College Creek Restoration Success Stories

College Creek Restoration Success Story: *"A proactive community responds to stream bank erosion..."*

Eroded soil is one of the most commonly identified pollutants in Iowa streams and lakes. The sources of erosion include both upland areas as well as stream bank erosion. This story focuses on a neighborhood and City concerned about a particularly unstable segment of College Creek in Ames Iowa. Soil loss due to stream bank erosion was substantially reduced in this west Ames neighborhood through collaboration between neighbors, city and state officials and Iowa State University researchers and students. Future flooding risk was also reduced. Design and construction costs were shared between Iowa Watershed Improvement Review Board and the City of Ames as a part of the 3-year public outreach project.

Problem

Urban and agricultural watersheds both contribute pollutants and stream bank erosion to Iowa streams. Urban stream assessment estimated 460 tons of soil erosion from stream bank and gully erosion were being produced annually from College Creek in 2006, one of four tributaries draining through Ames. One particular segment of unstable stream conditions was located between Daley Park and South Dakota Avenue. At the beginning of the project in 2008, this 3400 LF (.64 mile) segment was estimated to be contributing 222 tons of soil erosion to College Creek annually. The segment was identified as "widening and down cutting," meaning that large sections of bank were caving in and collapsing due to the volume and intensity of runoff reaching the channel. Without intervention, the channel bottom would naturally have continued to deepen and the banks fail, eroding vast amounts of sediment each year until it reached the size needed to handle the stormwater being delivered. Simply lining the banks with rock or plants to stabilize would not have solved the problem. This section of the stream was located in both public and private ownership, with the most unstable portions located on public property. City officials successfully applied for Iowa WIRB funds to reconstruct the stream channel and banks, short-circuiting the erosion process and immediately improving in-stream habitat conditions.

What Happened

The goal of this collaborative effort was to reduce future bank erosion and restore a stable stream channel on this section of College Creek. The first step after securing funding for this construction was to listen to the priorities of the neighborhood and community in terms of goals for habitat and water quality enhancement alongside the restored channel. The site has high visibility because a high-use public walking path and public sidewalk follow the entire length of the stream. The public vision included maximizing native plant habitat and roughness in near-stream areas. The minimum amount of rock rip-rap needed to reduce erosion at the water's edge and preservation of large existing trees near the stream was also desired. A vision, including proposed sketches of the channel and near-stream area, was prepared based on public input by ISU.

Stream channel reconstruction occurred during summer 2010 and resulted in the removal of 4000 cubic yards of soil from the channel area. A length of 2800 feet of stream channel (4095 total feet of stream bank) was stabilized including some areas with a two-stage channel cross section. This created more room for the stream to move, store floodwater and provide stream-edge habitat. Erosion estimates for this section of College Creek were reduced 74% following construction compared to pre-construction

measurements. Four acres of publicly-owned mown lawn was replaced with native prairie, shrub and tree plantings following construction.

Conclusion

While Ames has many reasons to be proud of its natural resources, this project is an important accomplishment. Three years after beginning, this section of College Creek is yielding an estimated 165 fewer tons of soil and is more stable. The public walking path offers views of the restored stream channel and native plant filtering buffer. Adjacent homeowners and residents of Ames take pride in knowing they were proactive in reducing stream bank erosion and enhancing water quality and wildlife habitat. Also important, multi-disciplinary collaboration and cooperation led to a successful first experience with stream channel and riparian restoration in Ames. This experience opened the doors of possibility within this community in terms of cooperation between engineering, restoration sciences and the design of public open space.

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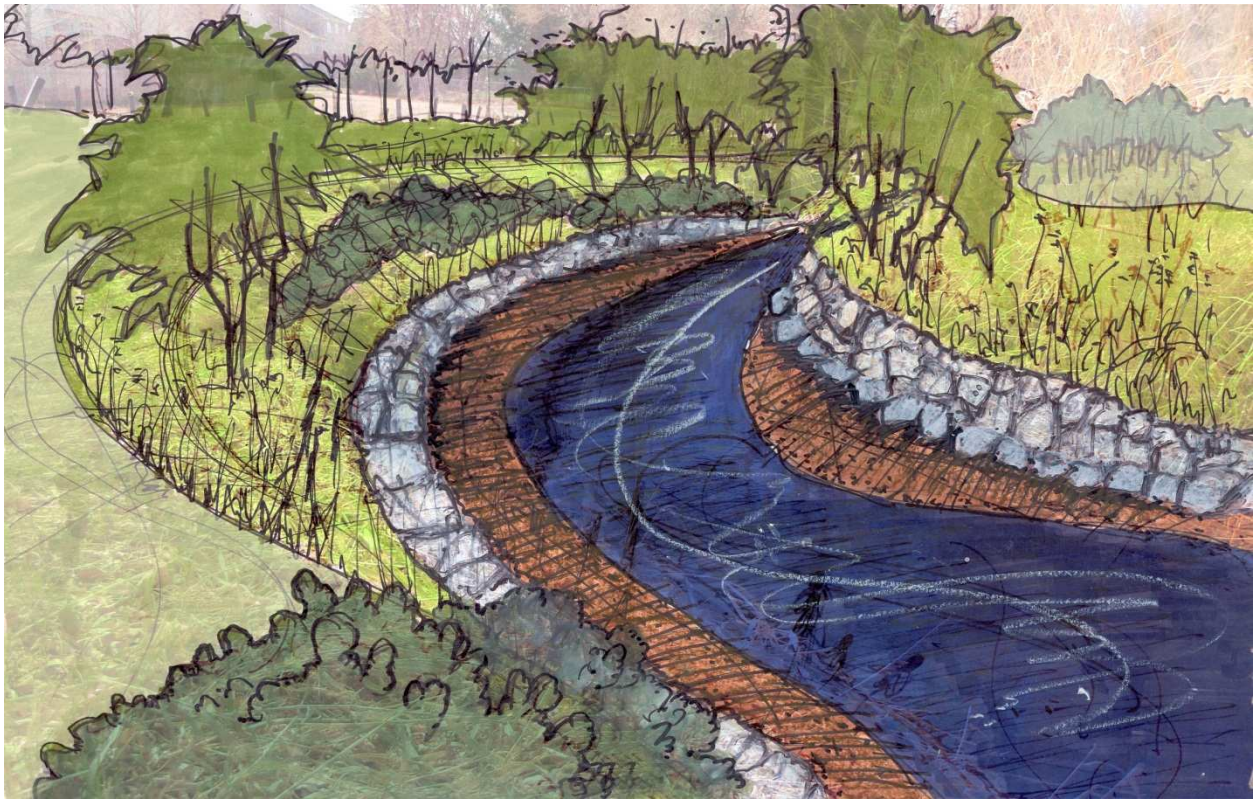
The segment of College Creek included in this report was highly eroding. The channel bottom was actively down cutting and stream banks failing.



This sketch represents the community vision for the restored stream channel: failing stream banks are replaced with the minimum amount of rock required, the channel bottom is wider and more stable and mown lawn near the stream is replaced with native vegetation.

Post-construction view of the restored stream channel shows mature trees salvaged, the two-stage channel and near-stream areas seeded and planted with native vegetation.

College Creek Restoration Success Story: *"We Want to Help Our Stream..."*

Much attention is focused on the condition of Iowa urban streams and water quality. Small streams, such as College Creek in Ames, often serve as play areas for children and form the backbone of community green spaces. This article focuses on one Ames neighborhood and their approach to pollution their yards were contributing to neighboring College Creek. Working with the City of Ames Public Works department, and ISU researchers and students, residents constructed stormwater best management practices designed to remove the majority of pollutants from first flush rains coming from their yards. Construction and monitoring costs were funded by Iowa Watershed Improvement Review Board and the City of Ames as a part of the 3-year College Creek Restoration project.

Problem

While the quality of water in streams is a product of runoff from its entire watershed, urban areas, by their nature, are known to consistently contribute certain pollutants. Both volunteer and technical water quality monitoring of Iowa streams, including College Creek, indicate persistently high concentrations of bacteria and nutrients such as nitrogen. Monitoring also indicated that pollutant concentrations tended to increase within urban areas compared with upstream rural portions of the watershed. The sheer volume of stormwater generated by urban streets and roofs also negatively impacts stream condition and water quality. Faced with these results, residents of Emerson Drive cul-de-sac in Ames agreed to coordinate construction of stormwater treatment practices in their yards to filter stormwater runoff from their roofs and yards before it entered the storm drain system leading to College Creek.

What They Did

The goal of this community-university research effort was to capture and treat the first 1.25 inches of rainfall occurring in a given storm, eliminating this drainage reaching the storm drain system. ISU faculty and students coordinated with homeowners to both construct the bioretention cells used to treat the stormwater, as well as to measure the amount of water leaving their cul-de-sac before and after construction. Faculty and students first installed flow meters in the storm drain pipe draining the cul-de-sac one year before construction began. Flow meters continuously monitor and record the amount of water flowing through the pipe. A second flow meter was installed in a similar adjacent cul-de-sac and used as the "control" area where no stormwater practices were installed.

Residents and students constructed 18 bioretention cells on private property. The cells were designed to appear as landscaped areas with local rock and native vegetation. Each cell included a 3' deep excavated hole that was backfilled with an engineered soil mix, planted, edged and mulched. Iowa engineering standards suggest this practice is effective in removing 65-100% of phosphorus, metals and bacteria as well as 30-65% of nitrogen and hydrocarbons from the stormwater they infiltrate. Bioretention cells were positioned in places to intercept the maximum amount of roof, driveway, and lawn drainage possible. This enabled them to treat as much stormwater as possible while also reducing the quantity of stormwater released directly to the stream.

Fourteen Emerson Drive homeowners (all but one) agreed to participate in the research project. The average bioretention cell construction cost was $609, not including labor. Of the total drainage area entering the storm drain system and College Creek, bioretention cells were constructed to capture and treat 80% of the roof drainage and 54% of lawn areas. The 18 cells constructed totaled 2,128 square feet in size.

How it is working

Post-construction, significantly less stormwater entered College Creek from the Emerson Drive cul-de-sac compared to the control area. Flow meters measured a 70% reduction in stormwater volume reaching the storm drain during the first inch of rainfall compared with the control area. When rainstorms were larger than 1.25 inches, measured stormwater flow was identical between the two sites. As designed, this feature assures homeowners that bioretention cells won't contribute to flooding in the event of large rainstorms—excess water enters the storm drain system as originally constructed. Importantly, near-record Ames rainfalls in August 2010 did not damage the bioretention cells or cause flooding.

The Emerson Drive homeowners reported a sense of satisfaction with their contribution to water quality enhancement. They appreciated having "hard data" demonstrating their efforts have paid off in terms of converting stormwater runoff to groundwater infiltration. Homeowners also acknowledged the amount of labor they invested in the bioretention gardens as well as the no-cost aspect of the project to them.

Conclusion

This project provides an important precedent for urban areas and neighborhoods. Iowa State University provided in-kind professional services. Though this effort was low-cost, we have now demonstrated the benefits that can be derived from homeowners taking action to manage the stormwater their homes and yards produce before it reaches the public right-of-way. We also realize the importance of cooperative efforts between stormwater management professionals, city staff and homeowners.

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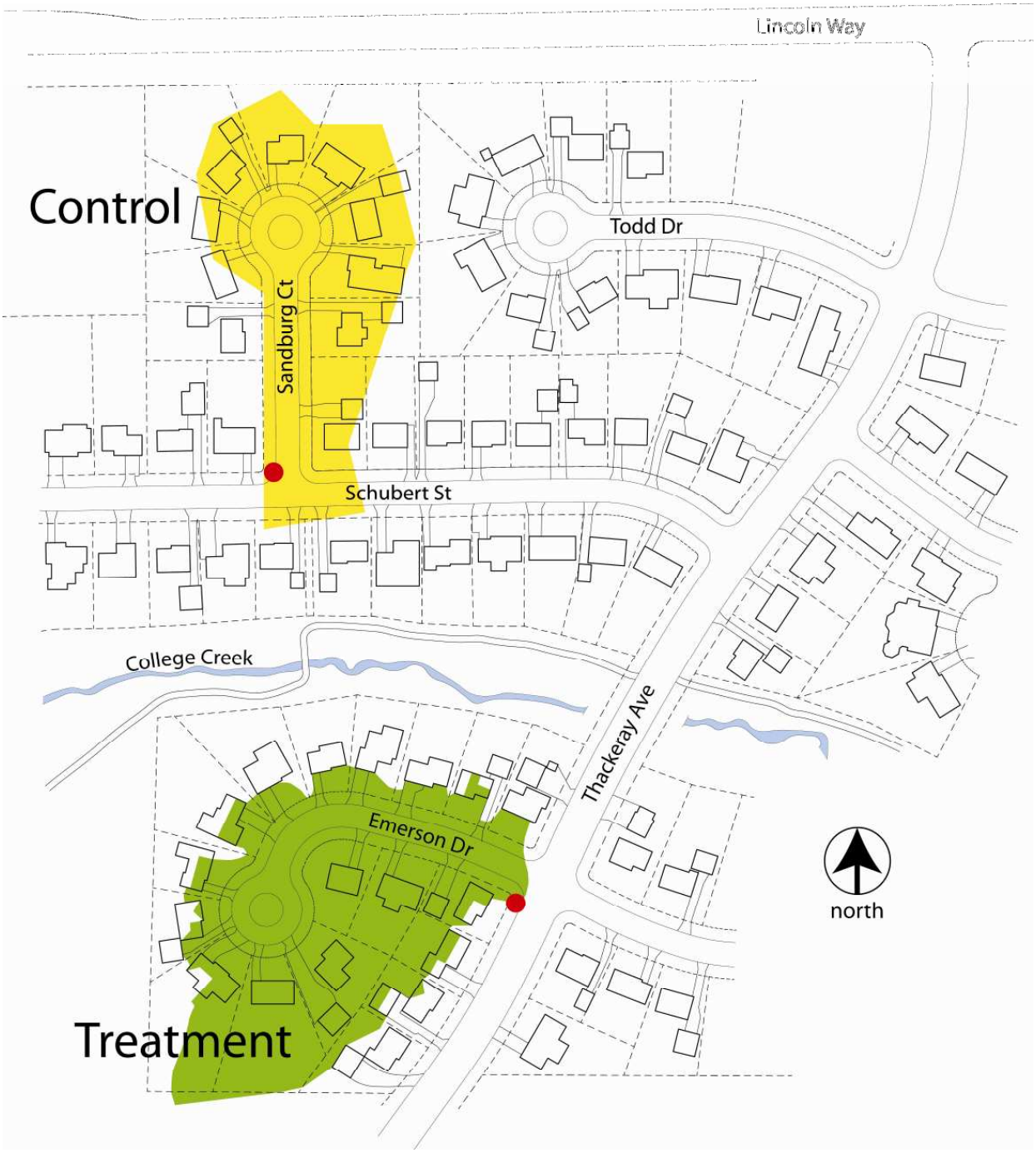
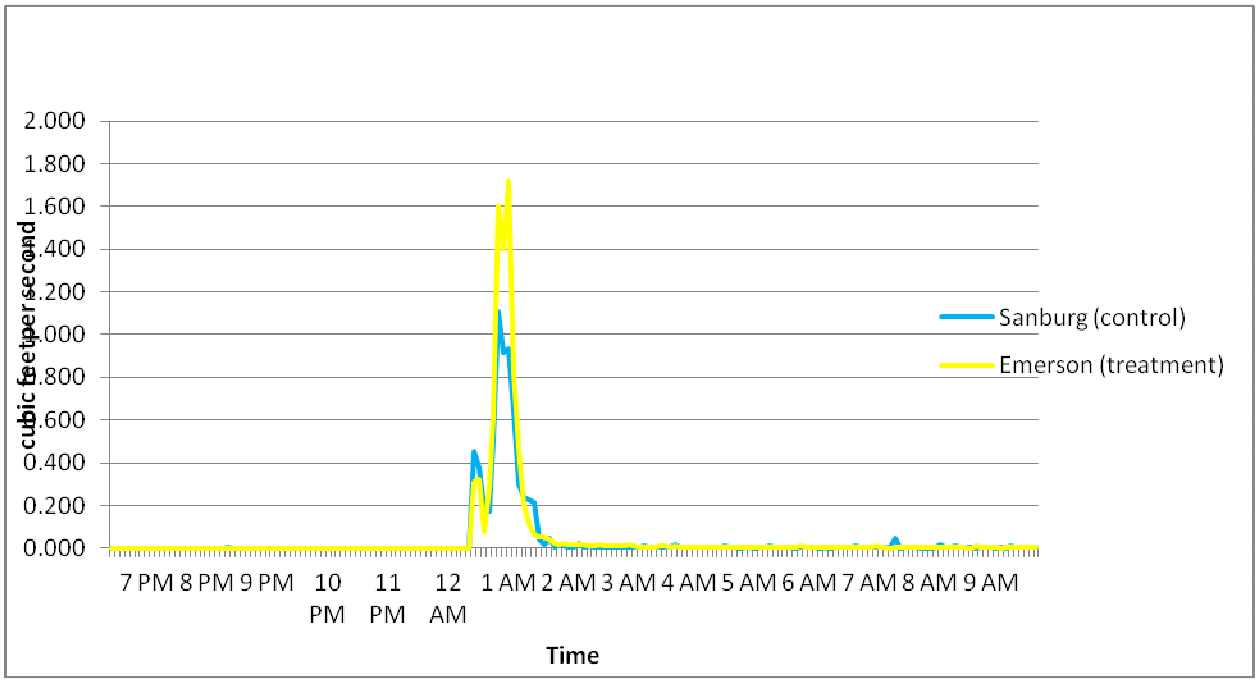


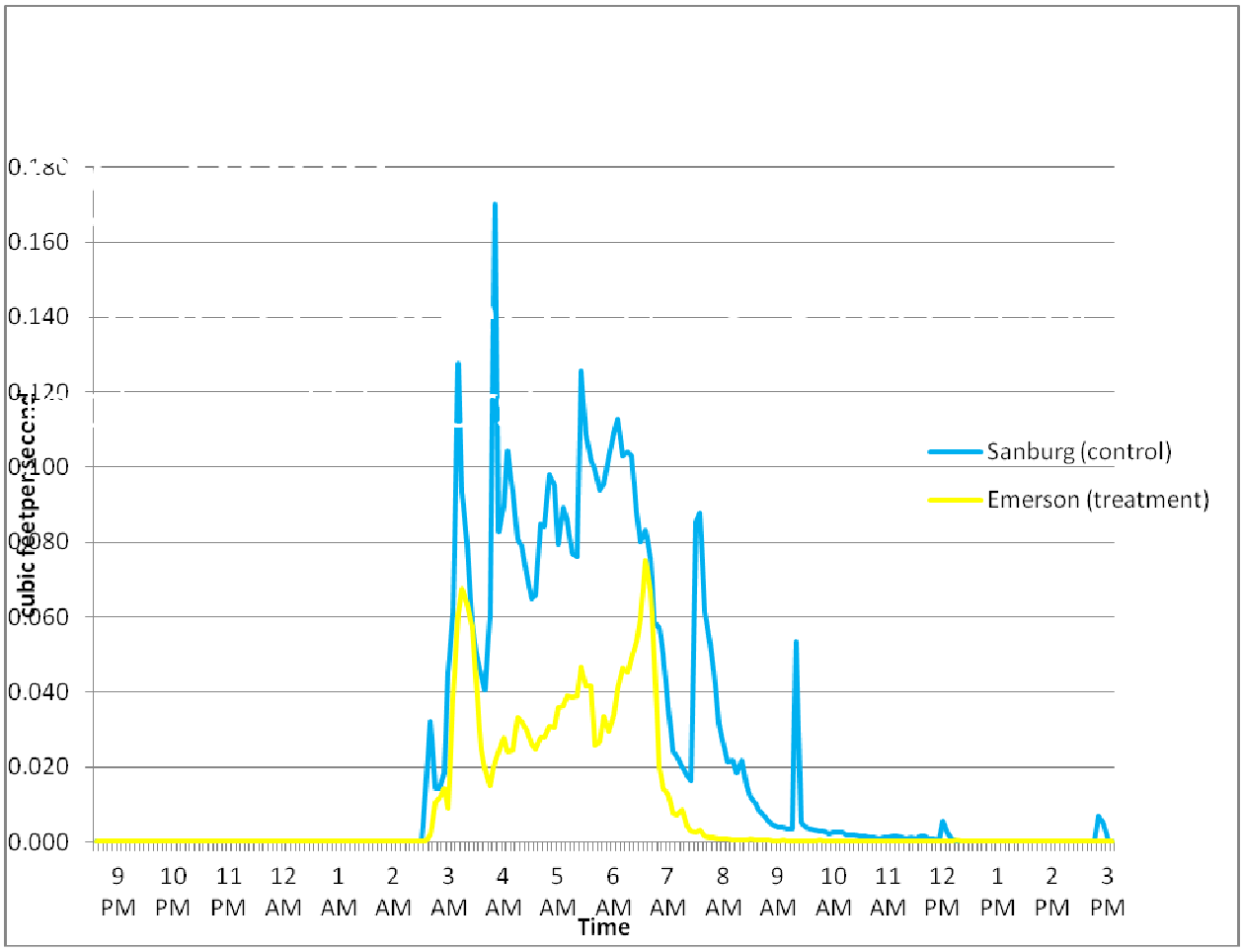
Base map of study site depicting both the stormwater treatment and control areas

Bioretention cell under construction in homeowners yard.



Pre-Construction – June 18, 2009 Storm Event (T= < 3-mo; 0.5 inches in 2 hrs)

Pre-construction stormwater runoff monitoring indicated the treatment area (Emerson Drive cul-de-sac show in yellow) shed more water than the control area (shown in blue.



Post-Construction – Sept. 25, 2009 Storm Event (T= < 3-mo; 0.54 inches in 8 hours)

Post-construction stormwater runoff monitoring demonstrated the treatment area (Emerson Drive cul-de-sac show in yellow) shed far less water than the than the control area (shown in blue) as water was captured in the bioretention cells rather than entering the storm drain system.

Completed and planted bioretention cell on Emerson Drive.

College Creek Restoration Success Story: *"Urban Streams are about more than just drainage…"*

The quality of water bodies can be understood in terms of what species are able to live there in addition to the water chemistry. Biological assessments, studies of what species are found at a site, are being used more and more frequently to understand conditions of streams and how to enhance them. This article focuses on a segment of an urban tributary in Central Iowa with particularly low biological quality and the City's approach to enhancing both water and habitat quality, as well as reducing non-point source erosion. Neighboring landowners worked with Iowa State University and Indiana University researchers to assess frog and toad species breeding in wetlands adjacent to the tributary. City of Ames Public Works department and the Iowa Watershed Improvement Review Board (WIRB) funded restoration of the stream channel as part of the 3-year College Creek Restoration project.

Problem

Streams in Iowa function for many purposes including drainage, groundwater recharge and recreation. Urban stream corridors can also serve as critically important wildlife corridors connecting open parks and green spaces with each other and the rural fringe, including migratory birds, fish and amphibians. The condition of the stream channel bottom is a significant determinant of how many other species can live in and near the stream. Iowa DNR monitoring of College Creek in 2007 at this study location was unable to obtain sufficient aquatic insects on the channel bottom for a valid assessment. This is significant considering downstream College Creek conditions, in the ISU Arboretum, scored 61 (out of a maximum of 84) for aquatic insects on the same day. Further stream channel analysis in 2008 mapped a minimum of 3" deep silt deposit on the bottom of the channel for 4200 feet of College Creek including this study location. These sediment deposits were attributed to the eroding stream banks and gullies in this segment of the stream. Silt deposits on channel bottoms are known to smother aquatic insect habitat, also eliminating the habitat and food sources needed for fish and amphibians. Residents were interested in determining what species of frogs and toads were present in the surrounding area and could benefit from silt removal and stream bank rehabilitation. Neighborhood landowners and ISU researchers cooperated to conduct a frog and toad assessment during the 2009 breeding season.

What They Found

Dr. Michael J. Lannoo, Professor at Indiana University School of Medicine and Iowa Lakeside Laboratory, directed the frog and toad assessment. Calls were recorded during the breeding season at wetlands in Daley Park and at Hobbit's Hill. The Hobbit's Hill wetland is a privately-owned prairie pothole reconstructed in 1999 and located approximately 900 feet upstream of the Daley Park wetland. The two wetlands are physically connected by privately-owned prairie plantings in the long term conservation program, CRP. Six species were identified by their calls during the breeding season including: American Toad, Cope's Grey Tree Frog, Eastern Grey Tree Frog, Western Chorus Frog, Plains Leopard Frog, and Northern Leopard Frog. Three of these species were identified only at Hobbit's Hill wetland, which is a higher quality habitat compared to Daley Park. The invasive Bull Frog was also identified at Daley Park.

Progress Since the Assessment

Significant steps have been taken to enhance habitat for amphibians, insects and fish since these assessments. The College Creek Restoration project rehabilitated unstable stream banks and gullies on both sides of 2800 feet of channel in the study area. Immediately following rehabilitation, the natural channel bottom sand and cobbles returned in place of the former muddy channel bottom. Native grasses, trees and shrubs were planted in lieu of mown grass. Both these changes provide improved

habitat conditions for the complete life cycle that insects and the frogs and fish that feed on them require.

Conclusions

The upper reach of College Creek included in this project is considered to have potential for high quality amphibian restoration due to disconnected channel reaches in the lower reaches. Several low head dams and structures exist which block seasonal migration of fish which would normally feed on amphibians. The headwater's location of this restoration is key to improving ecological condition and function in the entire stream length. Enhancements made through the City of Ames College Creek Restoration and those of the Joint Boone #93-B and Story #4 Drainage District stabilized stream banks and channels, stabilized incoming channel flow and reduced sediment supply to sustainable levels. The Daley Park wetland, while low quality habitat, provides a key link with the Hobbit's Hill wetland and the lower College Creek and Squaw Creek corridors. Improved habitat conditions in the stream channel above and below the Daley Park as a result of these efforts are expected to allow present insect and amphibian populations, some unusual for the Central Iowa region, to increase in size and new, additional species to establish.

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ISU Landscape Architecture students Brett Seelman (left) and Stephanie Nelson sample amphibians at Hobbit's Hill wetland near College Creek. This reconstructed prairie pothole provides key habitat to College Creek amphibians. Physical sampling was used to confirm digital sound recordings made earlier in the breeding season.

Students sample the Daley Park wetland for amphibian species. This wetland was classified as low quality by wetland scientists in 2009 but provides the opportunity for future enhancement. Invasive Bull Frogs were the most common species identified at this location in field assessment.

The theme of a public “Creek Chat” focused on results of the 2009 frog and toad inventory. ISU student Landscape Architecture student Brett Seelman, responsible for analysis of digital frog calls, shares research findings and examples of sound recordings made with Ames residents; neighborhood children shared frogs they collected from the stream area.