

Retrofitting Traditional Detention Basins for Water Quality

2019 Ohio Stormwater Conference



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Presentation Outline

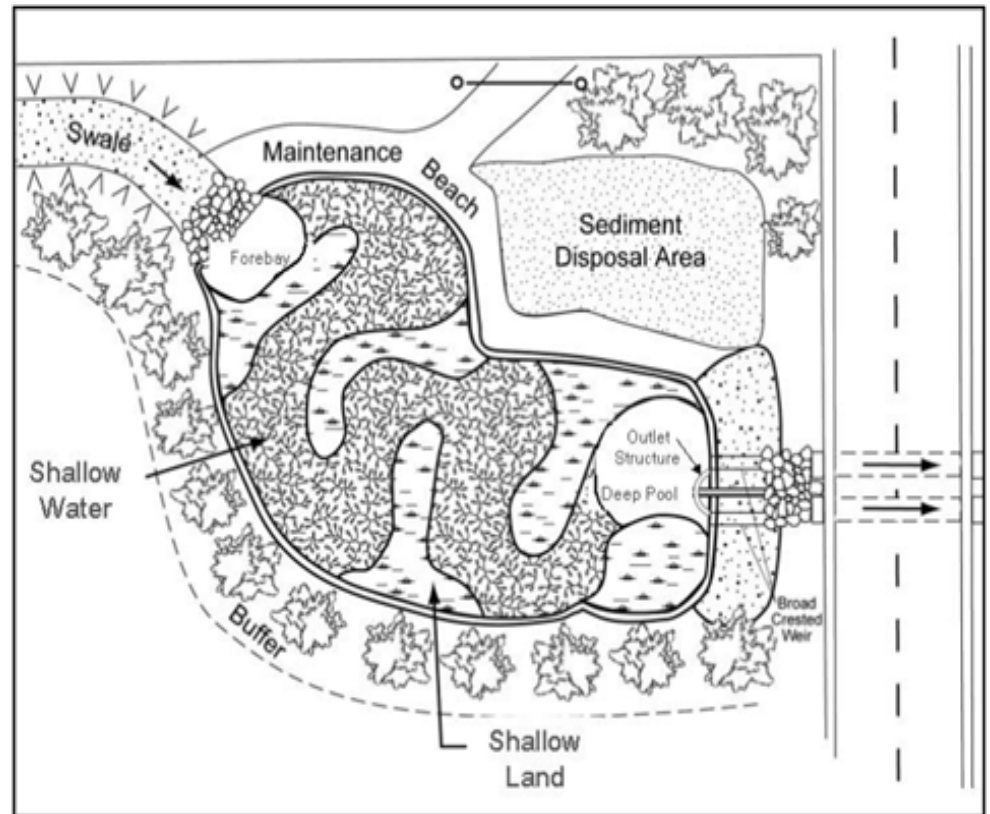
- **Introduction**
- **Design Principles**
- **Water Quality Improvement**
- **Constructed Examples**
- **Serving Multiple Functions**
- **Lessons Learned**

- **TRADITIONAL DETENTION BASINS**

- Intended to manage increased stormwater quantity due to development
- Storage of Peak storm Runoff volume
- Intended to reduce peak discharge rate

• WHAT IS A STORMWATER WETLAND ?

- Forebay,
 - Promotes Sedimentation
- Circuitous Wetland,
 - Promotes Microbial Action
- Outlet Pool,
 - Underwater outlet
- Control Structure,
 - Manages discharge rate



- **DESIGN PRINCIPLES**

Project Sizing

- Size wetland to treat 90% of storm events; in Ohio = 0.75" storm
- Size wetland at 1-2% of drainage area, for example:
 - 2 acre wetland serves 100 acre watershed
 - 5 acre wetland serves 250 acre watershed

Water Quality Improvement, Pollutant Removal Rates

Table 6

**Projected Long Term Pollutant Removal Rates
for Stormwater Wetlands in the
Mid-Atlantic Region^{a, c}**

<u>Pollutant</u>	<u>Removal Rate (%)</u>
Total Suspended Solids	75%
Total Phosphorus	45%
Total Nitrogen	25%
Organic Carbon^b	15%
Lead	75%
Zinc	50%
Bacteria	2 log reduction

From: Design of Stormwater Wetland Systems, Schueler 1992

Water Quality Improvement, Physical/Biological Processes

- **Sedimentation, largest pollutant process**
- **Adsorption to Sediment**
- **Physical Filtration by Plants**
- **Microbial Action**
- **Nutrient Uptake by Wetland Plants**
- **Uptake by Algae**

WHY RETROFIT ?

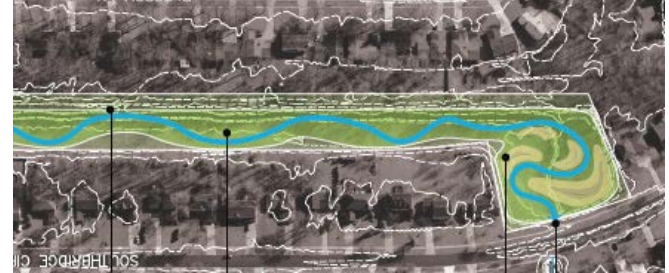
- Increase Flood Storage Capacity
- Water Quality Benefits due to Urbanizing Watershed
- Property Reconfiguration
- Grant Eligibility

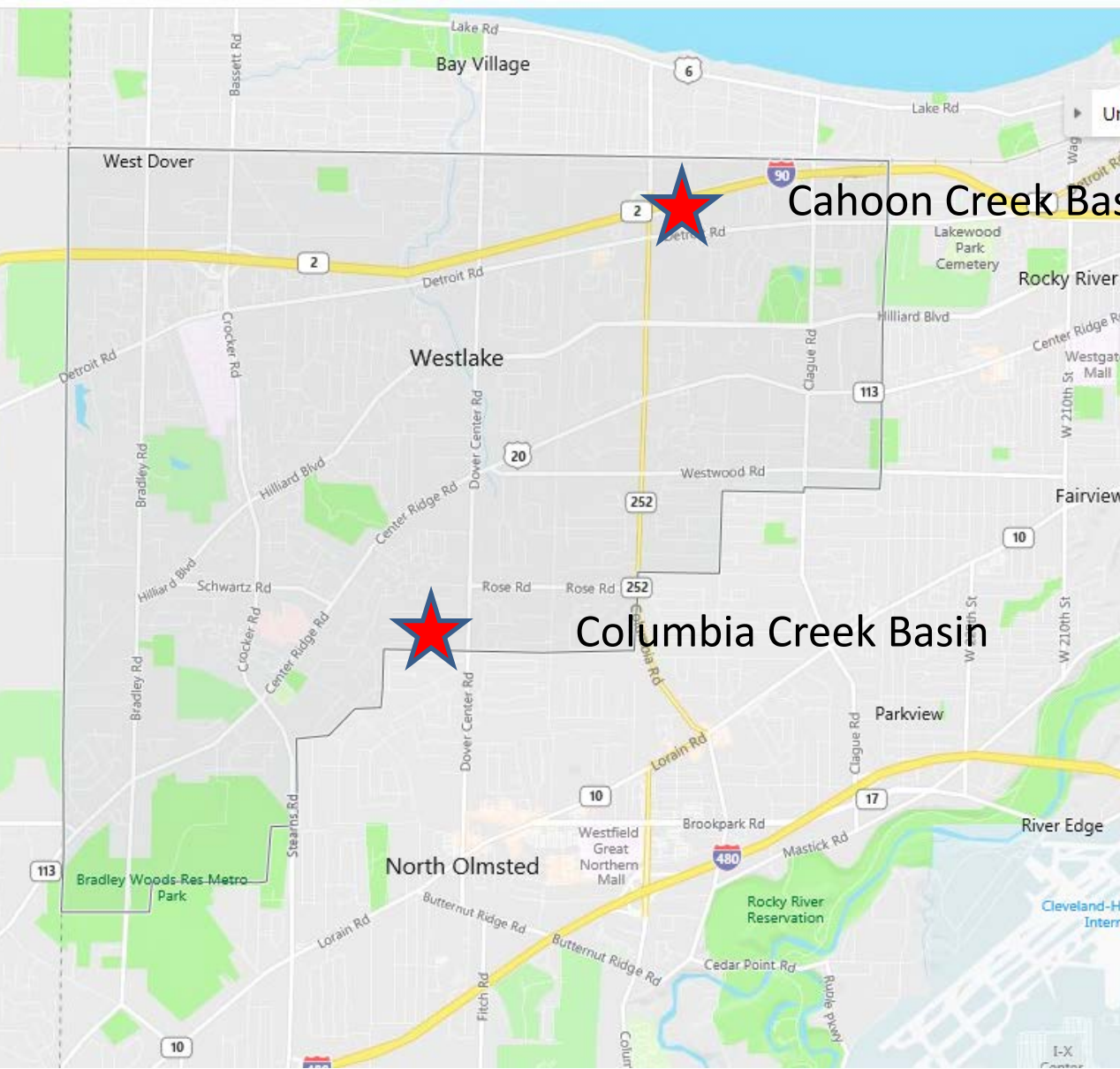
Serving Multiple Functions

- Provide Stormwater Storage, Flood Relief, Erosion Control
- Stormwater Filtration, Pollutant Breakdown, Water Quality,
- Wetland Mitigation potentials
- Open Space/Parks
- Public Education/Land Lab
- Public/Private Partnership potentials

Constructed Stormwater Wetland Examples

- Cahoon and Columbia Creek Floodplain Retrofits
Westlake, Ohio
- Smith/Ghent Pond Rehabilitation,
Akron, Ohio
- Elsa Drive Stormwater Basin retrofit,
Broadview Heights, Ohio





Cahoon Creek Basin

Columbia Creek Basin

Cahoon and Columbia
Creek Floodplain
Restoration

Site Location Plan – Westlake, Ohio

Cahoon and Columbia Creek Detention Basin Retrofits, Westlake, Ohio

Primary Goals:

- Address impaired runoff inflow from adjacent community
- Uptake nutrients
- Circuitous flow pattern
- Restore wetland vegetation
- Reduce maintenance
- OEPA 319 Grant funded



Conceptual Retrofit Plan



Before

Before:

- **Mowed,**
- **Straight channel**



After

After:

- **Native Riparian vegetation,**
- **Circuitous channel**



Before

Before:

- **Mowed,**
- **No Forebay**



After

After:

- **Native, Riparian Vegetation**
- **Forebay**

WHAT IS A WETLAND?



Defining Wetlands

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. (Environmental Protection Agency 40 CFR 230.201)

Wetland types differ depending on the water source (surface water or groundwater), the degree of connectivity to a stream or lake, the frequency of saturation or inundation (permanent or temporary), and the type of dominant vegetative cover. A range of wetland types can be found throughout Northeast Ohio, some of which include: emergent marshes, wet meadows, scrub/shrub wetlands, forested swamps, vernal pools, bogs, and fens.

Functions of Wetlands

Wetlands perform a range of functions for the environment and the local community.

Water Storage

Wetlands function like natural sponges to store and slowly release floodwaters. This slowing down of water's momentum reduces stormwater runoff and downstream flood heights.

Erosion Control

By slowing stormwater and stabilizing soil with vegetation, wetlands reduce erosion of soil.

Pollution Control

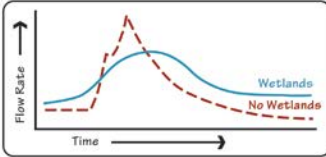
Wetlands are considered "nature's kidneys" for their ability to filter impurities from water. They remove sediments, nitrogen, phosphorous, and other pollutants from stormwater runoff.

Wildlife Habitat

Wetlands are some of the most biologically productive ecosystems in the world. Diverse vegetation and saturated conditions provide important habitat for a variety of wildlife, such as birds, amphibians, mammals, and insects.

Recreation and Educational Opportunities

Wetlands provide opportunities for nature watching, nature hiking, and educational research.



Wetlands reduce peak stormwater flows.



The City of Hiram received a \$200,000 grant from the Ohio Environmental Protection Agency under the provisions of the Surface Water Improvement Fund and the US EPA Great Lakes Restoration Initiative. This project is a collaborative effort between the City of Hiram and the Ohio Environmental Protection Agency. The project is a collaborative effort between the City of Hiram and the Ohio Environmental Protection Agency. The project is a collaborative effort between the City of Hiram and the Ohio Environmental Protection Agency.

Interpretive Sign topics

- Wetland functions
- Flora/Fauna

WETLAND BIODIVERSITY

Wetland Plants

Wetlands are home to approximately 31% of the plant species across the United States. These plant species have adapted to survive in water or saturated soil conditions. A common adaptation of non-woody wetland plants is having air-filled spongy tissues that run the length of the plant and supply oxygen to the roots.

What plants can you identify?

Some of the plants you might find in this wetland include:



Swamp White Oak



Red Maple



Buttonbush



Red Osier Dogwood



Swamp Rose



Fowl Manna Grass



Soft Rush



Rice Cutgrass



Tussock Sedge



Sensitive Fern



Blue Flag Iris



Blue Vervain

Wetland Wildlife

Wetlands provide habitat to a diverse array of mammals, amphibians, birds, and insects.

What animals can you identify?

Some of the animals you might find in this wetland include:



Spring Peeper



Green Frog



Green Darner Dragonfly



Little Brown Bat



Northern Cardinal

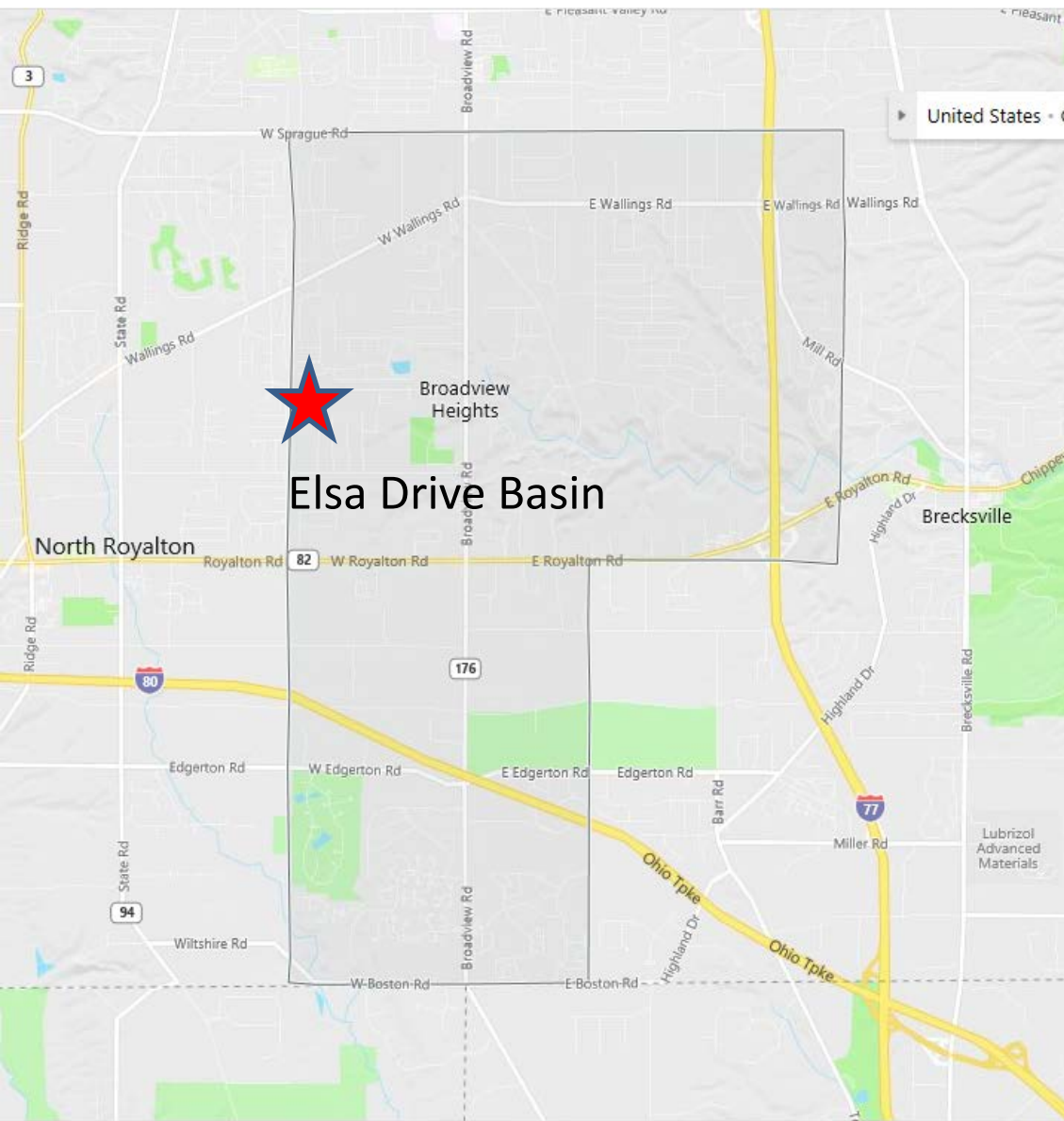


Red Winged Blackbird



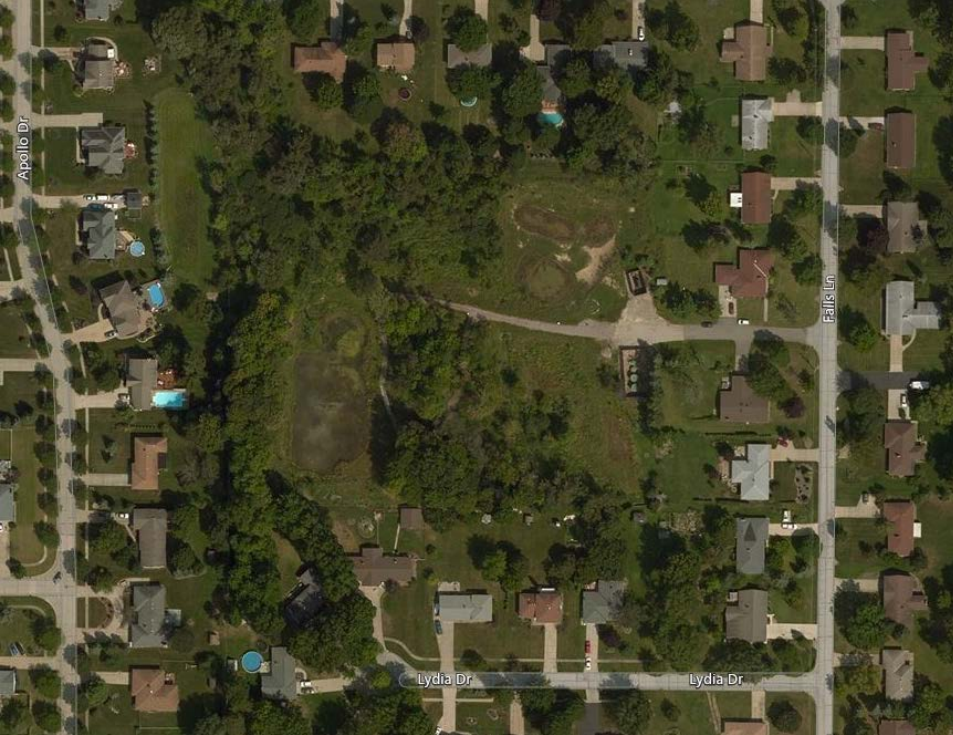
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- Elsa Drive Stormwater Wetland Retrofit

Site Location Plan – Broadview Heights, Ohio



Elsa Drive Stormwater Wetland Basin Retrofit, Broadview Heights, Ohio

Primary Goals:

- Enlarge existing wetland complex
- Enlarge Stormwater Storage Volume
- Reduce Peak Discharge
- OEPA 319 Grant Eligibility
- Install Nature Trails





Before



After

Elsa Drive Stormwater Wetland Basin Retrofit, Broadview Heights, Ohio

- Enlarged Wetland Basins
- Wetland Vegetation successfully established



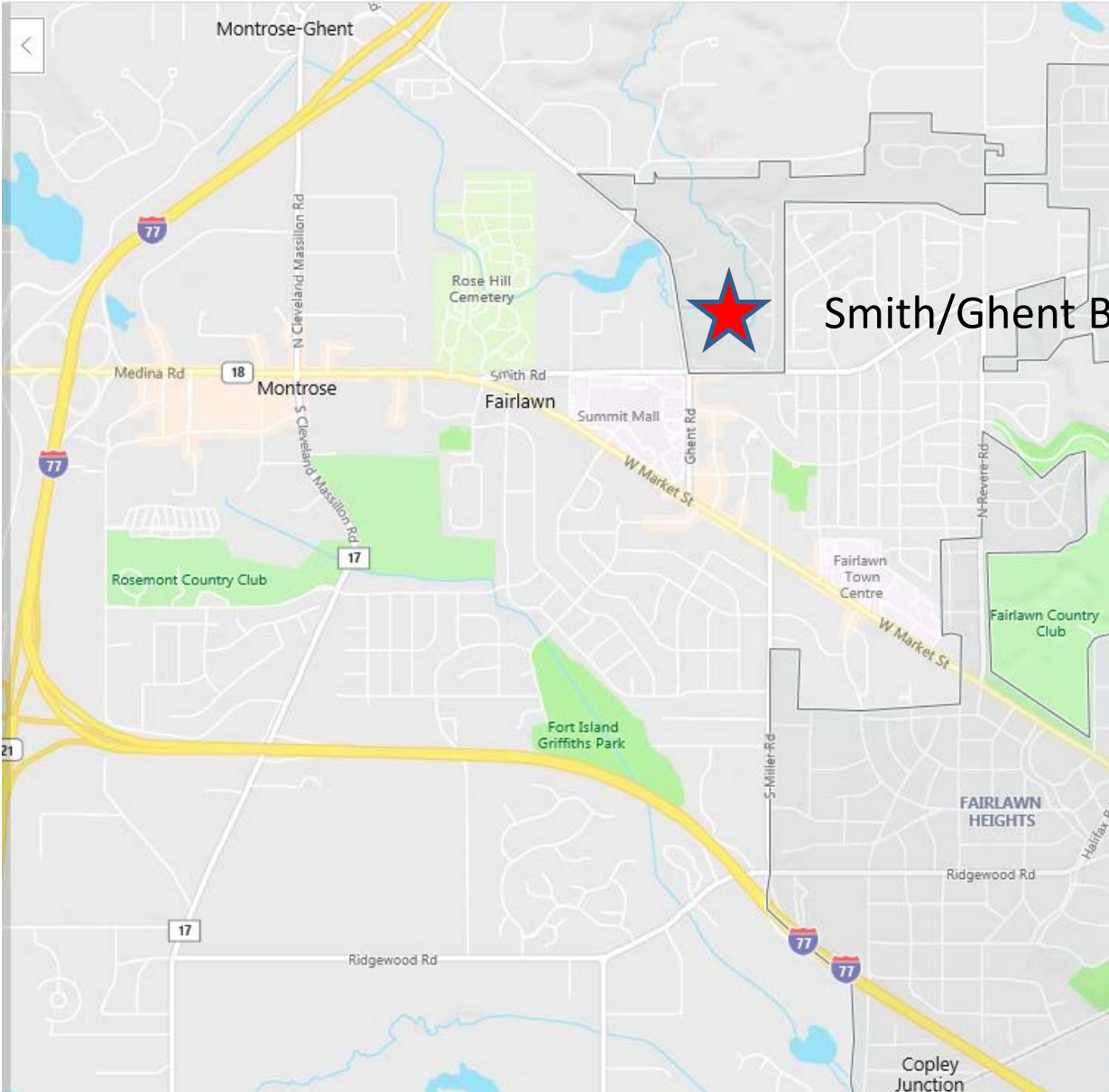
Before



After

Elsa Drive Stormwater Wetland Basin Retrofit, Broadview Heights, Ohio

- Enlarged Wetland Basins
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Smith/Ghent Basin

Smith/Ghent Pond Rehabilitation Akron, Ohio

Site Location Plan – Akron, Ohio



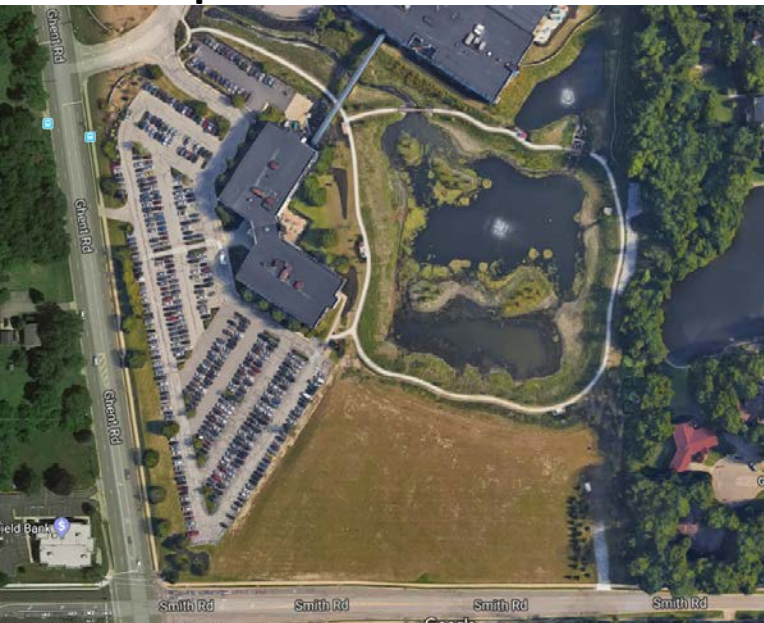
Pre Existing Aerial View

Primary Goals:

- Property Reconfiguration to support Corporate Campus Expansion, Economic Development
- Comply with Permitting Reqmts
- Reduce downstream flooding



Conceptual Plan



After Aerial View

Secondary Goals:

- Enhance Water Quality
- Beautify Corporate Campus
- Provide Fitness Trail



Before:

- Traditional Regional Detention Basin

Before



After:

- Stormwater Wetland Basin

After



Before

Before:

- Narrow Pond channel



After

After:

- Restored Stream channel



- Upper Pond, Overflow with Pond Aerator
- Fitness Trail, Permeable concrete
- Native riparian vegetation around perimeter of pond
- Contrasts with maintained corporate landscape



Potential Grant Eligibility

- **Ohio EPA 319**
- **Clean Ohio Conservation Fund**

LESSONS LEARNED

- Construction in active stormwater zone, pumping required
- Navigating Permitting, Nationwide Restoration Permit
- Delineate public/private property boundary
- Native vegetation slow to establish
- Problem with owner mowing wetland fringe
- Reduced mowing of municipal basins
- Former detention basins now perceived by residents as open space

Any Questions ?

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