



# Evaluation of a Stormwater Treatment Wetland

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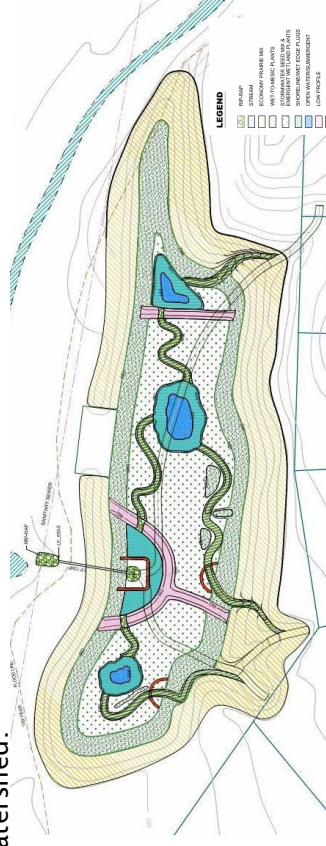
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## Introduction

Improper storm water management leaves a distinct, detrimental fingerprint on downstream water quality, urban flood control and receiving stream stability in developing landscapes. Butler County, Ohio has been experiencing high rates of urbanization within the last decade without a corresponding improvement in storm water management.

In a collaborative response to this problem, Butler Soil and Water Conservation District, Butler Storm Water District, Institute of Environmental Sciences of Miami University, Ohio Department of Natural Resources, Beckett Ridge Homeowner Association, and Mill Creek Watershed Council retrofitted a traditional stormwater basin with a wetland designed to improve quality of stormwater runoff and provide native wetland habitat in a suburban area of the Upper Mill Creek Watershed.



Site Restoration Plan

During the 2007 Undergraduate Summer Scholars session, water quality and biological data were collected at the basin to evaluate the progress of the restored wetland. The study included bi-monthly water samples and weekly inventories to evaluate the development of native habitat, including plants, birds, amphibians, and macro-invertebrates.

As part of the study, an additional storm water basin (Site B) in the Beckett Ridge area was evaluated and compared to the storm water treatment wetland (Site A). Site B is a 20+-year-old basin built on traditional concrete culverts that is currently overgrown with woody and other wetland vegetation.

## Amphibians

Funnel traps and voice surveys were used to sample amphibians. Traps were set on four separate days in the spring, left for 24 hours each time, and checked for presence of amphibians. No salamanders or their eggs or larvae were seen or caught in the funnel traps at Site A or Site B during the 2007 field session. One green frog was caught in a trap at Site A, but no frogs or toads were heard on three nights of listening and no tadpoles were found in any sampling.



Green Frog, April 2007

## Vegetation

Five random samples each were taken from two dominant plant communities at Site A and three communities at Site B using a square plot of 0.5m<sup>2</sup>. Samples were dried at 60-80°F for 24 hours and massed. The dry upland community at Site A was located on the elevated sections on the outer edges of the basin. The wet lowland community at Site A was located towards the center of the wetland in the areas surrounding the ponds and meanders. At Site B, the open field community was located farthest from the concrete culvert. An intermediate community was located between the culvert and the open field section. The streamside community followed the culvert stream that flows along the outer edge of the basin.



Plant Community	Dominant plants
Site A: dry upland	Wheat grass, rye grass, yellow clover, ragweed, teasel
Site A: wet lowland	Sedges, wetland grasses
Site B: open field	Grasses, teasel, goldenrod
Site B: intermediate	Willow trees, sedges, wetland grasses
Site B: streamside	Willow trees, goldenrod, wetland grasses

## Birds

Birds were surveyed on 16 visits to Site A and B between 8 a.m. and 10 a.m. with the exception of one evening visit around 9 p.m. Thirty minutes were spent at each site, recording all species and numbers of each species seen at the site. The Jaccard community similarity index was 0.889, indicating that the bird community at Site A was very similar to the community at Site B. Wetland dependent species comprised 16.7% of the species at site A and 12.5% of those at Site B.

Bird species at the Wetland (Site A) and comparison basin (Site B)

Species	Site A	Site B
<b>Great Blue Heron</b>	X	X
Cooper's Hawk	X	
Red Tailed Hawk		XX
<b>Mallard</b>	XX	XX
Mourning Dove	XX	XXX
Downy woodpecker	XX	XX
Cedar Waxwing	X	
Blue Jay	XXX	XX
American goldfinch	XX	XXX
Indigo Bunting	XX	XX
Northern Cardinal	XXX	XXX
Song Sparrow	XX	XX
Barn Swallow	XXX	XX
<b>Tree Swallow</b>	XX	XX

Species	Site A	Site B
Brown Headed Cowbird	XX	X
Common Grackle	XXX	XXX
<b>Red-Winged Blackbird</b>	XX	XXX
Gray Catbird	XX	XX
Carolina Chickadee	XX	XX
Magnolia Warbler		X
Palm Warbler		XX
Yellow warbler	X	X
House Sparrow	XX	XX
European Starling	XX	XX
Blue-gray gnatcatcher	X	XX
American Robin	XXX	XXX
Eastern Kingbird	X	X

X=sighted one day; XX=sighted more than once; XXX=sighted on at least 8 of the 16 days. Bold = wetland dependent species.

## Macroinvertebrates

Shannon-Wiener Diversity Index Values

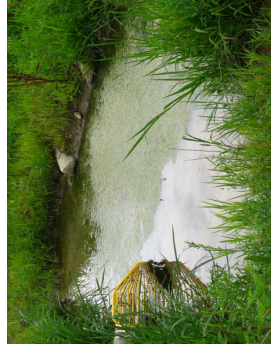
Sample #	Site A	Site B
1.	0.9739	0.7096
2.	1.233	1.808
3.	1.372	2.035
Average	1.193	1.517

Macroinvertebrates were sampled at three locations within both Site A and B. D-nets were used to sample the water column and substrate and macroinvertebrates were picked out of this material for later identification in the lab. The Shannon-Wiener diversity index and Jaccard similarity index were computed for Site A and Site B samples.

## Water Sampling

Water samples were taken bimonthly from inflow and outflow at sites A and B from May to August, for a total of 7 sampling days. Water samples were analyzed for nitrates, total phosphorous, bacteria, conductivity, total dissolved solids, pH, and turbidity as part of the Butler County Stream Team program, a volunteer water sampling and analysis project of Miami University's Institute of Environmental Sciences.

Paired t-tests found no significant difference between the inflow and outflow levels of phosphorous and nitrates at either Site A or Site B.



Site A, Outflow



Site A, Pond 3

## Discussion

Water sampling at Site A and B did not indicate an improvement in water quality from inflow to outflow. However, at site B, the macroinvertebrate diversity index increased from inflow to outflow, which suggests an improvement in water quality. Unfortunately, the design of Site A does not allow macroinvertebrates to be sampled directly at the inflow during the summer sampling season, so it was difficult to use macroinvertebrates to estimate water quality improvement at the wetland this year. The small size of both basins may limit water retention time and, consequently, may limit their ability to remove nutrients. As the wetland at Site A develops, a more mature macrophyte community may increase retention time and microbial communities, resulting in greater nutrient removal.

The relative isolation of the wetland within a suburban area, along with its small size, limits the level of species diversity that can be expected for both birds and amphibians. However, the wetland offers significant resources for birds that, though not wetland dependent, can utilize the abundant macrophytes, insects and seeds as food. In summary, the constructed wetland is providing habitat, but not necessarily for wetland dependent species. This function also could be expected to increase as the wetland develops.