Overlap of Issues and Opportunities for the Locust Creek Watershed and the East Locust Creek Reservoir Project.

A review based on the North Central Missouri - Locust Creek Watershed Study - Final Report written by HDR Engineering Inc. on behalf of the U.S. Army Corps of Engineers, Kansas City District and the Missouri Department of Natural Resources (November 2013).

John Holmes, Allstate Consultants LLC.
June 12, 2014

Introduction

The purpose of the North Central Missouri - Locust Creek Watershed Study - Final Report (the study) was *"to provide watershed planning for purposes of identifying watershed problems and restoration opportunities. For restoration opportunities the study evaluates various conceptual restoration actions and alternatives; implementation strategies; and planning level cost estimates."*

The purpose of this paper is to provide a brief review of the above mentioned study from the perspective of the East Locust Creek Reservoir with the intent of finding where the goals, problems and opportunities of the East Locust Creek Reservoir Project overlap with the goals, problems and opportunities described in the study. The intent is to use this report as a guidance document for development of the ELCR project to help avoid missing any win-win opportunities with various partners within the watershed.

The study takes a broad based view of the 647 square mile Locust Creek Watershed in terms of identifying watershed problems and opportunities for watershed health improvements. The Proposed ELCR Reservoir Watershed makes up the upper 32 square miles of the 49 square mile Headwaters East Locust Creek (HELC) HUC-12 watershed (102801030601) which is also part of the Locust Creek Watershed.

This paper reviews the study in terms of direct impacts of and on the reservoir, leaving out any discussion of opportunities for mitigation of reservoir impacts within the watershed. This omission is due to the simple fact that any of the restoration opportunities described in the study are at this point in time considered possibilities for mitigation. When the time comes for mitigation design for the reservoir's impacts on the Waters of the United States, the study should be reviewed again for such opportunities.

The cover of the watershed study has the following statement. "*Pre-decisional, not for implementation or for public release until further determination and formal designation as such by USACE-KCD and MDNR. This work for preliminary planning purposes only.*" Accordingly, this review will be likewise limited in its distribution and authority. For the purposes of this white paper, we are interpreting this cover statement to indicate a policy decision (or an appropriate and necessary avoidance of a policy decision) rather than an indication of any technical shortcomings in this seemingly sound analysis. In any case, it is the most current and thorough discussion of watershed needs available. In our opinion, illumination of relevant issues and approaches for the ELCR project constitutes one of the best possible uses of this study, caveats notwithstanding.

Watershed Issues

Only one of the five broadly defined watershed issues that were identified in the study is expected to also be a significant direct problem for the East Locust Creek Reservoir (ELCR). That is "*Land use, particularly cattle overuse of woodlands and/or riparian buffer in the summer for shade, are likely contributing excessive sediments, through gully erosion, to receiving waters and transporting sediments downstream causing aggradation.*" (executive summary) This gully erosion concern (along with other contributing factors to gully erosion in the ELCR watershed) is one of the key issues identified for protection of lake water quality due to:

- The potential for excessive sediment and nutrients entering the reservoir.
- The large sediment loading it undoubtedly produces
- The issues it creates with regard to maintaining fence around the perimeter of the reservoir.

While the ELCR project can be expected to directly contribute to the solution of this watershed issue, it can also be expected to indirectly contribute to three of the other four watershed issues (executive summary) by reducing peak flows and sediment loading. These three are:

- *"Channel morphology on Locust Creek and tributaries above Pershing Park are still adjusting from past channelization and levee confinement. Channel bank and bed erosion resulting from high flow events help re-adjust channel morphology, but likely contributes to aggradation as (sic) negative side effect."*
  - The reservoir will reduce peak flows to some degree and will capture the sediment needed for aggradation.
- *"Levee confinements on Locust Creek and tributaries have reduced floodplain function as the ability to diminish energy during high flow events is lost. In addition, lost water and sediment storage capacity functions have resulted."*
  - The reduction of peak flows due to the reservoir will reduce the energy of high flow events, thus replacing this floodplain function to a small degree.
  - The sediment captured by the reservoir will help offset the loss of sediment storage capacity.
- *"Loss of floodwater drainage conveyance capacity from Hwy 36 fill embankment across the Locust Creek floodplain."*
  - Sediment deposition is one of the mechanisms by which conveyance capacity is being lost and the sediment captured by the reservoir will help reduce sediment delivery to the Hwy 36 fill area.

Primary Goals

The study produced a list of ten primary goals and tied them to specific areas within the watershed

Of the ten primary goals that were identified in the study, two are directly aligned with ELCR goals.

- *"1. WW – Reduce Sheet, Rill and Gully Erosion Runoff from Agricultural Land Uses"*
  - Erosion from agricultural (and other) uses is expected to be a significant challenge for the reservoir as it produces sediment and nutrients that will reduce the life span of the reservoir and lead to increased operation costs for maintenance of the lake and treatment of the drinking water supply.
- *"2. WW/LLC – Reduce Stream Bank Erosion and Bed Head Cutting"*
  - Head cutting in the gullies just upstream of the reservoir represents a significant challenge

in terms of maintaining fence around the reservoir and sediment and nutrient loading into the reservoir.

The reservoir is very likely to have a positive impact on three of the ten primary goals from the study.

- *"4. LLC/PSP – Restore LC Channel Conveyance and Reduce Flooding."*
  - While the impacts will be small due to the relative small size of the ELCR watershed compared to the Locust Creek watershed, ELCR will reduce sediment loading and flood peaks in the LLC and PSP, offsetting the need for additional capacity.
- *"5. PSP – Restore Floodwater Drainage Capacity/Sediment Transport Through Hwy 36"*
  - While the impacts will be small due to the relative small size of the ELCR watershed compared to the Locust Creek watershed at Hwy 36, ELCR will reduce sediment loading and flood peaks, offsetting the need for additional capacity.
- *"10. LLC/LGR - Restore Sediment Transport/Floodway Capacity at Constrictions"*
  - While the impacts will be small due to the relative small size of the ELCR watershed compared to the LGR watershed, ELCR will reduce sediment loading and flood peaks, offsetting the need for additional capacity.

Depending on how it is managed, the ELCR has the potential to have a positive impact on two of the ten primary goals.

- *"8. PSP – Recover and maintain water flow, aquatic diversity, and natural meandering character of LLC in PSP, especially in Locust Creek Natural Area."*
  - There may be potential for the ELCR to contribute to the recovery of water flow by allowing some control over reservoir release rates to provide flow when needed. Especially during periods of drought.
- *"9. PSP – Restore or Enhance Forests, Marshes and Wet Prairie."*
  - There may be potential for the ELCR to contribute to the recovery of Marshes by allowing some control over reservoir release rates to provide flow when needed. Especially during periods of drought.

In some cases, the ELCR could represent challenges to the ten goals. Reservoir design and management will need to consider impacts on three of the ten goals to minimize negative impacts.

- *"7. PSP – Reduce or Prevent Further Loss of Forests, Marshes and Wet Prairie and prevent further decline in overall vegetative species diversity in PSP."*
  - Reduction in flow at critical times could contribute to the loss of Marshes and species diversity.
- *"8. PSP – Recover and maintain water flow, aquatic diversity, and natural meandering character of LLC in PSP, especially in Locust Creek Natural Area."*
  - Reduction in flow and withdrawals for drinking water use could negatively impact the water flow and aquatic diversity.
- *"9. PSP – Restore or Enhance Forests, Marshes and Wet Prairie."*
  - Reduction in flow and withdrawals for drinking water use could negatively impact downstream marshes.

Watershed Actions and Practices

A number of watershed actions and practices were evaluated for feasibility and potential for achievement of watershed goals. These actions and practices are too numerous to discuss individually, but the study placed them into broad categories including the following which are relevant to this discussion. The detailed list of actions and practices that are relevant to ELCR are included in Appendix A.

- *"Soil and Water Best Management Practices Action"* (Page 48)
  - This category includes many sub-categories of practices which would be directly beneficial to the reservoir including *"Sheet and Rill/Gully Erosion BMPs", "Grazing Management BMPs", "Animal Waste Management BMPS", "Nutrient and Pest Management BMPs", "Sensitive Area BMPs"* and *"Woodland Erosion BMPs"*
  - **Notably, "*Water Impoundment Reservoir*" is listed as one of the "Sheet and Rill/Gully Erosion BMPs" (page 49). So, the ELCR itself can be considered a BMP.**
  - *NCMRWC should investigate opportunities to encourage these activities on private property in the ELCR watershed. Potential avenues include:*
    - *Engage in educational activities*
    - *Look for opportunities to increase available cost-share to encourage property owners to implement.*
  - NCMRWC should establish funding to implement some of these activities within the lake buffer.
  - See Appendix A for a list of the BMPs that are particularly relevant to the ELCR.

- *"Floodplain Restoration Action"*
  - The goals of this category of action are generally in the LLC watershed and are not common to the goals of ELCR.
  - The drainage improvement opportunities described in this category will be enhanced by the flood peak reduction provided by the ELCR.
  - The ELCR will act as a grade control to the benefit of the Locust Creek watershed.
- *"Stream Restoration"*
  - There is potential for overlap of goals, if stream restoration projects are needed upstream of the reservoir.
  - The ELCR will act as a grade control, which is one of the recommended actions in this category.
- *"Agency Partnerships and Programs"*
  - This category of action encourages partnering within the watershed, which will be of benefit to both ELCR and the watershed.
- *"Public Awareness and Education Action"*
  - The North Central Missouri Water Commission and the East Locust Creek Lake Authority understand the importance of public awareness for protection of lake water quality.
- *"Organizational Structure Establishment Action"*
  - This action *"consists of establishing a "watershed boundary" based organization to work on behalf of those PAIs living and working in the LCW to provide oversight, regulation and stewardship on a variety of natural resource issues, project funding, public awareness and education."*
  - This action would be of benefit to ELCR.

Action Alternatives

Five action alternatives were identified to provide an organized approach for improvement of the Locust Creek Watershed as a whole. While the selected alternative is of relevance, this review is focused on the entire suite of potential actions and practices so that any activity of value to ELCR can be identified.

Even though the recommended alternative shows construction of the ELCR as the only recommended action/practice for the Headwaters of East Locust Creek, consideration should be given to the following:

- The actions/practices that achieve the common goals of the Locust Creek Watershed and the ELCR should still be considered for implementation in the ELCR watershed due to their positive effects on ELCR including
  - Improved lake quality (recreational perspective)
  - Reduced drinking water treatment costs
  - Extended reservoir life
- Any such actions/practices that are implemented in the ELCR watershed should provide additional benefits to the Locust Creek Watershed.

Abbreviations

BMP - Best Management Practice
ELC - East Locust Creek
ELCR - East Locust Creek Reservoir
HELC - Headwaters East Locust Creek (a 12 digit HUC)
HUC - Hydrologic Unit Code
LCW - Locust Creek Watershed
LGR - Lower Grand River
LLC - Lower Locust Creek
MDNR - Missouri Department of Natural Resources
NCMRWC - North Central Missouri Regional Water Commission
PAI - Potential Affected Interestes
PSP - Pershing State Park
USACE-KCD - United States Army Corps of Engineers - Kansas City District
WW -Watershed Wide

Appendix A. BMPs of Potential Interest to the ELCR project.

The North Central Missouri Locust Creek Watershed Study Final Report provided many possible actions and practices that would be expected to encourage restoration of the watershed. Following is the list of these practices that are relevant to the East Locust Creek Reservoir.

★ Indicates actions/practices that score green in all categories except landowner perception in the report and at least blue in landowner perception.

▲ Indicates actions/practices that would be applicable within the lake buffer (as well as outside)

All other practices listed show some potential for watershed benefit and are generally applicable outside of the lake buffer.

Text in italics is taken directly from the study.

4.2.1.1 Sheet and Rill/Gully Erosion BMPs

★▲ ***Permanent Vegetative Cover Establishment -*** *Establish a permanent vegetative cover to stabilize soil on land that is experiencing significant erosion.*

★ ***Permanent Vegetative Cover Improvement -*** *Improve plant health and diversity by introducing legumes into established grass communities to protect soil on land that is experiencing significant erosion.*

★ ***Terrace System -*** *Reduce the erosive force of water by placing terraced embankments to slow water runoff and increase water absorption on crop land that is experiencing significant erosion.*

★ ***Terrace System with Tile -*** *Reduce erosion with the placement of embankments on slopes to reduce the slope length and use underground piping to more quickly remove erosive water to a stable outlet from tracts that have experienced significant erosion.*

No-Till System (Residue & Tillage Management) *This practice is an incentive payment to encourage farmers to use conservation no-till to reduce erosion on land that is experiencing significant erosion.*

Permanent Vegetative Cover – Critical Area - *Establish a permanent vegetative cover on small critical areas such as gullies and steep banks to reduce erosion and protect water quality.*

★▲ ***Water Impoundment Reservoir -*** *Control erosion and protect water quality by constructing ponds to catch sediment and prevent it from leaving fields on land that is experiencing significant active erosion.*

★▲ ***Sediment Retention Water Control Structure -*** *Temporarily retain water to control the release of runoff water and settle out the soil particles and nutrients. This practice is applicable to*

areas on farms where runoff of substantial amounts of sediment or runoff containing pesticides or fertilizers constitutes a significant pollution hazard.

Grade Stabilization - *Earthen dam and associated water control structures constructed to manage water flow gradients and resultant erosion.*

Grassed (Sod) Waterway - *Prevent or reduce existing erosion and pollution of water or land from agricultural nonpoint sources by using sod-forming grasses to protect soil within waterways to efficiently transport rainfall.*

Diversion - *Control erosion and reduce or prevent pollution of land, water or air from agricultural nonpoint sources by directing rainwater to less sloping areas of the landscape and allowing it to dissipate or run off at a lower velocity, which encourages infiltration into the soil.*

Contour Buffer Strips - *Reduce erosion and water pollution by establishing strips of permanent vegetative cover between crops, around hill slopes, and alternated downhill slopes.*

Contour Strip Cropping - *Reduce erosion and water pollution by implementing crop and vegetation rotations through systematic arrangements of equal-width strips across fields.*

Cover Crops - *A crop of legumes, winter killed species, grasses and/or certified cereal grains, when planted for purposes of benefiting soil and/or other crops, but is not intended for harvest for feed or sale. Benefits of covers crops include soil quality improvements, erosion control, fertility improvements, suppressing weeds, and insect control.*

Conservation Crop Rotation - *A small grain crop that is rotationally planted with forage grass or legume crops planted for purposes of managing soil fertility, soil tilth, organic matter, pest management, moisture efficiency, improving crop yields, and wildlife habitat.*

4.2.1.2 Grazing Management BMPs

★ ***Permanent Vegetative Cover Enhancement -*** *Improve the vegetative cover on pastures by introducing legumes into the grass base using notill technology. Improving the plant community health protects the soil by reducing erosion and preventing water pollution.*

★ ***Grazing System Water Development -*** *Develop water sources (ponds, springs or wells) for livestock watering that are generally strategically located to help efficiently manage grazing resources (water and grasses).*

★ ***Grazing System Water Distribution -*** *Develop water distribution, including pipeline and watering tanks/troughs, for grazing areas. By providing water distribution to individual grazing areas, livestock can more effectively utilize the resource. A planned grazing system includes water availability in each grazing area.*

★ ***Grazing System Fence -*** *A planned rotational grazing system allows time for vegetation to rest and recover before being grazed again. Fencing is used to allow livestock access to a small area to be grazed.*

Grazing System Lime - *Manage the pH of soil for optimum fertility. This is an important factor in how effectively plants can take in soil nutrients. Lime is the most cost effective method to manage soil pH.*

 ***Grazing System Seed -*** *Interseed legumes in an established grass pasture grazing system to improve plant health and diversity and protect soil from erosion.*

 ***Prescribed Grazing -*** *The paddock system is used as a means to manage the number of days of livestock grazing per paddock cell for purposes of improving soil health, through reduced soil compaction, and increased plant growth, through reduced plant recovery time after stressed from grazing.*

Heavy Use Protection - *Gravel and/or concrete in heavy use portions of grazing areas to manage soil erosion.*

4.2.1.3 Irrigation Management BMPs

No Irrigation Management BMPs are included because none of them are indicated as being effective at meeting the watershed goals. Some of them may have minor benefit to the reservoir and so they should be considered in special circumstances.

4.2.1.4 Animal Waste Management BMPs.

No Animal Waste Management BMPs are included because none of them were scored as financially feasible or as being effective at meeting the watershed goals. Some of them may have minor benefit to the reservoir and so they should be considered in special circumstances.

4.2.1.5 Nutrient and Pest Management BMPs

Nutrient Management - *There are economic and environmental benefits to following an approved nutrient management plan to improve soil fertility and crop production. Planning is based on soil or plant nutrient testing to ensure adequate fertility without excess nutrient runoff.*

Pest Management - *There are economic and environmental benefits of following an approved pest management program to reduce pressure from pest species and to improve crop yields or forage production with proper pesticide application. Planning is based on field scouting for weeds and* insects.

4.2.1.6 Sensitive Area BMPs

Field Border - *Establish permanent grass buffers along the edges of crop fields to trap pesticide and fertilizer runoff. This practice reduces soil loss and improves water quality by preventing excess sediment and nutrients from entering streams.*

 ***Filter Strip -*** *Establish permanent grass filter strips below crop, hay and grazing land; and to prevent sediments, chemicals or nutrients from entering sensitive areas or water bodies.*

 ***Riparian Forest Buffer -*** *Protect soil and shallow groundwater from contamination by sediments, chemicals, nutrients, pesticides or organic matter and protect stream banks from erosion by planting woody species along the stream course and protecting the buffer area from trampling and grazing.*

Stream Protection (Access Control) - *Exclude livestock from stream corridors to allow re-vegetation with grasses and trees on the streambank. This also provides a filter to trap sediments, chemicals and nutrients.*

Streambank Stabilization - *Large stones or anchored cedar trees are used as mechanical protection of highly eroded stream banks to provide a stable area to establish grasses or other vegetation to protect the soil and water resource from erosion losses and contamination.*

Well Decommissioning - *Abandoned wells present a direct connection to the groundwater aquifer as well as a safety hazard. Wells that are properly treated, filled and sealed eliminate the safety hazard and protect the groundwater resource from possible pollution.*

4.2.1.7 Woodland Erosion BMPs

Forest Plantation - *Protect the soil and encourage the conversion of marginal soils to less intensive use by planting trees and shrubs and excluding livestock.*

Woodland Protection through Livestock Exclusion (Access Control) - *Reduce erosion in existing woodlands by installing fence to exclude livestock.*

Use Exclusion (Access Control) - *Install fence around existing woodlands and sensitive areas to reduce erosion.*

Timber Harvest Plan - *This practice provides financial assistance for the proper design and construction of logging roads and stream crossings for timber harvest operations.*

4.2.3 Stream Restoration

Channel Grade Control - *This restoration practice consists of preventing the progression of stream bed erosion (head cutting) with channel grade control structures such as an engineered rock riffle (aka Newbury Riffle or Structure). This practice also helps reduce channel bank erosion, gully erosion, the loss of farmland soils, and helps prevent damages and loss to bridges, culverts and pipeline crossings. Channel grade control is fairly cost effective because it tends to be small in size and localized in use, and is generally acceptable to landowners, local government agencies, and the public. An example engineered rock riffle grade control is shown in Figures 23 and 24.*

Bank Stabilization -Stone Toe Protection - *This restoration practice consists of protecting or restoring eroding stream banks with rock riprap features along the toe of the bank with stone toe protection features. Two well established stone toe protection measures are Longitudinal Peak Stone Toe Protection (LPSTP) and Longitudinal Fill Stone Toe Protection (LFSTP). These measures also help stop channel bank erosion, the loss of soils, and can help prevent damages and losses to bridges, culverts and pipeline crossings. This practice is fairly cost effective, especially if combined with bioengineered features to minimize rock costs, and is generally acceptable to landowners, local government agencies, and the public. An example LFSTP constructed on the Grand River in Gentry County is shown in Figures 26 and 27.*

Bank Stabilization - Bioengineered Protection - *This restoration practice consists of protecting or restoring eroding stream banks with bank reconstruction that includes biological plant materials, natural and/or synthetic blanketing, or rock riprap features on the toe and slope of stream banks. Many types and combinations of bioengineered bank protection exist. This practice also helps stop channel bank erosion, the loss of soils, and loss of native riparian habitats. Bioengineered bank*

stabilization costs can vary. This practice is generally acceptable to landowners, local government agencies, and the public provided sufficient education occurs. A conceptual and constructed example of a bioengineered project is shown in Figures 29 and 30.

Riparian Buffer Restoration and Enhancement - *This restoration practice consists of restoring or enhancing grassland, shrub and/or wooded riparian buffer found along stream banks with native plant materials. This practice helps stop channel bank erosion, the loss of soils, and restores native riparian habitats.*

4.2.6 On-going Natural Resources Management - *This restoration action consists of on-going resource management practices that are necessary or desired in order to continue providing natural resources functions in the watershed. Current natural resource management practices include log jam removal and management on LC in PSP and at bridges and culverts throughout the watershed. Potential new natural resource management practices include invasive plant species management (prescribed burning, etc.) and native plantings for restoration purposes. Functional results of log jam management include restoring flows to pass sediments and reduced flooding issues. Functional results of invasive plants species management and native plantings are to restore native biological plant diversity key to supporting ecosystem health.*

4.2.7 Agency Partnerships and Programs - *This restoration action consists of partnering to share, build and expand upon technical and financial capacities and programs between natural resource agencies, county and city governments, and local non-government organizations (NGO's). Agency partnerships consists first and foremost working together towards meeting common goals and objectives in the watershed and, where possible, sharing administrative, technical and financial resources to implement projects to meet goals.*

4.2.8 Public Awareness and Education Action - *This restoration action consists of providing watershed public awareness and education to those living and working daily in the LCW, those being PAIs. This action involves sharing information on the LCW problems and opportunities at different forum or media types including stakeholder focus groups, community workshops, newsletters, demonstration projects. Future efforts for the LGCOA working group agency partnership is to work on reaching those PAIs.*

4.2.9 Organizational Structure Establishment Action - This restoration action consists of establishing a "watershed boundary" based organization to work on behalf of those PAIs living and working in the LCW to provide oversight, regulation and stewardship on a variety of natural resource issues, project funding, public awareness and education.