from the mouth of the Missouri to New Orleans in the Rivers and Harbors Act dated May 24, 1824, by the removal of trees that were endangering the safety of navigating the river. In the Rivers and Harbors Act dated Jun 10, 1872, Section 2, Congress mandated that an examination and/or survey be completed of the Mississippi River between the mouth of the Missouri River and the mouth of the Ohio River, providing the first Congressional action to define this portion of the Mississippi River as distinct from the rest of the Mississippi River. Congress authorized the specific improvement of the Mississippi River between the mouth of the Missouri River and the mouth of the Ohio River in the Rivers and Harbors Act dated March 3, 1873. Between 1874-1892, Congress expanded this section of the Mississippi River to include that portion between the mouth of the Missouri River and the mouth of the Illinois, but in the Rivers and Harbors Act dated July 13, 1892, Congress removed this additional section of the river and once again referred to it as the Mississippi River between the mouth of the Ohio River and the mouth of the Missouri River. In the Rivers and Harbors Act dated June 25, 1910, Congress provided exactly how this Project was to be carried out by authorizing the construction, completion, repair, and preservation of "[i]mproving [the] Mississippi River from the mouth of the Ohio River to and including the mouth of the Missouri River: Continuing improvement in accordance with the plan adopted in [1881], which has for its object to eventually obtain by regularization works and by dredging a minimum depth." The 1881 plan called for the removal of rock hindering navigation, the contraction of the river to compel the river to scour its bed (now known as regulating works), and to be aided by dredging, if necessary. The 1881 plan also provided for bank protection improvements (now known as revetment) wherever the river is causing any serious caving of its banks. (Letter from the Secretary of War, dated November 25, 1881, 47th Congress, 1st Session, Ex. Doc. No. 10). The Project's current dimensions of the navigation channel were established in the Rivers and Harbors Act dated January 21, 1927 and July 3, 1930. The Rivers and Harbors Act dated January 21, 1927 modified the Project pursuant to the Chief of Engineers recommendations, which further detailed the purpose of the Project to construct the channel through regulating works and augment this by dredging, stating that dredging should be reduced to a minimum. The Project was also later modified to provide for the Chain of Rocks Canal and Lock 27 in Rivers and Harbors Acts dated March 2, 1945 to address the rock formation hindering navigation in this area, and the rock filled low water dam at the Chain of Rocks was authorized in the Rivers and Harbors Act dated July 3, 1958 to assure adequate depth over the lower gate sills at Lock and Dam 26.

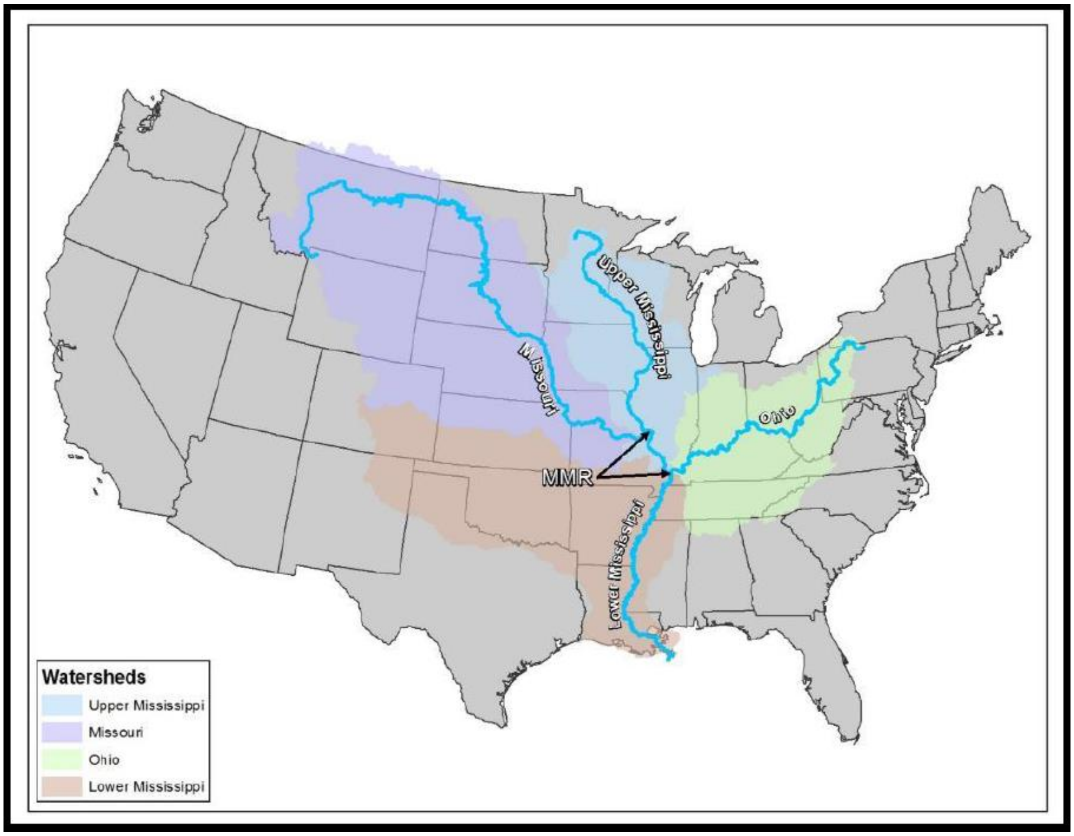


Figure 1. Location of the MMR within the Upper Mississippi River watershed.

resources project that was completed or under construction at the time of the passing of WRDA 1986. This authority is in contrast to Section 906(a) of WRDA 1986, which made mitigation mandatory for any newly authorized projects or those where construction had not started. Because the Regulating Works Project was already under construction at the time WRDA 1986 passed, it fell under 906(b). Therefore, since 1986, efforts have been made to avoid and minimize project impacts by modifying designs of river training structures. This has included various designs such as chevron dikes, notched dikes, offset dikes, W-dikes, L-dikes, multiple roundpoint structures, and bendway weirs. Compared to only using traditional dikes, these designs generally create more diverse main channel border habitat for the benefit of aquatic biota.

However, even with these alternative designs, recent analyses described in the SEIS suggest that river training structures would still result in the loss of main channel border habitat with certain depth, velocity, slope, and other functional characteristics. While the avoid and minimize mitigation measures implemented to date have been effective, the new information and circumstances further studied and analyzed as part of this SEIS reveal that the continued construction of river training structures would be expected to have a significant impact on main channel border habitat due to the potential loss of approximately 1,100 acres (8%) of the remaining unstructured main channel border habitat. While the severity of these effects to biota is difficult to pinpoint, the losses are concerning given the cumulative condition of main channel border habitat and the lack of specific habitat areas that meet these various conditions. For these reasons, the Corps decided that mitigation will be considered to offset losses to the greatest extent practicable in accordance with Section 906(b) of WRDA 1986, subject to the availability of future funding.

More specifically, the results of the 3-D numerical model developed as part of the SEIS effort revealed that placement of river training structures is likely to reduce shallow to moderate-depth, moderate-to high-velocity habitat along the main channel border, which is important for some MMR fish guilds that have seen declines in abundance since the mid-1900s. Although construction of river training structures does benefit some MMR fish species by providing low-velocity habitats, this does not offset or compensate for the anticipated adverse effects to shallow to moderate-depth, moderate- to high-velocity habitat. The adverse effects impact a different habitat type with a different function for a different group of fish than do the benefits. Due to these potential unavoidable adverse effects to main channel border habitat associated with future construction of river training structures, the District anticipated these impacts would result in the consideration of compensatory mitigation, and developed a Habitat Suitability Index (HSI) model in order to quantify changes to this specific MCB habitat type and ultimately guide the quantification of potential compensatory mitigation.

1.4 MMR Sturgeon Chub Model

To better understand the quality of MCB habitat impacted, and evaluate potential effectiveness and ultimately the practicability of different mitigation actions, the District developed the MMR Sturgeon Chub Model (Chub Model). The Chub Model is intended to help quantify the effects of river training structure construction or modification on the quality of sturgeon chub (*Macrhybopsis gelida*) habitat. Similarly, it would be used to evaluate the effectiveness of potential mitigation actions to improve or restore this specific type of MCB habitat. The Chub Model could also be used to evaluate other project actions that impact key variables in main channel border habitat of the MMR.

Sturgeon chub are small-bodied minnows (family Cyprinidae) often associated with large rivers such as the Mississippi or Missouri rivers. They appear to favor moderate to higher flow velocities, course substrates and shallow to moderate depths (Herzog 2004; Rahel and Thel 2004). They are relatively rare, and are currently being considered for listing under the Endangered Species Act. They were selected for modeling because their habitat requirements generally align with the shallow to moderate-depth, moderate- to high-velocity habitat that is anticipated to be lost through continued construction of river training structures under the Regulating Works Project.

The Chub Model consists of Habitat Suitability Index (HSI) parameters for the habitat variables depth, velocity, substrate, and structured/unstructured habitat (Figure 2). These represent key variables in determining sturgeon chub habitat that also are most directly influenced by the construction or modification of river training structures. HSI curve equations and categories are used in conjunction with corresponding data to compute an HSI score for each parameter that ranges between 0.0 (poor quality) to 1.0 (high quality or "perfect" condition). An overall HSI score is then calculated by taking the average of the parameter HSI scores:

$$(\mathbf{DEPTH_{HSI} + VELOCITY_{HSI} + SUBSTRATE_{HSI} + STRUCTURE_{HSI})/\ 4 = OVERALL\ HSI\ Score})$$

This simplistic approach applies equal weight to all variables. Discussion was held with agency partners on whether or not any variable should be weighted more heavily. However, no clear data or evidence suggests any variable more important than another under normal circumstances. However, in situations where the velocity is over 2.2 m/s, the overall HSI defaults to 0.0. This is done to account for the fact that high-velocity habitat is unusable, regardless of the values of the other variables.

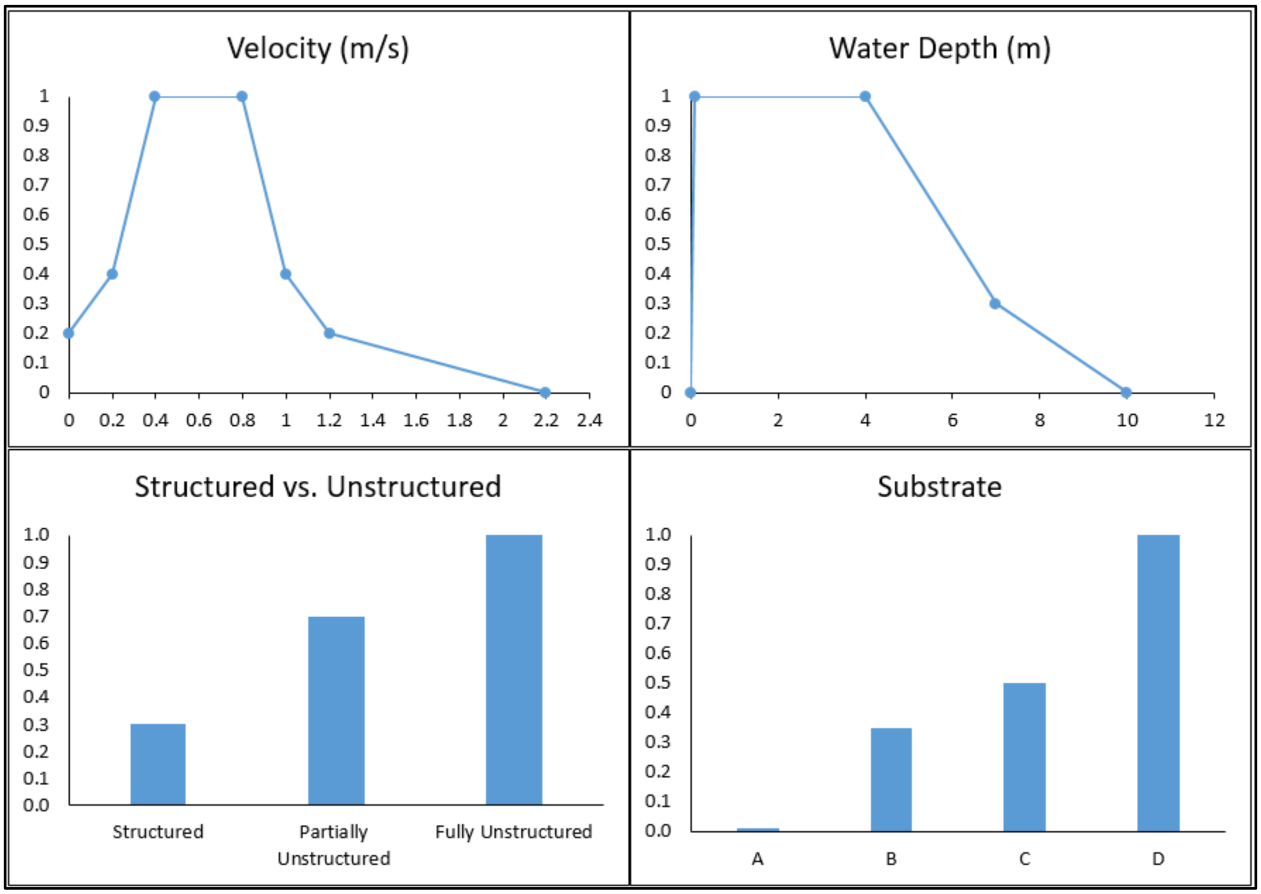


Figure 2. Habitat suitability index parameters developed for the MMR Sturgeon Chub Model. The y-axis represents the HSI score for the associated measurement (x-axis) of each parameter. Substrate parameter categories are (A) Silt, (B) Silt/Clay/Little Sand, (C) Sand/Mostly Sand, and (D) Gravel/Cobble/Hard Clay.

Model Development and Certification

Development of the chub model began with an interagency workshop in April 2016. This included participation from representatives of the U.S. Fish and Wildlife Service (USFWS), the Missouri Department of Conservation (MDC), and the Illinois Department of Natural Resources

(IDNR), as well as the U.S Army Corps of Engineers. Areas of expertise included fisheries biology, river ecology, river hydraulics, and maintenance activities for the river navigation channel. The agency workshop included facilitation and guidance by experts in model development, including representatives from the USACE Engineering Research and Development Center (ERDC) and the Ecosystem Restoration Planning Center of Expertise (EcoPCX). The agency workshop was conducted over three days with the focus of first building a conceptual model to describe key habitat factors for MCB riverine habitat affected by regulating works activities. Once key habitat variables were collaboratively identified, discussion was held on what fish species are most responsive to the variables of concern. After lengthy discussion the group selected chub species (e.g., sturgeon chub and sicklefin chub (*Macrhybopsis meeki*)) as possible representative species for the aspects of MCB habitat most directly affected by river training structures.

A draft of the conceptual model was developed at the conclusion of the agency workshop. This was refined over the next couple months and included additional resource agency review and input. During completion of the conceptual model, focus for development of specific habitat curves included both sturgeon chub and sicklefin chub. However, data review of the sicklefin chub suggested that habitat variables for this species did not align as well with the habitat conditions of concern identified during conceptual model development. For that reason, quantitative model development shifted focus to the sturgeon chub to represent key habitat conditions. Further, in order to better evaluate the effects of construction activities, selection of model variables focused on habitat parameters likely to be affected by construction. Therefore, only the four aforementioned model variables were retained for further development.

Primary literature and available field data were reviewed to verify key habitat requirements of sturgeon chub. Although limited, detailed habitat characteristics of sturgeon chub were available to facilitate development of a quantitative model. Trends in sturgeon chub Catch Per Unit Effort (CPUE) data were used to develop the equations and categories of the model parameters. Key references for model development include the following that are specific to sturgeon chub habitat in the MMR:

- Herzog, D. 2004. Capture efficiency and habitat use of sturgeon chub (*Macrhybopsis gelida*) and sicklefin chub (*Macrhybopsis meeki*) in the Mississippi River. Thesis. Department of Biology, School of Graduate Studies and Research, Southeast Missouri State University. Cape Girardeau, MO. March 2004.

- Missouri Department of Conservation routine trawl sampling data for the Middle Mississippi River.

The Herzog dataset is from trawling conducted on the Middle Mississippi River and just outside the Middle Mississippi River on the Lower Missouri River and the Lower Mississippi River from 2000 to 2001. The Missouri Department of Conservation dataset is from trawling conducted on the Middle Mississippi River from 2002 to 2014. Sampling was conducted with modified two-seam slingshot balloon trawls (i.e. Missouri trawls) in main channel, main channel border, side channel, and tributary habitats. Depth, velocity, substrate, and macrohabitat stratum information were collected at each sample location. Sturgeon chub collected were recorded, with select habitat conditions noted for the area trawled.

One of the limitations with this approach is that it collects fish over a protracted area (e.g., 100 yards or more per trawl run). The habitat notes that accompany the trawling observations are generalized over the duration of the trawl. It is impossible to know when or where a fish was collected within a trawling run and, thus, impossible to know the precise habitat conditions where the fish was collected within the trawl. However, the datasets represent the best available data to link sturgeon chub observations to habitat conditions, particularly on the MMR. As such, it represents the best source of information to describe habitat preferences of sturgeon chub on the MMR and, thus, prescribe a habitat model for the area. Moreover, where possible, trawling observations from Herzog (2004) and MDC were compared to other data sources to confirm reasonableness of the data.

In addition to the above, the following also served as a point of information and reference for sturgeon chub habitat:

- Rahel, F.J. and L.A. Thel. 2004. Sturgeon Chub (*Macrhybopsis gelida*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/sturgeonchub.pdf

- U.S. Fish and Wildlife Service. 2001. Updated Status Review of Sicklefin and Sturgeon Chub in the United States. U.S. Dept. of Interior. USFWS, Region 6. Denver Colorado. March 2001.

- Young, B.A., T.L. Welker, M.L. Wildhaber, C.R. Berry and D. Scarnecchia, editors. 1997. Population structure and habitat use of benthic fishes along the Missouri and Lower Yellowstone Rivers. 1997 Annual Report of Missouri River Benthic Fish Study PD-95-5832 to the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation.

Once the model parameters were developed and refined using the aforementioned data, the model review process began March 2017. Led by the ECO-PCX, a review team with extensive experience and knowledge of USACE planning policy, alternative evaluation and comparison, large riverine ecology, and sturgeon chub life history and habitat, thoroughly reviewed the model for technical quality, system quality, usability, and compliance with USACE policy. Model reviewers and developers worked through comments and resolved key issues based on reviewer recommendations, leading to a finalized model documentation and ultimately a recommendation from the EcoPCX to the Office of Water Project Review (OWPR) for the Model Certification Panel to consider. The model was certified by the panel in October, 2017.

Chapter 2. Impact Assessment

2.1 Site Specific Environmental Assessments

When the District began the process to consider supplementing the 1976 EIS in 2013, a decision was made to complete site specific Environmental Assessments (SSEAs) for all new Regulating Works Project construction prior to completion of the SEIS (Figure 3), including work associated with the District's Endangered Species Act obligations, in order to evaluate the new information and circumstances on a site-specific basis. These SSEAs made a commitment that should the analyses undertaken as part of the SEIS process reveal any new impacts on the resources, ecosystem, and human environment not accounted for in the SSEAs, measures would be taken within the Corps' authority to avoid, minimize, and/or compensate for the impacts during the SEIS process as appropriate. Therefore, the District has reevaluated the recent construction activities of the Regulating Works Project outlined in the SSEAs for impacts to shallow to moderate-depth, moderate- to high-velocity habitat using the Chub Model, given that the significant adverse impact to this habitat type was not known at the time the SSEAs were completed. The SSEAs finalized to date include the following:

- Mosenthein-Ivory Landing Phase 4 (April 2014)
- Eliza Point-Greenfield Bend Phase 3 (April 2014)
- Dogtooth Bend Phase 5 (April 2014)
- Mosenthein-Ivory Landing Phase 5 (June 2015)
- Boston Bar Side Channel Restoration and Island Creation Project (April 2016)
- Grand Tower Phase 5 (June 2016)
- Dogtooth Bend Phase 6 (July 2016)
- Burnham Island Sandbar Creation Project (June 2017)

The potential adverse impact to MCB habitat identified in the SEIS is a product of the continued construction of river training structures for the purpose of obtaining and maintaining the authorized navigation channel. As such, the SSEA's for new construction of river training structures for other purposes under the Project were deemed not to have a significant adverse impact on this habitat, so these SSEA's were not reevaluated with the habitat model. This includes work constructed in accordance with the Project's Biological Opinion and in coordination with the U.S. Fish and Wildlife Service for the District's Endangered Species Act obligations (i.e., Boston Bar Side Channel Restoration, Burnham Island Sandbar Creation), and the work completed under Dogtooth Bend Phase 6 to prevent the formation of a channel cut-off. The five remaining work areas were assessed for impacts to shallow to moderate-depth, moderate- to high-velocity habitat.

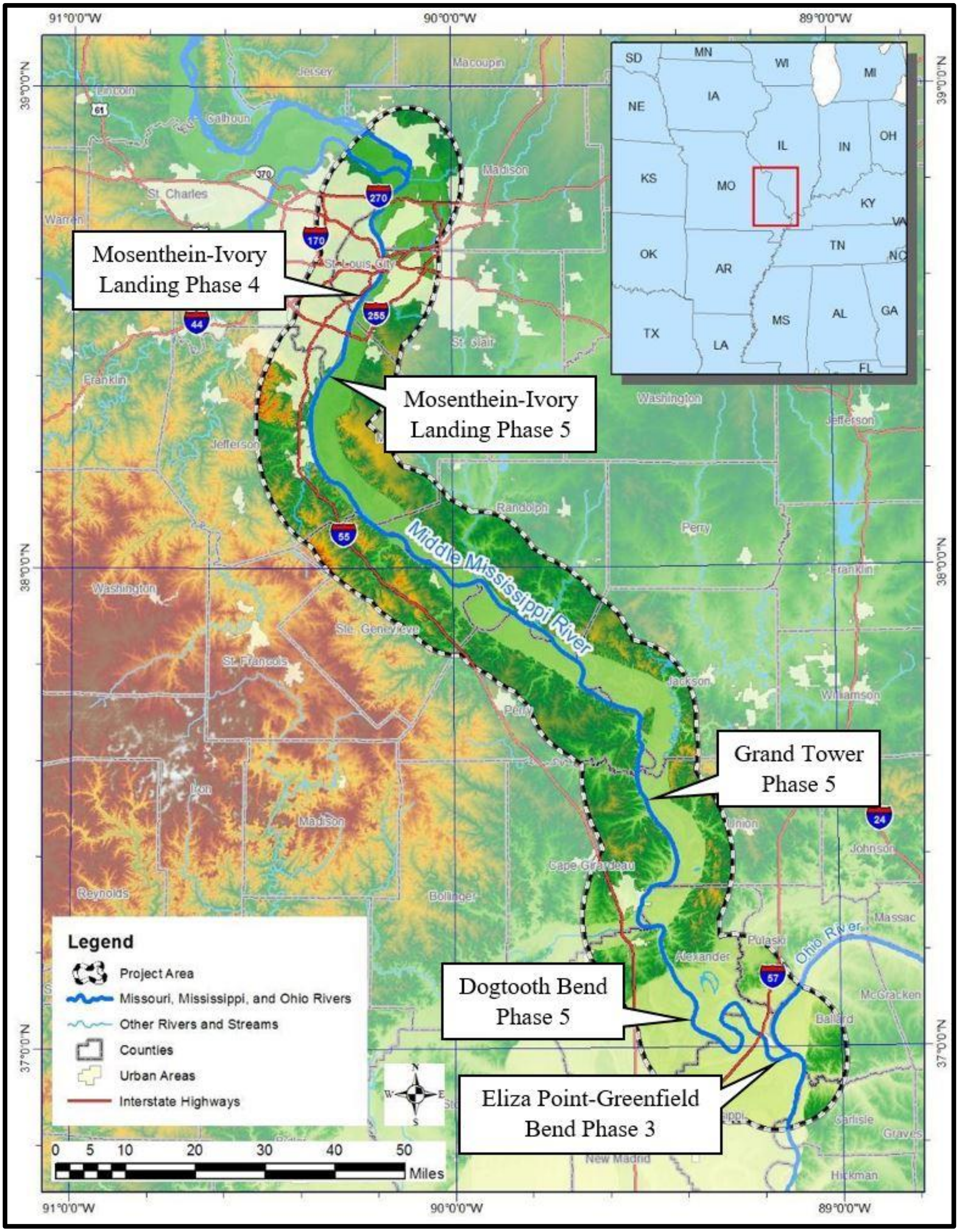


Figure 3. General location of recent work areas completed under the Regulating Works Project.

2.2 Chub Model Application

This section summarizes the general approach the District took in applying the Chub Model and calculating the impact to MCB habitat for the work areas assessed in the SSEAs. The assessment was carried out in the GIS platform of ArcMap. All input data were converted to a raster format with 50ft x 50ft cells. These data rasters were then converted to HSI score rasters using the model parameter equations outlined in the model documentation, resulting in four separate rasters representing each of the four model parameters (Figure 4). The HSI rasters were then combined and averaged to calculate each 50ft x 50ft cell's HSI value using the raster calculator tool.

Using the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service (USFWS 1976), habitat quality generated from the Chub Model was used in conjunction with the total area of influence (acres) to derive Average Annual Habitat Units (AAHUs), the metric by which Project construction and mitigation actions will be assessed. Pre-project HSI scores were used to calculate AAHUs for the Future Without Project (FWOP) condition, with the assumption that conditions will remain the same into the future. Post-project HSI scores were used to calculate AAHUs for the Future With Project (FWP) condition, with the assumption that post-construction conditions are reached three years after construction completion. Both the FWOP and the FWP were assessed using a fifty year period of analysis, after which the net difference in AAHUs between these scenarios was derived.

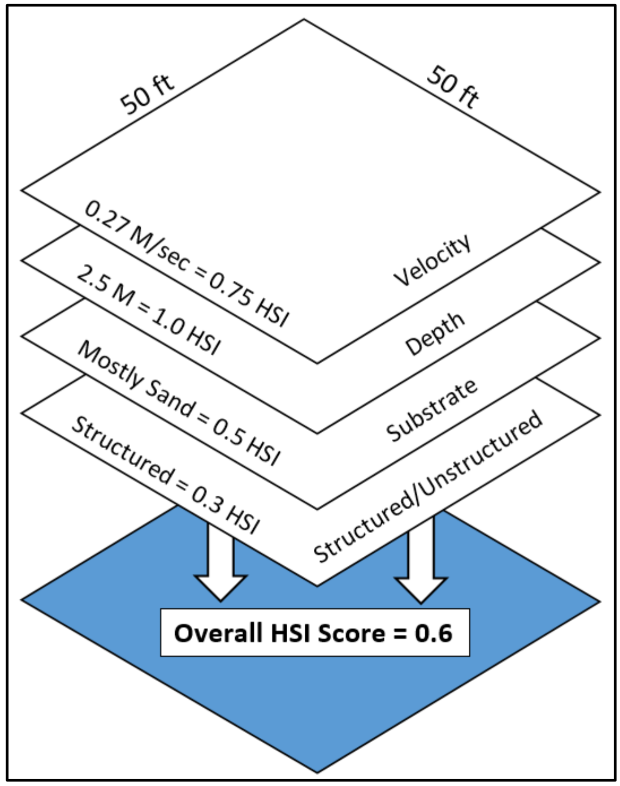


Figure 4. Conceptual model of HSI score calculation process for a 50ft x 50ft cell within a work area. Example data and resulting HSI scores are included for demonstration. Refer to model parameters (Figure 2) for explanation of specific score calculations.

Data Sources and Collection

The District is committed to using the best available data during all mitigation assessments. As such, multiple sources were relied upon to develop the pre- and post-construction inputs for various model parameters. Data sources included 2-D numerical models developed by the District during the design phase of each work site, field data from work sites, the results of Hydraulic Sediment Response (HSR) models, and/or the previously mentioned 3-D model developed as part of the SEIS effort.

As part of its mitigation plan, the District will make a reasonable effort to collect post-construction field data from work sites during periods of moderate discharge, replacing some of the input data discussed herein, and updating this mitigation assessment as needed (see Chapter 3). Further, recognizing these data requirements moving forward, the District will attempt to collect depth and velocity data for both pre- and post-construction conditions for all future work completed under the Project, such that reliance on multiple data sources will be reduced during future mitigation calculations. However, given common resource and budgetary constraints, coupled with the site-specific hydrologic windows during which field data can be collected, it is anticipated that multiple data sources will frequently be required.

Furthermore, prior to collecting post-construction field data, each work area will be given the opportunity to undergo the physical changes that result from implementation. Collection of post-construction field data will not be finalized until work sites reach a state of dynamic equilibrium, in which ongoing significant changes to bathymetry and flow patterns are no longer occurring. Allowing enough time for these changes to occur will ensure that post-construction field data best reflects the physical changes that would result from construction activities, and that mitigation assessments accurately capture the net gain/loss in AAHUs. The immediate changes that result from construction or modification of river training structures typically occur within three years of implementation, during which different seasonal hydrologic events can act upon the site (e.g., high-flow events, droughts, etc.), progressing it toward a state of dynamic equilibrium.

Total Area of Influence
The first step in calculating the net change in habit units was delineation of the total area of influence for each of the work areas. Ideally, the area of influence would be drawn large enough to capture all the potential changes that occur due to construction or modification of river training structures, but small enough to focus the analysis on the effects of the structure(s) in question.. In general, the area of influence encompasses a stretch of main channel border, starting from an existing upstream structure and ending at an existing downstream structure, extending riverward from the bankline to a location approximately 250 feet riverward of the most riverward located structures. If an existing structure was not present upstream or downstream of the newly constructed river training structures, the length of the area of influence was extended by 1,200 ft upstream and downstream of the newly constructed features. This length represents the average distance between river training structures in the MMR. Because this general approach relies heavily on best professional judgment, some degree of subjectivity is required to ensure all potential changes to the aquatic habitat fall within the analyzed area of influence. Specifically, if changes to depth and velocity characteristics were anticipated further upstream or downstream, either due to the results of modeling efforts, post-construction data collection, or simply best professional judgment, the area of influence was extended to encompass such changes.

Structured vs Unstructured Area of Influence
The model includes a categorical parameter for the presence/absence of river training structures, which is intended to gauge the degree to which an area provides habitat that is not influenced by river training structures, provides longitudinal connectivity for fish movement, and provides large patches of contiguous habitat of the same type. The structure parameter is also intended to capture the impact of changes to habitat not specifically included in the other model parameters,

such as sandbar slope and channel crossovers. While the model documentation and instructions provide a general definition for each of the three categorical options, some degree of best professional judgment is required during the process of categorizing areas based on the definitions. The low quality category (HSI = 0.3) is defined as main channel or main channel border habitat that is influenced by either an unmodified existing river training structure or newly constructed river training structure. The moderate quality category (HSI = 0.7) is defined as main channel border habitat that is influenced by the notch or modification of an existing river training structure to provide improved longitudinal connectivity or patch size; or the area is unstructured main channel border habitat that is influenced by existing river training structures. The high quality category (HSI = 1.0) is defined as contiguous main channel border habitat created by complete removal of existing structures; or the habitat is a large contiguous main channel border habitat that is devoid of river training structures. This "influence" and how to delineate area of influence for this model parameter is based upon professional judgment to ensure the model is applied in the most biologically sound and appropriate manner, tailored to site-specific characteristics of a work area.

Figure 5. Delineation of the total area of influence (left) as well as pre- (center) and post-construction (right) delineation of the structured/unstructured parameter categories for the Mosenthein Ivory Landing Phase 4 work area. Construction of the rootless dike (red) reduces the score immediately downstream of the dike to 0.3, and the remainder of the area to 0.7, because a dike is now present within the total area of influence.

When applying the model to the construction documented in the completed SSEAs, the District addressed the structure parameter in the following manner. Regarding the pre-construction condition, the areas immediately downstream of any existing structures were assigned the low quality score (0.3). These areas were delineated by connecting dike tips, thereby capturing the complete area encompassed by a traditional dike field, and the lack of longitudinal connectivity they provide. In the case of a single existing structure, the same approach taken to delineate the total area of influence was used; the low quality area was drawn 1,200 ft downstream roughly parallel with the thalweg. After the low quality area was delineated at a given site, the remaining area was assigned the moderate quality score (0.7). While the longitudinal connectivity of these areas is not reduced in the same manner as the area within the dike fields, it was determined these areas are still "influenced" by the existing structures within the work area. The high quality score (1.0) was applied only when the total area of influence was located at MCB habitat that was completely void of river training structures. In that case, the entire area of influence was given the high quality structure score.

The same approach was used for the post construction condition, which generally involved delineating new areas of influence and modifying the structure score of some areas. The most commonly encountered scenario was new structures built in moderate score areas, resulting in a reduced structure score (0.7 to 0.3) for the area immediately downstream of the new structure. Further, if a structure was built in a high quality unstructured area, the drop in structure score was more severe (1.0 to 0.3) for the area immediately downstream of the structure, while the remaining area also dropped (1.0 to 0.7) because this area is now "influenced" by the structure (Figure 5). Lastly, a slightly different approach was taken to address the removal of structures. Given the definition of each category in the structured/unstructured parameter, the removal of any structure should result in a high quality structure score (1.0). Therefore, dike removal boosts the structure score (0.3 to 1.0) for the immediate downstream area, even if river training structures still exist within the total area of influence, that would otherwise be deemed as an "influence" on the newly opened area. This would result in a less substantial boost (0.3 to 0.7) to the structure score if the same approach to adding structures was used. Preliminary hydraulic modeling of potential mitigation sites revealed that structure removal would often fail to affect the depth and velocity parameters. Meaning these parameters would not capture any benefit of structure removal. Therefore, this alternate approach was necessary in order to fully quantify the benefit of complete structure removal when implementing future mitigation actions. The same habitat analysis and approach will be applied to mitigation actions in order to quantify the resulting net gain in AAHUs.

Substrate

Similar to the structure parameter, substrate was also developed as a categorical model parameter, with categories representing the varying degrees of coarseness in substrate constituents. However, given the fact that little predictive capability exists regarding changes to substrate composition resulting from the Project, and the fact that substrate data were not available, it was assumed that the substrate in the work areas was mostly sand (HSI = 0.5) for both the pre- and post-construction conditions. This assumption was further supported by empirical evidence from previously constructed dike fields within the MMR. Thus the substrate parameter had no influence on the net change to AAHUs in this initial assessment. However, new pre- and post-construction substrate data may become available as data are collected and visual observations are made at planned and completed work sites. Therefore, this assumption may be revisited during future project planning and mitigation assessments, at which time the pre- and post-construction substrate category could be updated for any of the work sites assessed herein, potentially altering the programmatic change in AAHUs.

Depth and Velocity

Unlike the substrate and structured/unstructured categorical parameters, the depth and velocity parameters were developed as traditional HSI curves, comprised of multiple linear equations with varying slopes for different depth and velocity ranges. In cases where bathymetry data and Acoustic Doppler Current Profiler (ADCP) data collected at moderate flows were available for specific work areas, these data were converted to a raster format (50ft x 50ft cells) within the total area of influence, each cell was then converted to the appropriate HSI score using the model parameters presented in Figure 2. As previously discussed, site-specific bathymetry and ADCP data were often not available, meaning other sources were needed to supplement the data used in assessing the SSEA work areas. In particular, pre-construction velocity data were not readily available.

The 3-D hydraulic model from the SEIS effort served as one of the primary sources of input data for the velocity parameter. Specific areas of the modeled reach were selected to provide velocity input data for the work sites discussed in the SSEAs (Figure 6). 3-D model sites were selected based on their physical characteristics and layout. Within the 3-D model, depth averaged velocity rates were analyzed at the selected locations at a moderate discharge (213,000 ft^3/sec), and a velocity HSI score was then developed from the average velocity at each site. These HSI scores were used as the input data for many of the work sites discussed in the SSEAs. Sites with similar physical characteristics and layout, or an average HSI score from multiple surrogate sites were used. Utilized sites from the 3-D model include traditional dike fields, an unstructured sandbar, an unstructured point bar, chevrons, islands, offset dikes, and notched dikes.

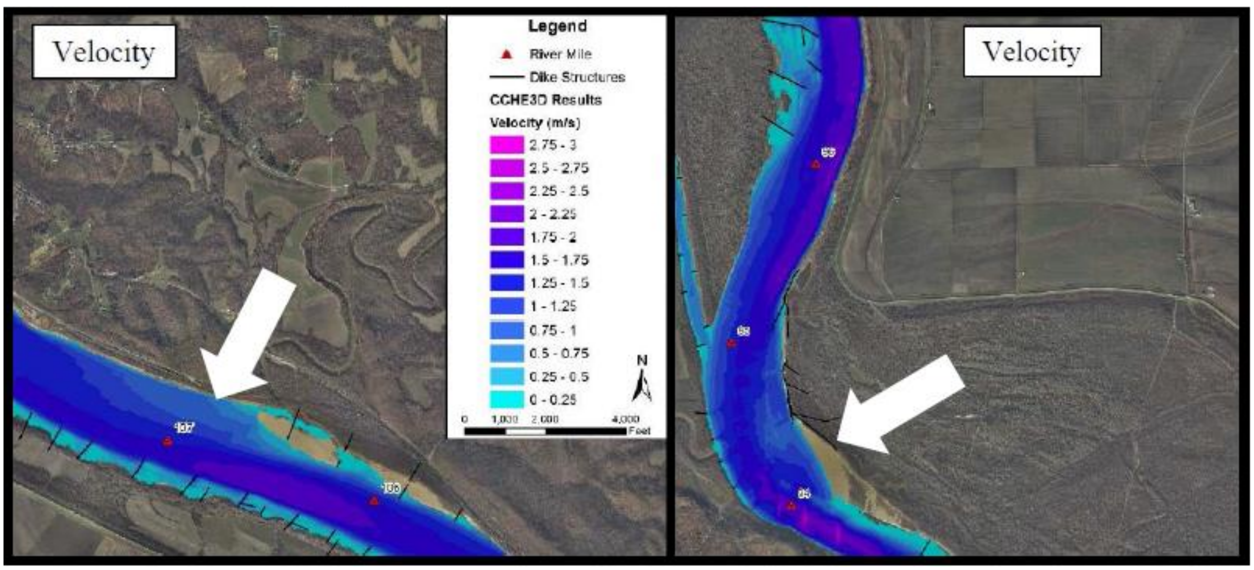


Figure 6. Example of sites from the 3-D model used to supplement pre-construction velocity HSI scores. HSI scores of 0.75 (left) and 0.51 (right) were developed from the unstructured MCB sandbar and point bar habitat indicated by the arrows.

2.3 Site Specific Quantification

The following section describes the assessment of impacts to shallow to moderate-depth, moderate- to high-velocity habitat for each of the five most recent work areas completed under the Regulating Works Project. Included are details on the area of influence delineations, structured/unstructured delineations, input data sources for the depth and velocity parameters, and pre- and post-construction HSI scores for each of the work areas. A brief description of each work area is provided herein; for more detailed descriptions, refer to the SSEAs found here, incorporated by reference:

http://www.mvs.usace.army.mil/Missions/Navigation/SEIS/Library.aspx

Mosenthein-Ivory Landing Phase 4

This work involved construction of a rootless dike near the left descending (left) bank at RM 173.4 (Figure 7) and placing bankline revetment at four locations on the left bank from RM 175 to RM 171. The only component considered in this assessment was the rootless dike, which was built 550 ft long, and to a design elevation of 389 ft NGVD (+ 15 ft LWRP).

Figure 7. Aerial imagery of the Mosenthein Ivory-Landing Phase 4 work area, including the new rootless dike (white).

The rootless dike was built in an area of unstructured MCB habitat downstream of the Cahokia Chute tributary. The area of influence completely lacked any existing river training structures, and was therefore assigned the high quality structure score (1.0) for its pre-construction condition. Construction of the dike produced a sharp drop to the low quality structure score (0.3) for the area downstream of the dike, and a drop to the moderate structure score (0.7) for the remainder of the area, resulting in a lower average structure score (0.63) for the total area of influence (Figure 5).

Regarding the depth parameter, both pre and post-construction HSI scores were based on bathymetric survey data collected before and after construction. Prior to construction, the site consisted of a heterogeneous mix of different depths, ranging from high quality to low quality HSI scores, and resulting in a moderate pre-construction depth HSI score (0.57). A post-construction bathymetric survey revealed the expected outcome had occurred. Reduced velocity downstream of the dike resulted in increased deposition and reduced depth, while areas surrounding this depositional area had deepened. The depth HSI score was slightly reduced due to construction (0.53).

The pre-construction velocity HSI score was derived from multiple sites in the 3-D model. Specifically, the velocity HSI scores from the RM 107 sandbar and the RM 94 point bar (Figure 6) were used to develop an average HSI score (0.63) that could be used for similar unstructured MCB areas, such as the Mosenthein Ivory Landing Phase 4 work area. The post-construction velocity HSI score (0.68) was developed from field data collected after construction. This slight increase to the velocity HSI score is far outweighed by the decreased depth and structure HSI scores, which ultimately results in a net loss in AAHUs within the work area (Table 1).

Eliza Point-Greenfield Bend Phase 3
This work consisted of building a rootless dike along the left bank near RM 3.0 (Figure 8) and four bendway weirs along the right descending (right) bank at RM 2.2 and RM 2.6. Under the Project, bendway weirs are built within the navigation channel, which is relatively deep and swift compared to MCB habitat. The physical conditions in the navigation channel effectively "zero out" the chub model (i.e., HSI = 0) prior to construction of bendway weirs, meaning these structures would not affect the HSI score, and do not need to be considered during mitigation assessments. The only work area component considered in this assessment is the rootless dike at RM 3.0 which was built 615 ft long, to a design elevation of 296 NGVD (+18 ft LWRP), and with two large notches.

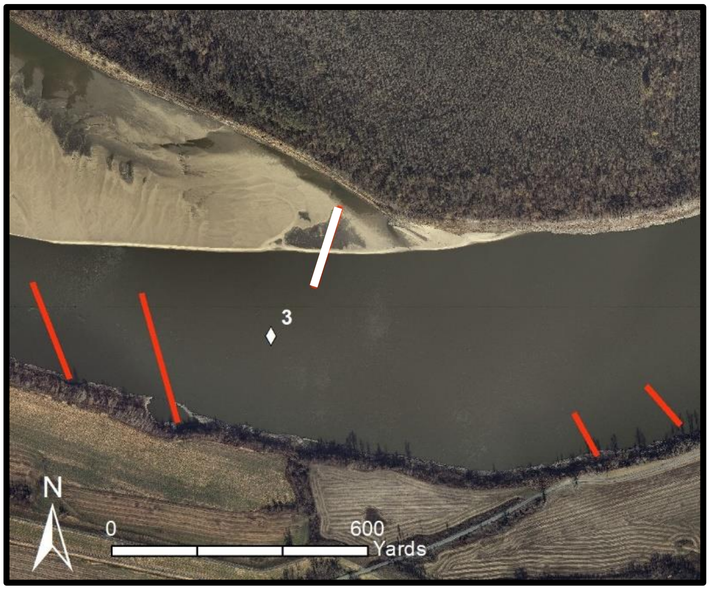


Figure 8. 2012 Aerial imagery of the Eliza Point-Greenfield Bend Phase 3 work area, including the new rootless dike structure (white), and bendway weirs along the right bank (red).

The rootless dike was built in an area of unstructured MCB habitat near the lower end of Angelo Towhead. The area of influence completely lacked any existing river training structures, and was therefore assigned the high quality structure score (1.0) for its pre-construction condition. Construction of the dike produced a sharp drop to the low quality structure score (0.3) for the area downstream of the dike, resulting in a lower average structure score (0.61) for the total area of influence.

Regarding the depth parameter, both pre and post-construction HSI scores were based on bathymetric survey data. The area was relatively shallow prior to construction, as demonstrated by its pre-construction depth HSI score (0.72). Post-construction bathymetric surveys revealed a lower average bed elevation within the total area of influence, particularly due to deepening of the area between the dike and the navigation channel. Similar to the structure parameter, this resulted in a sharp decrease to the overall depth HSI score (0.34).

Both the pre- and post-construction velocity HSI scores were the same as those used in the Mosenthein-Ivory Landing Phase 4 assessment (above). These HSI scores were deemed appropriate to use given the similarities between the two work areas; the Mosenthein Ivory Phase 4 work area also consisted of building a rootless dike in unstructured MCB habitat. Using these input data results in a slight boost to the post-construction velocity HSI score, which is subject to change after post-construction data is collected from the Eliza Point work area. However, this slight increase to the velocity HSI score is far outweighed by the decreased depth and structure HSI scores, which ultimately produce a net loss in AAHUs within the work area (Table 1).

Dogtooth Bend Phase 5

This work area involved the construction of two bendway weirs along the left bank near RM 34, four bendway weirs along the left bank near RM 32, two bendway weirs along the right bank near RM 31, and a dike along the right bank at RM 31.6 (Figure 9). The conditions in the navigation channel effectively "zero out" the chub model (i.e., HSI = 0), the weirs were therefore not considered in the assessment. The only component considered in this assessment is the dike at RM 31.6, which was built 300 ft long and to a design elevation of 310.4 NGVD (+15 ft LWRP).

Figure 9. 2012 Aerial imagery of the Dogtooth Bend Phase 5 work area, including the new river training structure (white), and existing river training structures.

The dike was built in a relatively deep, high-velocity area directly adjacent to the navigation channel. Even though no existing structures were present within the area of influence, the moderate quality structure score (0.7) was applied to the entire area of influence for the pre-construction condition. This was done because the area is more characteristic of the main channel, rather than the main channel border, and to remain consistent with the model parameters and their associated definitions. Construction of the dike changed the structure score from moderate (0.7) to the low quality (0.3) for a large portion of the area. This resulted in a lower average structure score (0.6) for the total area of influence. Regarding the depth parameter, both pre- and post-construction HSI scores were based on bathymetric surveys collected before and after construction. Differences between these surveys reveal an overall decrease in the average bed elevation within the area, resulting in a lower overall depth HSI score (0.25) for the area.

Pre- and post-construction velocity HSI scores were derived from sites in the 3-D model. Specifically, the pre-construction HSI score (0.37) was developed from an outside bend area near RM 99 within the 3-D model. This location was chosen to supplement the input data for the pre-construction condition because of similarities shared by the sites - both are located on an outside bend, lack existing structures, are generally deep and swift, and are directly adjacent to the navigation channel. The post-construction velocity HSI score (0.52) was developed from the outside bend near RM 101 within the 3-D model. This site is similar to the aforementioned site at RM 99, except for the presence of relatively short dikes located along the outside bend, which is similar to the post-construction condition of the Dogtooth Bend Phase 5 work area. Using these 3-D model site HSI scores increases the overall velocity HSI score within the work area. This is due to reduced velocities occurring immediately downstream of the dikes along the otherwise swift outside bend. Ultimately, this increased post-construction velocity score results in a slight net gain in AAHUs within the total area of influence (Table 1). This net gain is subject to change, however, as the post-construction velocity HSI score is likely to be updated with a different score developed from field data collected during a period of moderate discharge.

Mosenthein-Ivory Landing Phase 5

This work consisted of building four bendway weirs on the right bank and three rootless dikes on the left bank between RM 160 and RM 162.5 (Figure 10). The conditions in the navigation channel effectively "zero out" the chub model (i.e., HSI = 0), the weirs were therefore not considered in the assessment. Only the three rootless dikes were considered in this assessment. The dikes were built between 300 - 600 ft long, and to a design elevation of 389 ft NGVD (+ 15 ft LWRP).

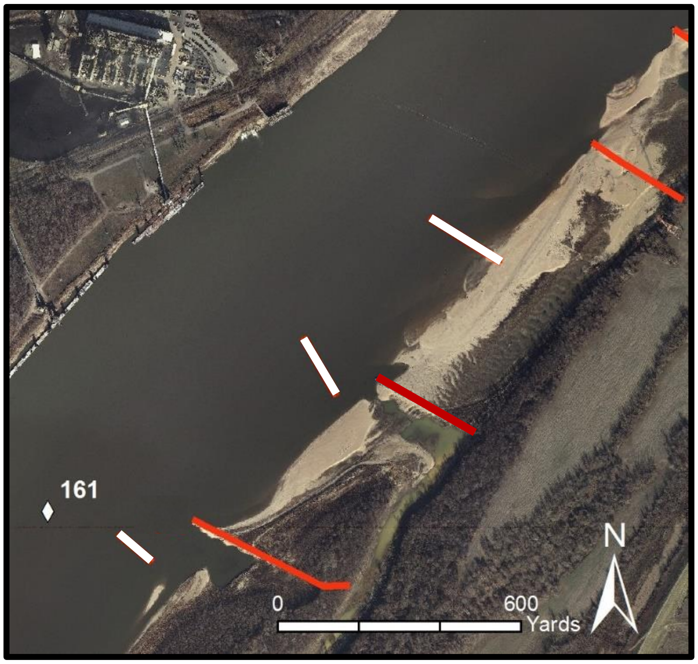


Figure 10. 2012 Aerial imagery of the Mosenthein-Ivory Landing Phase 5 work area, including the new rootless dike structures (white), and existing river training structures.

Unlike the previous work areas, existing river training structures were present in this area prior to construction. The area of influence was delineated along MCB habitat just outside of an existing dike field. Therefore, a portion of the area was assigned the low quality HSI score (0.3) for the structure parameter, this portion lies within the existing dike field, and the remainder of the area was assigned the moderate quality structure score (0.7), given that this area is highly influenced by the existing dikes in the area. Construction of the new rootless dikes occurred outside of the existing dike field (riverward), lowering the post-construction structure score in this area, as well as the average structure parameter score for the entire area of influence (0.47).

Regarding the depth parameter, both pre- and post-construction HSI scores (0.46 and 0.55 respectively) were based on bathymetric survey data. While some scouring occurred around the new rootless dikes, lowering the bed elevation and thereby decreasing the depth HSI score for much of the area, a substantial amount of deposition occurred immediately downstream of the new rootless dikes. These depositional areas raised the bed elevation and increased the depth HSI score, which outweighed the decrease due to scouring. The overall post-construction depth HSI score for the work area increased slightly due to these effects.

Similar to the aforementioned work areas, the pre-construction velocity HSI score was derived from multiple sites within the 3D model. Specifically, a velocity HSI score was calculated from a number of different areas characterized as being traditional dike fields. The average of these velocity HSI scores (0.50) was used as the pre-construction velocity HSI score for this work area, given that it is also characterized as a traditional dike field. Post-construction velocity field data (ADCP) has been collected for this work area, which reveals decreased velocities immediately downstream of the rootless dikes, resulting in an increased velocity HSI score (0.74). The increased velocity score gives a substantial boost to the overall HSI score for the work area, and ultimately results in a net gain in AAHUs (Table 1).

Grand Tower Phase 5 - Crawford Chevrons

Features of the Grand Tower Phase 5 work were constructed at two separate work locations and each location was assessed for mitigation separately. The Crawford Towhead portion is located near the left bank between RM 74 and RM 72, and consisted of building two 300 ft x 300 ft chevron dikes and extending an existing dike by 300 ft. All features were built to a design elevation of 339 ft NGVD (+18 LWRP). Existing river training structures were present in this area prior to construction of the new features.

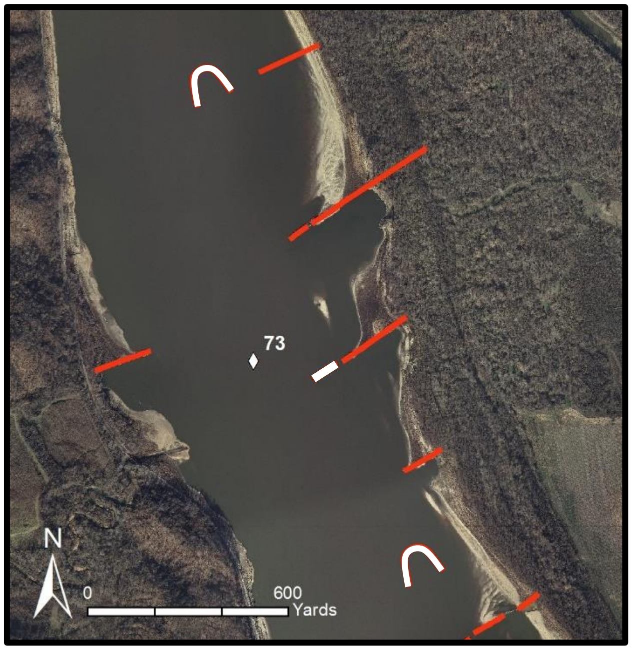


Figure 11. 2012 Aerial imagery of the Grand Tower Phase 5 - Crawford Chevrons work area, including new river training structures (white), and existing river training structures (red).

The entire MCB habitat in the area was delineated as the total area of influence, including the preexisting dike field. The preexisting dike field was assigned the low quality HSI score (0.3) for the structure parameter, and the remainder of the area was assigned the moderate quality structure score (0.7), given that this area is highly influenced by the existing dike field. Construction of the new chevron dikes and extension of dike 72.9L occurred outside of the existing dike field (riverward), lowering the post-construction structure score in this area, as well as the average structure parameter score for the entire total area of influence (0.54 to 0.44).

Similar to all the previously discussed work areas, bathymetric survey data were used to develop the pre-construction depth HSI score (0.54). However, given that this work has only recently been completed, a post-construction bathymetric survey has not yet been performed. The depth HSI score for the RM 104 Chevron site from the 3-D model was used as the input data for the post-construction depth HSI score (0.46), resulting in a slightly reduced depth HSI score.

The pre-construction velocity HSI score was derived from a 2-D numerical model developed during the planning phase for the work. The modeling effort revealed swift current within the work area vicinity prior to construction, resulting in a relatively low velocity HSI score (0.41). The post-construction velocity HSI score (0.64) was also derived from the RM 104 Chevron site from the 3-D model, similar to the post-construction depth HSI score. These data suggest that construction activity in this work area would reduce flow velocity downstream of the structures. This increases the average velocity HSI score, and essentially cancels out the decrease to the depth and structure HSI scores, resulting in a slight gain in AAHUs (Table 1.)

Grand Tower Phase 5 - Vancill Dikes

The second portion of the Grand Tower Phase 5 work consisted of building multiple features along the left bank between RM 67 and RM 69. This analysis only considered the features that could potentially impact the identified MCB habitat: the construction of three 750 ft long S-dikes, the repair of 350 ft of an existing traditional dike, and the shortening of two traditional dikes.

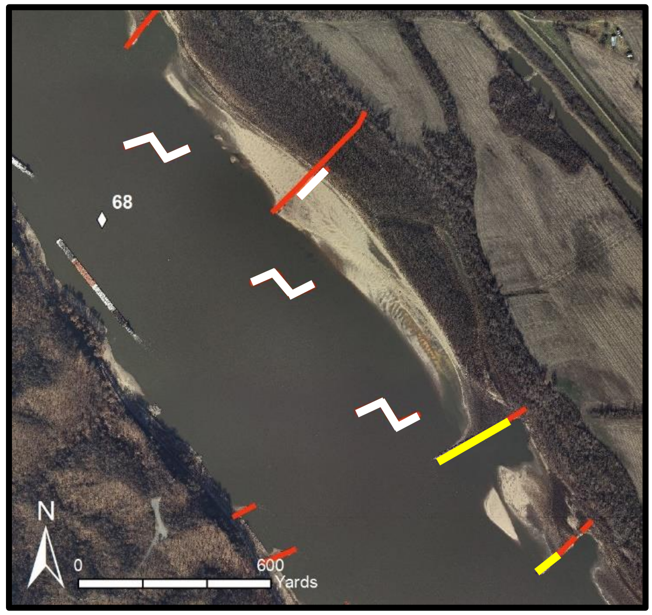


Figure 12. 2012 Aerial imagery of the Grand Tower Phase 5 - Vancill Dikes work area, including new river training structures (white) structure removal (yellow), and existing river training structures.

Traditional dikes were already present along the left descending bank; the area between the dikes was assigned the low-quality structure HSI score (0.3), and the remaining area was assigned the moderate structure score (0.7). Construction of the S-dikes drops the structure score for the area immediately downstream of these structures (0.7 to 0.3). The shortening of dikes 67.3L and 67.1L enhances the structure score for the area downstream of the removed portion (0.3 to 1.0). Although construction of the S-dikes reduces the structure HSI for a large portion of the area, this effect is outweighed by the dike removal component, which boosts the overall structure HSI score (0.51 to 0.54).

Bathymetric survey data were used to develop the pre-construction depth HSI score (0.51), and unlike any of the previously mentioned work areas, the results of an HSR model developed for this site were used as the input data source for the post-construction depth HSI score (0.57). The HSR model demonstrates that construction of the S-dikes would result in sediment deposition immediately downstream of the structures, increasing the average bed elevation within the area and boosting the depth HSI score within the work area.

The pre and post-construction velocity HSI scores were developed using a 2-D numerical model developed during the design phase of this work. The majority of the work area had relatively swift current before construction was implemented, producing a low pre-construction HSI score (0.38). Building the S-dikes reduced the velocity for a significant portion of the area, increasing the average velocity HSI score for the total area of influence (0.56). Ultimately, because the S-dikes were built relatively far from the bank and near the navigation channel, they reduce the velocity and increase the bed elevation in an area that would otherwise have an overall HSI score of 0.0 (i.e., too deep and swift). These effects boost the overall HSI score (0.48 to 0.55), producing a relatively large net gain in AAHUs (Table 1).

However, like the previously discussed Crawford Chevrons, this work has only recently been completed. Conditions at the site will be given the opportunity to change and eventually reach a state of dynamic equilibrium, after which field data can be collected, and the post-construction HSI scores for depth and velocity can be updated. Therefore, the current net gain in AAHUs from this work will likely increase or decrease after a future reevaluation.

2.4 Initial Assessment Results

While some of the construction has reduced the aforementioned habitat type in certain work area vicinities, the programmatic results demonstrate an overall net gain of this habitat type (i.e., increased AAHUs) within the MMR. This outcome is largely due to the construction activity completed at the Vancill Towhead work area - primarily the construction of the innovative S-dike structures. This work seemingly transforms a relatively large portion of low-quality MCB habitat into high-quality MCB habitat. The structures have achieved their desired effect of helping maintain the navigation channel and reducing the need for channel maintenance dredging, while simultaneously diverting flow bankward and creating a myriad of flow patterns and depositional areas. The S-dike structures created a large swath of the specific habitat type that was identified in the SEIS as potentially being significantly impacted from the continued construction of the overall Project. This is not completely surprising as the Vancill Towhead reach was extensively coordinated with the natural resource agencies and consisted of both dike shortening and the placement of what were modeled to be environmentally friendly structures. This resulted in an overall net gain in AAHUs for the evaluated construction activities (Table 1)

The details and process described above represent the District's initial assessment of the potential compensatory mitigation for the Regulating Works Project described in the SEIS. As committed to in the SSEAs, the District has evaluated the impacts to MCB habitat for the five most recently completed construction activities carried out under the Project. More specifically, the impacts to shallow to moderate-depth, moderate-to high-velocity habitat have been evaluated and quantified using the Chub Model. Given the results of this initial assessment, compensatory mitigation is not currently warranted. However, post-construction AAHUs are subject to change in light of new information gathered through monitoring efforts, which may result in a reevaluation of compensatory mitigation resulting from the impacts of these work areas. Further, the District will continue to evaluate the programmatic impact of future Project construction utilizing the Chub Model and the process discussed herein. Based upon the analyses completed as part of the SEIS and this initial assessment of the completed SSEAs, the District still anticipates that compensatory mitigation will need to be considered moving forward, and will thus proceed accordingly and plan feasible mitigation actions (described below), so they will be ready for execution if deemed appropriate for the circumstances moving forward.

Table 1. Results of the Project's initial mitigation assessment, and the tentative monitoring plan for each of the work areas discussed in the SSEAs.

Project Work Area	FWOP HSI	FWP HSI	Net Change	Latest Assessment
Mosenthein-Ivory Landing Phase 4 (71 acres)				
Velocity	0.63	0.68	+0.05	Nov-17
Depth	0.57	0.53	-0.04	Nov-17
Substrate	0.50	0.50	0.00	Nov-17
Structured/Unstructured	1.00	0.63	-0.37	Nov-17
Overall HSI Score	0.67	0.58	-0.09	Nov-17
AAHUs	**47.5**	**41.32**	**-6.19**	Nov-17
Monitoring: Post-construction field data has already been collected and assessed once for the velocity and depth parameters. Progress to dynamic equilibrium (DE) will be determined upon collection of channel survey bathymetric data. Monitoring will end if the site has reached DE, and all HSI scores and AAHUs will be deemed final. If site has not reached DE, it will continue to be monitored and will be reassessed after periodic channel surveys are performed and provide updated bathymetry. Once the site has reached DE, velocity field data will be recollected and reassessed.				
Eliza Point-Greenfield Bend Phase 3 (52 acres)				
Velocity	0.63	0.68	+0.05	Nov-17
Depth	0.72	0.34	-0.38	Nov-17
Substrate	0.50	0.50	0.00	Nov-17
Structured/Unstructured	1.00	0.61	-0.39	Nov-17
Overall HSI Score	0.71	0.53	-0.19	Nov-17
AAHUs	**37.25**	**28.09**	**-9.16**	Nov-17
Monitoring: Post-construction depth data has already been collected and assessed once. Progress to dynamic equilibrium (DE) will be determined upon collection of channel survey bathymetric data. If the site has reached DE, velocity field data will be collected and all HSI scores and AAHUs will be deemed final. If site has not reached DE, it will continue to be monitored and will be reassessed after periodic channel surveys are performed and provide updated bathymetry. Once the site has reached DE, post-construction velocity field data will be collected and assessed.				
Dogtooth Bend Phase 5 (25 acres)				
Velocity	0.37	0.52	+0.14	Nov-17
Depth	0.31	0.25	-0.06	Nov-17
Substrate	0.50	0.50	0.00	Nov-17
Structured/Unstructured	0.70	0.60	-0.10	Nov-17
Overall HSI Score	0.45	0.46	+0.01	Nov-17
AAHUs	**11.21**	**11.45**	**+0.24**	Nov-17

Monitoring: Post-construction depth data has already been collected and assessed once. Progress to dynamic equilibrium (DE) will be determined upon collection of channel survey bathymetric data after the next periodic channel survey is performed. If the site has reached DE, velocity field data will be collected and all HSI scores and AAHUs will be deemed final. If site has not reached DE, it will continue to be monitored and will be reassessed after periodic channel surveys are performed and provide updated bathymetry. Once the site has reached DE, post-construction velocity field data will be collected and assessed.				
Mosenthein-Ivory Landing Phase 5 (122 acres)				
Velocity	0.50	0.74	+0.24	Nov-17
Depth	0.46	0.55	+0.09	Nov-17
Substrate	0.50	0.50	0.00	Nov-17
Structured/Unstructured	0.60	0.47	-0.13	Nov-17
Overall HSI Score	0.52	0.56	+0.05	Nov-17
AAHUs	**63.38**	**68.11**	**+4.73**	Nov-17
Monitoring: Post-construction field data has already been collected and assessed once for the velocity and depth parameters. Progress to dynamic equilibrium (DE) will be determined upon collection of channel survey bathymetric data. If the site has reached DE, velocity field data will be collected and reassessed and all HSI scores and AAHUs will be deemed final. If site has not reached DE, it will continue to be monitored and will be reassessed after periodic channel surveys are performed and provide updated bathymetry. Once the site has reached DE, velocity field data will be recollected and reassessed.				
Grand Tower Phase 5 - Crawford Chevrons (175 acres)				
Velocity	0.41	0.64	+0.23	Nov-17
Depth	0.54	0.46	-0.07	Nov-17
Substrate	0.50	0.50	0.00	Nov-17
Structured/Unstructured	0.54	0.44	-0.10	Nov-17
Overall HSI Score	0.50	0.51	+0.01	Nov-17
AAHUs	**87.49**	**89.18**	**+1.70**	Nov-17
Monitoring: Post-construction field data has not been collected for any of the parameters. This is a more recent construction activity, meaning it is unlikely the site has reached dynamic equilibrium (DE). Depth field data will be assessed after multiple periodic channel surveys have been performed, such that temporal changes to bathymetry can be observed. Once the site has reached DE, post-construction velocity field data will be collected and assessed.				
Grand Tower Phase 5 - Vancill Dikes (257 acres)				
Velocity	0.38	0.56	+0.18	Nov-17
Depth	0.51	0.57	+0.06	Nov-17
Substrate	0.50	0.50	0.00	Nov-17
Structured/Unstructured	0.51	0.54	+0.03	Nov-17
Overall HSI Score	0.48	0.55	+0.07	Nov-17
AAHUs	**123.36**	**140.81**	**+17.45**	Nov-17

Monitoring: Post-construction field data has not been collected for any of the parameters. This is a more recent construction activity, meaning it is unlikely the site has reached dynamic equilibrium (DE). Depth field data will be assessed after multiple periodic channel surveys have been performed, such that temporal changes to bathymetry can be observed. Once the site has reached DE, post-construction velocity field data will be collected and assessed.		
Programmatic AAHUs	**+8.77**	Nov-17

Chapter 3. Mitigation Plan

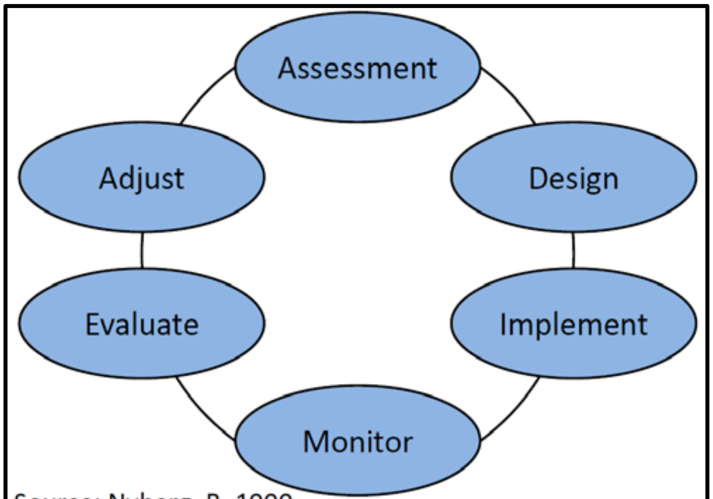
Corps regulations (Engineering Regulation 1105-2-100) guide the process for mitigation planning. Changes to habitat must be assessed as a function of improvement or degradation in habitat quality and quantity, as expressed quantitatively in physical units or indexes (but not monetary units). In the case of mitigation for significant environmental impacts, ecosystem restoration actions must be formulated and evaluated in terms of their net contributions to increases in ecosystem value, expressed in non-monetary units. Various mitigation actions also should be compared to each other through a Cost Effectiveness and Incremental Cost Analysis (CE/ICA) to ensure benefits are optimized relative to cost.

Accordingly, the District has assessed the impacts to shallow to moderate-depth, moderate-to high-velocity habitat for the work areas discussed in the SSEAs using a Habitat Suitability Index model (i.e., Chub Model), and will apply the model in the same manner to future river training structure construction and mitigation work carried out under the Project for the purpose of obtaining and maintaining the navigation channel. As previously discussed, applying the model generates a general habitat quality score between 0 and 1. The HEP analysis is then performed to derive a total number of AAHUs lost. Those AAHUs lost that are determined to be a "significant" impact could result in mitigation. It should be noted that what level of loss is significant is a judgment determined by the Corps after collaboration with resource agencies and utilizing all information that is readily available. The simple loss of AAHUs does not in and of itself constitute a significant impact to consider mitigation to offset an equal amount of AAHUs. However, the Corps does anticipate pursuing mitigation for the types of habitat change forecasted within the SEIS. The levels of impact, impact significance, and mitigation (including the type and amount and a detailed mitigation plan) would be developed and documented in future Tier II site specific Environmental Assessments.

When mitigation is required by law, Corps regulations require an adaptive approach be taken to implementing, monitoring and modifying mitigation actions to ensure they are offsetting significant project impacts (USACE Implementation Guidance for Section 2036(a) of WRDA 2007, Aug 2009). This guidance requires mitigation plans include: 1) a description of the mitigation action; 2) a description of the type and amount of habitat to be restored; 3) ecological success criteria including specific metrics to quantify success; 4) a monitoring plan; 5) a contingency plan; and 6) a real estate plan. The mitigation plan also will establish a consultation process with appropriate federal and State agencies to evaluate mitigation effectiveness, including monitoring and determining the success of mitigation. While this is not required by law for the Regulating Works Project, it is anticipated that any mitigation done under the Project would follow this process (see below).

3.1 Monitoring and Adaptive Management

The impact to this specific habitat was deemed to be a significant impact on a programmatic basis within the SEIS; therefore, the compensatory mitigation will also be considered on a programmatic basis moving forward. This will be achieved through a monitoring and adaptive management plan developed specifically for the Project.



Source: Nyberg, B. 1999.

The foundation of the adaptive management plan is provided in the SEIS, which outlines the basic steps of the adaptive management process; (1) Assess; (2) Design; (3) Implement; (4) Monitor; (5) Evaluate; and (6) Adjust. In practice, adaptive management is implemented in a non-linear sequence, in an iterative way, starting at various points in the process and repeating steps based on improved knowledge.

The Regulating Works Project is somewhat unique relative to other construction projects, given that it has been ongoing for many years and will likely continue until a minimal amount of dredging is required to maintain the navigation channel in the MMR. Further, construction activities carried out under the Project are implemented at various sites throughout the MMR, all with different timelines and completion dates. As such, the Project's adaptive management plan and the aforementioned steps of the process cannot be tailored to a single mitigation action implemented for a completed construction activity, which would result in a relatively straightforward and simplified adaptive management process. Rather, the adaptive management process for the Regulating Works Project will have an added level of complexity; not only will it be an iterative process, but multiple steps will take place concurrently.

Specific construction activities and mitigation actions could fall under any of the six steps outlined above, and switch to a different step at any given time in light of new information or data collected through monitoring efforts. Further, because the Project's mitigation is being implemented on a programmatic basis, the step at which any given work area falls under is dependent on all the other work areas. For example, an assessment of planned construction activity could reveal a loss in AAHUs would result from the work. The adaptive management team (see below) may then decide to implement a mitigation action that had been previously designed. However, a concurrent monitoring effort of a previously completed mitigation action could reveal a higher increase in AAHUs than what was initially anticipated through modeling efforts. The newly revealed increase in AAHUs essentially offsets the loss that triggered the implementation of the mitigation action, thereby moving the new mitigation action from the implementation step back to the design step.

That hypothetical situation is just one of many different scenarios that are likely to occur as the Project's adaptive management plan is implemented. Given the nature of the Project and the subsequent complexities of its monitoring and adaptive management plan, the District is committed to being fully transparent with every detail of the process, including data sources used, site-specific and programmatic updates to AAHUs due to monitoring efforts, mitigation site planning, decisions made at adaptive management team meetings, etc. Accordingly, all future SSEAs will include the site-specific information presented in Table 1, make note of the updated information, and provide discussion on how updated information has affected the overall adaptive management process for the entire Project.

3.2 Adaptive Management Team

An Adaptive Management Team (AMT) would provide essential support to meeting goals and objectives through the application of a systemic approach to evaluating project impacts, mitigation and mitigation effectiveness. The AMT will consist of a multi-agency (state and Federal) staff from the appropriate disciplines, including engineering, planning, environmental science and resource management. As the project sponsor, the Corps serves as the AMT leader.

The AMT for the Project is essentially already established, in the form of the current interagency coordination process the District uses, which was officially codified in a 2002 Memorandum of Understanding (MOU) between the District and the U.S. Fish and Wildlife Service, the Illinois Department of Natural Resources, and the Missouri Department of Conservation and described in the SEIS. The MOU created the River Resources Action Team (RRAT) as the official forum to be used for interagency coordination of all Regulating Works Project and other Mississippi River navigation channel actions within the District. The RRAT was created to:

- Enhance and formalize the interagency coordination process;
- Foster a cooperative interagency partnership;
- Ensure consistency of interagency coordination;
- Identify a collaborative mechanism for project coordination;
- Provide effective implementation of the 2000 Biological Opinion; and
- Use a team approach to restore and protect UMR watersheds and ecosystems.

Through the RRAT the District coordinates all Project activities with interagency coordination meetings at least twice per year and on an as needed basis for specific work areas or activities. All aspects of compensatory mitigation, monitoring, and adaptive management for the Regulating Works Project will be coordinated with the interagency partners that comprise the RRAT. Further, they will be intimately involved in the planning process for activities carried out under the adaptive management plan, including mitigation site selection, mitigation measures (e.g., dike notching, dike removal), collection of monitoring data, as well as the establishment of goals and objectives. Since the completion of the SEIS, AMT coordination and discussions have occurred at two separate RRAT meetings as follows:

- RRAT Executive meeting - 19 December 2017.
- RRAT Executive meeting - 23 January 2018.

These initial AMT discussions involved coordination and presentation of the information found in Chapter 2 of this report, including the development of the MMR Sturgeon Chub Model, the model application process, and the results of the initial mitigation assessment. Further, AMT members discussed the selection of proposed mitigation sites (see below), details of the AM process, due-outs of AMT members, and the next steps of the AM process.

3.3 Goals, Objectives and Performance Standards/Metrics

The SEIS discusses the incorporation of goals, objectives, and performance standards/metrics, within the adaptive management plan. The goals and objectives will be fully developed based on input from the AMT during future Tier II site specific Environmental Assessments, which will include detailed mitigation plans when applicable. Goals and objectives will be largely based on the existing conditions within the proposed mitigation area. Examples might be to increase longitudinal connectivity of aquatic habitat within a dike field, increase the overall area of a sandbar, etc. While the goals and objectives developed by the AMT might be somewhat subjective in nature, based largely on subject matter expertise, they must ultimately be captured by the performance standard/metric in order to successfully quantify the effectiveness of a specific mitigation action.

Performance standards/metrics include potential metrics for quantifying impacts following construction and measuring mitigation effectiveness. Because the general goal of mitigation will be to replace the habitat value lost through significant project impacts, the performance metric will be the same metric used to assess the compensatory mitigation requirements (i.e., AAHUs). For planning purposes, the MMR Sturgeon Chub Model will be used to estimate the AAHUs that would result from a proposed mitigation action prior to implementation. This will be done to ensure that proposed mitigation actions compensate for the appropriate amount of habitat lost due to new construction activities. The initial AAHU calculation will be achieved by using the best available existing data, as well as hydraulic modeling efforts. However, while the estimated AAHUs will officially be accounted for within the overall programmatic AAHU tally and, thus, impact the decision making and adaptive management processes, these numbers are subject to change at any given time as a result of post-construction monitoring. All updated AAHUs will be noted and discussed in all subsequent NEPA documentation.

3.4 Mitigation Site Planning

Once the specific amount of significant adverse future impact that warrants consideration of mitigation has been identified by the AMT, the Corps will consider multiple alternatives to mitigate these impacts. This includes consideration of the cost for different mitigation alternatives, and the amount of mitigation benefits generated by each alternative. Mitigation benefits will be estimated and quantified with a HEP analysis, which will produce potential AAHUs that could be achieved through each mitigation action. Then a Cost Effectiveness/Incremental Cost Analysis (CE/ICA) will be performed to compare the alternatives. This helps ensure the Corps is making an informed selection on the most cost-effective mitigation approach.

Potential mitigation actions may include, but are not limited to the following: wing dike notching, dike removal, wing dike creation using alternative designs (e.g., rootless dikes), use of rock piles, dredging or material placement of sand, and other possible activities. Mitigation will be tailored toward the goals and objectives identified by the AMT, but will generally be designed to compensate for the loss of shallow to moderate-depth, moderate-to high-velocity habitat along the main channel border habitat. Such habitat may be challenging to design and effectively implement. The ability to design for such habitat, including the associated costs, may need to be carefully considered within the context of the impacts. Mitigation from impacts will be considered to the extent practicable.

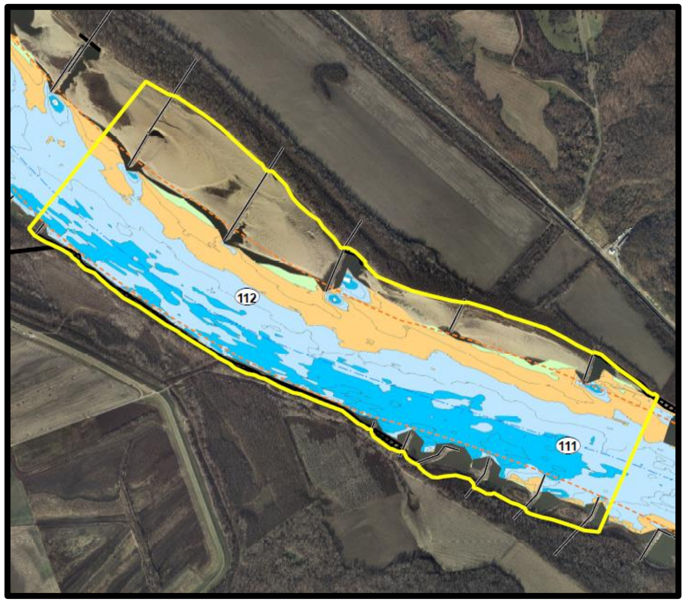


Figure 13. Example of a potential mitigation work site in the MMR identified by District hydrualic engineers.

Due to the results of the initial assessment, compensatory mitigation action is not currently warranted. However, it is anticipated that some degree of compensatory mitigation will eventually be warranted as new work is carried out under the Project. Therefore, planning of mitigation work will proceed concurrently with the normal Project process. Through a cooperative effort with the AMT, the District is in the process of selecting prospective mitigation sites in preparation for designing various mitigation alternatives. Initially, District hydraulic engineers identified a list of potential mitigation work areas in the MMR, with the overarching criteria that mitigation work could not negatively affect the navigation channel, leading to future channel maintenance dredging. Five comprehensive hydrographic surveys (2005, 2007, 2010, 2013, and 2014) were studied to identify reaches that had a thalweg with sufficient depth and width beyond the minimum authorized dimensions (depth that exceeded -18 LWRP14). Next, specific criteria were used to further refine the potential mitigation sites:

- ➢ The desired depth was not within a weir field
- ➢ No recent construction has occurred in the area
- ➢ The area has existing structures that could be removed or modified to restore habitat
- ➢ No plans for future construction in the area
- ➢ Work in the area would not impact the navigation channel in another district.

This effort resulted in 23 reaches of various lengths within the MMR in which mitigation work would likely be feasible (Figure 13). During the RRAT Executive meeting held 23 January 2018, the AMT discussed the restoration potential of each of the 23 sites, shared ideas on potential mitigation measures that could be implemented at each site, and ranked the sites accordingly. The AMT decided the top six sites would be carried forward into the design phase. Currently, District hydraulic engineers are designing and modeling potential mitigation measures at each of the six sites based on input from the AMT. This effort will ensure the discussed mitigation measures are feasible, would not adversely affect the navigation channel, and would result in a net gain in AAHUs. Ultimately, multiple mitigation alternatives will be developed for each of the six sites, after which a CE/ICA will be performed thus ensuring the District and the AMT have a sufficient list of cost effective mitigation alternatives to select from when compensatory mitigation measures are considered and deemed warranted due to future construction of river training structures.

3.5 Monitoring

The CEQ NEPA Task Force (CEQ 2003) suggests that the effectiveness of adaptive management hinges upon an effective monitoring program to establish objectives, thresholds, and baseline conditions. As discussed above, this will be achieved through a stepwise process that includes pre- and post-construction monitoring of physical habitat. These monitoring activities will occur for both impact and mitigation sites, allowing impacts to be verified, and for mitigation effectiveness to be evaluated.

Following the adaptive framework of this document, impacts will be monitored over time and performance of measures will be assessed to determine whether additional avoidance, minimization, or compensatory mitigation measures should be considered. Future monitoring will provide information on the accuracy of the conclusions reached on the extent of impacts from the project features and evaluate the effectiveness of mitigation. Monitoring activities, including review of results, will be performed collaboratively with the AMT. The specific monitoring methods will be tailored to each of the Chub Model parameters, except for the structured/unstructured model parameter which does not require any monitoring, as it is simply based on the delineation of river training structures in the work areas. Details are as follows:

- Velocity - Once completed work areas have reached dynamic equilibrium, District channel survey vessels will be used to collect acoustic doppler current profile (ADCP) data during a period of moderate discharge. Timing and execution of ADCP data collection is largely dependent on river stage/discharge and the existing physical conditions found at each site, coupled with the location and workload of the survey vessels at that given time. Therefore, ADCP data collection will be tentatively scheduled only after completed work areas have reached dynamic equilibrium, without strict execution dates. This flexibility will allow for proper execution during the appropriate stage and discharge. Collecting velocity data at flows that are higher or lower than the moderate discharge used in the development of the model can impact the model results. If velocity data cannot be collected during the appropriate stage and discharge, a numeric model or other method of estimating velocity may be required.

- Depth - District channel survey vessels will be used to collect bathymetric survey data. The District monitors the navigation channel depths by maintaining updated bathymetry throughout the MMR. This is achieved by performing periodic reach-wide channel surveys using single-beam bathymetry. These data will be relied upon to monitor and update depths for each of the work areas, and to determine whether sites have reached dynamic equilibrium. If and when the channel surveys lack sufficient data for specific work areas, the District may deploy survey vessels to collect site specific multi-beam bathymetric data.

- Substrate - Monitoring of substrate conditions at completed work sites will be largely based on visual observations made at completed work sites, at which time the post-construction substrate category could be updated for any of the work sites assessed herein, potentially altering the programmatic tally of AAHUs. Further, if visual observation suggest that substantial changes to the substrate composition have occurred within a work area, ponar dredge grab samples could be collected to assess and confirm the observed changes.

The tentative schedule for site specific monitoring activities is presented in Table 1, along with the results of the initial mitigation assessment. Completed monitoring activities and subsequent changes to the monitoring and adaptive management process will be updated and discussed in all future NEPA documentation for the Regulating Works Project. Further the programmatic impacts of the Regulating Works Project will continue to be updated in further NEPA documentation.

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FINDING OF NO SIGNIFICANT IMPACT

Supplemental Environmental Assessment:

Mosenthein-Ivory Landing Phase 4
Eliza Point-Greenfield Bend Phase 3
Dogtooth Bend Phase 5
Mosenthein-Ivory Landing Phase 5
Grand Tower Phase 5

1. In accordance with the National Environmental Policy Act, I have reviewed and evaluated the documents concerning the supplement to the aforementioned Site-Specific Environmental Assessments (SSEAs) for the Regulating Works Project (Project). As part of this evaluation, I have considered:

    a. The potential impact on main channel border habitat identified in the SEIS.

    b. The Project's impact on main channel border habitat at the five work areas listed above.

    c. The development of the Middle Mississippi River Sturgeon Chub Model and its use in assessing the site specific work areas.

    d. The mitigation plan developed for the Project.

2. The potential impact to main channel border habitat identified in the SEIS was unknown at the time the SSEAs were implemented. The completed construction activities have now been assessed in regards to this potential impact, and my evaluation of this assessment has contributed to my finding:

    a. Main channel border habitat has not been significantly impacted by the construction of river training structures associated with the SSEAs.

    b. Compensatory mitigation action is not currently warranted for the Project, but will be re-evaluated as future site-specific construction activities are planned.

    c. An appropriate mitigation plan has been developed, which will ensure the Project is implemented without adversely affecting the environment.

3. Based on the evaluation and disclosure of impacts contained within the Supplemental Environmental Assessment, I find no significant impacts to the human environment are likely to occur as a result of the implemented actions.

____________________ (Date)

____
BRYAN K. SIZEMORE
COL, EN
Commanding

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Miller, M
Missouri Corn Growers Association
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