

An information paper was presented by David Penny of Master's Dredging Company, Inc., to Coffey County Commissioner Fred Rowley, Jr., and to Jacobs Creek residents. The paper, titled "*Project to Remove the Neosho River Logjam at the Entrance to John Redmond Reservoir*" has been subsequently distributed to State legislators and Congressional interests, who have in turn referred the paper to the Corps for the information it contains. The paper provides valuable information on the history and current condition of the logjam. The paper is attached (Enclosure 3) because of its wide distribution. No company endorsement is implied.

One statement in the paper requires comment. Page 3 contains the following wording: "In the case of the raft above John Redmond Reservoir, the immediate removal of the logjam can prevent the destruction of the present national wildlife refuge and the flooding of the village of Jacobs Creek." The implication of refuge destruction and future flooding of lands other than those lands acquired for operation of the Reservoir as a result of the current logjam or a reasonable forecast of future logjam conditions appears to lack substantiating analysis.

Forecast Future Conditions Without Logjam Removal (the No Action Plan)

All assumptions presented in this report are based on professional judgment having assessed the information described herein.

The forecast conditions assuming "no action" form a baseline from which to compare potential solutions. The potential solutions are the action plans.

Discussions with local interests and government have identified a concern that the current logjam will "grow" upstream toward Hartford and possibly impact river access via the Hartford boat ramp. A concern has also been expressed that the backwater effect of the logjam, even now, may be causing flooding problems as far away as Emporia. The potential for the logjam to extend upstream of its current location is dependent on rainfall, runoff, and stream flow (for which significant amounts of data and predictive models exist) as well as future ice storms and other factors that would produce woody materials for expansions of the logjam (for which relatively little information exists to predict future conditions). Currently, the logjam blocks a portion of the Neosho River channel. In that configuration, there appears to be sufficient floodplain available to convey "normal" and flood flows without causing flooding upstream of Corps lands.

The logjam that occurred in 2004 is the only recorded event of such a magnitude at the Reservoir since it was impounded 40 years ago. The 2004 logjam is roughly four times larger than any previous logjam. Based on the limited data available, there is an opportunity for the logjams to grow in length. However, a lack of data and information about the interrelationship of riparian agricultural practices, riparian forestry, and basin hydrologic and meteorological parameters prevents a definitive conclusion concerning growth of the current logjam. In addition, when considering a future projection of conditions, the issues of "natural" processes of logjam decomposition and (new) channel migration compound the difficulties in forecasting conditions. The lower end of the "plug" that formed in the late 1980's or early 1990's is decomposing and has partially cleared. Also a "compression" of the upper end of the logjam that

a new Neosho River channel is formed. Flow that cannot pass through the logjam will utilize the floodplain area. Flow will follow the path of lowest resistance in its downhill route to the Reservoir.

- The logjam and resulting overland flow (versus in-channel flow) would tend to increase the elevation of stream flows upstream of the logjam (backwater effects). If the logjam were to migrate several miles upstream (for example, another 10 miles or so), an assessment of the risk of backwater effects may be necessary. Under that set of conditions, backwater effects might eventually exceed the boundaries of lands acquired for operation of the Reservoir. (Note that the flowage easements were acquired at elevation 1075, over 30 feet higher than the Conservation Pool with the proposed (2nd) storage reallocation.)
- A continued loss of the Jacobs Creek Landing ramp access to the Neosho River would relate to:
 - A potential reduction in Jacobs Creek Landing property values.
 - A reduction in local fishing and an associated local economic impact.
 - A regional reduction of fishing and an associated regional economic impact.

In this report, the three following parameters are assumed factors that should also be considered in forecasting future conditions in the absence of large scale Federal or State action to deal with the logjam:

- There will likely be a third conservation pool elevation increase from flood control storage to water supply storage.
- Unmet needs for boat ramp access to the River will be met, in part, through improvement or development of other access points.
- Sedimentation of the Neosho River and John Redmond Reservoir will continue to impact various natural, recreation, and economic resources.

Because of the large height of the flood control pool (about 30 feet) and the associated project design, hydrologic modeling, and real estate acquisition, there is no reasonable expectation of a logjam causing flooding outside of project lands.

Storage Reallocations

The first storage reallocation was implemented in 1976/1977 to make an equitable redistribution of the storage remaining between the flood control pool and the conservation pool due to uneven sediment distribution. The conservation pool was raised from elevation 1036 to 1039 to increase the water supply storage. Prior to that reallocation, sediment had been collecting mainly in the conservation pool, thereby reducing the conservation pool storage faster than was predicted.

The second storage reallocation study is underway and is scheduled to be completed early in 2005. The need for the second reallocation was the same as before – equitable redistribution of remaining storage.

A third and final storage reallocation is likely. Assuming the third storage reallocation is implemented within the next 50 years, the conservation pool would be at elevation 1043.

Fishing Access

The Eagle Creek or Hartford ramps are assumed to provide the most viable locations for fishing access. The Eagle Creek ramp currently only provides access to Eagle Creek fishing due to the recently formed logjam at the mouth of Eagle Creek. The permanency of the Eagle Creek logjam is unknown. The Hartford ramp only provides access to the Neosho River. In the absence of large-scale debris removal, channel clearing, pilot channel, property buyout, or other major action, it is assumed that one or both of these ramps will be improved to partially offset river fishing access lost at the Jacobs Creek Landing ramp.

Improvement of the ramps (or other facilities) at one or both of these locations presumes that the more catastrophic projections by local residents of logjam expansion will not occur. If the logjam on the Neosho River were to extend another mile upstream of its current terminus, it would also block the Eagle Creek confluence, thereby limiting fishing from the Eagle Creek ramp to only Eagle Creek. If the Neosho River logjam were to extend at least 8 miles upstream of its current location, both the Eagle Creek confluence to the Neosho River and the Hartford community ramp to the Neosho River would be blocked. In that event, the next most likely access point would be upstream at Neosho Rapids. No public access is currently provided at Neosho Rapids.

Institutional Support

The Corps supports the Kansas Water Office in the application of the State's Watershed Restoration and Protection Strategy (WRAPS), watershed planning, and riparian forestry management to reduce the risk of conditions that developed between 2002 through 2004 that resulted in the 2004 Neosho River logjam.

The WRAPS program has been discussed by various State agencies as an approach to reduce the risks of logjams occurring in the future at any location along Kansas's streams. The WRAPS program would not address the existing logjam at John Redmond Reservoir, but it could reduce future maintenance costs for either the no-action plan or any of the action alternatives that might be implemented by reducing the amount of woody debris that would be transported down the Neosho River. Information about the strategy is contained in Enclosure 4.

The following excerpt is extracted from the Kansas Water Office website:

[http://www.kwo.org/KWP/Rpt_Watershed Res Protection WISP Summary 060704 kf.pdf](http://www.kwo.org/KWP/Rpt_Watershed_Res_Protection_WISP_Summary_060704_kf.pdf)

The Watershed Restoration and Protection Strategy approach is intended to provide a framework to: 1) provide a means of engaging all stakeholders of a watershed in a

collaborative process of identifying watershed restoration and protection needs, establishing management goals and, selecting a cost effective plan to achieve the goals; and 2) provide a report that documents the decisions of the watershed stakeholder team concerning goals, the action plan, and the resources required to execute the action plan.

Description and Assessment of Potential Solutions (In Contrast to Forecast Future Conditions Without Logjam Removal)

These are the action plans (or solutions) considered for implementation. They are described in qualitative terms and are generally compared to the no action plan. Occasionally, comparisons are made between solutions to highlight specific features or differences. In the following discussion, “maintenance measures” are considered to be near-term solutions that are within the operational authority of the project. The discussion of “alternatives” refers to long-term solutions that would require study under the reconnaissance/feasibility GI process or Section 1135 authority. The study and implementation of alternatives would require a cost sharing sponsor.

Four near-term maintenance measures are discussed. These measures are considered to be within the operational authority of the Corps. Minimal assessment is discussed with respect to the availability of funding, operational priorities, economic feasibility, or long-term viability. It is assumed that these are short-term responses and could be revised or stopped based on future conditions, management decisions, or the lack of funding due to budgetary limitations. Any maintenance measure’s future funding would be subject to national priority ranking based on performance based budgeting.

Maintenance Measure 1. Remove the logjam in the vicinity of the Jacobs Creek Landing boat ramp. This ramp has a long history of access, and the Neosho River is a significantly larger area in which to fish than is available at Eagle Creek (the temporary access point). The cost of removing debris in the immediate vicinity of the boat ramp would be relatively low. However, there is an unquantifiable risk of failure in that additional accumulations of debris next spring (or subsequent years) could close the ramp again. If the ramp were then abandoned, the cost of debris removal would have provided minimal benefit. If the decision were to continue debris removal, the overall cost of maintaining the ramp would include periodic debris removal.

If another large accumulation of debris does not occur, this measure could provide social and economic benefits. Environmental issues are modest, if measurable, for implementation of this measure. Monitoring the accumulation of debris through the spring of 2005 before implementing this measure would provide a small insight into its viability.

Maintenance Measure 2. Remove the logjam at the mouth of Eagle Creek and construct a permanent access road and boat ramp on Eagle Creek. Constructing permanent facilities on Eagle Creek and providing access to the Neosho River through debris removal and dredging of the sediment accumulation would have a higher initial cost, but would have a lower associated risk of failure in the event of large future debris flows. The length of the current

Neosho River logjam would have to increase by another mile before impacting Eagle Creek access to the Neosho River. This is believed to be the first time a logjam on Eagle Creek has blocked access to the Neosho River. Environmental issues would be greater with this measure due to the need for sediment removal and disposal from the mouth of Eagle Creek. The proximity of Eagle Creek to the Jacobs Creek Landing community would, in part, tend to mitigate potential social and economic impacts due to the loss of the Jacobs Creek boat ramp.

Maintenance Measure 3. Construct a permanent boat ramp on the Neosho River at Neosho Rapids. Constructing an access point at Neosho Rapids would provide a reduced risk of failure due to large debris accumulations. The current Neosho River logjam would have to fill another 8 miles or more of the Neosho River before reaching Neosho Rapids. The cost and environmental impact of a new boat ramp would be relatively low. The potential impacts to the Jacobs Creek Landing community from the loss of the Jacobs Creek boat ramp would not be mitigated by a new ramp at Neosho Rapids. A social and economic benefit would be expected for the community of Neosho Rapids.

Maintenance Measure 4. Develop and implement a long-term Neosho River debris and sediment removal plan. Removal of debris and sediment at the lower end of the logjam would occur annually. Adaptive management would allow the development of long term forecasts for ultimate removal of the logjam. Implementing removal of the logjam over a longer period of time would reduce the risks of sediment loads impacting the water supply storage; disturbance of the Refuge, including migratory bird habitat and hunting; exceeding total maximum daily loads of contaminants in the Neosho River in Kansas and Oklahoma; and would provide opportunities to minimize overall funding as site specific knowledge of best management practices is gained. The overall environmental impacts would be higher than the other near-term measures because of the large scope of logjam removal. Economic and social impacts of the 2004 loss of the Jacobs Creek Landing boat ramp would not diminish significantly until the long-term plan was completed. The plan is could begin in the near term, but would span about 20 years. This measure would require a significant increase in O&M funding.

Below are discussions of eight long-term alternatives. Current authorities for new-start civil works projects would require detailed study and implementation cost sharing. The assessment of the approach consists of the following post-completion conditions.

Alternative 1. Clear the Neosho River logjam in the vicinity of the Jacobs Creek boat ramp to a location downstream on the Neosho River (for example, 200 yards downstream). To provide a temporary storage area for future debris while minimizing the initial costs of removal, allow a new River channel to form. (This alternative differs from Management Measure 1 by over excavating the existing logjam and providing a long-term plan of maintenance that would ensure that the ramp provides access to the River for a planning horizon of about 50 years). The assessment of this alternative consists of the following post-completion conditions:

- The Jacobs Creek ramp would be accessible for river fishing with conditions similar to those of about the past 15 years. Future woody debris would continue to collect and would require removal. As debris accumulates in the temporary storage area, it would

be removed on an as-needed basis. The need to budget for funding to maintain ramp access on a 1 or 2 out-year budget would be a factor in determining the size of the temporary storage area in the River.

- The Reservoir would not be accessible in the near term and might not be accessible in the future. Over time, a channel is anticipated to form to convey River flows around the logjam. It is expected that as a new channel forms, the current Neosho channel will be cutoff from low flows and will eventually fill with sediment, the woody debris will decompose, and the old channel will convert to terrestrial habitat.
- As-needed log clearing maintenance would be required at the boat ramp location, perhaps annually. There is a risk of occasional periods of ramp closure if large debris accumulations occurred as in the spring of 2004.
- Deadwood removal would require a disposal process, either by chipping, burning, or decomposition, and would require a disposal area. The disposal area options are on refuge lands or on lands to be acquired. Refuge lands are an attractive option due to the proximity to the debris removal location, but disposal within the Refuge would impact habitat wildlife and possibly recreation activities.
- Hunting access to the Refuge from the Jacobs Creek location would be dependent on floodplain overflow conditions downstream of the Jacobs Creek boat ramp and potential backwater conditions that may cause floodplain overflow upstream of the ramp.
- This relatively small scope of action would have a relatively low initial cost of implementation.
- Similar to the cost of implementation, there would be (assumed) a relatively low annual maintenance cost.
- Dependent on the area used for debris disposal, there could be a low level of impact to the Refuge or to the overall environment. However, maintenance activities would include long-term, low-level recurring impacts as additional debris was removed from the River and placed in the disposal area.
- This approach includes a risk of occasional significant accumulation of debris that could temporarily block fishing access before removal could be completed. Funding and a 2-year budget cycle for the Corps of Engineers could result in delays of 1 to 3 years before removal could be completed.
- This approach affords an opportunity for a new channel to form, thereby providing lake access at some future date. As the channel forms, a significant number of live trees would need to be removed from the new channel banks to minimize the risk of more costly removal as they fell into the newly forming channel.
- This alternative has an associated risk that any future channel will also become temporarily impassible due to new logjams. Until the new channel geometry is sufficient to carry large debris, there would be a high risk of new logjams forming.
- This approach relates only to the symptoms of the boat ramp problem and excludes the causes of the problem in the upstream watershed or downstream in-lake sedimentation. This approach would not address the mudflat in the upper end of the lake.
- The effort and expenditures for management is likely to vary from year to year until the new channel becomes relatively stable. Until then, estimating annual maintenance for budgetary purposes will be speculative, especially for maintenance of the new channel for tree removal along the bank and newly forming logjams.

- The potential local social acceptability is assumed to be low to moderate by only providing a return to River fishing access conditions similar to about the past 15 years, but no assurance of Reservoir access from the River. That assumption is supported by the alternative's component to ensure future River access through maintenance of the Jacobs Creek Landing. There is also a lesser potential for future Reservoir access along the naturally formed channel. The potential effect of this alternative on the local economy and Jacobs Creek real estate prices would be a moderate stabilizing influence.
- Regional social acceptability is assumed to be low to moderate. Access would be limited to the River only, in the near term. Visitors traveling to fish and boat may be inclined to use lake access instead of competing for parking space and a more limited area in which to fish in the Neosho River.
- The potential for economic justification and overall Federal interest would be low. Costs significantly exceed social and economic impacts of no action. The potential exists for a low level of environmental impact and associated mitigation costs. Formation of a new Neosho River channel would tend to support white bass runs to the Neosho River, but there appears to be a moderate risk of failure in the absence of a stable channel and a dredged opening through the in-lake mud flat. Other in-lake issues would also influence white bass.
- The ability to construct the alternative would be high due to the small scope, cost, and environmental impacts.
- Environmental sustainability would be moderate due to recurring maintenance and associated low-level environmental impacts. The formation of a new channel would tend to aid fish passage between the Reservoir and the River. The aquatic connection would provide an opportunity to support annual white bass runs. However, the potential for success of a newly and "naturally" formed channel capable of facilitating annual white bass runs is judged to be poor.

Alternative 2. Excavate a pilot channel to the Reservoir avoiding the logjam. Extend the pilot channel through the in-lake mudflat by dredging. Leave the balance of the logjam in place and abandon the Jacobs Creek boat ramp (suggested by some residents). The pilot channel alignment would be chosen to minimize the risk of logjams and facilitate easier maintenance access. Geomorphologic conditions would be assessed for the design of a stable channel, also for minimizing maintenance. The assessment of the approach consists of the following post-completion conditions:

- The Jacobs Creek boat ramp would be permanently closed. The local economy and real estate prices would be dependent on improvements of other River and Reservoir facilities for hunting and fishing. It is likely that the Jacobs Creek Landing real estate values would be lower than the pre-2004 logjam conditions.
- River access to the Reservoir would not be possible in the near term and may not be possible in the future. The time required for a new stable channel to form is unknown. In the interim, white bass runs would be expected to be sporadic, thereby impacting the local economy and fishing success.
- As-needed log clearing maintenance would be required at the boat ramp location and along the pilot channel, perhaps annually.

- Deadwood removal requires disposal, either by chipping, burning, or storage for decomposition.
- Creation of a pilot channel would require overland or barge equipment movement, live tree removal along the pilot channel location, and soil and tree disposal areas.
- Hunting access to the Refuge from the Jacobs Creek location would be dependent on the amount of floodplain overflow downstream of the Jacobs Creek boat ramp and potential backwater conditions that may cause floodplain overflow upstream of the ramp. Floodplain overflow would potentially diminish as the pilot channel formed a stable Neosho River channel.
- The approach would have moderate initial costs of implementation. The pilot channel would include an additional cost over the previous alternative as would dredging through the mud flat in the upper end of the Reservoir.
- Moderate annual maintenance costs would be incurred to remove debris in and along the Neosho River to provide unobstructed river flow to the Reservoir and to avoid the formation of a new logjam.
- There would be a moderate level of impact to the Refuge or to the overall environment. Maintenance activities would include long-term, moderate-level recurring impacts due to debris and sediment removal in the River and the mudflat area of the Reservoir.
- This approach includes a risk of occasional significant accumulation of debris that could temporarily block fishing access at the Jacobs Creek Landing boat ramp before debris removal could be completed.
- This approach includes an opportunity that a stable channel will form along the pilot channel, thereby providing lake access at a future date. The approach also suggests that backwater effects caused by the current logjam will be reduced as the pilot channel forms a stable Neosho River channel. There is an opportunity that backwater effects of the current logjam may be eliminated as a stable channel forms.
- The alternative poses a risk that any future channel will also become impassible due to new logjams. Maintenance would include periodic removal of significant accumulations of debris and sediment in the channel. However, temporary logjams may close the pilot channel to fish or fishing access between the Reservoir and the River.
- The approach relates only to the symptoms of the boat ramp problem and potential backwater conditions of debris in the Neosho River. It excludes the causes of the problem in the upstream watershed and only partially addresses the downstream in-lake sedimentation by maintaining a clear flow passage through the mudflat. Ultimately, sedimentation of the Reservoir will prompt consideration of another storage reallocation from flood control storage to water supply. That third reallocation would be the final operational modification available due to the physical geometry of the embankment and reservoir basin. Maintaining regional surface water supply storage far into the future would require:
 - significant structural modification to the Reservoir embankment and reservoir perimeter,
 - storage restoration through dredging, or
 - construction of a new reservoir.
- Local social acceptability of the alternative would be low due to the permanent loss of the Jacobs Creek Landing. Access to the Reservoir would not be assured from the

River. The primary purpose of the pilot channel would be for “normal flow” conveyance of river flows. The pilot channel would be maintained through the removal of debris and sediment. Fish movement between the Reservoir and the River may occur at times when flow is sufficient. The connectivity between Reservoir and River is expected to improve as the pilot channel forms a stable channel capable of conveying “normal” river flows. Improvement of an alternate River access ramp would likely be included in this alternative. Those ramp improvement costs are considered to be negligible when compared to the pilot channel construction and maintenance costs.

- Regional social acceptability is assumed to be low to moderate. Access would be limited to the River only, in the near term. Visitors traveling to fish and boat may be inclined to use lake access instead of competing for parking space and a more limited area in which to fish in the Neosho River.
- The potential for economic justification and overall Federal interest would be low. Costs significantly exceed the social and economic impacts of no action.
- Constructability would be high due to moderate scope, cost, and impacts. Construction and maintenance would utilize standard techniques.
- Environmental sustainability would be moderate due to recurring maintenance and associated moderate environmental impacts. The eventual formation of a new channel would tend to aid fish passage between the Reservoir and the River. The restored fish passage would provide the opportunity to restore annual white bass runs, which in turn would measurably improve the local economy.

Alternative 3. Clear the Jacobs Creek Landing ramp and downstream reach and create a pilot channel into the lake; dredge through the in-lake mudflat but leave the balance of the logjam in place. The pilot channel alignment would be chosen to minimize the risk of logjams and facilitate easier maintenance access.

Geomorphologic conditions would be assessed for the design of a stable channel, also for minimizing maintenance. The assessment consists of:

- The Jacobs Creek ramp would be accessible for River fishing.
- The Reservoir would be not accessible in the near term and may not be accessible in the future.
- As-needed debris clearing maintenance would be required at the boat ramp location and along the pilot channel, perhaps annually.
- Deadwood removal requires disposal by chipping, burning, or storage for decomposition.
- Creation of a pilot channel would require overland equipment movement, live tree removal along the pilot channel location, and soil and tree disposal areas.
- Hunting access to the Refuge from the Jacobs Creek location would be dependent on floodplain overflow downstream of the Jacobs Creek boat ramp and potential backwater conditions that may cause floodplain overflow upstream of the ramp.
- This alternative would have a moderate initial cost of implementation.
- This alternative would have a moderate annual maintenance cost to remove debris in and along the Neosho River to provide unobstructed river flow to the Reservoir.
- A moderate level of impact would occur on the Refuge environment, and maintenance activities would include long-term, moderate-level recurring impacts.

- The approach includes a risk of occasional significant accumulation of debris that could temporarily block fishing access at the boat ramp before removal could be completed.
- The approach includes an opportunity that a stable channel will form along the pilot channel, thereby potentially providing lake access at a future date. Implementation of this alternative also suggests that backwater effects caused by the logjam restriction will be reduced by the pilot channel and essentially eliminated as a stable channel forms.
- This alternative includes a risk that any future channel will also become impassible due to new logjams. Maintenance would include periodic removal of significant accumulations of debris.
- The approach relates only to the symptoms of the boat ramp problem and potential backwater conditions of debris in the Neosho River. It excludes the causes of the problem in the upstream watershed and only partially includes downstream in-lake sedimentation by clearing and maintaining a channel through the in-lake mud flat.
- Potential local social acceptability would be expected to be moderate by providing a return to Neosho River fishing accessing conditions similar to about the past 15 years and by ensuring future access through maintenance. Access to the Reservoir would not be assured. The primary purpose of the pilot channel would be for “normal flow” conveyance of river flows. The pilot channel would be maintained for flow, and debris would be removed.
- Regional social acceptability would be expected to be low to moderate.
- The potential for economic justification and overall Federal interest would be low. Costs significantly exceed social and economic impacts of no action.
- The effort to construct the alternative would be moderate due to moderate scope, cost, and impacts. Construction and maintenance would utilize standard techniques.
- Environmental sustainability would be moderate due to recurring maintenance and associated moderate environmental impacts. The eventual formation of a new channel would tend to aid fish passage between the Reservoir and the River. The restored fish passage would provide the opportunity to restore annual white bass runs and improve the local economy and fishing success.

Alternative 4. Clear the logjam from the existing Neosho River channel and dredge through the in-lake mudflat. The assessment of the approach consists of the following:

- The Jacobs Creek boat ramp would be accessible for river fishing.
- The John Redmond Reservoir would be accessible for fishing and other lake recreation from access points along the Neosho River upstream of the reservoir.
- As needed log clearing maintenance would be required along the Neosho River within the Federal reservoir lands, perhaps annually.
- Deadwood removal requires disposal by chipping, burning, or storage for decomposition. Removal of the current logjam would initially generate about 100,000 cubic yards of woody debris (enough debris to cover 10 acres about 6 feet deep). Future debris removal would require additional storage space as the initial deadwood was processed, dried and burned, or decomposed.

- Restoring the Neosho River channel would require sediment removal within the river channel, channel alignment, and dredging within John Redmond Reservoir where a mud flat has formed. Disposal of about 1 million cubic yards of material would be required. A dredged material disposal area would be required to drain and dry the sediments for reuse as Refuge habitat.
- Hunting access to the Refuge from the Jacobs Creek location would return to near pre-logjam conditions but would be dependent on storage reallocation pool elevations and seasonal pool plan elevations.
- High initial cost of implementation.
- High annual maintenance cost.
- High level of impact to Refuge or overall environment, and maintenance activities would include long-term, high-level recurring impacts during restoration of storage, but would be moderate during maintenance of that storage.
- Low risk of occasional significant accumulation of debris that could temporarily block fishing access at the boat ramp before removal could be completed and in the pilot channel.
- No risk that the Neosho River will become impassible due to new logjams.
- The approach relates to the symptoms of the boat ramp problem but excludes the causes of the problem in the upstream watershed; the approach fully addresses the downstream in-lake sedimentation.
- Potential local acceptability would be high by providing a return to fishing access conditions similar to about the past 15 years in the Neosho River and by ensuring reservoir access.
- Regional social acceptability would be expected to be moderate to high.
- Continued sediment excavation within the Neosho River and at the mud flat location would act to slow the accumulation of sediment in the reservoir, thereby prolonging the resource availability of water supply storage.
- Potential for economic justification and overall Federal interest would be low. Costs significantly exceed social and economic impacts of no action.
- Constructability would be moderate although scope, cost, and impacts are large. Construction and maintenance would utilize standard techniques.
- Environmental sustainability would be low due to recurring river and lake maintenance and associated high environmental impacts. However, maintaining a more effective aquatic connectivity between the Reservoir and upstream River through dredging would a positive environmental component. Also, by providing a small increase in conservation storage (through mud flat dredging), the approach would provide additional aquatic habitat volume. The quality of the additional habitat that would be restored is not addressed in this report.

Alternative 5. Clear roughly one half the width of the existing logjam by stacking the removed debris on top of the remaining debris in the channel, dredging through the in-lake mudflat, and initiating an annual dredging program to maintain the river channel. This alternative assumes that the stacked debris would be relatively stable and would not be redistributed during flooding conditions. The assessment of the approach consists of the following:

- The Jacobs Creek boat ramp would be accessible for River fishing.
- The John Redmond Reservoir would be accessible for fishing and other lake recreation from access points along the Neosho River upstream of the reservoir.
- As-needed log clearing maintenance would be required along the Neosho River within the Federal reservoir lands, perhaps annually.
- Future debris would be placed on the remaining channel debris or immediately landward on the channel bank.
- Restoring the Neosho River channel would require sediment removal within the river channel, channel alignment, and dredging within John Redmond Reservoir where a mud flat has formed. Disposal of about 300,000 to 500,000 cubic yards of material would be required. A dredged material disposal area would be required to drain and dry the sediments for reuse as Refuge habitat.
- Hunting access to the Refuge from the Jacobs Creek location would return to near pre-logjam conditions but would be dependent on storage reallocation pool elevations and seasonal pool plan elevations.
- High initial cost of implementation.
- High annual maintenance cost.
- Moderate level of impact to Refuge or overall environment, and maintenance activities would be long term.
- Moderate risk of occasional significant accumulation of debris that could temporarily block fishing access at the boat ramp before removal could be completed and in the partially restored Neosho River channel.
- Moderate to high risk that the Neosho River will become impassible due to new shifting debris along the channel caused by high river flows or reservoir pool elevations.
- The approach relates to the symptoms of the boat ramp problem but excludes the causes of the problem in the upstream watershed; the approach does not address downstream in-lake sedimentation, except for dredging the in-lake mud flat.
- Potential local and regional social acceptability would be high by providing a return to fishing access conditions similar to about the past 15 years in the Neosho River and by ensuring access between the Reservoir and the River.
- Continued sediment excavation within the Neosho River and at the mud flat location would act to slow the accumulation of sediment in the reservoir, thereby prolonging the resource availability of water supply storage.
- Potential for economic justification and overall Federal interest would be low. Costs significantly exceed social and economic impacts of no action.
- The effort required to construct the alternative would be moderate although scope, cost, and impacts are moderate to large. Construction and maintenance would utilize standard techniques.
- Environmental sustainability would be better than Alternative 3 due to a reduced level of River maintenance and associated environmental impacts. However, maintaining a more effective aquatic connectivity between the Reservoir and River through dredging would be a positive environmental component. Also, by providing a small increase in conservation storage (through the mud flat dredging), the approach would provide additional aquatic habitat volume. The quality of the additional habitat that would be restored is not addressed in this report.

Alternative 6. Clear the logjam from within the existing Neosho River channel through the in-lake mudflat and initiate a long-term program of dredging to both maintain the river channel and revitalize the reservoir's water resources. The assessment of the approach consists of the following:

- The Jacobs Creek boat ramp would be accessible for River and Reservoir fishing.
- The John Redmond Reservoir would be accessible for fishing and other lake recreation from access points along the Neosho River upstream of the reservoir.
- The Reservoir sediment accumulation would be removed over a planned long-term period of dredging and storage maintenance; for example, 5% per year.
- As-needed log clearing maintenance would be required along the Neosho River within the Federal reservoir lands, perhaps annually.
- Deadwood removal requires disposal by chipping, burning, or storage for decomposition. Removal of the current logjam would initially generate about 100,000 cubic yards of woody debris (enough debris to cover 10 acres about 6 feet deep). Future debris removal would require additional storage space as the initial deadwood was processed, dried and burned, or decomposed.
- The approach would restore the Neosho River channel through sediment removal, restore the River to Reservoir transition by removal of the in-lake mud flat, and revitalize the reservoir resources through long term sediment removal within the lake. Reservoir dredging would generate about 8,700 acre-feet of silts (enough sediment to cover one square mile about 15 feet deep). Large dredged material disposal areas would be required to drain and dry the sediments. There are opportunities to utilize the material for development of Refuge habitat such as duck ponds, sediment traps, wetland areas, and other habitat features.
- Hunting access to the Refuge from the Jacobs Creek location would return to pre-logjam conditions but would be dependent on storage reallocation pool elevations and seasonal pool plan elevations.
- This alternative would have the highest initial cost of implementation. The long-term implications (100-years or greater) are generally beyond the scope of this report. Restoring the Reservoir's water supply and flood control storage and recreational and aquatic resources would provide long-term benefits to the region. The need for regional water supply could, in the future, force dredging of the Reservoir or construction of a new reservoir.
- This alternative would have the highest annual costs, both during restoration and following restoration when River and Reservoir maintenance continued to preserve the restored resources.
- This alternative would have the highest potential to negatively impact the Refuge or the overall environment due to the volume of dredged material. The alternative may also have the highest potential to positively benefit the Refuge and the overall environment by avoiding the construction of a replacement water supply reservoir and lowering the conservation pool. Maintenance activities would include long term, moderate to high-level recurring impacts.

- There would be a low risk of occasional significant accumulation of debris that could temporarily block fishing access at the boat ramp before removal could be completed and in the pilot channel.
- This alternative assures that a stable Neosho River channel will be maintained, thereby providing lake access. Backwater effects caused by the current logjam restriction would be eliminated.
- The approach relates to the symptoms of the boat ramp problem but excludes the causes of the problem in the upstream watershed. This is the only approach that fully addresses downstream in-lake sedimentation.
- Local and regional acceptability would be high by providing River fishing access, ensuring Reservoir access, and restoring Reservoir resources.
- Continued sediment excavation within the Neosho River and at the mud flat location would act to slow the accumulation of sediment in the reservoir, thereby perpetuating the storage resource availability for water supply.
- The potential for economic justification and overall Federal interest are beyond the scope of this report.
- The effort to construct the alternative would be moderate although scope, cost, and impacts are large. Construction and maintenance would utilize standard techniques.
- Environmental sustainability would be low due to recurring river and long term lake debris removal and dredging maintenance. The associated environmental impacts would be relatively high and recurring. However, without eventual dredging, the aquatic habitat in the Reservoir will continue to decline. Maintaining a more effective aquatic connection between the Reservoir and River would be a positive environmental component. By restoring conservation storage in the Reservoir, significant additional aquatic habitat volume and diversity would be restored. The quality of the additional habitat is not addressed in this report. Restoring conservation pool volume would tend to defer storage reallocation or reverse previous storage reallocations, thereby returning Refuge area covered by the higher conservations pool to terrestrial habitat.

Alternative 7. Offer voluntary buyout and relocation assistance for Jacobs Creek Landing property owners. The assessment of the approach consists of the following:

- This alternative would assume that the logjam caused significant negative impacts to the social and economic conditions at the Jacobs Creek Landing.
- Proposing this approach assumes that a buyout option is more economically attractive than other action alternatives.
- The environmental impacts of a buyout are minimal.
- Issues of fish movement between the Reservoir and River are not addressed.
- Issues of future water supply needs and Reservoir aquatic habitat are not addressed.
- Local social acceptability is expected to be mixed and assumed to be low overall.
- Regional acceptability is expected to be low because the logjam, fish spawning, and River access issues would not be addressed.
- Costs would be expected to be relatively low compared to the initial costs of dredging and the long-term costs of maintenance.
- The economic justification is reduced to a determination of the least costly acquisition and relocation alternative acceptable to the property owner or the Courts.

Alternative 8. Clear a 100-foot wide working area along the south bank of the River and use an excavator and other necessary equipment to remove the logjam from the channel and stockpile the debris along the working area for drying and later burning. The approach would also include dredging of the in-lake mudflat. (Suggested by the Flint Hills Wildlife Management Refuge.) The assessment of the approach would be similar to Alternative 4.

Preliminary Cost Estimates

The following cost estimates are limited in detail and are presented to facilitate a gross fiscal comparison of alternatives.

The dredging estimates were developed by calculating excavation quantities (whether woody debris, sediment, or excavation of wooded floodplain) times an average excavation and disposal cost of \$4 per cubic yard to form a construction cost. A total estimated cost was developed by including an estimate of formulation, NEPA documentation, engineering and design, and supervision and administration of contracts of 15% times the construction cost, plus contingencies of 25% times the construction cost.

The estimation of quantities is based on information presented herein and on limited field investigations. Quantities are simple rectangular channel estimates with no allowance for expansion, loss, or compaction of excavated materials. Overland haul distances are assumed to be less than 1 mile. Channel excavation is assumed to be accomplished by barge. Soil and sediment disposal for channel excavation is assumed to be placed adjacent to the channel for the purposes of a maintenance road and for the construction of Refuge features such as; wetlands or duck ponds. Woody debris disposal is assumed to be placed along the limits of the floodplain or beyond the floodplain, within the Refuge.

The boat ramp estimates were developed assuming minimal signage, access road, lighting, and parking – similar to existing facilities. A single lane concrete ramp and real estate are estimated based on John Redmond Reservoir ramp costs. No additional maintenance costs were estimated.

Timber clearing was estimated at \$10,000 per acre.

Annual channel maintenance costs are assumed to be \$25,000 per mile of maintained channel (rounded up to the nearest mile. All costs are rounded. Interest during construction was not estimated. The value of money over time for those plans with assumed 20 year implementation plans was not adjusted by the Federal discount rate.

The completion of annual maintenance is contingent on budget limitation and other Reservoir maintenance priorities that compete for available funds on a national level.