



Civil & Environmental Consultants, Inc.

Macroscale Urban Culvert Daylighting & Stream Restoration, Flooded with Challenges, Innovation, and Restoration Success

Stream Restoration 2022: Sharing Visions for the Future

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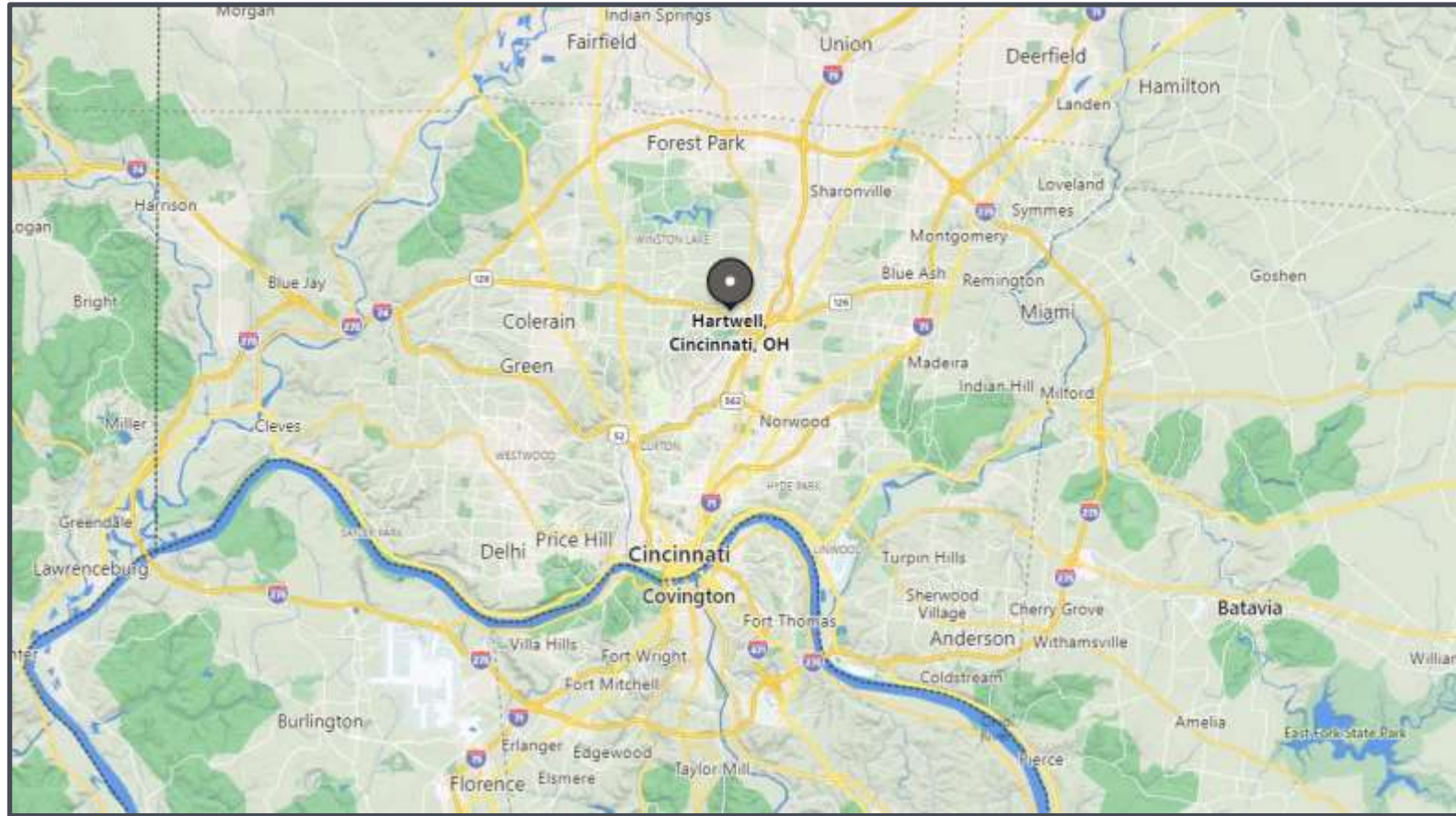
Outline

- Project Introduction
- Project Objectives
- Design Constraints
- Project Outcomes
- Lessons Learned
- Q&A



Project Introduction

- Former Hartwell Golf Course Opened in Mid-1930's
- Hartwell, Cincinnati, Ohio
- Congress Run just upstream from Mill Creek
- 3.82 Sq. Mi. Drainage
- 530 Lf 10.5' Span x 7.5' High Metal Arch Culvert
- FEMA Flood Zone AE



Project Introduction

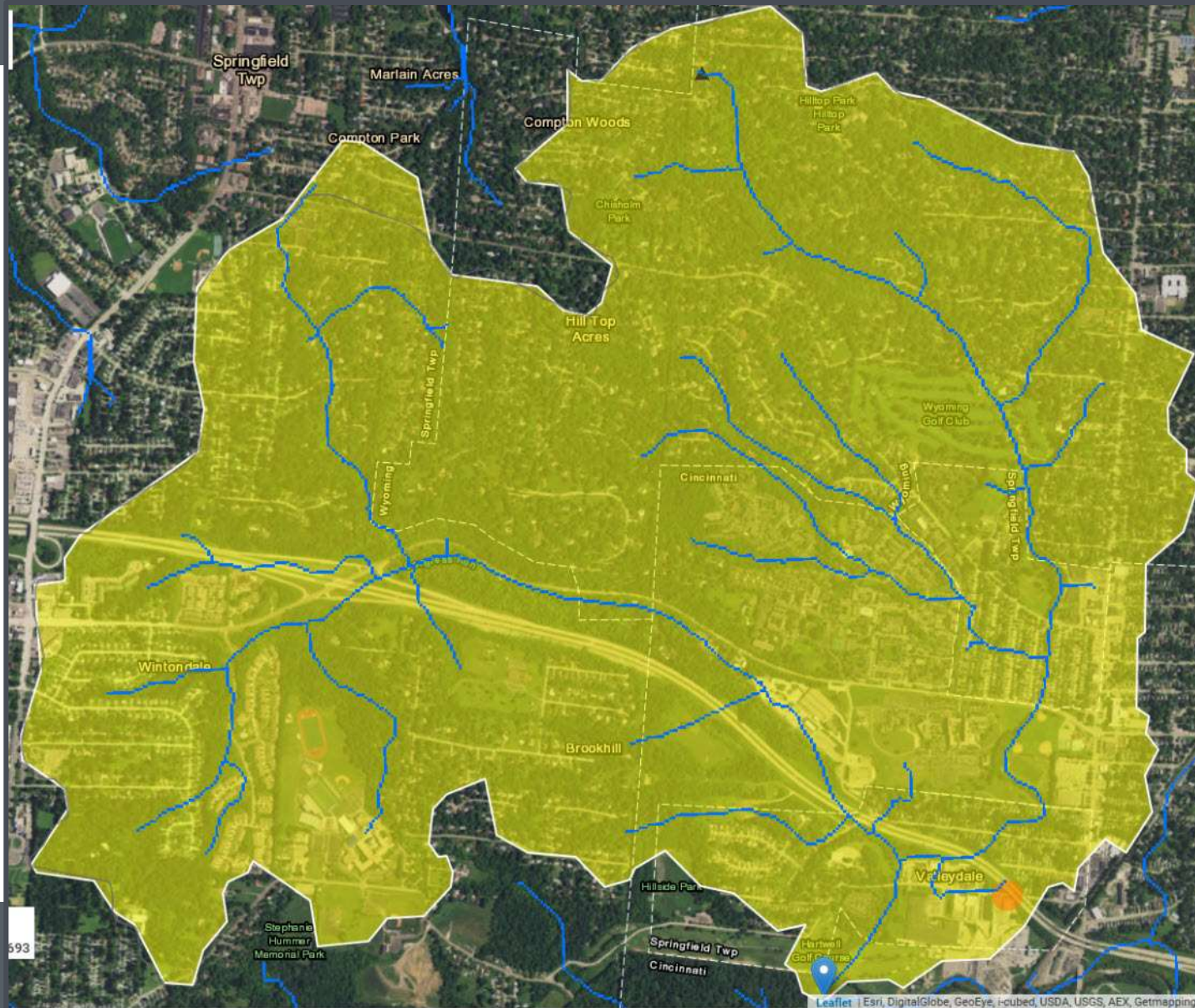
- Flood Mitigation Project
- 2 Phase Construction
 - Phase 1 – Stream Diversion
 - Phase 2 – Culvert Daylighting & Stream Restoration
- Culvert < 2 Yr. Design Flood Capacity
- Backwater Influence from Mill Creek – 115 Sq. Mi. at Congress Run (10,940 cfs)

STREAM MITIGATION TABLE					
STREAM	DRAINAGE AREA (AT UPSTREAM END OF EX. CULVERT)	EXISTING CULVERT LENGTH	TOTAL EXISTING STREAM & CULVERT LENGTH	PROPOSED RESTORATION LENGTH	BANKFULL WIDTH
CONGRESS RUN	3.82 SQ. MILES	530 LF	689 LF	800 LF	28.25 FT

CHANNEL EXCAVATION TABLE					
STREAM	DRAINAGE AREA (AT UPSTREAM END OF EX. CULVERT)	EXISTING CULVERT FLOW CAPACITY	EXISTING CULVERT FLOW CAPACITY STORM EQUIVALENT	DIVERSION CHANNEL FLOW CAPACITY	TOTAL CAPACITY (CULVERT & DIVERSION)
CONGRESS RUN	3.82 SQ. MILES	470 CFS	<2-YEAR STORM (2.75" RAIN EVENT)	210 CFS (1.8" RAIN EVENT)	680 CFS (>2-YEAR STORM, 2.9" RAIN EVENT)



Project Introduction



Project Introduction



Project Introduction



1938

Project Introduction



1949

Project Introduction



Project Introduction



Project Introduction



Design Objectives

- Flood Mitigation
- Floodplain Connection
- Ecosystem Restoration
- Hydraulic & Ecological Diversity

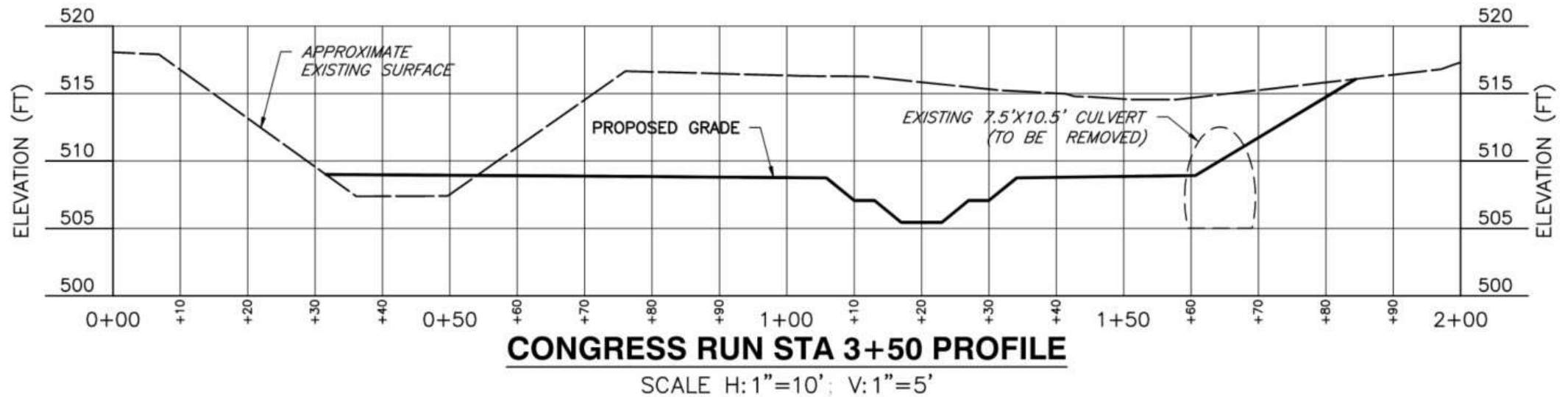


Design Constraints

- Impaired & Flashy Urban Stream
- Undersized Culvert
- Backwater from Mill Creek
- High Voltage Electric Transmission Lines
- 30" Sanitary Sewer & Manholes
- Storm Sewer Outfalls
- USGS Stream Gauge
- 2 Permitting Jurisdictions



Design Constraints



Project Outcomes

- Significant Flood Reduction from the Base Flood (1% AC)

Location	Profile	Flow (cfs)	WSE (ft)	Δ (ft)
Culvert Inlet	EC 1% AC	4,398	522.9	
Culvert Inlet	PC 1% AC	4,398	516.0	-6.9
Culvert Inlet	EC 1% AC w/ Backwater	4,398	522.9	
Culvert Inlet	PC 1% AC w/ Backwater	4,398	520.3	-2.6



Project Outcomes



Project Outcomes

- Stream Diversity



Lessons Learned

- Water Control in Urban Systems
 - Mother Nature Wins!
 - Add more downtime in schedule for flooded conditions
- 1930's Civil Works
 - Mass Concrete
 - 3 Phase Culvert Install = Buried Inlet/Outlet Structures



Questions?

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