Wetland Restoration Project
Cedar Niles Future Park Site
Johnson County Park & Recreation District

Wood Ducks

Southern Leopard frog

Thomas R. Biebighauser
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Introduction

Opportunities for restoring wetlands to help the environment were identified on land owned by Johnson County Park & Recreation District (JCPRD) near Olathe, Kansas. Wetlands were designed to improve habitat for a diversity of animal and plant species, and to implement direction contained in the master plan for the Cedar Niles Future Park Site. The restored wetlands would be attractive to look at and be fascinating and safe places for children and adults to explore. Taking action to restore wetlands would also reduce flooding, improve water quality, and recharge groundwater.

Locations for restoring wetlands at the Cedar Niles Future Park Site were identified by Thomas R. Biebighauser, Dr. Eliodora Chamberlain (US EPA Region 7), Jeanne Christie (Association of State Wetland Managers), Jason Daniels (US EPA Region 7), Monte Fiegel (JCPRD), Matthew Garrett (JCPRD), Bill Maasen (JCPRD), Cliff Middleton (JCPRD), and Jeannette Schafer (US EPA Region 7) on October 20 & 22, 2014.

Wetlands would be built so they fill naturally from rainfall and snowmelt. No pumps, pipes, or diversions from streams would be used to maintain water or plants in the wetlands. The wetlands would attractive and function like natural wetlands.

Roads would not be built to access the wetland restoration sites. Existing roads and stream crossings would be used to move heavy equipment to worksites for construction. Soil removed to restore the wetlands would not be moved off site.

The wetland restoration projects were designed to accomplish the following objectives:

1. Implement a portion of the Master Plan for Cedar Niles Future Park
2. Provide habitat for uncommon frogs, toads, salamanders, and crustaceans
3. Improve habitat for wood ducks, great blue herons, and turtles
4. Increase wildlife viewing opportunities
5. Improve the beauty of the landscape
6. Provide exciting places for the public to explore
7. Increase opportunities for students to learn outdoors
8. Improve water quality
9. Replenish groundwater
10. Reduce flooding
11. Improve habitat for pollinators such as butterflies and bees
12. Strengthen partnerships with other agencies and volunteers
13. Provide a training opportunity for natural resource managers
14. Reduce mosquito numbers

Background

Over 48-percent of the wetlands in Kansas were lost to drainage from the 1780s to 1980s[1]. A majority of the natural wetlands in Johnson County have been historically modified or destroyed. Many of these wetlands were drained to improve land for farming. Wetlands were dried by digging deep and shallow ditches, and by installing buried drain lines made from wood, rock, clay, and plastic. Wetlands were also filled and leveled using soil.

Ditches, surface inlets, and drain line outlets can be observed in Johnson County. Many of the ditches that were dug were once natural streams that formed long and sinuous wetlands. The natural streams on level ground contained braided channels with numerous beaver ponds along their length. These natural streams were moved and channeled to dry land for crop production.

Many of the ditches that were dug years ago are eroding because of head-cuts that have formed in them. These head-cuts are causing a deepening and widening of the ditches, resulting in significant erosion. As the ditches erode they cause the elevation of groundwater to drop further below the surface, resulting in greater drainage of surrounding wetlands.

Problems associated with historic drainage activities continue today in Johnson County. Soil erosion along stream banks is common. Large trees growing in riparian areas are falling into the streams as stream banks collapse. The wetlands normally associated with floodplains have been filled with soil, increasing runoff. The modifications made to the landscape are not expected to heal over time without implementing the restoration practices identified in this report.

Johnson County supports wetland restoration. The County has recently completed two wetland projects, one at Shawnee Mission Park (http://www.olssonassociates.com/our-projects/shawnee-mission-lake/index.html), and another along the Blue River.

Purpose and need

The Master Plan for Cedar Niles Future Park shows wetlands being built near the confluence of Cedar and Little Cedar Creek, in the rapidly growing city of Olathe, only 25-minutes from Kansas City.

[1] Dahl, T.E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 21pp.

(http://jcprd.com/pages/img/08_Reike_Sunflwr_CedarNiles/Oct_08_CedarNiles_Mastrplan/08_oct_CedarNiles_North_Mastrplan_lg.pdf).

Restoring wetlands at Cedar Niles Future Park Site would have the following ecological benefits:

1. Improved water quality by filtering surface water runoff
2. Flood control and groundwater recharge
3. An increase in water storage on the landscape; which is especially important during drought periods
4. Improved habitat for rare plant species
5. Improved habitat for rare animal species such as the crawfish frog
6. A more scenic landscape
7. Increased opportunities to view wildlife

The wetlands would provide habitat for a diversity of animals and plants, and provide the public with interesting places to explore. Wetlands may be constructed at low cost at the Cedar Niles Future Park Site to control erosion, clean runoff, restore the elevation of groundwater, increase wildlife habitat, and improve wildlife viewing opportunities. Wetlands would also add to the beauty of the future park landscape.

Wetlands provide great opportunities for outdoor learning. Students can be taught science and mathematics by experiencing lessons firsthand. The wetlands would increase opportunities for outdoor recreation.

The successful techniques developed for restoring wetlands by the Center for Wetlands and Stream Restoration may be used to complete these wetland projects.[2] The restored wetlands would appear natural, and require little, if any maintenance. Heavy equipment would be used to control erosion, loosen compacted soil, restore the wetlands, and recharge groundwater.

Actions would be taken to control non-native invasive plants that are growing on the wetland restoration sites. These plants may be controlled prior to construction, or be removed by heavy equipment during construction and be buried in and near the new wetlands, providing control while sequestering carbon. Exposed soil would be seeded to wheat, native grasses, and wildflowers, and then covered with straw to reduce the potential for erosion and the colonization by non-native plants.

[2] Biebighauser, Thomas R., 2011. Wetland Restoration and Construction – A Technical Guide. The Wetland Trust, New York, 186pp.

Site Selection

Sites were selected that appeared to be drained and filled wetlands. The actions needed to restore wetlands at Cedar Niles Future Park Site were identified by using hand-held sampling tools. The current and historic elevation of groundwater at each site was determined by using a 48-inch long tile probe and a 48-inch long soil auger. The soil texture at each location was identified by using maps, a soil auger, and by using the ribbon test.

A construction level and clinometer was used to measure slope on each site. The perimeter of each work area was marked so that it had no more than a 2-percent slope, and changed 18-inches or less from upper to lower edge.

A GPS was used to record the location of each possible wetland project. Photographs were taken of each work area. Plastic ribbons were used to mark the perimeter of each possible wetland area. A detailed Wetland Design Form and a budget were prepared for each wetland restoration site.

Access

Heavy equipment would be used to restore wetlands described in this report. The routes that heavy equipment would use for access would be planned in advance, and marked using brightly colored plastic ribbons. The access routes would follow existing roads as much as possible. The heavy equipment would be taken across Cedar Creek using existing crossings. Shrubs and trees would not be cleared to create access. It would be difficult to find the access routes after the projects are completed. The heavy equipment contractor would be guided by Tom Biebighauser.

Project design

A primary objective of this project is to restore wetlands so they appear and function like natural wetlands. The following factors would be used to guide the restoration of each wetland project. The finished habitats would appear natural, benefit wildlife and plants, and require little, if any maintenance:

1. Streams would not be blocked or dammed. The risk of wetland failure is high when streams are dammed. One generally armors with rock or uses concrete to reinforce spillways of wetlands built by damming streams. Dams that cross streams are expensive to design and build. They also require extensive review and permitting, along with

regular inspections and maintenance. Wetlands that are built by damming a stream are often short lived and soon fill with sediment.

2. No above ground dams higher than 6-inches would be built to restore wetlands. Above ground dams with steep slopes require maintenance by regular mowing to prevent trees and shrubs from taking root and causing damage. Above ground dams must be inspected regularly for breaches and for damage caused by beaver and muskrat burrowing. In addition, building high dams requires extensive review and permitting.
3. Water control structures would not be used. Instead, wetlands would be designed and built to obtain desired hydro-periods. Water control structures often become points of failure in a wetland project. Beaver can block them and they can be vandalized. In addition, each water control structure can be expected to leak over time.
4. Any head-cuts that threaten wetlands would be controlled as part of each project. Head-cuts downstream from a site can advance into a wetland and cause failure, much like a drainage ditch. Head-cuts located upstream from a wetland project can erode, and fill the wetland with soil. Head-cuts would be controlled by installing buried vertical grade control structures. The vertical grade control structures would generally be made from rock that is at least 8-inches in diameter. They may also be made from large diameter trees under special circumstances. The structures would be buried across the floodplain, immediately upstream from each head-cut to be controlled. In addition, the banks on either side of the eroding ditches would be sloped to reduce sheer stresses, and to prevent water from going round the buried structure.
5. The restored wetlands would be supplied naturally with groundwater, and with surface water runoff. No pumps or wells would be used to supply the wetlands with water.
6. The slopes surrounding each restored wetland would generally be made gradual, averaging 5-percent or less.
7. The spillways constructed for each restored ephemeral and emergent wetland would be made to become wet-meadow wetlands. Buried vertical grade control structures would be added to spillways if needed to prevent erosional head-cuts from forming.
8. The soil removed for building wetlands would be spread on site and not hauled away. The size and shape of each wetland designed took in consideration the disposition of soil removed to build the wetland. The excess soil would always be placed so that it would not cause flooding of homes, buildings, roads, trails, and farm fields.
9. Some of the soil that is removed to build wetlands would be placed so that it would become saturated and form wet-meadow wetlands. This soil would not be compacted. The hydrology of the wet-meadows would be maintained by water flowing from the restored wetlands.
10. Much of the soil that is removed to build wetlands would be placed in naturally appearing ridges and mounds around the wetlands to be restored. This soil would provide sites for planting wildflowers, trees and shrubs. The wildflowers would provide great benefits to pollinators such as bees and butterflies. Planting the exposed soil

would be optional, as native species of plants are expected to colonize the site over time.

11. The soil removed from restoring the wetlands would not be compacted. The soil would be placed loosely so it would not erode, and would provide excellent conditions for supporting wildflowers, trees, and shrubs.
12. The area surrounding each proposed wetland site would be examined to make certain that rare species of plants or animals are not negatively affected by restoration activities.
13. Required permits would be obtained prior to construction.
14. Heavy equipment would be cleaned prior to construction to avoid introducing non-native plants to wetland restoration locations.
15. New roads or trails would not be built to access work sites. The heavy equipment would be "walked" carefully between trees and shrubs to each area. The machines would not disturb the ground with blades or buckets while accessing work sites. It would be difficult to see where the heavy equipment has traveled after the project is completed.
16. Desirable plants growing on each site would be carefully removed and, saved, and replanted following restoration activities. Heavy equipment would be generally used to accomplish this task.
17. Heavy equipment would be used to remove non-native vegetation, topsoil, and organics from each work site. The topsoil and organics would be saved for later spreading in and around the completed wetlands to further improve habitat for plants and animals.
18. Heavy equipment would be used to dig shallow depressions for each wetland. Excess soil would be spread near each work site and blended into the surroundings. The soil would be loosened and planted to native trees, shrubs and wildflowers for pollinators.
19. Below surface-groundwater dams would be constructed as needed to increase wetland success. The groundwater dams would not be visible and would help disable subsurface water flow in ditches, buried drainage structures, and thru permeable layers of sand and gravel.
20. Naturally appearing pit and mound topography would be formed in the wetlands to improve plant and animal diversity.
21. Large and small woody debris would be added to the wetlands to improve habitat for plants and animals.
22. Where possible ditches located along the base of hills would be reshaped to restore a sheet-pattern of water flow down the hillsides. Deep constructed diversion ditches would be filled. This would involve removing organic material from each ditch, placing mineral soil in the ditch, and compacting the mineral soil so that water would not follow the ditch underground. Topsoil, and woody debris would be placed over the filled ditch. The area surrounding each contoured ditch could be planted to native trees, shrubs, and wildflowers.
23. Areas of compacted soil would be loosened and may be planted to native trees, shrubs, and wildflowers. An excavator would be used to loosen compacted soils to a depth of

18-inches or more. The loosened soil would be rough graded with pits and mounds. Treated areas would absorb runoff and not erode. Wheat would be sown by hand on exposed soils for erosion control. Straw would be spread by hand for mulch to control erosion, and to provide conditions for plant germination and growth.

Amphibian habitat needs

These actions may be taken to restore the wetlands so they provide habitat for pond breeding amphibians:

1. The wetlands should be made shallow so they dry by the end of September. This will prevent fish from living in the wetlands that prey on amphibians and their eggs. The periodic drying of the wetlands would also reduce possible colonization by the American bullfrog that also preys on amphibians.
2. Hibernation sites can be created by making mounds of vegetation and woody debris in the wetlands. These mounds can be built from root masses and clumps of vegetation.
3. Hiding cover can be improved around the restored wetlands by scattering logs, large woody debris, and piles of rock.
4. Wetlands of various shapes, sizes, and depth can be restored in each area to provide for seasonal amphibian habitat needs.

Logs and snags

Large woody debris and vertical snags should be placed in wetlands to improve habitat for animals and plants. Large diameter logs placed in and near wetlands can be expected to be used by birds and insects for perches, and turtles for basking. Snags would also used by birds for perches, and by bats for roosting.

Mosquitoes

The restored wetlands can be expected to lower mosquito numbers. The dragonfly larvae, damselfly larvae, salamander larvae, and invertebrates that thrive in the restored wetlands can be expected to control mosquitoes. Swallows, bats, and dragonflies will consume adult mosquitos. The wetlands should become population “sinks” for mosquitoes.

Heavy Equipment

The wetlands should be constructed by using heavy equipment with skilled operators. The Wetland Design Form prepared for each project lists the type and size of heavy equipment needed to complete each project. At a minimum, the heavy equipment should meet the following specifications:

Excavator: 100 Series
80HP or larger
22,500lbs minimum
Bucket that is 42-inches wide with thumb attachment
On tracks, not wheels

or

Excavator: 200-Series
148 HP minimum
47,000lbs minimum
Bucket that is 60-inches wide with thumb attachment
On tracks, not wheels

One should generally use a 100 or 200-Series Excavator to build the wetlands. Here are some of the advantages of using a larger excavator for wetland construction:

1. The excavator can stay in one place and reach a large portion of the work area. This saves destroying surrounding vegetation because the machine does not have to encircle the work area to remove soil.
2. The large excavator does not have to move the soil a number of times, greatly speeding progress. A mini excavator must swing the soil a number of times across the work area. The longer reach means less moving, which is especially important when using pads or logs to stay afloat on saturated soils.
3. The unit cost of moving soil is less for a large excavator compared to a smaller machine.

For compacting soils, one of the following pieces of heavy equipment are recommended:

Wheel loader with operator
With rubber tires
Rated net power = 154HP minimum
Operating weight 30,479lbs minimum
Bucket capacity 4.0 yrd^3 or greater

or

Backhoe Loader with Operator
Large size with rubber tires
90HP minimum
19,000lbs minimum

Contracting

Service contracts should be used to hire heavy equipment and operators to complete the wetland project. Under a Service Contract, the heavy equipment and operator are hired by the hour for completing the work. The award of the service contract may be based on a combination of factors that include: ability to provide the required heavy equipment, performance operating heavy equipment, experience restoring wetlands, and price. The price for building these wetlands will be greatly reduced if the contractor is paid by the hour, not by the job for building the wetlands

Copies of requisitions and contracts that include an experience questionnaire, equipment questionnaire, and specifications are available from Tom Biebighauser, who is also available to be on site directing the construction of each wetland.

Buried utilities

For safety a check for buried utilities must be conducted prior to building the wetlands described in this report. All buried utilities that are in the area should be marked so they can be avoided. The wetlands should not be built unless this critical step is completed. It is the law that one calls 811 before digging, and it can take 3-days or more for the utility companies to respond and check for buried utilities.

Permits

Permits may be required before proceeding with the restoration of wetlands described in this report. Johnson County is asked to coordinate permitting needs with appropriate state and federal agencies.

Wetland and Stream Restoration Photos

Photographs showing some of the wetlands restored by Tom Biebighauser are available for viewing at:

School Wetlands
https://picasaweb.google.com/105985116543820569589/SchoolWetlands#

Arizona Wetland Construction
https://picasaweb.google.com/105985116543820569589/ArizonaWetlandConstruction

Tulaberry Farm Wetland Restoration Project
https://plus.google.com/photos/105985116543820569589/albums/5916157203616332017?authkey=CN-Lh8qpxr6mQg

Dix River Stream and Wetland Restoration Project
https://picasaweb.google.com/105985116543820569589/DixRiverStreamAndWetlandRestorationProject#

Queens Wetland Restoration Project
https://picasaweb.google.com/105985116543820569589/QueensWetlandRestorationProject#

Slabcamp Creek and Stonecoal Branch Stream and Wetland Restoration Project
https://picasaweb.google.com/105985116543820569589/SlabcampCreekStonecoalBranchStreamAndWetlandRestorationProject#

Wetlands Built Using Liners
https://picasaweb.google.com/105985116543820569589/WetlandsBuiltUsingLiners#

Wetland Construction from Deep Ponds
https://picasaweb.google.com/105985116543820569589/WetlandConstructionFromDeepPonds#

Wetlands Restored in Autumn
https://picasaweb.google.com/105985116543820569589/WetlandsRestoredInAutumn#

Wetlands Restored and Created
https://picasaweb.google.com/105985116543820569589/WetlandsRestoredAndCreated#

Wetland Restoration Books

Detailed information describing how wetlands may be restored can found in these books:

1. Thomas R. Biebighauser. *Wetland Restoration and Construction - A Technical Guide*. Upper Susquehanna Coalition, 186 pages, 2011.
2. Thomas R. Biebighauser, *Wetland Drainage, Restoration, and Repair*, Lexington, KY, University Press of Kentucky, 2007.

Planting

It is recommended that the soil exposed from restoring wetlands be seeded to wheat, native grasses, and wildflowers for erosion control. All areas of exposed soil should be covered with a layer of wheat, oat, or native grass straw to reduce erosion and to increase plant survival. Hay should not be used as it contains too many weeds that are difficult to control later. Native trees and shrubs may also be planted on areas that are seeded and mulched.

Restoration Practices

The Wetland Restoration projects would be implemented using the techniques described in the books by Thomas R. Biebighauser *Wetland Restoration and Construction - A Technical Guide,* and *Wetland Drainage, Restoration and Repair*. The Wetland Design Forms attached to this report were also prepared by Thomas R. Biebighauser, who has restored over 1,700 wetlands in 21-States and two Canadian Provinces.

Volunteer Involvement

Volunteers would be welcomed to help implement these wetland restoration projects. Volunteers may take an active role in the construction, planting, and monitoring of each wetland restoration project. Volunteers can help monitor construction, control erosion, establish native plants, and control non-native species. They may also work to measure project success by completing plant and animal surveys.

Training

The actual restoration of these wetlands may be accomplished as part of a *Hands-on Wetland Restoration Workshops* instructed by Tom Biebighauser. Tom works in partnership with agencies and organizations to instruct practical training sessions where participants learn about wetlands and how to restore them by becoming actively involved

in the construction and planting of wetlands. Tom has instructed Hands-on Wetland Restoration Workshops across North America for 11-years. The training program has been effective at encouraging individuals to initiate wetland and stream restoration programs in their communities.

Construction monitoring

Tom Biebighauser is available to assist with implementing the wetland restoration projects identified in this report. Tom can be onsite monitoring construction, responding to concerns from the public, and providing training. Please contact him if you have any questions about these projects.

Summary

Wetlands may be restored at the Cedar Niles Future Park Site to provide habitat for a diversity of animals and plants. Implementing wetland restoration projects would reduce flooding, clean runoff, replenish groundwater, and improve habitat for plant and animal species. The restored wetlands may be built at a low cost and would require little, if any maintenance. The wetland projects may be completed in combination with the instruction of a Hands-on Wetland Restoration Workshop, where people in the community and agency personnel receive practical training in wetland restoration techniques. Completing these wetland restoration projects would help the environment and strengthen relationships between agencies, nonprofit organizations, and the public.

Prepared by:

Thomas R. Biebighauser
Wildlife Biologist and Wetland Ecologist
Wetland Restoration and Training LLC
3415 Sugar Loaf Mountain Road
Morehead, KY 40351

E-mail: tombiebighauser@gmail.com
Website: www.wetlandrestorationandtraining.com
606-784-6175 (home)
606-356-4569 (cell)