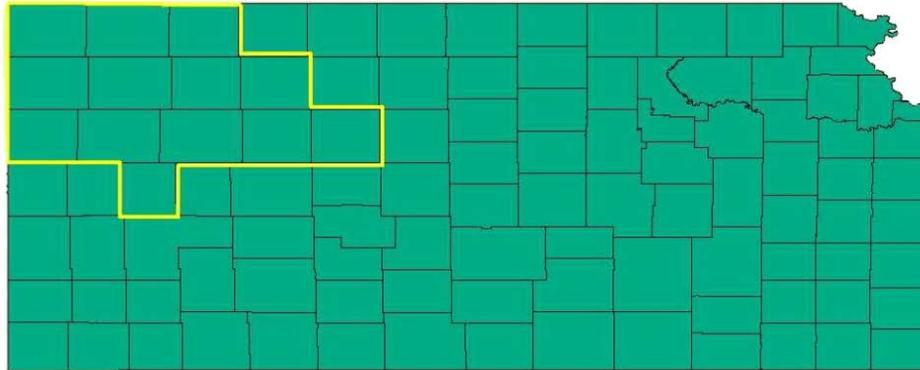


Cedar Bluff District Fisheries

Kansas Department of Wildlife, Parks, and Tourism Fisheries Division
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The above figure shows the 13 counties outlined in yellow that comprise the Cedar Bluff District

Colby-Villa High Pond Renovation Nears Completion

Villa High Pond is a two-acre pond located on Prairie Dog Creek in Villa High Park, Colby, Kansas. The pond originated as a borrow pit in a pasture owned by the nearby KXXX radio station. The basin provided fill material for the construction of Interstate 70 in 1966 and 1967. As quarrying was conducted, the resulting basin kept filling with water from time to time and would have to be pumped out to allow continued fill removal. When the need for fill material ended the pit was abandoned and allowed to fill with water. One thing led to another and it was decided that the radio station would donate the land to the City for the purpose of developing a public park that included a fishing pond. As best as records indicate, Kansas Fish and Game Commission (KFGC) involvement with management began in 1975 and consisted of fish population sampling and channel catfish stocking. The City officially entered into cooperative management agreement with the KFGC under the Community Lake Assistance Program (now Community Fisheries Assistance Program) in 1986.



Villa High Pond prior to renovation

Villa High cont....

From a fisheries management standpoint Villa High Pond is a classic example of an urban pond in that close proximity to human population density is the pond's most positive and negative attribute at the same time. The pond is literally in city residents' back yards making it easily accessible so people can go fish or just sit by the pond and picnic whenever they desire. Further, the relative scarcity of public recreational water in northwest Kansas, also magnifies the importance of the pond as many residents have at least spent some time at the pond. This fact



Excessive algae bloom at Villa High

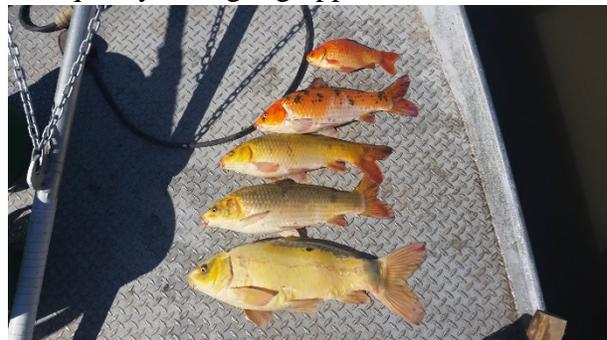
increases the value of the pond in the collective mind of residents and generates much interest in projects involving the pond. Given the opportunity KDWPT has attempted to maximize fishing opportunities at the pond through the Community Fisheries Assistance Program (CFAP) by implementing a winter trout stocking program and stocking catchable-sized channel catfish periodically through the fishing season.

In contrast to the positive potential of Villa High, the high degree of human activity in the watershed negatively impact water quality and limit the potential of available fishing opportunities. Surface run-off water flowing from yards, livestock confinement, and row-crop fields carry excess nutrients in the form of fertilizer and animal waste that increase nitrogen and phosphorus concentrations in the pond water.

Excessive algae blooms have been relatively frequent and often led to partial fish kills at Villa High. The fish kills tended to kill desirable sportfish like largemouth bass, bluegill, and channel catfish, but

were not severe enough to eliminate fish species capable of tolerating low dissolved oxygen concentrations such as black bullheads, green sunfish, fathead minnows, and golden shiners. Further, unauthorized public stocking of tolerant aquarium fish species such as goldfish and koi carp resulted in a hodge-podge fishery that limited the quality of angling opportunities available.

High sedimentation rates from construction of adjacent homes, cultivation of agricultural fields, and other dirt work over the years decreased the volume and depth of Villa High resulting in a pond with a maximum depth of less than 6 feet and average depth of approximately 2.5 feet. Lack of pond volume simply limited the physical space available to fish. Further, nutrients can often be sequestered from pond water if the nutrients become buried by sediment and locked in an anaerobic state. However, given the shallow pond depth,



Example of goldfish and koi carp from Villa High

Villa High cont....



Early stages of excavation at Villa High, note sediment thickness and overall shallowness of basin

nutrients that could have potentially been taken out of circulation were reintroduced into the system when sediments were resuspended by wind action or bottom feeding fish.

For all the positive potential at Villa High, the fact that the pond had become a nutrient rich mud hole was limiting. Renovating the pond was the only way to turn the clock back and remove the nutrients and sediment that had collected over the lifespan of the pond. General community interest in rehabilitating the pond resulted in a cooperative effort between the City of Colby, Thomas County, Colby Convention and Visitors Bureau, KDHE, and KDWPT. EBH Engineering was retained by the City for

surveying, planning, and oversight. McCormick Excavation was retained to complete much dirt work and sediment removal. In addition to pond renovation, the complete project consists of a general upgrade to park facilities, but this article will focus solely on pond renovation.

A principle objective of the project was to remove all sediment accumulated over the years and return the pond to its original depth. To accomplish complete sediment removal the pond had to be completely dewatered to allow equipment access to the pond bottom. Since Villa High is an excavated basin no dam and associated toe drain exists to enable draining the pond. Consequently, the water had to be pumped out. City employees utilized a trash pump from September to December 2019 to pump at least 2 million gallons of water out of the pond.

Once the pond was almost completely dewatered excavating began using track hoes to remove sediment and load it in dump trucks to be hauled off site and disposed of in an abandoned city wastewater lagoon. Sediment removal was initiated mid-December 2019 and continued until February 2020. Sediment thickness generally varied from 3 to 8 feet and a total of approximately 12,500 cubic yards were removed. Once sediment removal was complete the pond now has a maximum depth of 12 feet and average depth of 7 feet at full pool.



Another example of sediment thickness, note the light-colored original bottom material

Villa High cont....



Aerial view of Villa High early excavation on December 23, 2019. Note dark sediment and light-colored original pond basin

Once excavating began to uncover the underlying pond bottom, water retention capability of the parent material that comprised the new pond bottom came into question. To answer the question, representative samples of various types of pond bottom material were collected and sent to GSI Engineering to test hydraulic conductivity, or how leaky, the pond bottom was expected to be. Lab tests indicated that hydraulic conductivity ranged from 0.03 to 0.19 feet/year. So, the bottom material was not characterized as being excessively leaky if the material was compacted. However, concern about erodibility of the bottom material with constant exposure to water brought into question whether the material would remain sufficiently compacted to maintain

a sealed pond bottom.

It has been common practice to use soda ash, or sodium carbonate, in certain soil types to bind and improve the compaction of soil particles thus sealing a lake bottom. To minimize water loss from leakage it was decided to seal the Villa High basin by applying soda ash, but soil moisture content had to be reduced. Complicated by snow and rain, the City and County staff spent the better part of three weeks ripping and disking the basin to dry it out. Finally, drier weather combined with soil manipulation reduced moisture content to an optimal level.

The approach used to seal the basin consisted of creating two six-inch layers of bottom material into which soda ash had been incorporated as uniformly as possible and each layer was compacted. A final six-inch layer of untreated bottom material was spread over the shallower portions of the seal and compacted to form a protective blanket. Creating multiple layers meant moving and stockpiling bottom material such that enough



Aerial view of sediment removal progress on January 21, 2020

Villa High cont....

material would be available to form the successive layers. It was decided that as bottom material was ripped, disked and dried, it would be pushed up from the basin bottom and stockpiled in a concentric ring around the shoreline. The final seal configuration consisted of two treated and compacted six-inch layers over the deeper parts of the basin while the 10 to 15-yard-wide ring around the shoreline was a single layer treated with soda ash, compacted, and was overlaid with untreated material to protect the seal.

City and County crews, with oversight from EBH engineering and a private consultant with experience in the technique, sealed the basin over the course of one day in early-March 2020. Once the bottom material that was to become the first seal layer was exposed it was disked and let set until the proper moisture level was achieved. Soda ash was spread at a rate of 14 lbs. per 100 square feet of pond bottom using fertilizer spreaders. Once applied, the soda ash was then disked into the pond bottom to ensure uniform contact with bottom material particles. Once the soda ash was incorporated, the treated bottom material layer was compacted using sheep's foot equipment.



City and county staff drying and stockpiling bottom material prior to basing sealing



County staff diskings white soda ash into bottom material

Once the first layer was complete, stockpiled bottom material was moved down and spread over the first treated layer using motor graders, soda ash applied, and compacted as above to form the second layer. To finish, all remaining stockpiled material was moved down the sides of the basin exposing the untreated ring around the shoreline. This ring was disked, soda ash applied, and packed as above. To eliminate a seam between the two sealed areas the edges of the respective areas were overlapped. Finally, the remaining untreated, stockpiled bottom material was moved up to create a uniform

protective layer over the upper portion of the basin. In all phases of seal installation, precision motor grader operation was required to achieve uniform layer thicknesses.

Villa High cont...

Once the seal was installed, efforts turned to protecting the seal from wave action and flowing water erosion, and fish habitat structures were installed. Large slabs, and smaller crushed, concrete chunks were placed to armor the basin at points of inflow and in a band around the entire upper basin to prevent erosion. A wide range of materials including broken concrete, whole cedar trees, and artificial structures were constructed and installed at various water depths. Prior to renovation, fish habitat availability in Villa High was almost non-existent, but with all the work and creativity of City staff, fish habitat availability has been maximized.



Villa High beginning to impound water, note fish habitat structures and basin armoring

To date, most of the physical, in-basin work has been completed and the pond is being allowed to refill with water. At the time of writing the pond water level was approximately 6 feet below full. Initial stockings of 2,000 golden shiners, 2,000 fathead minnows, and 250 adult bluegills have already been made in time for these species to spawn in 2020 and create a forage base upon which largemouth bass and channel catfish populations will be established. A return to stocking catchable-sized channel catfish and rainbow trout under their respective Urban Catfish and Trout stocking programs will resume in upcoming years.



Aerial view of fish habitat distribution at Villa High

Prior to completing any of the current stockings, the existing fish population in, and upstream of, Villa High was eradicated to eliminate undesirable fish populations. It is worth noting that it is illegal to release any fish into public waters unless caught from that water. Although it may seem humane or that releasing fish into public waters is helpful, unauthorized public stockings created management problems at Villa High in the past. For example, goldfish and koi carp populations undoubtedly originated from illegal stockings and both species are known to

Villa High cont...

resuspend bottom sediments by their rooting, bottom-feeding behavior thus muddying the water. Initiating establishment of the fishery under “clean slate” conditions creates the best potential for maximizing the quality of the resulting fishery.

Although much has been accomplished relative to improving many basic physical and biotic factors that determine the potential of establishing a more desirable fishery at Villa High, future activities will be necessary, and management will be ongoing. At this point the most difficult part of the project, i.e. dredging and sealing the pond basin, has been completed utilizing the best-known approach. In addition to the countless man-hours expended by City and County personnel, excellent cooperation, communication, and coordination greatly facilitated what has been accomplished. Developing a broad coalition of cooperative working relationships is critical to effective management of urban waters and greatly facilitated major upgrades completed at Villa High Pond.