**STREAM TEAM REPORT FOR CITY OF YUKON**
**Mulvey Pond and Turtle Creek**

**July 2005 Final Report**

## I. INTRODUCTION:

The Tulsa Area Stream Team was contacted by Anna Wagoner, City of Yukon, to examine Mulvey Pond and downstream Turtle Creek for potential improvements for bank stabilization and erosion control (see Figure 1). Technical staff from the Natural Resources Conservation Service (NRCS), US Army Corps of Engineers (COE), Association of Central Oklahoma Governments (ACOG), and the Indian Nations Council of Governments (INCOG) visited the sites on June 8, 2005. In addition, technical comments on the pond were received from the Oklahoma Water Resources Board (OWRB) and Rob Armstrong with Huitt-Zollars just prior to field visit. Observations from the site visit with recommendations are presented below with contact information at the end of the document.

## II. YUKON CONCERNS:

Mulvey Pond:

1. Possible replacement of existing concrete "rip-rap" along south and west banks
2. Excess nutrients from ducks and geese and upstream land use sources
3. Potential pond bank erosion requiring stabilization
4. Turtle Creek bank erosion at pond outlet possibly eroding bridge, sidewalk and trees

Turtle Creek and Trail:

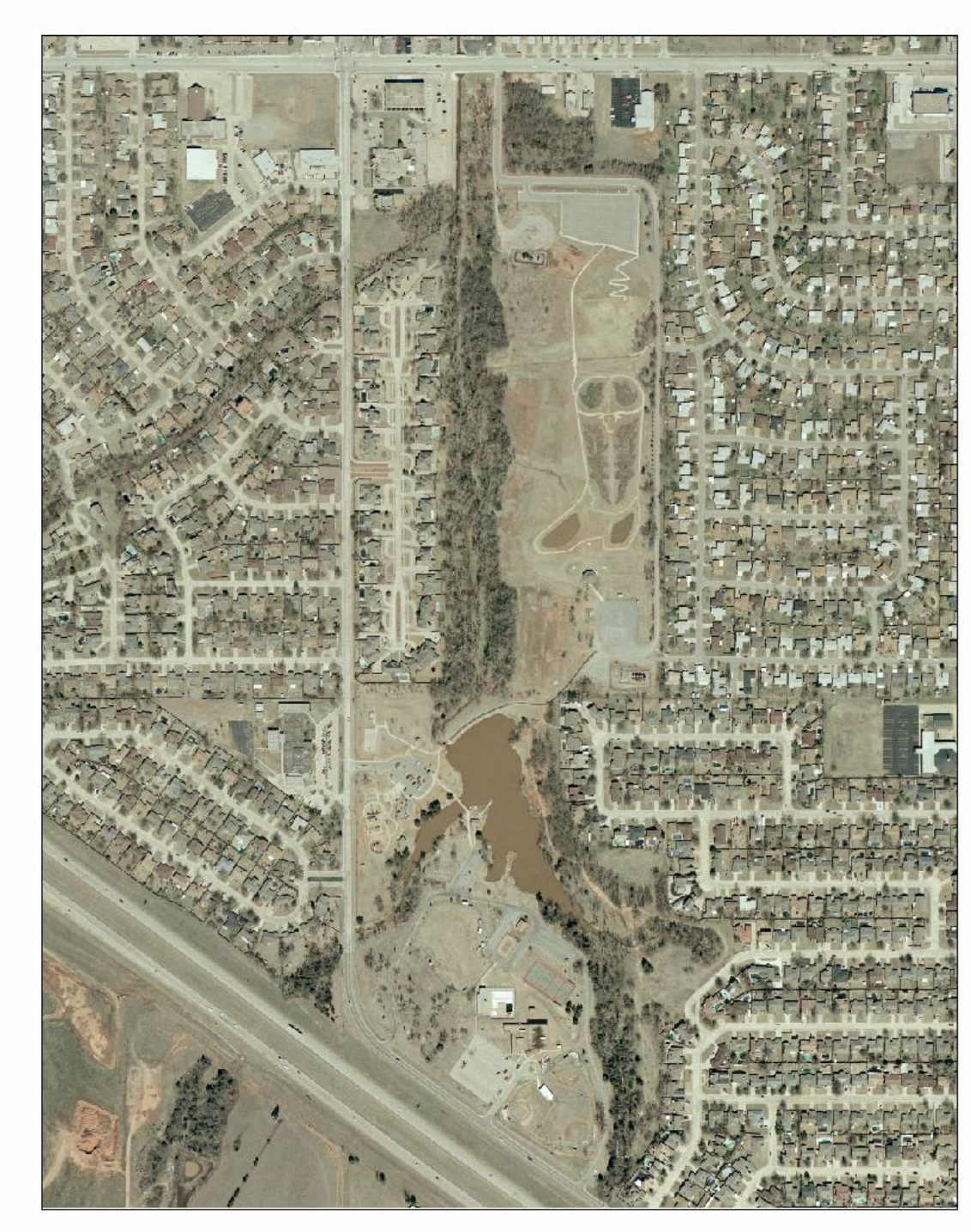
1. Erosion of stream banks in many locations, increasing downstream
2. Riparian management along stream by trail
3. Trail needing surface or other work
4. Other ideas on how to use the park-like setting of the creek and trail

## III. ASSESSMENT AND RECOMMENDATIONS:

**1. Mulvey Pond Rip-Rap:** Figures 2 and 3 show the existing "rip-rap" on the south and west banks of the pond. This material is actually broken concrete pavement that has been in place for many years as evidenced by the well established vegetation growing between the material. The concrete, while not as attractive as true limestone or sandstone rocks and boulders typical to more formal rip-rap on slopes, is actually performing well to stabilize both the south and west banks of the pond. No significant pond bank erosion was observed. Removal of this material would require extensive use of heavy equipment and be very costly as would replacement with new stone.

Recommendations: Since the existing material is performing well, it is recommended that this be left in place. No changes to the material are recommended other than that trash and construction debris such as rebar should be removed to lower the risks to people using the area.

FIGURE 1: Aerial View of Mulvey Pond and Turtle Creek, Yukon, OK



Figures 2 and 3: Concrete "Rip-Rap" on South and West Banks of Mulvey Pond


**2. <u>Mulvey Pond East Bank Stabilization</u>:** Part of the pond's east bank has erosion problems, and this is an area with no rock or rip-rap. This could benefit from native aquatic vegetation along the shoreline to stabilize erosion. In addition, some willow trees close to the water could provide shade for pond fish during summer. The pond is not a regulated wetland, but this portion of the pond could be stabilized with a wetland character with the right vegetation. Additional evaluations of the east bank are provided by Chuck Potts, OWRB, and Rob Armstrong, P.E., Huitt-Zollars, Inc., at the end of this document.

<u>Recommendations</u>: Johntee Aldridge, US Fish and Wildlife Tulsa office, should be contacted about how best to establish a vegetative buffer on the east bank and possible funding of the work. The FWS can partner with the NRCS to provide resources to establish trees and aquatic vegetation. Additional recommendations for shoreline vegetative stabilization and creation of a shelf to help maintain the vegetation is provided at the end of the document by Chuck Potts and Rob Armstrong.

**3. <u>Water Quality in Mulvey Pond</u>:** Two sources of excessive nutrients were discussed before the meeting and at the site: the local duck and geese populations and upstream land uses that may contribute excess nutrients and sediment. While many Yukon citizens enjoy feeding and viewing the avian wildlife on the pond, other citizens are concerned that too many birds can contribute to water quality problems, especially nutrients and bacteria from fecal droppings. Anna Waggoner described the upstream land uses as being mostly rural with cattle and wheat production. At the end of this document, Chuck Potts, OWRB, provides a detailed evaluation of the water quality problems he has observed in past years in Mulvey Pond along with his recommendations. Bank stabilization with vegetation also aids water quality by reducing sediment loading and acting as a nutrient buffer from surface runoff. This will be

especially important along the east bank where vegetation buffers, trees and aquatic plants are recommended for establishment to control erosion. The pavilion and boardwalk into the pond on the west bank provide excellent opportunities for local schools to educate students on pond management and water quality. While only small amounts of floating and shoreline algae were evident on the day of inspection, Mulvey Pond is reported by Chuck Potts to have much greater problems with excess algae and nutrient over-enrichment at other times. Algae are plants that respond to fertilizer effects just as a lawn. Too many nutrients (too much fertilizer) results in excess algal growth. In ponds, this can turn water green, cause unsightly floating algal mats along the shoreline, release offensive odors and consume dissolved oxygen at night. While cleanup of algal mats in ponds is difficult work, mechanical harvesting of these mats is the best way to avoid nutrient recycling and otherwise introducing toxic chemicals for algal control.

Recommendations: Establishing a vegetative buffer and some trees on the east bank, along with aquatic emergent plants, will not only protect against erosion but provide enhanced water quality in the pond regarding sediment and nutrients. There are additional recommendations at the end of this document by Chuck Potts for stabilizing erosion at the pond inlet. Sediment loss and nutrients from upstream land uses will eventually end up in Mulvey Pond. Controlling pollutants at the source is much easier than cleaning the accumulations from the pond. Resources to help with land use nutrient management in watersheds are the NRCS, FWS, Oklahoma Conservation Commission (OCC) and OSU Extension Service (see contacts at the end of the document).

**4. Mulvey Pond Outlet:** There is considerable erosion at the outlet structure of the pond resulting from multiple sources. The flow over the pond weir is uncontrolled and can allow considerable volumes of water to fall quickly to the stream bed with great force.

In addition, the paved parking lot to the west of the pond apparently has mis-aligned drainage structures. Water from the parking lot enters via drop inlets, flows underground in concrete drain pipes and enters the creek at the pond outlet. The drop inlets along the curb of the parking lot are not at the lowest point so the water emerging into the creek via the pipe does not convey all of the water from the parking lot. Evidence of sediment residue and surface erosion between the parking lot and the creek suggests that there is considerable flow from the undrained southeast side of the parking lot entering the creek. This surface flow has already started eroding around the new sidewalk and is apparently contributing to further erosion on the west stream bank between the foot bridge and the large cottonwood tree. The entire creek channel at the outlet structure is layered with old broken concrete paving that had been added as bank erosion but is now falling into the bottom of the creek with bare eroding banks exposed to further erosion. Not only is this unsightly, but if the erosion

continues, it could affect the structural integrity of the foot bridge base, the sidewalk on the west bank and the large cottonwood tree on the west bank. The east bank is more stable probably due to having less slope, more concrete rip-rap and no surface flows from the parking lot or drain pipe.

Recommendations: The parking lot drainage needs to be evaluated for ways to effectively channel runoff into the drainage system and minimize surface runoff across the sidewalk and down the stream's west bank. The concrete drain pipe emerging into the creek's west bank needs to have additional support and the west bank from which it protrudes stabilized to prevent further erosion. This may involve changing the slope of the bank to 3:1 and adding toe-of-slope protection. As an alternative to a dry channel filled with rip-rap, the stream channel could be redefined by creating a small "stilling basin" using a permanent pool that would act to dissipate the water's energy from the drain pipe and from the pond's overflow weir. This would also create a more pleasant appearance. Much of the collapsed concrete paving needs to be removed from the creek bottom. A design engineer needs to provide plans and specifications for this project.

**5. Turtle Creek Stream Bank Erosion:** Much of the creek channel immediately downstream of the pond outlet is fairly stable with no significant erosion. There is a bermuda grass slope between the dam and the creek on the north face of the dam that is mowed by city crews. Past the dam face the stream turns north and enters a rich riparian woodland setting with a parallel trail of about 15 feet in width on the east bank. This riparian zone is approximately 10 - 20 feet wide on both banks and is apparently undisturbed (that is, not mowed or trimmed).

The back yards of a row of houses all along the west bank abut the stream's riparian zone, but most homeowners do not disturb the stream's vegetation. Where Turtle Creek turns north from the dam face there is a small patch of wetland vegetation and trees fed by a gentle underground seep. It is not clear whether or not the water is coming from the dam itself or if it is a natural groundwater seep. The seep/spring has been there for decades, and its outlet has actually moved from an area closer to the dam to where it is now. Dye testing could determine if the water

is coming from the pond. In any event, the flow has been there for years as evidenced by established vegetation.

The north bank of Turtle Creek at the dam face is degraded in places. Portions of the bank have sloughed into the creek leaving sheared banks. This is likely due to increased velocity of water from the parking lot and pond, and perhaps realignment of the stream channel years ago during dam construction. The loss of natural channel meander length increases the channel slope which increases water velocity and shear stresses and thus erosional potential. Since bringing back stream meanders at the toe of the dam is not possible, other in-stream structures such as J-hooks or grade stabilization measures can be used to reduce stream velocity and deflect energy away from critical areas of the bank. These structures can create riffle-pool transitions that will protect the stream channel from erosion due to further meandering which can occur as the stream seeks to lengthen and decrease its erosional potential.

Further downstream, additional points of entry for surface flow are evident. These include several sloped grassy paths or swales from the park uphill to the east (see Figure 1 aerial), and a tributary between homes and a concrete surface drain between two homes apparently draining the street in front of the homes. These new water sources cause additional flow in Turtle Creek. As a result, the creek channel widens and deepens, and erosion is more pronounced. This continues to the point where the creek channel has been lined with concrete. The transition between natural channel and concrete channel is eroding slightly and will need to be stabilized to prevent eventual undermining of the concrete channel. This point represents the farthest downstream location of the field inspection by the Stream Team staff.

Recommendations: Erosion on the north bank by the dam is relatively minor, and energy dissipation structures should be considered to prevent further stream bank and channel erosion. Portions of the north bank may need to be re-sloped to provide greater stability. Consulting with the FWS, NRCS, OSU Extension Service and OCC staff may provide sufficient information to do this with local city equipment and resources, and these organizations may be able to identify some funds to help offset part of the cost. The more significant erosion further downstream may require formal engineering design to address erosion caused by excess runoff from street drains between homes, the tributary and the three swales from the park to the east that act to conduct surface runoff from the park to the creek. The same agencies listed above can

provide information on potential resources and level of effort needed to restore the creek channel. The City should integrate the design to control surface runoff from the park to the creek on the east bank into the plans for improving the trail and nature walk.

**6. Improving the Trail and Options for a Nature Walk**: The existing dirt trail extends from the dam northward to the concrete lined channel. Initially, it was thought that the trail could be extended along the west bank of the creek with an access bridge by the concrete channel. However, there are too many homes that now have lawns, fences and yard structures (planters, swing sets, flower beds, etc.) that are too close to the creek to allow a trail. However, the existing trail on the east bank has a fairly stable and well-compacted dirt bed, and the tree canopy and understory brush are far enough from the trail to allow at least a 10 to 15 foot wide path. Several places will require stabilization, especially by the grassy paths or swales that channel surface runoff from the park on the east upslope bank. Any hardening of the trail (e.g. gravel, screenings, asphalt, etc.) will need to account for this surface flow from the park. It was not clear what type of drainage systems exist at these locations as the east side of the trail dropped off in many places to low areas with thick brush. Some concrete pipes were seen, but it is not known how effective they are for conveying the park's drainage under the trail to the creek.



There will likely be varied opinions in the community on the use of the trail (e.g. walking only, bicycling and skating as well, etc.). The final use of the trail will dictate the type of material used for bedding and surfacing. Improvements to the trail should be incorporated into the designs for stream bank and stream bed erosion control plans.

The existing trail corridor provides an excellent opportunity for developing a nature trail, arboretum and/or habitat. Specific plants and trees could be marked with common and scientific names, and benches with lighting could be provided. It may be possible to tie the trail into another city amenity such as the park to the east. Planning for these changes should involve input from citizens and the city staff and city council. The FWS Tulsa office can provide assistance with developing the trail system and identify potential funding. There also may be Federal Transportation funds available for urban trail development. The Oklahoma Department of Transportation (ODOT) should be contacted about funding and possible technical assistance with planning, design and construction of urban trails.

Recommendations: The existing trail has great potential for urban recreational use and can also incorporate wildlife habitat amenities including use as an arboretum and education experience for local schools. Decisions concerning the ultimate use of the trail rests with the City's planning process, therefore City officials need to begin long range planning for the trail.

Agencies and organizations that should be contacted for help with conceptualization, design and possible funding are the OSU Extension Service, OCC, NRCS, FWS, ACOG, ODOT and private landscape design and consulting firms. In addition, OU and OSU schools of landscape architecture and schools of engineering may be able to provide class project assistance to help with the planning and design phases.

## ADDITIONAL EVALUATIONS BY CHUCK POTTS, OWRB, AND ROB ARMSTRONG, P.E., HUITT-ZOLLARS, INC.

Neither Mr. Potts nor Mr. Armstrong was able to attend the June 8 site visit, but Chuck Potts lives in Yukon and is very familiar with the pond's water quality issues. Rob Armstrong reviewed the OWRB comments and the aerial and photos and provided several recommendations if the site visit determined that significant bank stabilization was needed.

**Chuck Potts, OWRB, Recommendations:**

There appears to be a significant nutrient (fertilizer) loading in the pond itself. Several things can be done to reduce this load and thus improve its appearance and usefulness.

1. Manually remove as much algae (not the plants) as possible. This way, the nutrients can be removed from the system and not just recycled through the algae again and again. Volunteer labor from civic groups (or individuals serving community service sentences) armed with garden rakes and a little education can removed hundreds of pounds of algae over the course of a summer and thus reduce the "nutrient load" being cycled through by physically removing the nutrients from the system. This may need to be done several times. This algal mat can be used as mulch for other applications outside the ponds' drainage basin.
2. Control, as much as possible, the nutrient input into that system. Fertilizer run-off from the lawns east of the pond and the park grounds is one source. Manure from the waterfowl is another. Wherever these birds go to feed, they are bringing that nutrient load back with them to the ponds. Consider reducing the number of resident waterfowl. Discourage, at least temporarily, the feeding of the waterfowl which keeps them coming back when they should be migrating.
3. Encourage true aquatic plants to establish. There are many sources of these plants including many local sites. These will provide beneficial cover for fish and help regulate the nutrient cycle within the pond.

Much of the shoreline vegetation has been removed increasing the erosive potential of the shore. Consider selecting areas for planting with natural vegetation. The presence of so many waterfowl contributes to the erosion by eating the near-shore vegetation.

Development along the eastern side of the pond has increased the soil load being carried into the pond. Maintaining the walking path with coarse mulch, additional terracing, mowing the grass to

a taller height, and allowing the under story to re-establish all along the east side of the pond will all help in reducing the erosion.

The small creek channel flowing into the NE corner of the pond is unstable and contributes its own sediment load. Consider adding some high-quality rip-rap to stabilize the banks and slow the flow to the pond. Cattails at the mouth of this channel will slow the flow even further and allow the sediments to precipitate out before they reach the pond. This is a very shallow area and plants should be able to establish very easily. Discourage traffic through that area by removing the steps and adding a couple of trees to that path.

Comparing pre- and post-development aerial photos of the Turtle Creek area, it appears that much of the vegetation has been removed. The canopy is much thinner than before suggesting that some thinning of the trees and shrubs has occurred leaving the area more susceptible to erosion since:

1. more rainfall can now fall unabated to the ground
2. less vegetation is present to stabilize the ground and
3. open areas invite more foot and bicycle traffic.

Consider fencing off the riparian area or simply not managing the area to allow vegetation to re-establish and stabilize the banks throughout the riparian zone. Discourage traffic through the area to prevent disturbing the soils thus increasing the erosive potential.

I regret that I could not be available for this meeting but I'd be glad to sit and talk with you at length about this.

**Rob Armstrong, P.E., Huitt-Zollars, Recommendations**:
Unfortunately I'm not going to be able to make it to the meeting due to some previously scheduled commitments. However, based upon a review of the info. you have sent, I would say that OWRB's suggestions look great, the only thing I would add emphasis to, is that in order to establish long-lasting vegetation around the pond, the pond edge should be re-shaped to create a 3' – 5' bench along the shoreline, with the bench being about 2 feet below the elevation of the normal pond pool elevation. The bench and the wetland vegetation planted on the bench will act together to prevent erosion around the pond by drastically reducing erosion due to wave action, thus eliminating the need for the riprap that is currently in place around the pond. Depending on the use of the pond, fishing, etc., specific areas can be left free of the bench to provide better access to the water's edge. However, these areas would need some type of hard edge treatment to prevent erosion due to wave action. An alternative is to construct the bench all the way around and also construct wooden piers out over the bench and to deeper water to provide better access and viewing of the now-natural pond.

**RECOMMENDED CONTACTS FOR ASSISTANCE:**

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| **Rob Armstrong, P.E.**<br>**Huitt-Zollars, Inc.**<br>3131 McKinney Ave., Suite 600<br>Dallas, TX 75204<br>(214) 871-3311 | **Duane Crider, District Conservationist**<br>**Natural Resources Conservation Service**<br>El Reno Field Service Center, 1625 E. Hwy 66<br>El Reno, OK 73036-5769<br>(405) 262-1958 x106 |
| **Chuck Potts**<br>**Oklahoma Water Resources Board**<br>3800 N. Classen<br>Oklahoma City, OK 73118<br>(405) 530-8800 | **Michael Smolen**<br>**OSU Extension Service**<br>218 Ag Hall<br>Stillwater, OK 74078<br>(405) 744-8414 |
| **Johntee Aldridge or Dave Martinez**<br>**US Fish and Wildlife Service**<br>222 S. Houston, Suite A<br>Tulsa, OK<br>(918) 581-7458 | **Dan Butler or Chris Dubois**<br>**Oklahoma Conservation Commission**<br>P.O. Box 53134<br>Oklahoma City, OK 73152<br>(405) 522-4500 |
| **Brian Nusbaum**<br>**Oklahoma Department of Transportation**<br>200 N.E. 21st Street<br>Oklahoma City, OK 73105<br>(405) 521-6781 | **John Harrington**<br>**ACOG**<br>21 East Main, Suite 100<br>Oklahoma City, OK 73104<br>(405) 234-2264 |
| **Dale Davidson**<br>**US Army Corps of Engineers**<br>1645 South 101st East Avenue<br>Tulsa, OK 74128<br>(918) 669-4321 | **Ron Flanagan**<br>**R.D. Flanagan & Associates**<br>2745 E. Skelly Dr., Suite 100<br>Tulsa, OK 74105<br>918-749-2696 |
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