Upper Browns Bar HSR Model Study Read-Ahead

Ivan Nguyen

Purpose

The U.S. Army Corps of Engineers, St. Louis District, conducted a sedimentation improvement study of the Upper Browns Bar reach of the Middle Mississippi River between River Miles (RM) 29.00 and 20.00 near Dogtooth Island which passes through Scott and Mississippi County in Missouri and Alexander County in Southern Illinois. This study was funded by the Regulating Works Project of the U.S. Army Corps of Engineers, St. Louis District. The objective of the model study was to find a river engineering solution to reduce or eliminate the need for repetitive dredging between RM 25.00 - 23.50 while maintaining the environmental features within the reach.

Goals

The goals of this study were to:

i. Investigate and provide analysis on the existing flow mechanics causing the sedimentation problems.
ii. Evaluate a variety of remedial measures utilizing an HSR model with the objective of identifying the most effective and economical plan to reduce or eliminate sedimentation at RM 25.00 - 23.50. In order to determine the best alternative, three criteria were used to evaluate each alternative.

    a. The alternative should have the potential to significantly reduce or eliminate sedimentation at RM 24.50.
    b. The alternative should maintain the navigation channel requirements of at least 9 feet of depth and a minimum of 300 feet of width.
    c. The final alternative will not significantly impact existing environmental features within the reach.

iii. Communicate the model results and plans for improvements to all stakeholders and partners including; river industry personnel, Non-Governmental Organizations, and environmental agency personnel.

Replication vs. Prototype

Bathymetric trends were recorded from the model using a 3-D Laser Scanner. Replication was achieved after numerous favorable bathymetric comparisons of the prototype surveys were made to several surveys of the model. Results of the HSR model replication test bathymetry and a comparison of the 2001 through 2013 prototype surveys indicated that the thalweg was located in the correct location throughout the model extents with similar channel depths. These prominent features within the model did not always precisely replicate the elevations of the prototype surveys, but the general trends were very comparable. Once the general trends were met, model replication was considered successful and the model was considered calibrated.

Note that on the prototype survey (2011 and 2013 hydrographic survey), the bar encroached further out into the channel at RM 24.00 when compared to the replication. The reason for this difference is that dredge disposal has been periodically placed in this area, thereby artificially sustaining high bar elevations.

Please see the draft report at the following link.
http://mvs-wc.mvs.usace.army.mil/arec/Documents/HSR_Models/Upper_Browns_Bar/Upper_Browns_Report_Draft.pdf

Testing Process

A total of 44 alternatives have been tested in the HSR model. The alternatives include such structures as dikes, weirs, closures, extensions and notches.

Testing of alternatives 41, 42, 43 and 44 (modified alternative 39 & 40 which were presented during the model meeting on 8/24/2014) showed that Buffalo Chute work had no significant bathymetry changes in the navigation channel beside increasing connectivity in the chute. As a result, Buffalo Chute work will be removed from the design of this model study and Alternative 42 will be recommended. However, Buffalo Chute work can proceed under Biological Opinion with the approval of partners/stakeholders and the project manager (Alternative 41).

Testing Success

Alternative 42 was recommended as the most desirable alternative because of its potential to eliminate the need for repetitive dredging between RM 25.00 - 23.50 while maintaining flow through Upper Brown's Chute.

If there are any additional ideas or concerns about the reach and/or alternatives, please call (314-865-6358) or email me (Ivan.H.Nguyen @usace.army.mil).

A final meeting was held on August 28, 2014 at the Applied River Engineering Center. At the meeting the proposed alternative (39) was slightly changed (remove Dike 24.25R) and additional tests were requested (meeting minutes can be found on the following pages).

After the additional tests (Alternatives 41-44) were completed, the plates/results were sent out to the group via email. Alternative 42 was recommended, and some representatives from partnering agencies responded with some comments. On the RRAT trip further discussion needs to occur to clarify any confusion and help us choose a path forward for this reach.

Upper Brown's HSR Model Study Final Meeting
8/28/14 at 9am

-Ivan presented a powerpoint and then opened the floor for discussion regarding the recommended alternative.

-First comment by navigation was regarding proposed Dike 24.25R. It's located in an existing "waiting location", so Ivan will remove it from Alternative 39 and test it as Alternative 41.

-Shannon and Bernie said that there should be no structures below RM 24.6R.

-Dave Knuth (MDC) thoughts:

1. The reach hasn't been dredged for 4 years
2. Previous four years spent an average of $280,000/year to dredge
3. Minimum of 10 structures needed to solve the dredging issue – he thinks the cost benefit ratio would be outrageous
4. There's a minimal amount of natural/raw crossings left on the Middle Mississippi (no weirs) – would hate to lose that natural habitat due to its use as a migratory passage for fish
5. He's wondering if it's a needed project, thinks it's a lot of rock, and would like to leave the natural crossing alone.

- Lance Engle, Mike Rodgers, and Dave Gordon discussed the dredging issue. They said that if the Ohio River is up it depletes the need for dredging below the Thebes reach. They said historically that the Upper Brown's crossing area has been a depositional area and needed repetitive maintenance dredging. There has been nothing that has changed significantly upstream or in the immediate vicinity to think that the dredging issue has been solved.

-Matt Mangan (F&WS) thoughts:

1. Said he would like to see flow monitoring of the river/side channel after the weirs were constructed to make sure they aren't affecting Upper Brown's Chute.
2. He is fine with the structure adjustments in and around Buffalo Chute.
3. He is concerned with the LDB trail dikes near Upper Brown's. He doesn't know what will happen when those go in to the surrounding habitat and small channels that are existing.
4. He highly recommended going with a phased construction approach, testing how many extended trail dikes were necessary on Upper Brown's bar (1, 2, or 3?). He wants to monitor the bar as well, to see if they change the habitat.
5. His last concern was about the loss of raw crossover habitat if weirs were introduced to the area.

Path Forward: Do two additional tests – Alternative 41 = Alternative 39 minus Dike 24.25R
Alternative 42 = Alternative 41 minus the Buffalo Chute work (to see if the structures improve the navigation channel/alignment)
AREC will communicate those results to all agencies/interested parties
Once we have approval for that alternative, Ivan will begin testing phased construction (weirs will go in first, then Buffalo Chute structures, and then 1 trail dike on the LDB, then 2 trail dikes on the LDB, then 3 trail dikes on the LDB).

The environmental agencies present said they would be responsible for sending their own notes in to us from today's meeting.

REPLICATION

ALTERNATIVE 41

Dike

Weir

Proposed Structure

Elevation

LWRP (Feet)

- 10 And Above
- 10 - 0
- 0 - -5
- -5 - -10
- -10 - -15
- -15 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -50 And Below

Elkins Landing
Wilbourne Island
Buffalo Island
Brooks Point
Dogtooth Is
Browns Chute
Browns Bar
Hacker Towhead
29
28
27
26
25
24
23
22
DIKE 28.00L
DIKE 27.60R
DIKE 27.30R
DIKE 27.00R
DIKE 27.50L
DIKE 26.90R
DIKE 27.20L
DIKE 26.70R
DIKE 26.80L
DIKE 26.40R
DIKE 26.10R
DIKE 25.50R
DIKE 25.30R
DIKE 25.40L
DIKE 25.30L
DIKE 25.20L
DIKE 25.00L
DIKE 24.90L
DIKE 24.80R
DIKE 24.50L
DIKE 24.40L
DIKE 24.30L
DIKE 24.70R
DIKE 24.60R
DIKE 24.20L
DIKE 23.80L
DIKE 22.20L
CHEVRON 21.80L
DIKE 21.90L
DIKE 21.40L
DIKE 22.30L
DIKE 22.10L
DIKE 23.40R
DIKE 23.30R
DIKE 23.30R
WEIR 23.20R
WEIR 23.10R
WEIR 23.00R
WEIR 22.90R
WEIR 22.80R
WEIR 22.70R
WEIR 22.4
Closure Dike
Construct Weir 25.70L, 25.60L 25.40L, 25.20L
Construct Offset Rootless Dike
Notch Closure
Construct Dike 24.75R
Remove Partial Closure
Construct L-Dike Extension

830,000 835,000 840,000 845,000 850,000 855,000 860,000

425,000 430,000 435,000 440,000 445,000

420,000 425,000 430,000

PLATE NUMBER 80

0 1,000 2,000 4,000 Feet

REPLICATION VS. ALTERNATIVE 41
2012 AERIAL PHOTOGRAPH

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

MISSISSIPPI RIVER BASIN
ST. LOUIS DISTRICT
UPPER BROWNS BAR HSR MODEL

DRAWN BY: I. NGUYEN	CHECKED BY: B. KRISCHEL
SUBMITTED BY: I. NGUYEN	CHECKED BY: A. COX
PLOT DATE: 9/5/2014	APPROVED BY: R. DAVINROY, P.E.
FILE NAME: UPPER BROWNS PLATE ALTERNATIVE	

APPLIED RIVER ENGINEERING CENTER

US Army Corps of Engineers
St. Louis District

REPLICATION

ALTERNATIVE 42

Dike
Weir
Proposed Structure

Elevation

LWRP (Feet)

- 10 And Above
- 10 - 0
- 0 - -5
- -5 - -10
- -10 - -15
- -15 - -20
- -20 - -30
- -30 - -40
- -40 - -50
- -50 And Below

Elkins Landing
Wilbourne Island
Buffalo Island
Brooks Point
Dogtooth Is
Browns Chute
Browns Bar
Hacker Towhead

29 28 27 26 25 24 23 22

DIKE 28.00L
DIKE 27.60R
DIKE 27.30R
DIKE 27.00R
DIKE 27.50L
DIKE 26.90R
DIKE 27.20L
DIKE 26.70R
DIKE 26.80L
DIKE 26.40R
DIKE 26.10R
DIKE 25.50R
DIKE 25.30R
DIKE 25.40L
DIKE 25.30L
DIKE 25.20L
DIKE 25.00L
DIKE 24.90L
DIKE 24.50L
DIKE 24.80R
Closure Dike
DIKE 24.70R
DIKE 24.60R
DIKE 24.40L
DIKE 24.30L
DIKE 24.20L
DIKE 23.80L
DIKE 22.20L
CHEVRON 21.80L
DIKE 21.90L
DIKE 21.40L
DIKE 22.30L
DIKE 22.10L
DIKE 23.40R
DIKE 23.30R
WEIR 23.30R
WEIR 23.20R
WEIR 23.10R
WEIR 23.00R
WEIR 22.90R
WEIR 22.80R
WEIR 22.70R
WEIR 22.4

Construct Weir 25.70L, 25.60L 25.40L, 25.20L
Construct Offset Rootless Dike
Construct Offset Rootless Dike
Construct Offset Rootless Dike
Construct L-Dike Extension
Construct L-Dike Extension
Construct L-Dike Extension

830,000 835,000 840,000 845,000 850,000 855,000 860,000

420,000 425,000 430,000

435,000 440,000

PLATE NUMBER 81	0 1,000 2,000 4,000 Feet REPLICATION VS. ALTERNATIVE 42 2012 AERIAL PHOTOGRAPH	U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS ST. LOUIS, MISSOURI	DRAWN BY: I. NGUYEN	CHECKED BY: B. KRISCHEL
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		MISSISSIPPI RIVER BASIN ST. LOUIS DISTRICT UPPER BROWNS BAR HSR MODEL	PLOT DATE: 9/5/2014	APPROVED BY: R. DAVINROY, P.E.
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