Fore to Forest for Fins and Feathers:
Transforming Acacia Country Club

Suzanne Hoehne
Senior Ecological Designer
Biohabitats
GREAT LAKES BIOREGION

August 2022

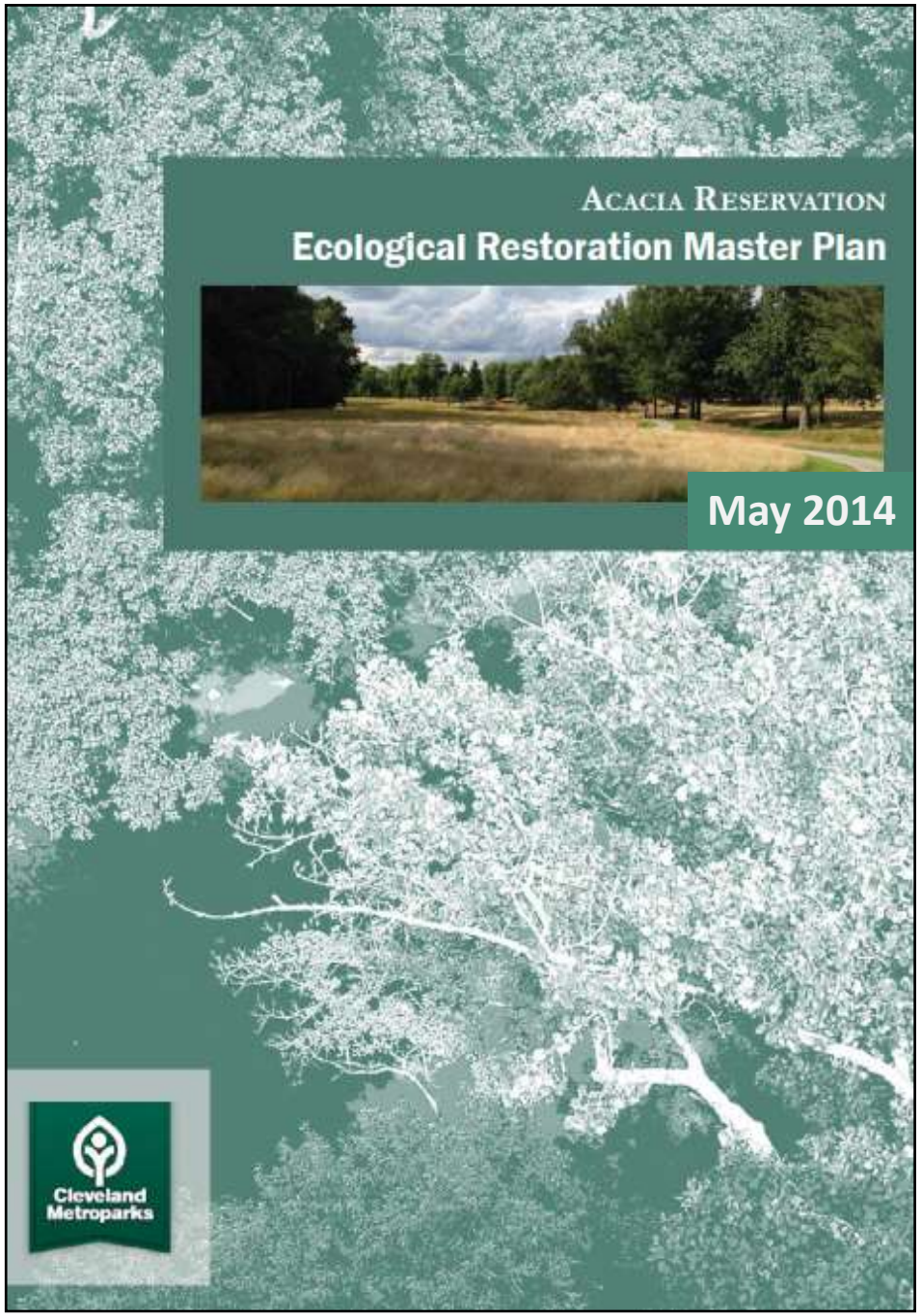
- 155 Acres
- Operated as a Donald Ross designed course for 90 years (1922-2012)
- Purchased by Conservation Fund $14.75M
- Donated to Cleveland Metroparks 2012
- Deed Restrictions
- Restoration / Passive Open Space Focus

Phase 1: Community Outreach & Baseline Data

- Public Meetings
- BioBlitz
- Annual Day in the Life of Euclid Creek
- Academic research partners

Phase 2: Planning

- Ecological Restoration Master Plan
- Acacia Reservation Master Plan



Restoration Goals

1. Restore the natural hydrological function
2. Establish native forest and wetland communities
3. Develop adaptive management that incorporates scientific research and stewardship
4. Integrate public use and social reflection to connect people with habitat restoration

Phase 3: Implementation

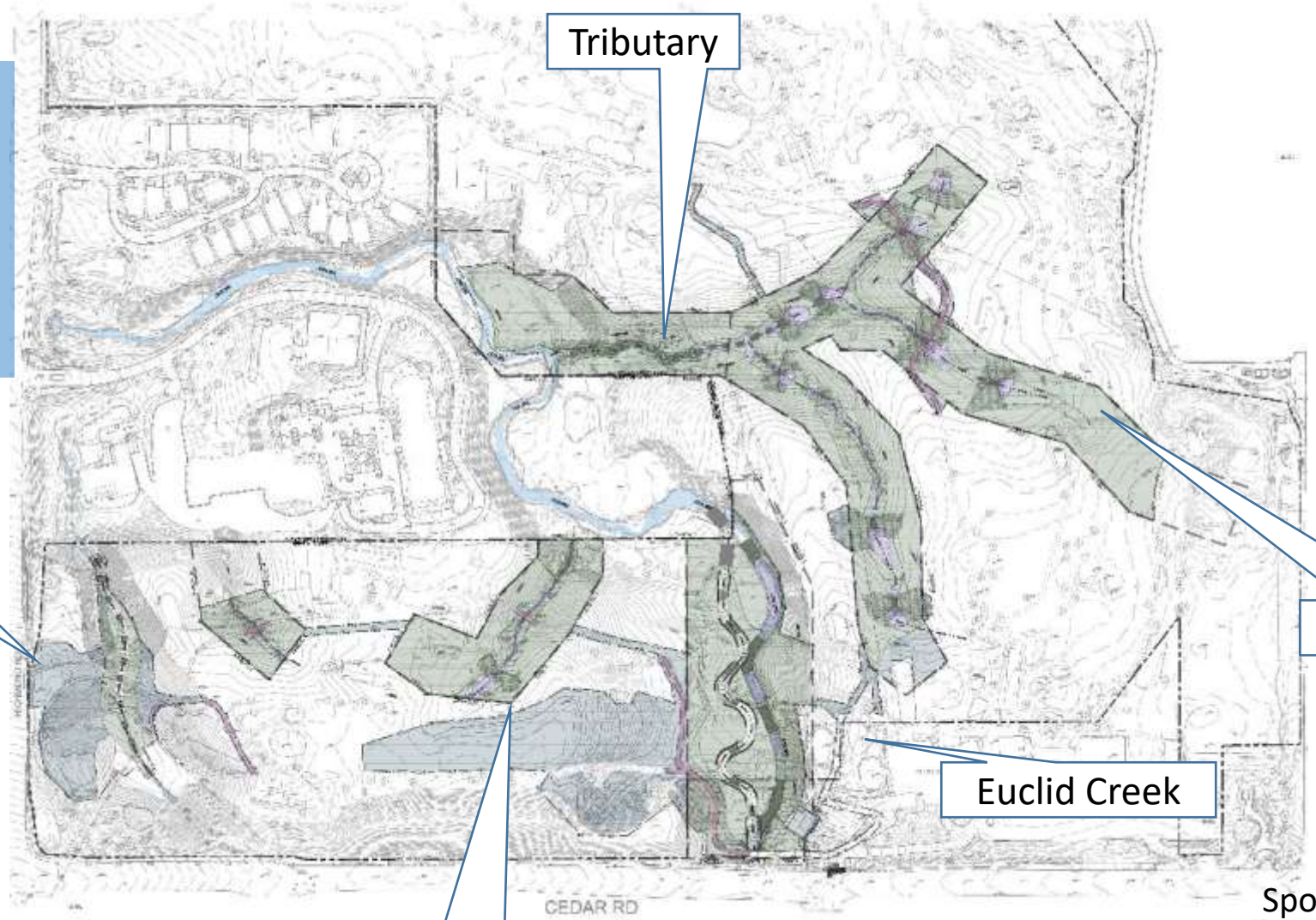
2015

- Invasive plant mgt
- Tile breaking
- Meadow establishment
- Reforestation
  (Tree planting & seedling protection)
- Deer management

Euclid Creek, Tributaries & Headwaters

Designer/Contractor: Biohabitats

Construction Subcontractor: Meadville Land Service, Inc.



Funded by: OhioEPA

Sponsored by: Northeast Ohio Regional Sewer District — Protecting Your Health and Environment

Stream Functions Pyramid

A Guide for Assessing & Restoring Stream Functions » OVERVIEW

FIGURE 1

wharman@stream-mechanics.com

StreamMechanics

Summary of Pre-restoration Results

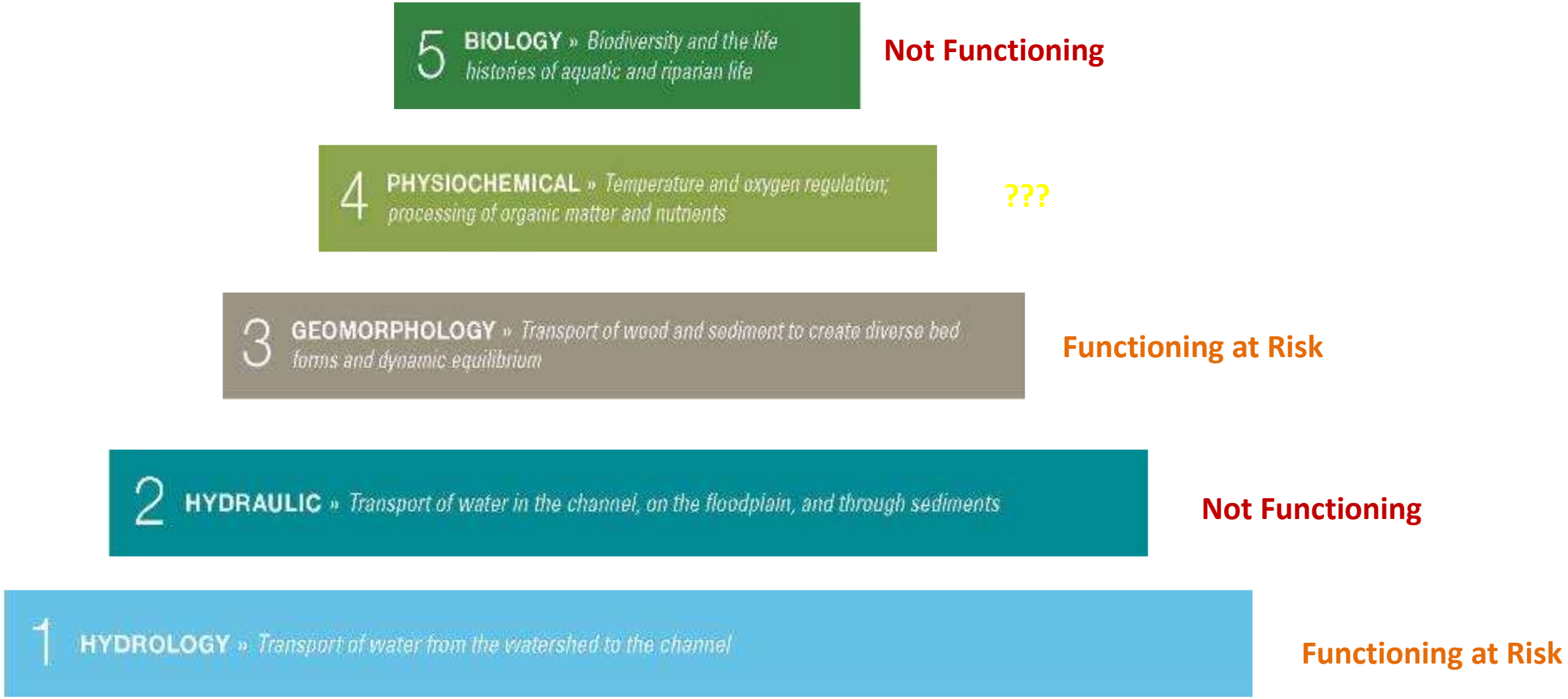


Photo attribution: Stream Mechanics

Ecological Uplift Goals

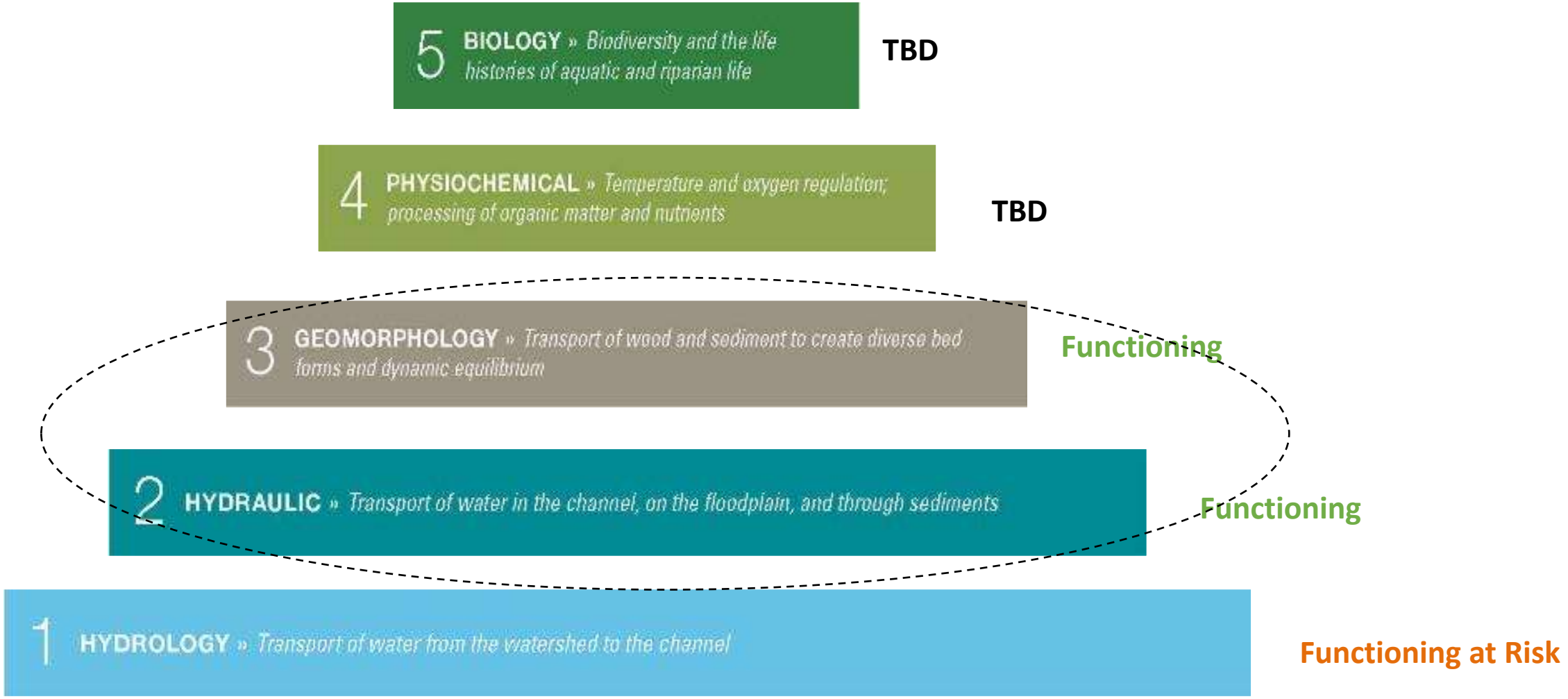
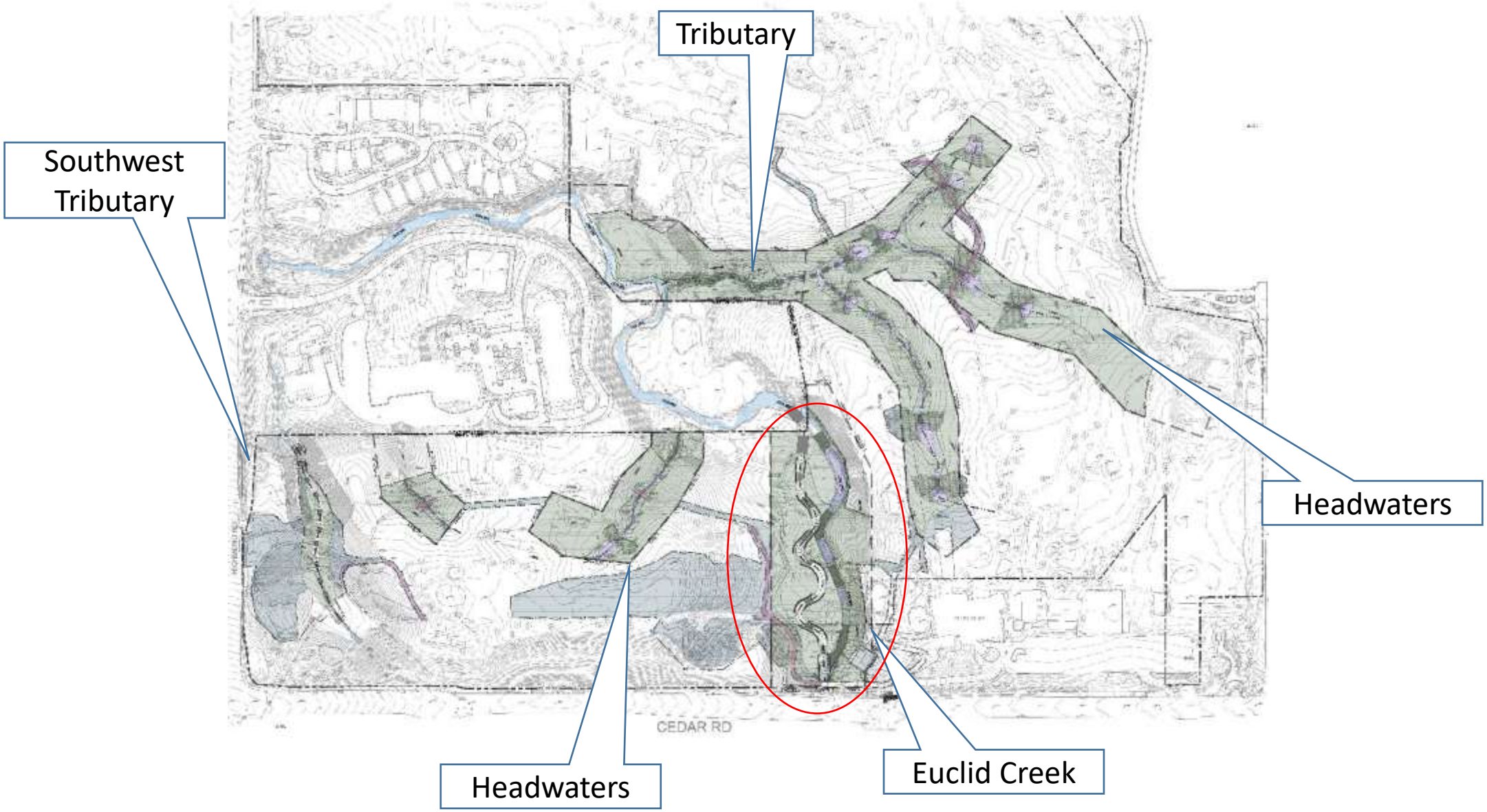


Photo attribution: Stream Mechanics

Euclid Creek, Tributaries & Headwaters



Goal 1: Restore ±900 linear feet of Euclid Creek and bring it into attainment of its WWH aquatic life use designation.

- Indicator: QHEI scores ≥60 for segments of Euclid Creek within Acacia Reservation within 10 years of restoration.

    - *Objective A* – Change **geomorphic parameters** that influence stream habitat (large woody debris and bed form diversity) from "Functioning-At-Risk" to "Functioning" along the ±900 linear feet stretch of Euclid Creek.

    - *Objective B* – Change **floodplain connectivity** from "Not Functioning" to "Functioning" along ±800 linear feet of the segment of Euclid Creek. This includes raising the streambed where incised.

Goal 2: To restore ±3.5 acres of floodplain habitat to buffer the effects of stormwater inputs, increase infiltration capacity, and decrease erosion.

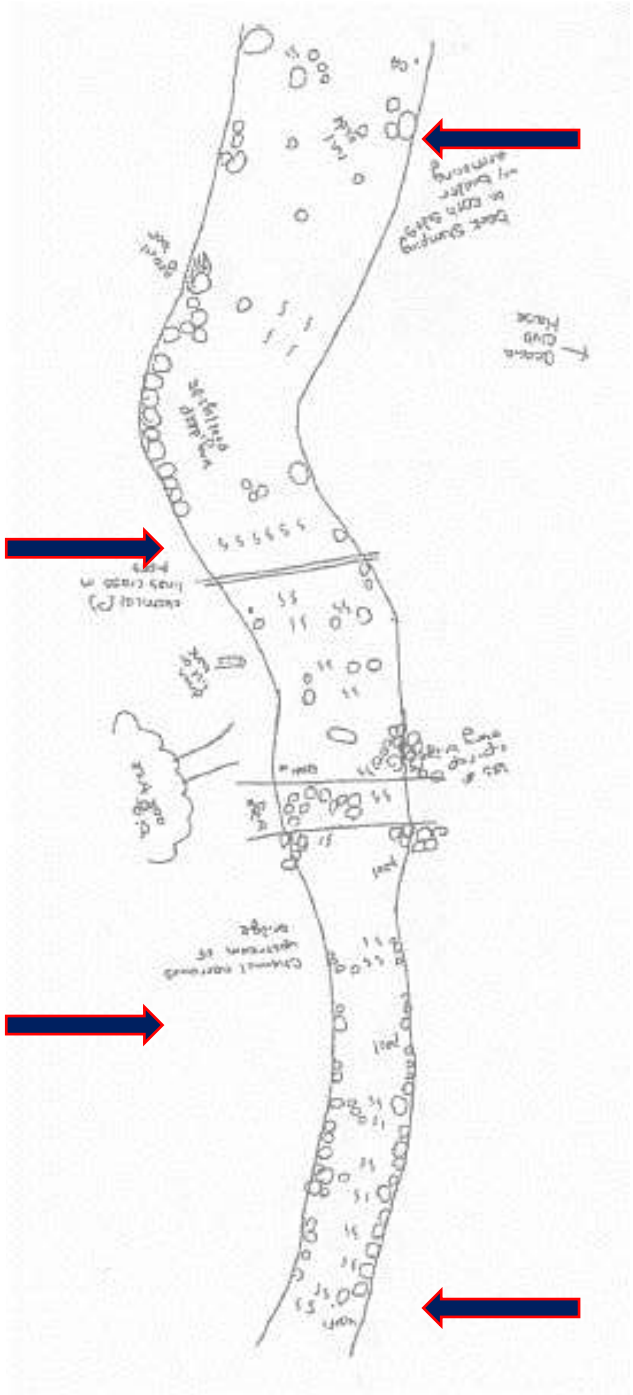
- Indicator: QHEI scores ≥60 for segments of Euclid Creek within Acacia Reservation within 10 years of restoration.

    - Change riparian vegetation from "Functioning-At-Risk" to "Functioning" by restoring ±3.5 acres of riparian zone and floodplain. This includes disrupting historic drain tiles to achieve more natural hydrology and planting native trees, shrubs, and herbaceous plugs. The addition of an intact floodplain will reduce the impact of peak flows on the system.

Euclid Creek Constraints

- Culvert at Upstream End
- Incised Channel at Downstream End
- Large Trees
- Eroding Shale Bedrock
- FEMA Flood Hazard Area
- Downstream Property
- Flashy Flows

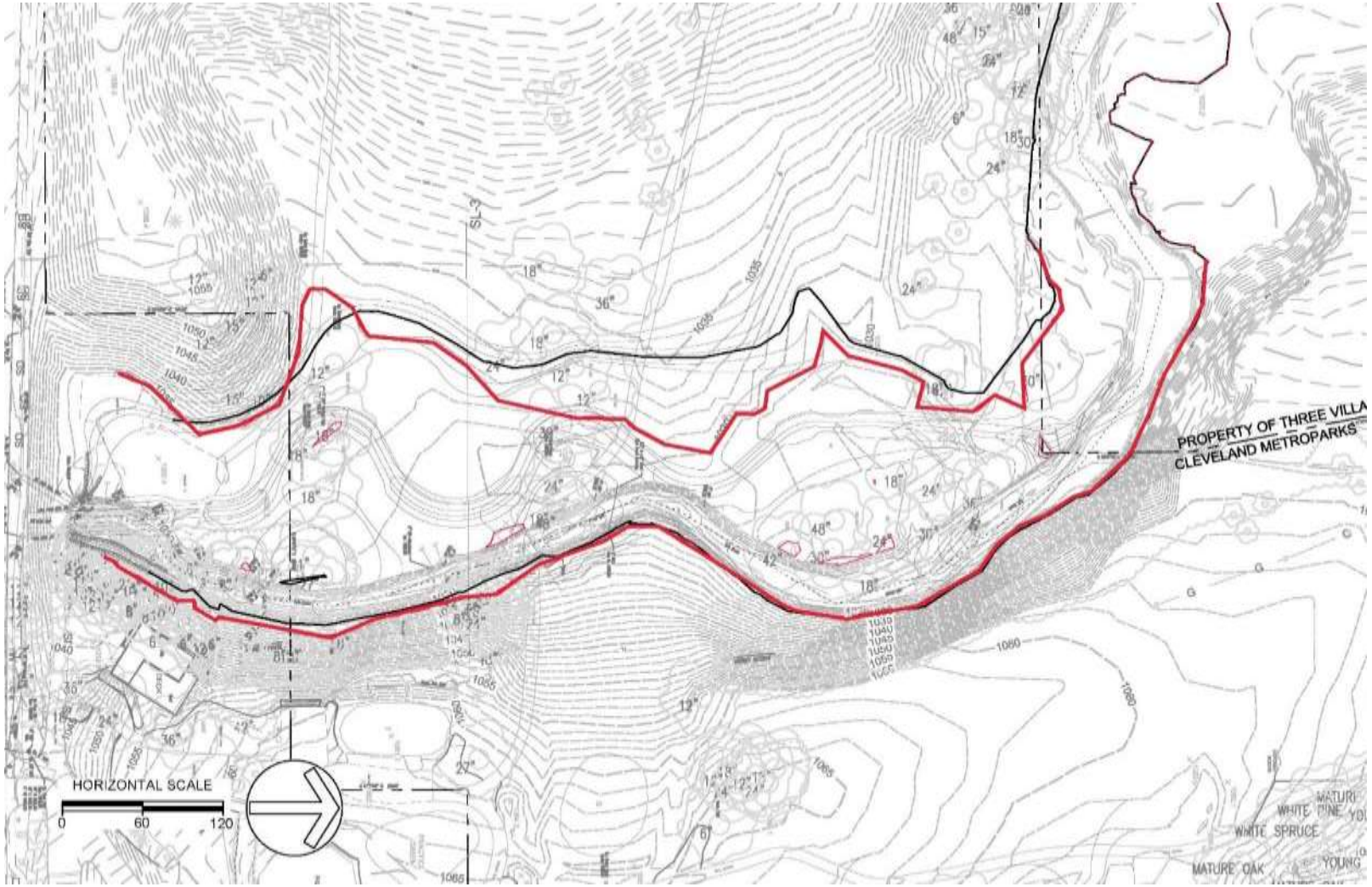
Euclid Creek
Existing Conditions



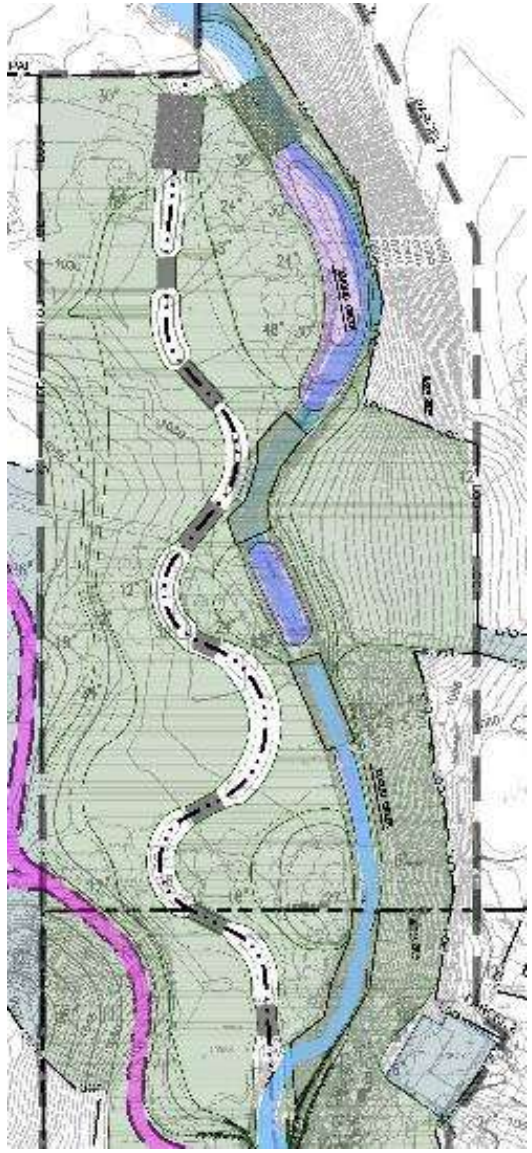
Euclid Creek Design

- Floodplain reconnection of Euclid Creek by raising streambed and excavating new floodplain

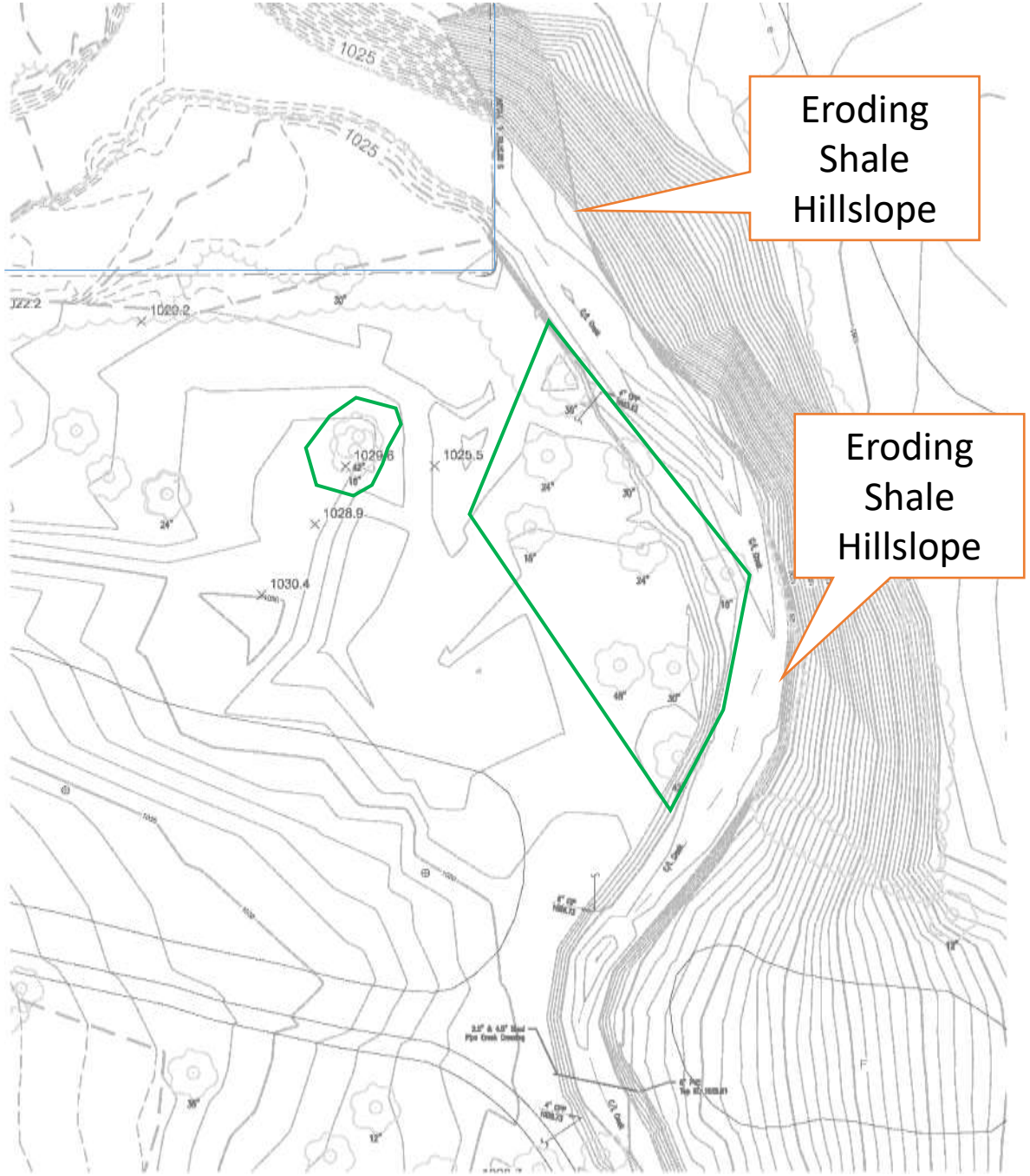
- Create floodplain and riparian forest in former fairways



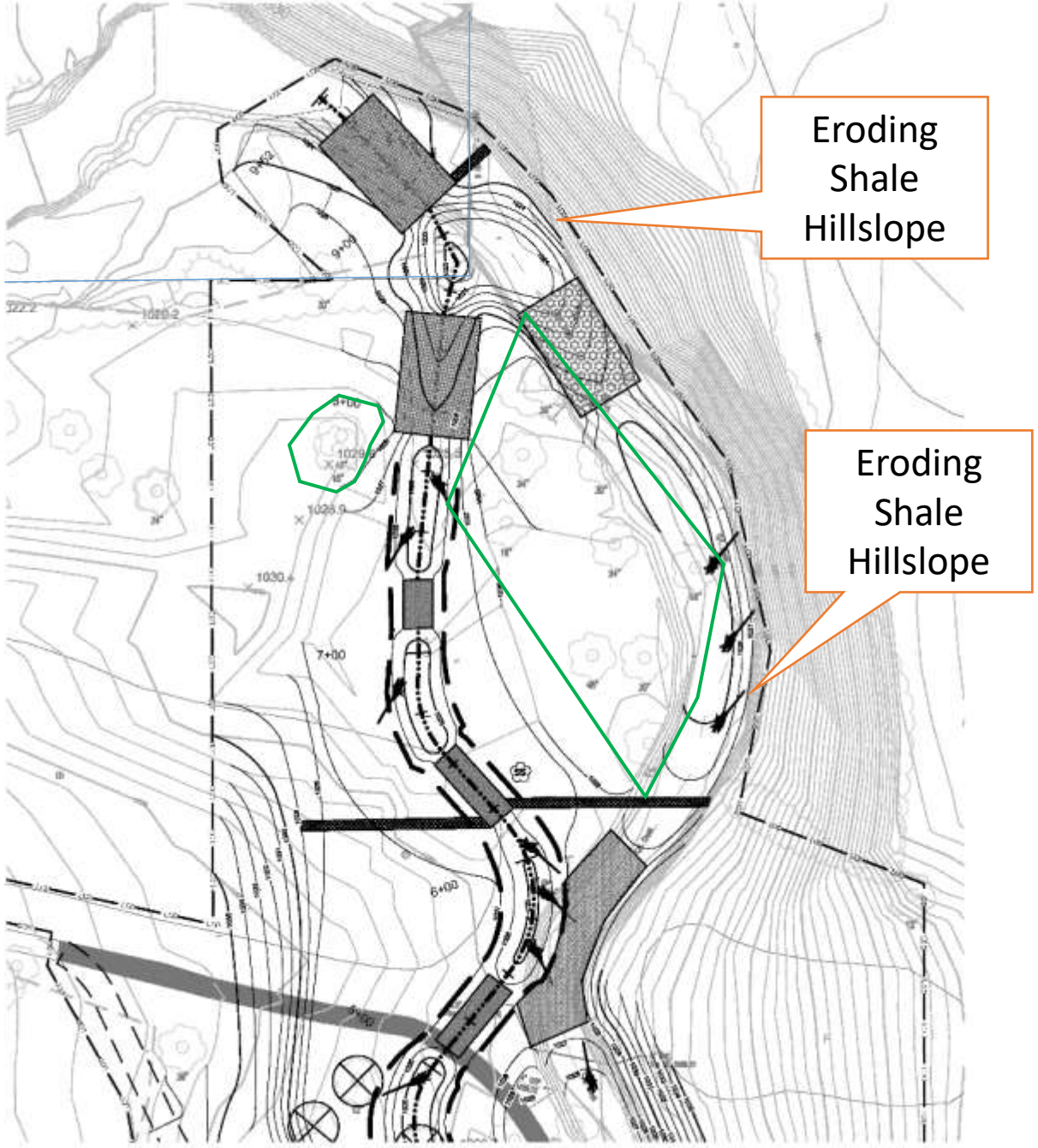
Euclid Creek Design



Euclid Creek Design



Euclid Creek Design

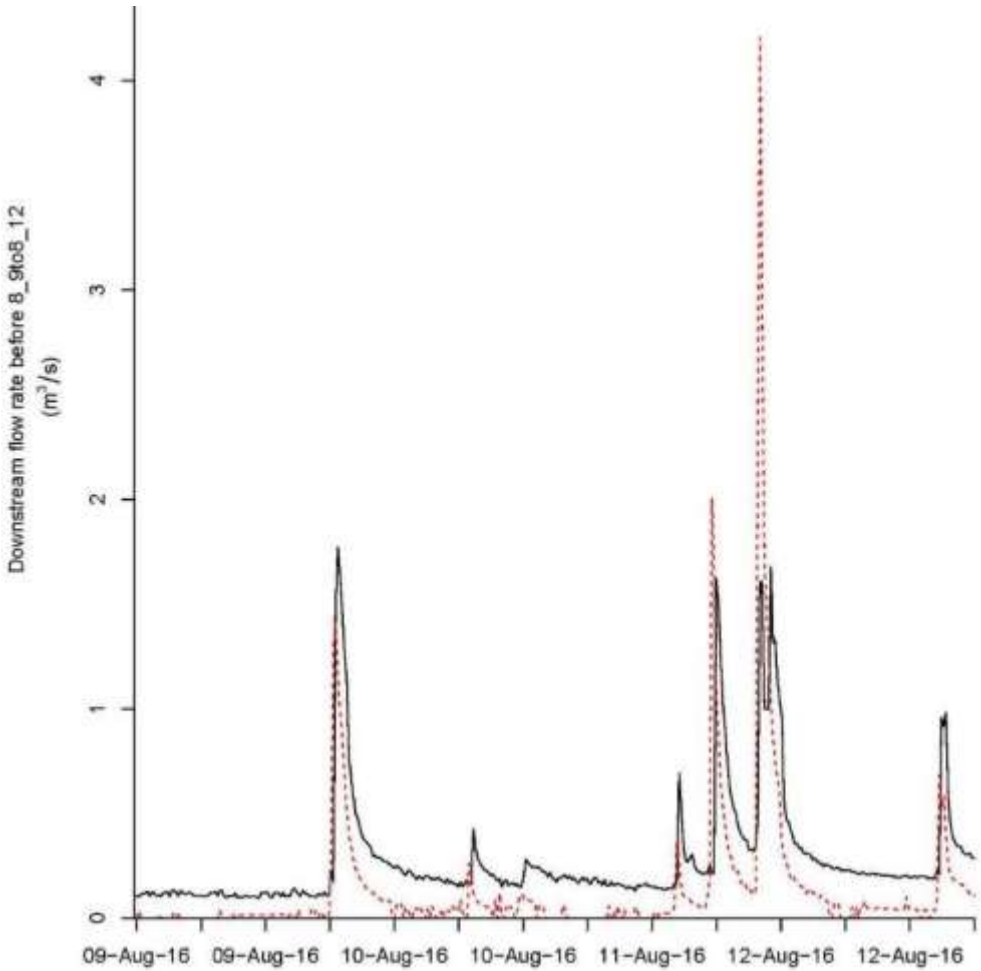


Euclid Creek Design

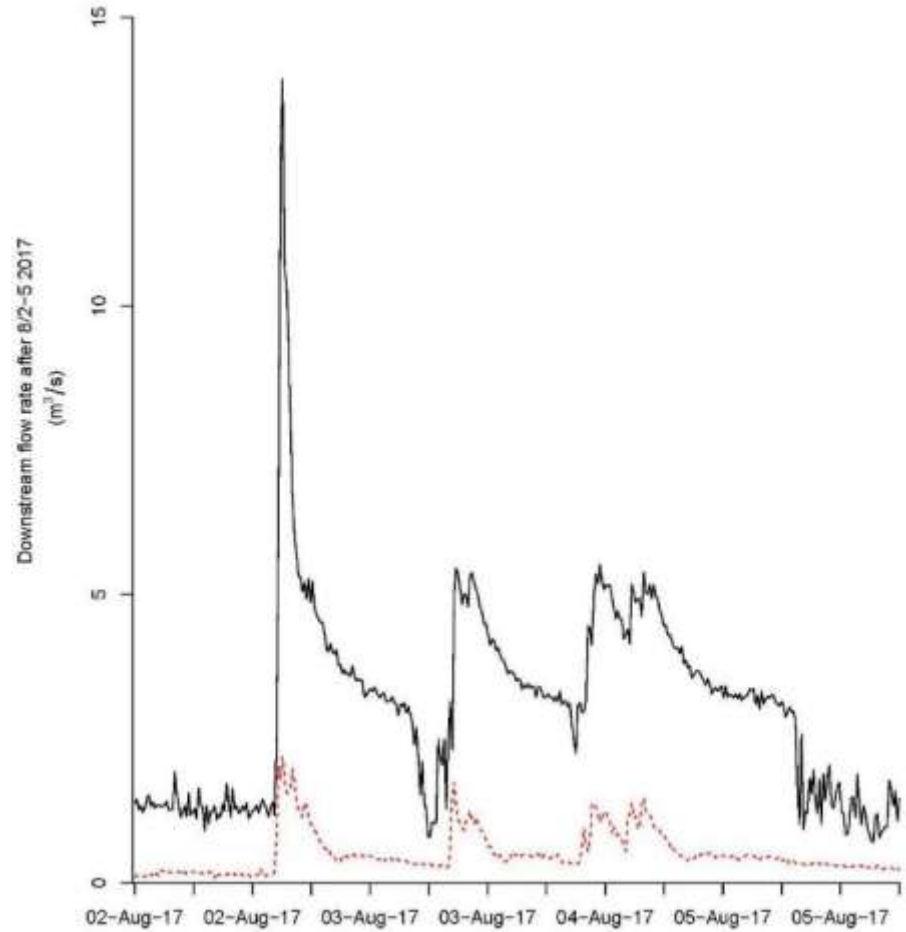
Post Construction

Post Construction

Before

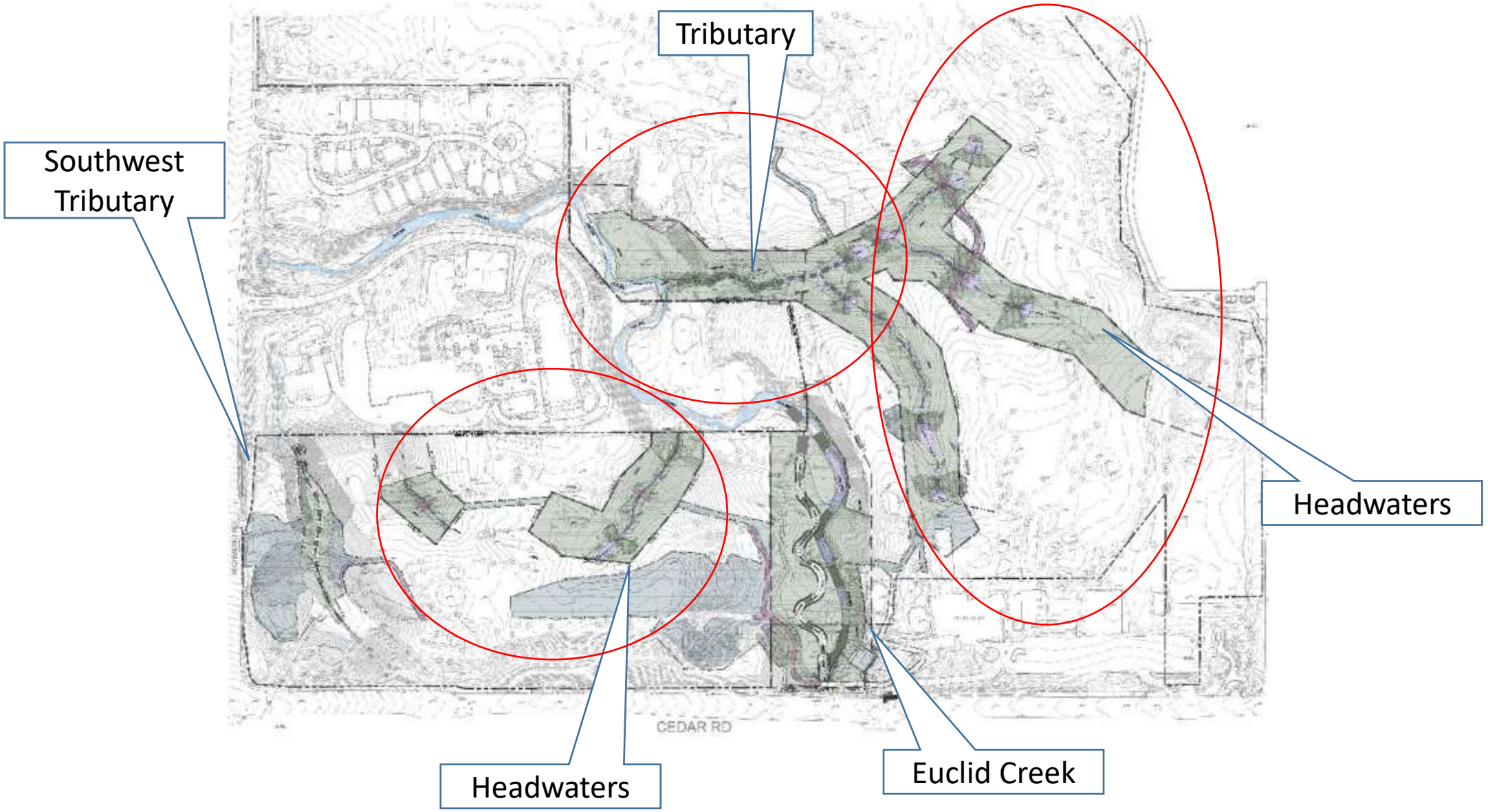


After

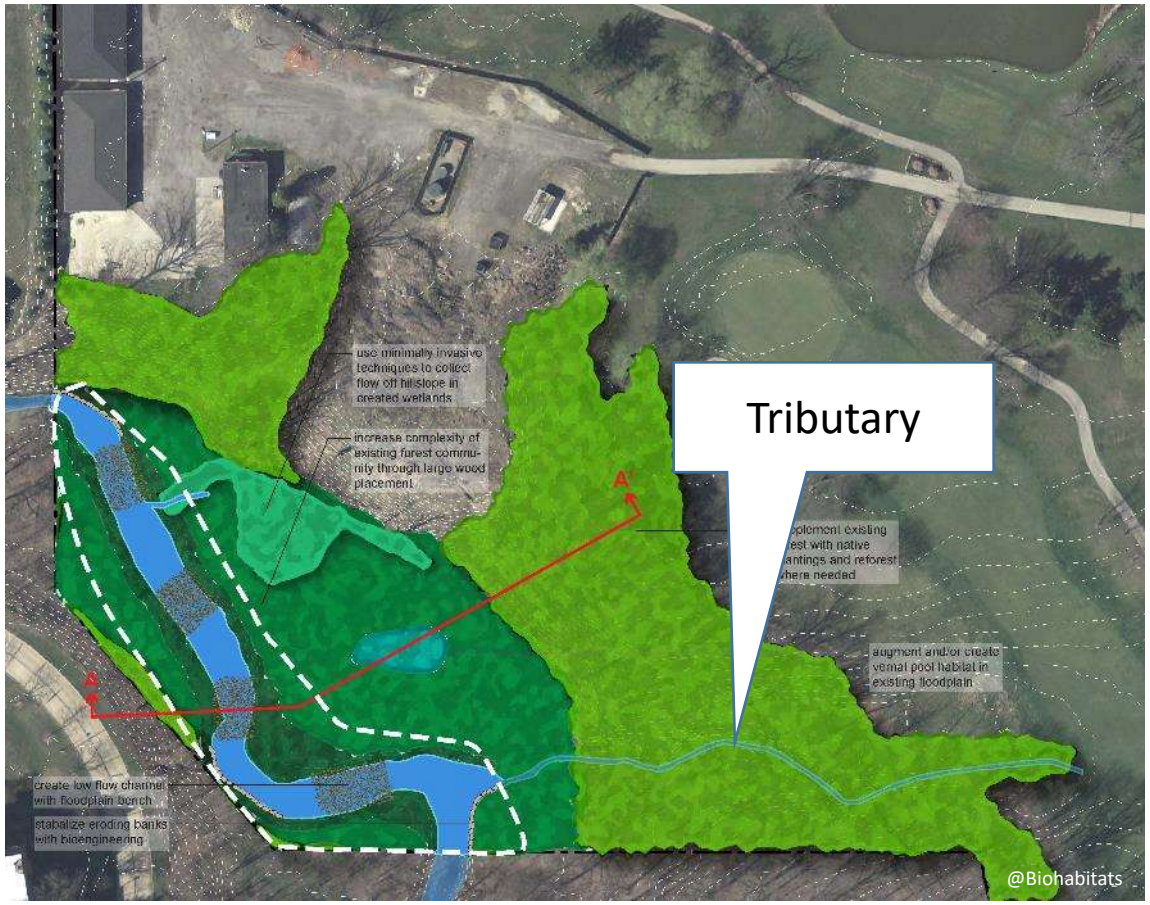


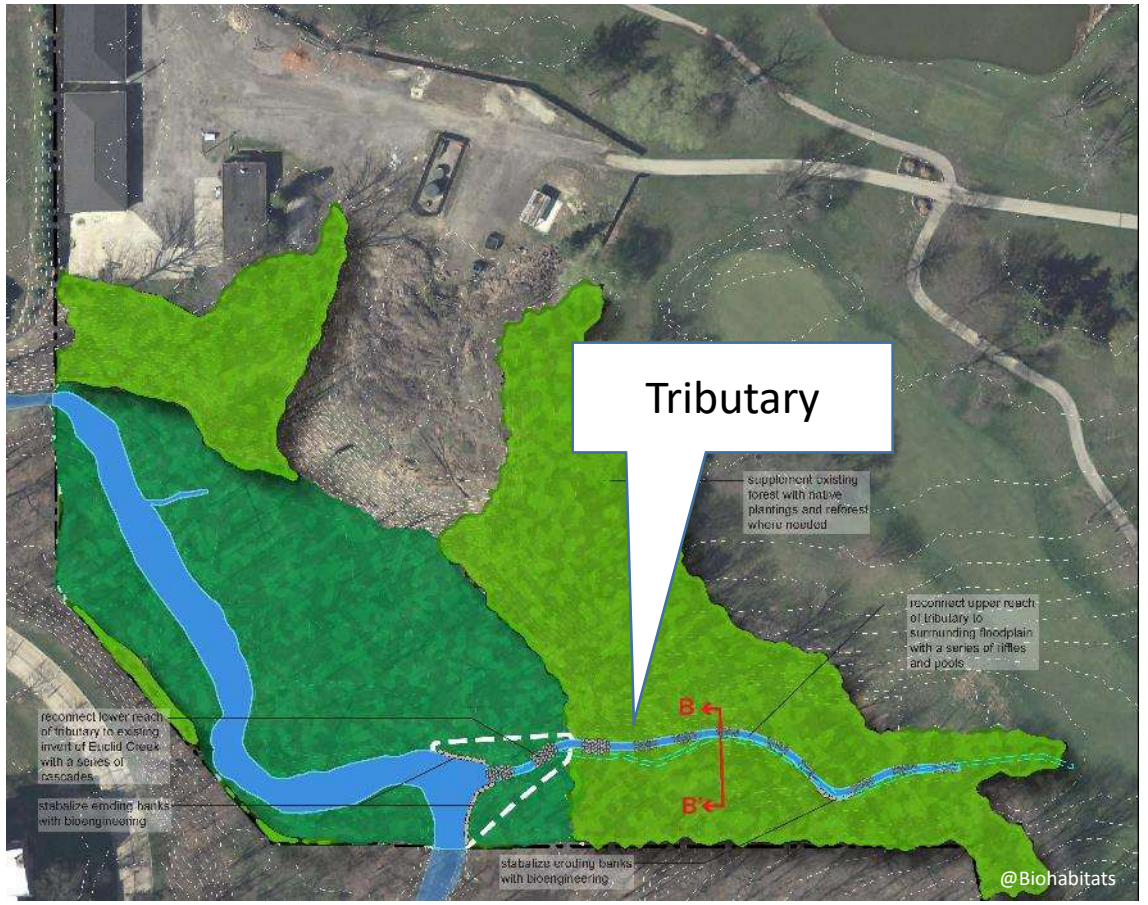
Pyramid Level	Parameter	Before Restoration	2017	2019	2021	
Biological	IBI	NF (12, Very Poor)	NF (24, Poor)	NF (22, Poor)*	NF(24, Poor)	↑
Physiochemical	No official data					
Geomorphology	Pool Max Depth	Not evaluated	F (5.91)	Not evaluated	>4 ft	
	Meander Width Ratio	Not evaluated	F (8.19)	Not evaluated	3.67	
	% Riffle	Not evaluated	NF (30.7%)	Not evaluated	NF 27.3%	
	BEHI/NBS	FAR (Mod/Mod)	F (Low-Mod/Low)	Not evaluated	F Low-Mod	↑
	QHEI	FAR (54, Fair)	F (59, Good)	F (71.5, Excellent)	F(78.5, Excellent)	↑
	Simon's Channel Evolution Model	NF (Level 4)	F (Level 6)	Not evaluated	F (Level 6)	↑
	Large Woody Debris	FAR (6)	NF (3)	Not evaluated	FAR (4.3)	
	Riparian Health	FAR (Marginal)	FAR – F (Sub-optimal)	Not evaluated	FAR – F (Sub-optimal)	↑
Hydraulics	Entrenchment Ratio	NF (1.6)	F (16.38)	Not evaluated	F Upstream = 4.1 Downstream = >10	↑
Hydrology		FAR	FAR	FAR	FAR	–

Euclid Creek, Tributaries & Headwaters



Euclid Creek, Tributaries & Headwaters





Tributary

Goal: To restore 372± linear feet of intermittent tributary to Euclid Creek to reduce sediment loadings and provide for stable channel.

- *Objective A:* Change lateral stability parameter to address erosion and siltation from "Not Functioning" to "Functioning" for 372± linear feet of intermittent stream restoration.

- *Objective B:* Change geomorphic parameters that influence stream habitat (bed form diversity) from "Not Functioning" to "Functioning" along 372± linear feet of intermittent channel.

Headwaters

Goal 1: To restore approx. 14.3 acres of wetland swales along existing drainage network to further increase infiltration capacity, decrease sediment and pollutant loads, increase native habitat, and contribute to a more resilient watershed.

- *Objective 1*: Remove invasive plant material and debris from swales.

- *Objective 2:* Re-established surface drainage and promote infiltration by removing/plugging/breaking drainage tile within the 75 foot buffer.

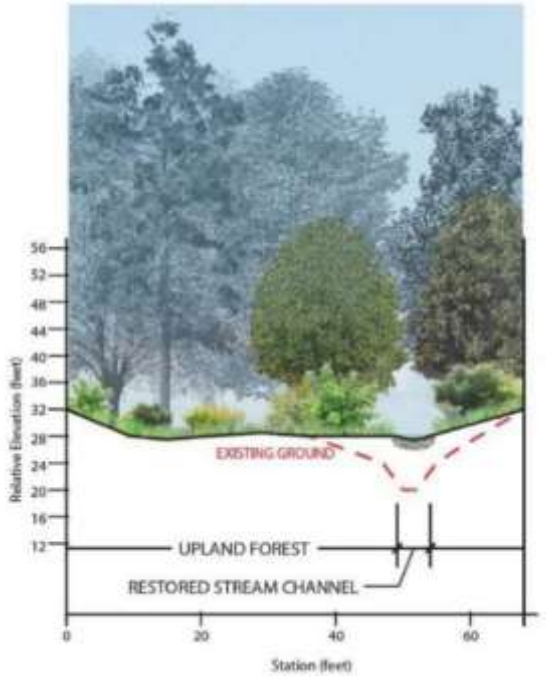
- *Objective 3:* Restore wetlands through use of sand seepage beds and other soil saturation techniques and provide for stable channel through use of cascades and other techniques in steeper locations where restoration/creation may not be possible.

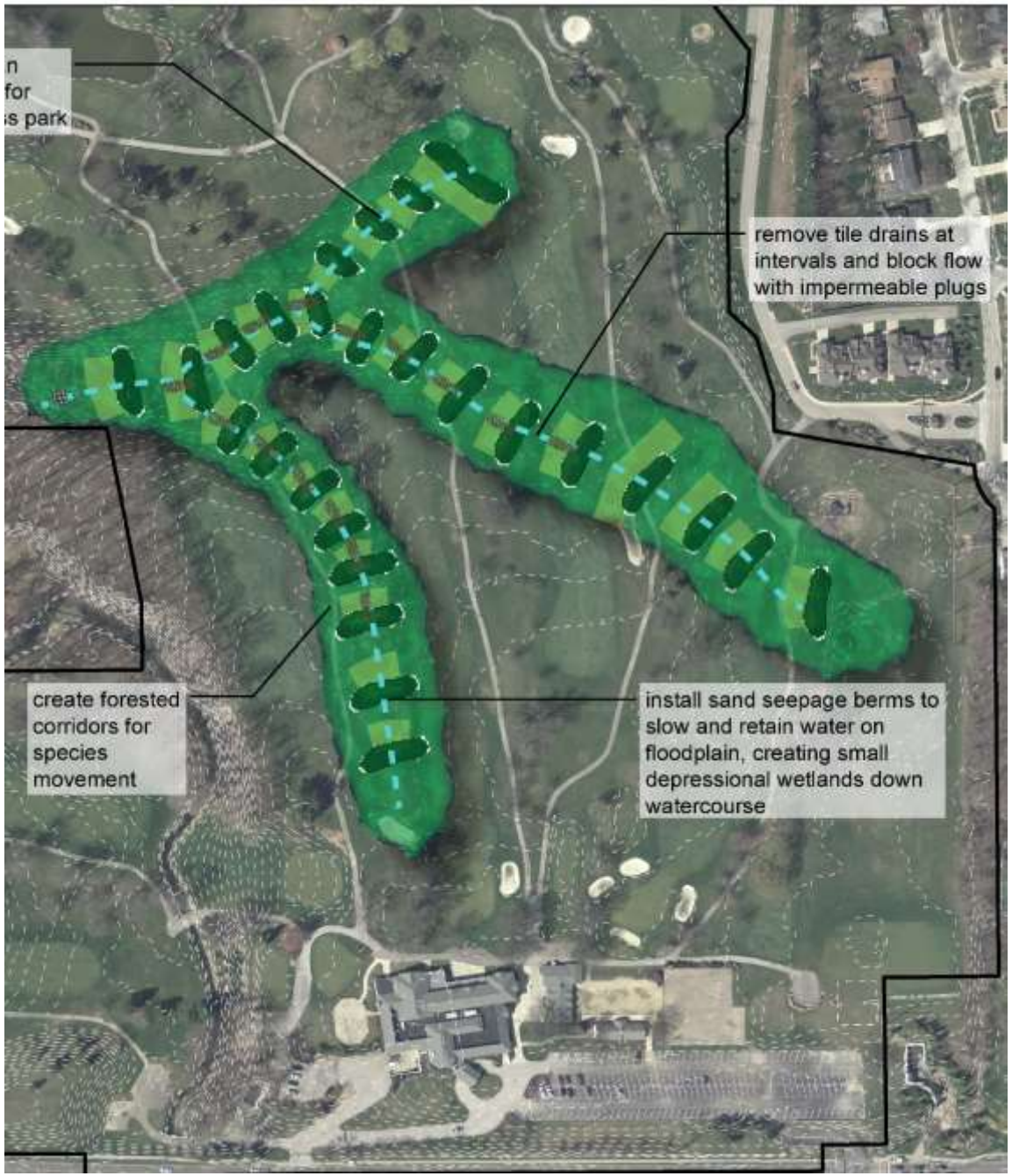
- *Objective 4*: Provide habitat for wildlife by incorporating habitat features such as woody debris piles and standing snags.

- *Objective 5:* Include a 75-foot buffer around the identified drainage corridor.

Headwaters and Tributary Constraints

- Steep Slopes
- Existing Tree Canopy
- Friable Shale Bedrock
- Hard Pan
- Asian Worms



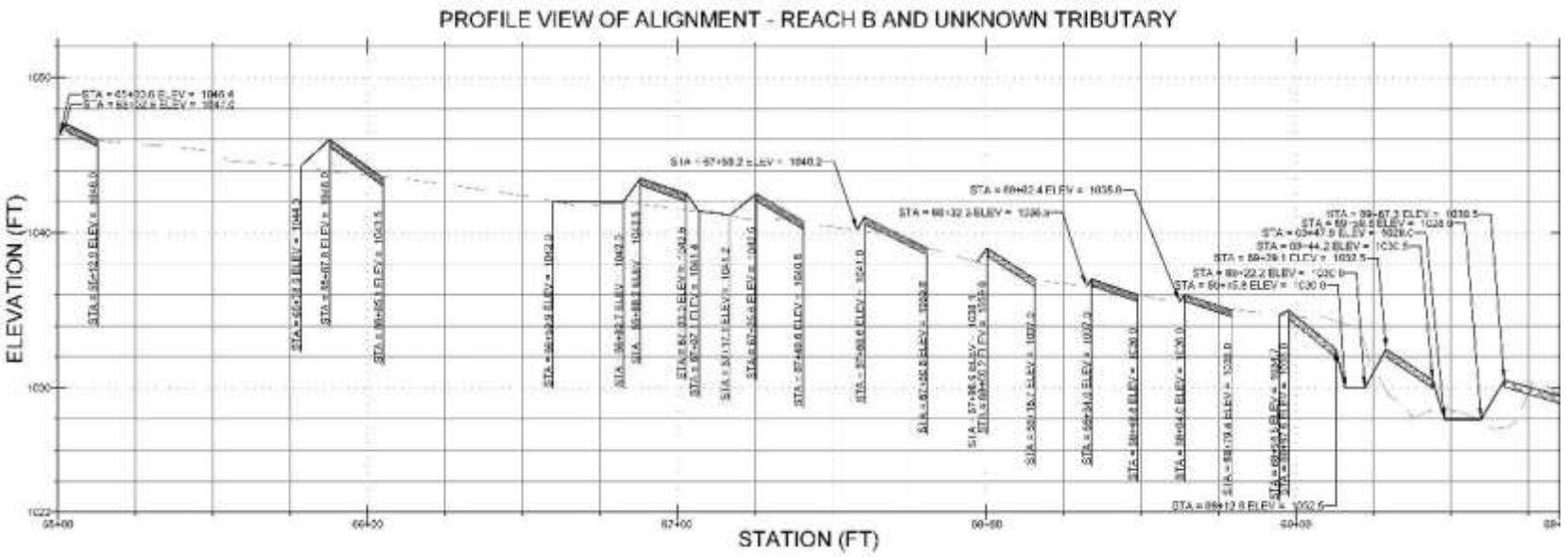


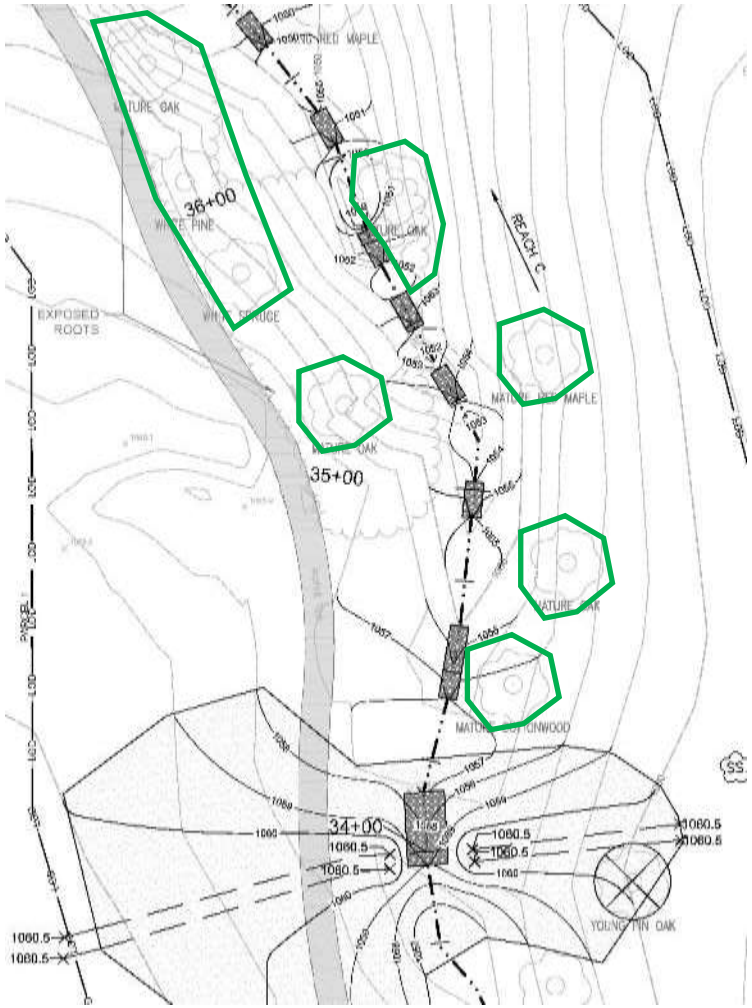
Headwaters and Tributary Existing Conditions

Headwaters and Tributary Design

Stress Conditions	τ_{fp} (psf)
Low Stress- Channel doesn't need to conform to floodplain alignment. If space allows, channel can be highly sinuous.	< 1.0
Medium Stress -Channel planform is highly dependent floodplain planform and curvature	1.0-1.5
High Stress -Erosion in floodplain will cause floodplain channels to form and the potential development of an anabranched channel network. Provide grade control and plan for anabranched channel network	1.5-2.0
Very High Stress - Need to protect high stress regions of the floodpalin with rock or other vertical control to prevent degradation unless floodplain is covered with mature brushy vegetation that has a complete coverage of the high stress regions of the floodplain.	>2.0

Headwaters and Tributary Design





Headwaters and Tributary Design

Tributary Design

Headwaters Post Construction

Before

Immediately After

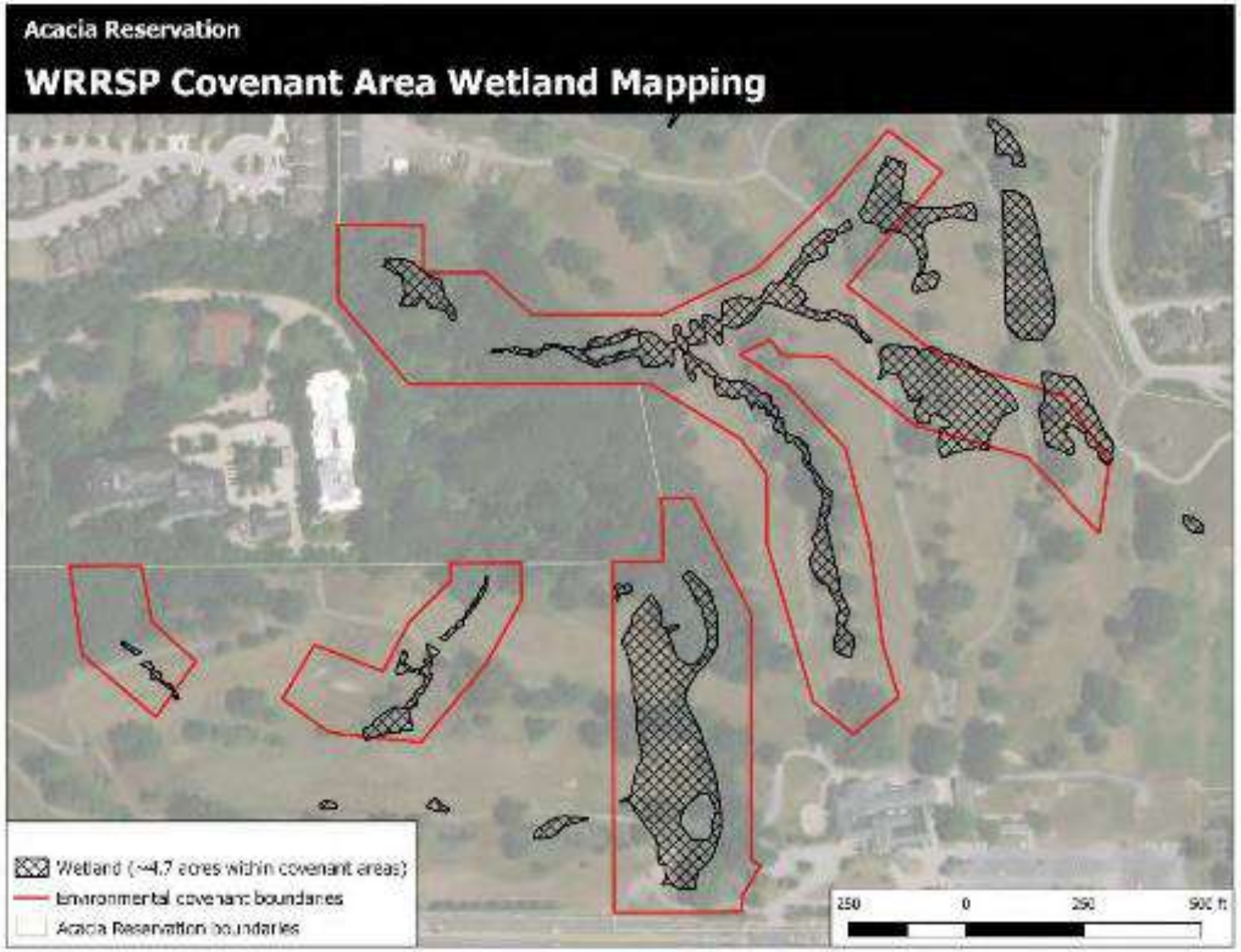
Five years post

Tributary Post Construction

Apr. 2017

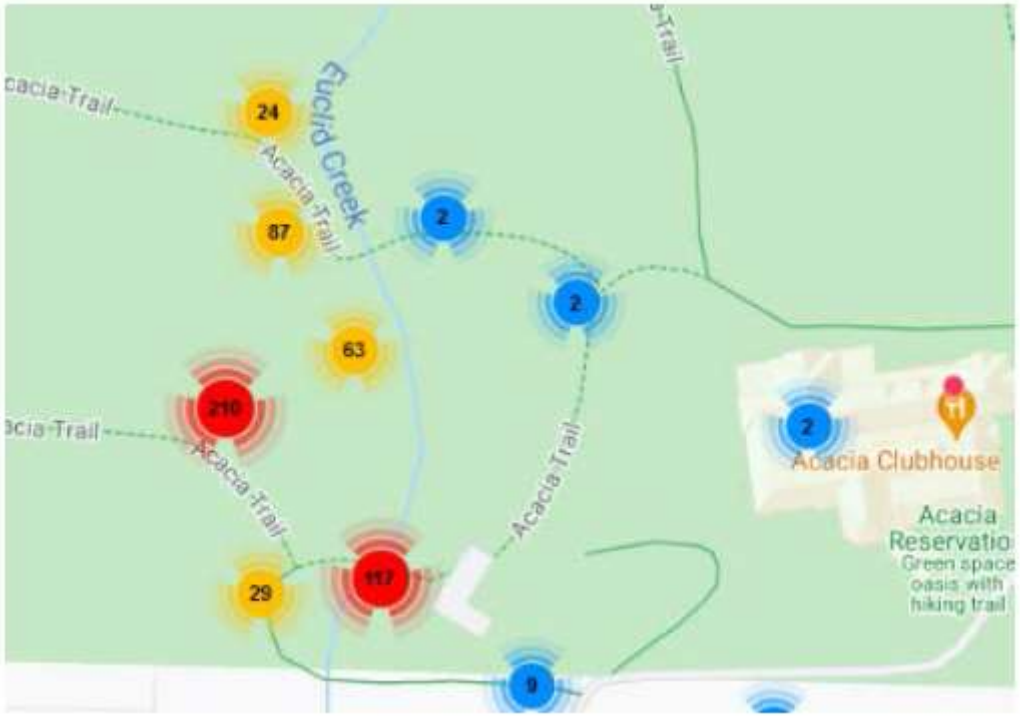
Aug. 2017

Wetland Creation (2018)

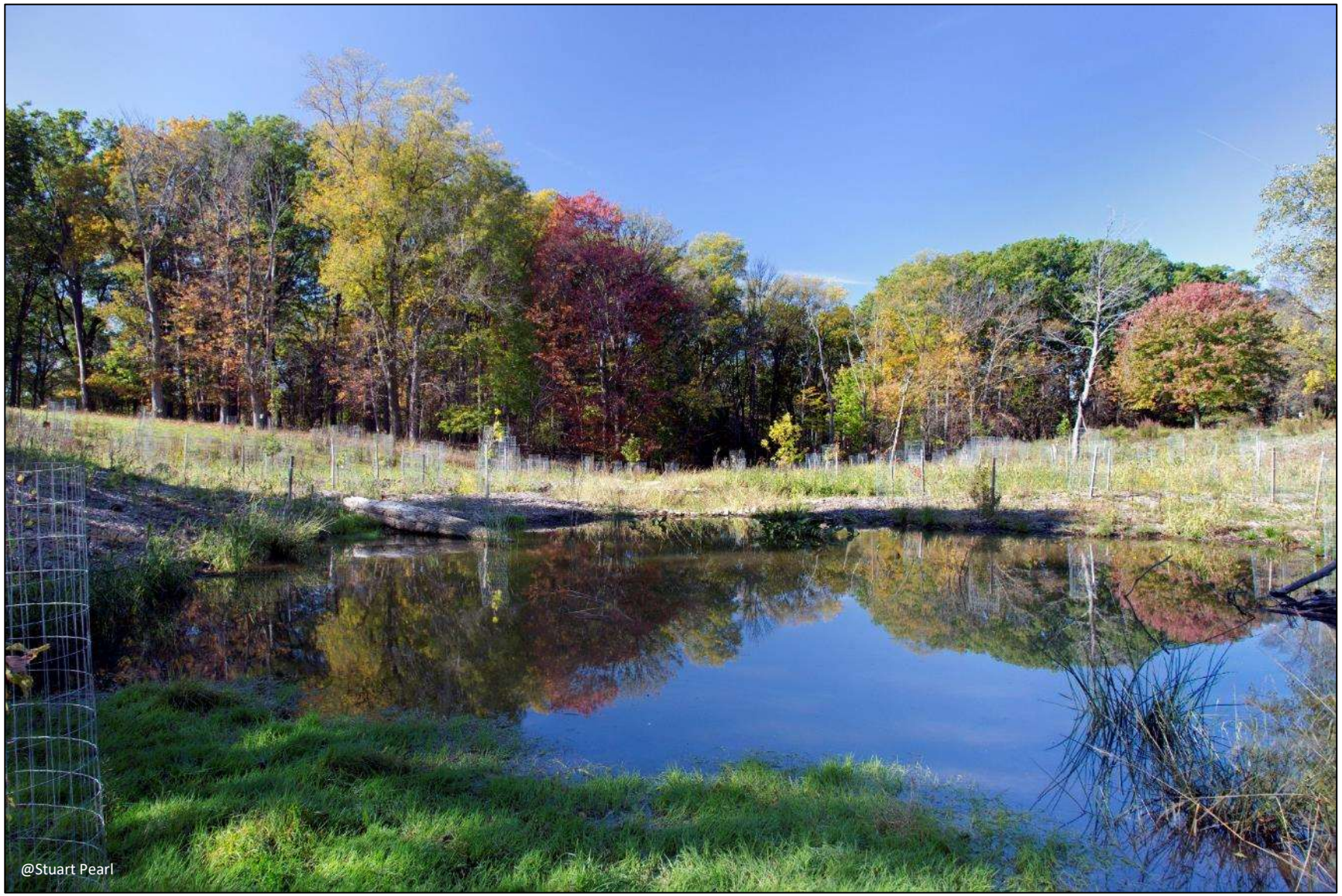


Wildlife Infill

Ongoing Issues -



QUESTIONS?



Suzanne Hoehne
Senior Ecological Designer

Biohabitats
GREAT LAKES BIOREGION

August 2022