LANDSCAPE PERFORMANCE SERIES

Boneyard Creek Restoration: Scott Park and the Second Street Detention Basin – Champaign, IL
Methodology for Landscape Performance Benefits
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Environmental

Provides 100-year flood protection by containing the 15 million gallons of stormwater generated during a 100-year storm event.

Providing 100-year flood protection was the primary goal of the project, with 2006 project documentation stating that "the primary objective.. was to provide additional stormwater detention with the associated conveyance requirements to provide 100-year flood protection." The design team sought to achieve this primary goal while creating a community amenity which would improve circulation and support economic development.

Consulting firm CDM created a hydrologic and hydraulic model in 1999 for all of Boneyard Creek. The model was developed using SWMM 4, the US EPA's Stormwater Management Model, Version 4. This model was later transferred into the program's next version, SWMM 5, and segmented for individual phases. The model created scenarios for each phase in both its existing and future conditions.

These models determined that the site could withstand both the 50-year, 2-hour storm and the 100-year, 2-hour storm, with maximum water surface elevations remaining below street level at all reaches in the City of Champaign. This table and report excerpt summarize the key findings:

> The maximum water elevations for the 50-year and 100-year storms are shown on Figure 2-2. With the planned improvements, the model shows that maximum water surface elevations should stay under street levels at all reaches in the City of Champaign. The proposed improvements would also provide a 25-year level of protection to the viaducts at Logan Street, Springfield Avenue and University Avenue as shown in Table 2-2. Further refinement and optimization of the proposed improvements will be investigated during the schematic design phase to evaluate the practicality of achieving the desired 50 year level of protection in the viaducts.

Table 2-2
Viaduct Analysis Results – Future Condition

Viaduct	Street Elevation (feet)	25-Year Max. Water Elevation (feet)	Ponding Depth (feet)
Logan Street	722.1	721.4	None
Springfield Avenue	724.1	723.4	None
University Avenue	727.7	725.3	None

Source: *Boneyard Creek Phase 2 Improvements: Program Development Summary Report. Street locations noted on plan below.*

The SWMM model also shows the storage capacity of the Second Street Basins:

16.5 acre-ft (North Basin) + 30.5 acre-ft (South Basin) = 47.0 acre-ft

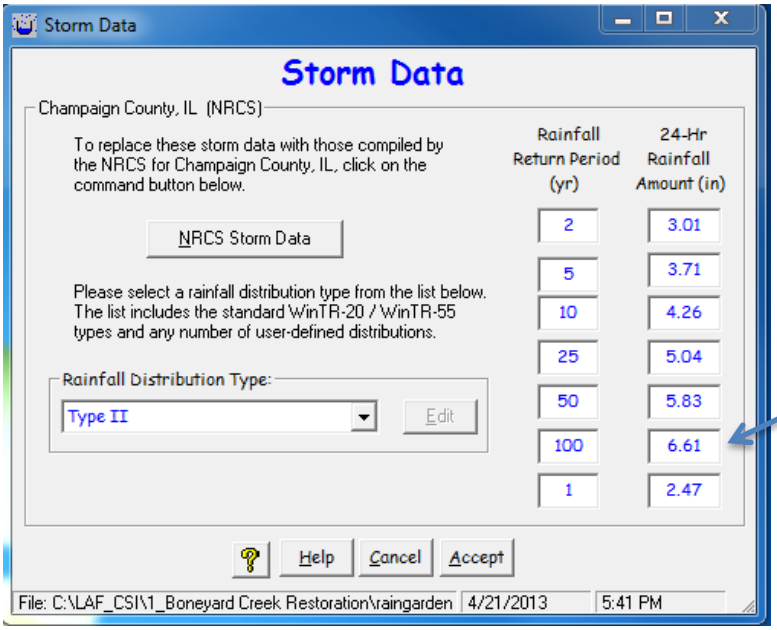
47.0 acre-ft = 15.3 million gallons

Summary of SWMM Model Results Boneyard Creek Improvements City of Champaign		100 year / 2 hour Storm			
		Elevation		Flow (cfs) or Storage	
Location	Node	Existing$_1$	Future$_2$	Existing$_1$	Future$_2$
University Ave. East of 2nd St. (See note 3)	13900	726.3	724.7	220	325
First Street @ White St	1ST	n/a	723.8	n/a	365
North Detention Basin on Second St.	WHTBAS	n/a	723.6	n/a	16.5 ac.ft.
South Detention Basin on Second St.	STGBAS	n/a	722.8	n/a	30.5 ac.ft.
Scott Park	12272	720.3	719.6	530	485
Underground Storage Entrance	119402	719.0	715.9	530	490
Wright Street	9705	714.1	713.6	750	675

Using the Natural Resources Conservation Service (NRCS), the CSI research team estimated the volume of stormwater produced during the 100-year, 24-hour storm:

Catchment area: 83.5 acre

83.5 ac x 43,560 sf/ac = 3,637,000 sf



Since the 24-hr rainfall amount for the 100-year storm event in Champaign County in Illinois is 6.61 inch total, the amount of stormwater entering the project site would be:
6.61 inch/12in/ft x 3,637,000 sf = 2,003,380 cf
2,003,380 cf x 7.48052 gal/cf = 15,000,000 gal

Improved habitat value of the site from "poor/marginal" to "suboptimal". USEPA Rapid Bioassessment habitat scores for the Detention Basin and Scott Park Stream rose from 58 and 69 (May 2008) to 133 and 135 (August 2012). Ducks, Canada geese, turtles, and green heron have been observed on the site.

Data on habitat was collected following the USEPA Rapid Bioassessment Protocols. Parameters that were evaluated include epifaunal substrate/available cover, pool substrate characterization, pool variability, sediment deposition, channel flow status, channel alteration, channel sinuosity, band stability, vegetative protection, and riparian vegetative zone width. Habitat scores are ranked on a 0-200 point scale and divided into four categories; 0-50 (Poor), 51-100 (Marginal), 101-150 (Suboptimal), 151-200 (Optimal).

In May 2008, CDM completed a Rapid Bioassessment of Boneyard Creek, during the pre-construction phases of the project. The Bioassessment included assessments on habitat, periphyton and macroinvertebrates. Individual habitat assessment scores fell in the "poor" to "marginal" range, with Section 1 scoring 69 and Section 2 scoring 58. Additional information is available within the report completed for the City of Champaign entitled "Rapid Bioassessment of Boneyard Creek for Phase 2, Boneyard Creek Improvements" (May 14, 2008).

As part of Corps permit requirements for the Boneyard Creek project, Applied Ecological Services Inc. (AES) was contracted by the City of Champaign to continue stream and wetland monitoring after the completion of the project. AES conducted monitoring of the site on May 24, 2012 and September 25, 2012. Monitoring requirements and success criteria are outlined in the "Boneyard Creek Mitigation Plan – Boneyard Creek Phase 2 Improvements – City of Champaign, IL." Monitoring is to occur for a period of five years to ensure success criteria are filled.

Habitat was evaluated in the North Branch reach and Scott Park reaches during both 2012 visits.

2012 Habitat scores indicate that both the North Branch and Scott Park stream reaches are “Suboptimal”, which meets the target goal and fulfills the success criteria.

May 24, 2012		August 25, 2012	
North Basin	Scott Park	North Basin	Scott Park
130	132	133	134

From *Annual Monitoring Report for the Boneyard Creek Project Site in Champaign, Illinois* (AES Project #12-0248).

Improved physical characteristics and water quality in the creek. According to monitoring data, water pH dropped from 7.93 to 6.96 in Scott Park and 7.54 to 6.89 in the North Basin. Total number of taxa increased from 3 to 7 in Scott Park and from 5 to 8 in the North Basin.

Pre-project water quality monitoring was summarized within the City of Champaign report entitled “Rapid Bioassessment of Boneyard Creek for Phase 2, Boneyard Creek Improvements” (May 14, 2008). The water quality data at the time was as follows:

Table 3.1 Physical and chemical water quality measurements

	Section		
	1	2	3
Temperature (deg C)	16	17	22*
Dissolved Oxygen, (% saturation)	99.4	100.9	99.2
Dissolved Oxygen (mg/L)	9.81	9.69	8.7
pH	7.93	7.36	7.54
Oxidation reduction potential (mV)	237.4	218.5	196.5

Section 1 is Scott Park, Section 2 is Springfield Ave to White St (South Basin), and Section 3 is White St to University Ave (North Basin).

Source: “Rapid Bioassessment of Boneyard Creek for Phase 2, Boneyard Creek Improvements” (May 14, 2008).

Post project monitoring was completed by the City, with the 2012 figures above sourced from *Cellini, J. 2013. 2012 Annual Monitoring Report for the Boneyard Creek Project Site in Champaign, Illinois (AES Project #12-0248).*

Social

Provides educational and volunteer opportunities for the community. The annual Boneyard Creek Community Day attracts some 300 volunteers to remove litter and invasive plants. Since 2010, over 150 planners, landscape architects, engineers, college students and senior citizens have taken educational tours of the site.

The annual Boneyard Creek Community Day attracted 300 volunteers in 2013, with events including clean-up and education on environmental stewardship, water quality monitoring and the history of Boneyard. Information on the annual Boneyard Day was sourced from the Boneyard Creek Community Day website, which is accessible at: http://www.boneyardcreek.org . The event has been held eight times

and is scheduled to next occur in April 2014. The East Central Illinois News Gazette confirmed that 300 participants attended the 2013 event and 275 attended the 2006 event. The articles are accessible at:

http://www.news-gazette.com/multimedia/photogallery/2013-04-06/boneyard-creek-community-day-2013 .

http://www.news-gazette.com/living/2006-04-23/volunteer-workers-remove-garbage-invasive-species-boneyard.html

Eleanor Blackmon, Assistant City Engineer at the City of Champaign, provided an estimate on the number and types of individuals engaging in educational tours of the site.

Provides the first complete bike path connection between the University of Illinois campus and downtown Champaign. As of the University's last mobility survey, 42% of students use bikes at least once a week, and 4% of employees use bikes as their primary mode of transportation.

The designers confirmed that the park provides the first complete pedestrian/bike connections between the campus and Champaign central business district. The university has over 52,000 students, faculty, and staff: http://illinois.edu/about/overview/facts/facts.html

The University of Illinois' 2013 Campus Bike Plan cited the bike user statistic from the last campus mobility study, conducted in 2007. The 2013 Campus Bike Plan (downloadable at: https://icap.sustainability.illinois.edu/files/project/37/May_2013_Draft_Campus_Bike_Plan.pdf) is quoted below:

> *"In 2007, the Mobility Implementation Plan (miPlan) survey included questions about bicycle ridership. About half of the students had access to a bike, and 42 percent reported using a bicycle at least once a week. Additionally, four percent of employees reported using a bicycle as their primary mode of transportation, while 70 percent owned a bike. At the time of the survey, there were 41,495 students and 11,676 employees on campus which implies there were 17,428 student bicyclists and 467 employee bicycle commuters."*

References

Barbour, M.T., Gerritsen, J., Snyder, B.D., Stribling, J.B., 2008. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Bethic Macroinvertebrates, and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Camp Dresser & McKee Inc, 2008. Boneyard Creek Mitigation Plan - Boneyard Creek Phase 2 Improvements – City of Champaign, IL

CDM. 2008. Rapid Bioassessment of Boneyard Creek for Phase 2m, Boneyard Creek Improvements – City of Champaign, IL.

Cellini, J. 2013. 2012 Annual Monitoring Report for the Boneyard Creek Project Site in Champaign, Illinois (AES Project #12-0248).