

# GLASS CITY METROPARK

## Environmental Landscape Performance Assessment



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- Introduction and Project Overview
- Project Goals and Design Intent
- Performance Focus and Questions
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Photo Source: Metroparks Toledo



# INTRODUCTION





# PROJECT GOALS

This research evaluated Glass City Metropark 6 years after its initial Phase 1 construction, and 3 years after Phase 2 construction. It is intended to **assess the environmental benefits of the park** and **investigate if the design meets the primary objectives** set before construction and completion. This investigation was conducted in collaboration with the design firm SmithGroup. SmithGroup's environmental design goals for this site design included **prioritizing reforestation, improving water quality, and adhering to the 80/20 rule of park development.**

The research involved collecting and reviewing both primary and secondary source data. This data consisted of **collecting citizen science records** on species biodiversity, **calculating total runoff** and comparing current site conditions with former, and **calculating carbon sequestration of trees** planted on site.

1. Quantify the park's ecological impacts.
2. Evaluate effectiveness of ecological design elements.
3. Identify key ecological benefits and limitations.
4. Establish basis for future ecological managements.
5. Contribute to broader landscape performance assessment studies.



# CARBON STORAGE AND SEQUESTRATION



How does planting new tree species influence carbon sequestration in the area?  
How could carbon sequestration be predicted for 20 years from now?



# Methods and Metrics

## METHODOLOGY OVERVIEW

- Data Source: iTree Eco v6.1.57
  - Collects data from complete tree inventories to quantify environmental effects, structure, and value to communities.
- Personal Site Observations
  - Collected from trees installed during Phase 1 and Phase 2 of construction



Figure 1.1. Different tree species measured on site. Source: 1-6 taken during site visit on April 10, 2026.



# Methods and Metrics

## TRACKED METRICS

- Tree Observations On-site
  - Measure diameter breast height (DBH)
  - Convert on-site DBH values into DBH weighted average
  - Apply DBH weight to complete planting inventory

DBH Weight = (Average DBH – DBH at planting) / DBH at planting

Table 1.1. Site Measurements taken on April 10, 2026.

| Design Phase | Species Name         | DBH (in) |
|--------------|----------------------|----------|
| 1            | Crabapple            | 6        |
| 1            | Red Sunset Maple     | 7.5      |
| 1            | London Planetree     | 12       |
| 1            | Bald Cypress         | 7.25     |
| 1            | Elm                  | 7.5      |
| 2            | Red Maple            | 6.25     |
| 2            | Kentucky Coffee tree | 8        |
| 2            | Redbud               | 7        |
| 2            | Hawthorn             | 6        |

Table 1.2. Calculations for DBH Weighted Average

| Design Phase      | Average DBH (in) | DBH at planting (in) | DBH Weight (in) |
|-------------------|------------------|----------------------|-----------------|
| 1                 | 7.06             | 1.5                  | 3.71            |
| 2                 | 6.81             | 1.5                  | 3.54            |
| London Planetree* | 12               | 1.5                  | 7               |

\*London Planetree excluded from average DBH weight calculations for faster than average growth rate



# Methods and Metrics

## TRACKED METRICS

- iTree Eco Process

Figure 1.2. DBH Categories in iTree Eco

Project Configuration > Define Data Fields > DBH

| ID | Description | DBH (in) |
|----|-------------|----------|
| 1  | 0 - 3 in    | 1.5      |
| 2  | 3 - 6 in    | 4.5      |
| 3  | 6 - 12 in   | 9        |
| 4  | 12 - 18 in  | 15       |
| 5  | 18 - 24 in  | 21       |
| 6  | 24 - 30 in  | 27       |
| 7  | 30 - 36 in  | 33       |
| 8  | 36 - 42 in  | 39       |
| 9  | 42 - 48 in  | 45       |
| 10 | > 48 in     | 52.8     |

Figure 1.3. % Dieback Categories in iTree Eco

Project Configuration > Define Data Fields > Crown Health

| ID | Description | % Dieback |
|----|-------------|-----------|
| 1  | 0%          | 0         |
| 2  | 1% - 5%     | 3         |
| 3  | 5% - 10%    | 8         |
| 4  | 10% - 15%   | 13        |
| 5  | 15% - 20%   | 18        |
| 6  | 20% - 25%   | 23        |
| 7  | 25% - 30%   | 28        |
| 8  | 30% - 35%   | 33        |
| 9  | 35% - 40%   | 38        |
| 10 | 40% - 45%   | 43        |
| 11 | 45% - 50%   | 48        |
| 12 | 50% - 55%   | 53        |
| 13 | 55% - 60%   | 58        |
| 14 | 60% - 65%   | 63        |
| 15 | 65% - 70%   | 68        |
| 16 | 70% - 75%   | 73        |
| 17 | 75% - 80%   | 78        |
| 18 | 80% - 85%   | 83        |
| 19 | 85% - 90%   | 88        |
| 20 | 90% - 95%   | 93        |
| 21 | 95% - 99%   | 98        |
| 22 | 100%        | 100       |

# Methods and Metrics

## TRACKED METRICS

- iTree Eco Analysis – Phase 1
- Inputs
  - Species Name
  - DBH
  - % Crown Dieback (10)
  - Land Use (Park)

Table 1.3. Annual Carbon Sequestration for Phase 1

| Species                      | Gross Carbon Sequestration (ton/yr) | CO <sub>2</sub> Equivalent (ton/yr) |
|------------------------------|-------------------------------------|-------------------------------------|
| Ironwood                     | 0.01                                | 0.05                                |
| Amur Maple                   | 0.06                                | 0.23                                |
| Red Maple                    | 0.12                                | 0.43                                |
| Serviceberry spp             | 0.12                                | 0.45                                |
| Downy Hawthorn               | 0.03                                | 0.11                                |
| Black Gum                    | 0.04                                | 0.13                                |
| Honeylocust                  | 0.05                                | 0.19                                |
| Kentucky Coffee tree         | 0.03                                | 0.12                                |
| Witchhazel spp               | 0.01                                | 0.02                                |
| Japanese Flowering Crabapple | 0.07                                | 0.24                                |
| American Sycamore            | 0.03                                | 0.10                                |
| Swamp White Oak              | 0.08                                | 0.29                                |
| Bur Oak                      | 0.03                                | 0.11                                |
| Redbud                       | 0.03                                | 0.12                                |
| Common Linden                | 0.03                                | 0.11                                |
| Elm spp                      | 0.05                                | 0.19                                |
| <b>TOTAL</b>                 | <b>0.79</b>                         | <b>2.90</b>                         |



# Methods and Metrics

## TRACKED METRICS

- iTree Eco Analysis – Phase 2
- Inputs
  - Species Name
  - DBH
  - % Crown Dieback (10)
  - Land Use (Park)

Table 1.4. Annual Carbon Sequestration for Phase 2

| Species                      | Gross Carbon Sequestration (ton/yr) | CO <sub>2</sub> Equivalent (ton/yr) |
|------------------------------|-------------------------------------|-------------------------------------|
| Ironwood                     | 0.04                                | 0.13                                |
| Red Maple                    | 0.45                                | 1.67                                |
| Sugar Maple                  | 0.15                                | 0.55                                |
| Serviceberry spp             | 0.46                                | 1.68                                |
| American Hornbeam            | 0.09                                | 0.31                                |
| Downy Hawthorn               | 0.24                                | 0.89                                |
| Honeylocust                  | 0.16                                | 0.59                                |
| Kentucky Coffee tree         | 0.04                                | 0.14                                |
| Witchhazel spp               | 0.09                                | 0.32                                |
| Tuliptree spp                | 0.20                                | 0.73                                |
| Japanese Flowering Crabapple | 0.13                                | 0.47                                |
| Norway Spruce                | 0.12                                | 0.43                                |
| Serbian Spruce               | 0.07                                | 0.24                                |
| London Planetree             | 0.44                                | 1.63                                |
| Redbud                       | 0.05                                | 0.19                                |
| Common Linden                | 0.24                                | 0.89                                |
| Elm spp                      | 0.08                                | 0.31                                |
| <b>TOTAL</b>                 | <b>3.73</b>                         | <b>13.69</b>                        |

# Methods and Metrics

## TRACKED METRICS

- Convert Gross Carbon Sequestration
  - Convert into pounds per year
  - Estimate 20-year forecast

Phase 1: 2.90 tons/yr x 2000 lbs =  
**5,800 lbs CO<sub>2</sub>/year**

Phase 2: 13.69 tons/yr x 2000 lbs  
= **27,380 lbs CO<sub>2</sub>/year**

20-year forecast: (Phase 1 + Phase  
2) x 20 years



# Performance Findings

The 1,149 newly planted trees have sequestered roughly **33,180 lbs of CO<sub>2</sub> this year.**

When compared with the former industrial site barren of trees.

These trees are projected to sequester over **663,600 lbs of CO<sub>2</sub> over the next 20 years.**

Table 1.5. Summary Table of Performance Findings

| Design Phase | CO <sub>2</sub> Sequestered in lbs (1 year) | CO <sub>2</sub> Sequestered in lbs (20 years) |
|--------------|---------------------------------------------|-----------------------------------------------|
| Phase 1      | 5,800                                       | 116,000                                       |
| Phase 2      | 27,380                                      | 547,600                                       |
| <b>TOTAL</b> | <b>33,180</b>                               | <b>663,600</b>                                |

# Limitations

- **Not every tree included in the planting plan was measured** on-site individually. Real DBH measurements and estimated DBH measurements used in iTree Eco could vary.
- Some **specific tree varieties were not listed** under iTree Eco's tree inventory database and were **substituted for similar** varieties for calculations. This could have shifted the carbon sequestration results slightly.
- DBH at planting values were **determined from standard and average values** taken from other sources. Actual DBH at planting values could be different resulting in a slightly different calculation.
- The 20-year projection of carbon sequestration is based on a **constant sequestration value**. Trees grow and sequester more carbon over time, making the projection a rough estimate and not biologically grounded.

# Discussion

- This study highlights the importance of designing for **long term ecological performance**.
- Understanding how **canopy growth changes site performance over time** leads to lasting impacts in carbon storage and sequestration.
- **Transforming degraded land into multifunctional landscapes** has many environmental benefits.



Figure 1.4. The Glass City Event Lawn. Source: Metroparks Toledo



# HABITAT QUALITY

How much has bird species richness increased after habitat improvements, compared to pre-design conditions in Glass City Metropark?

Photo Source: Earthscape Play



Red Winged Black Bird



Red-breasted Nuthatch



Blue Grosbeak



Lark Sparrow

- Nature-based play area inspired by Blue Grosbeak, a **native migratory bird**
- Reinforces park's identity as **habitat stopover**

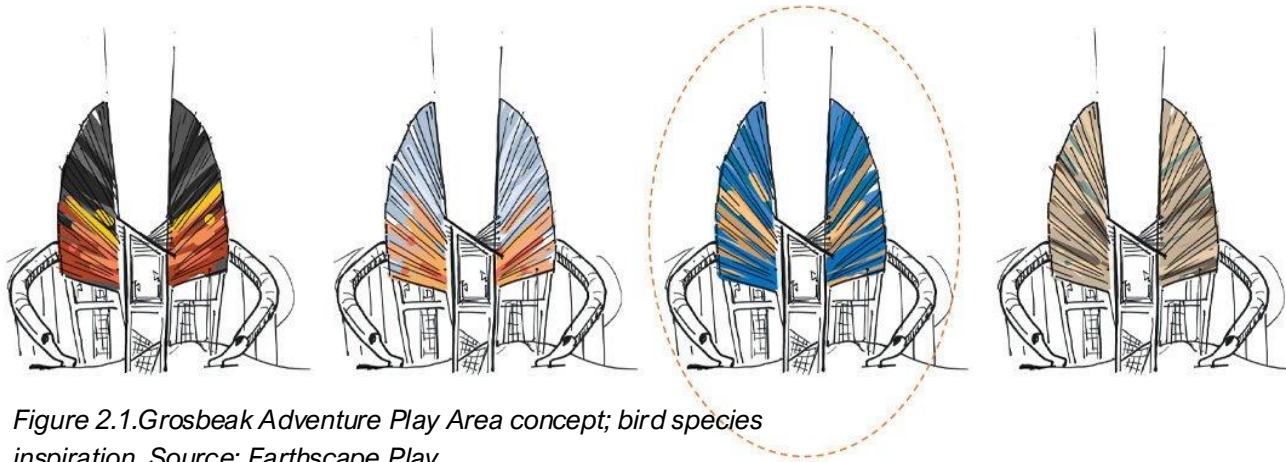


Figure 2.1. Grosbeak Adventure Play Area concept; bird species inspiration. Source: Earthscape Play

- Designed to connect users with **bird habitat and ecology**
- Functions as both a **recreational space and ecological education feature**

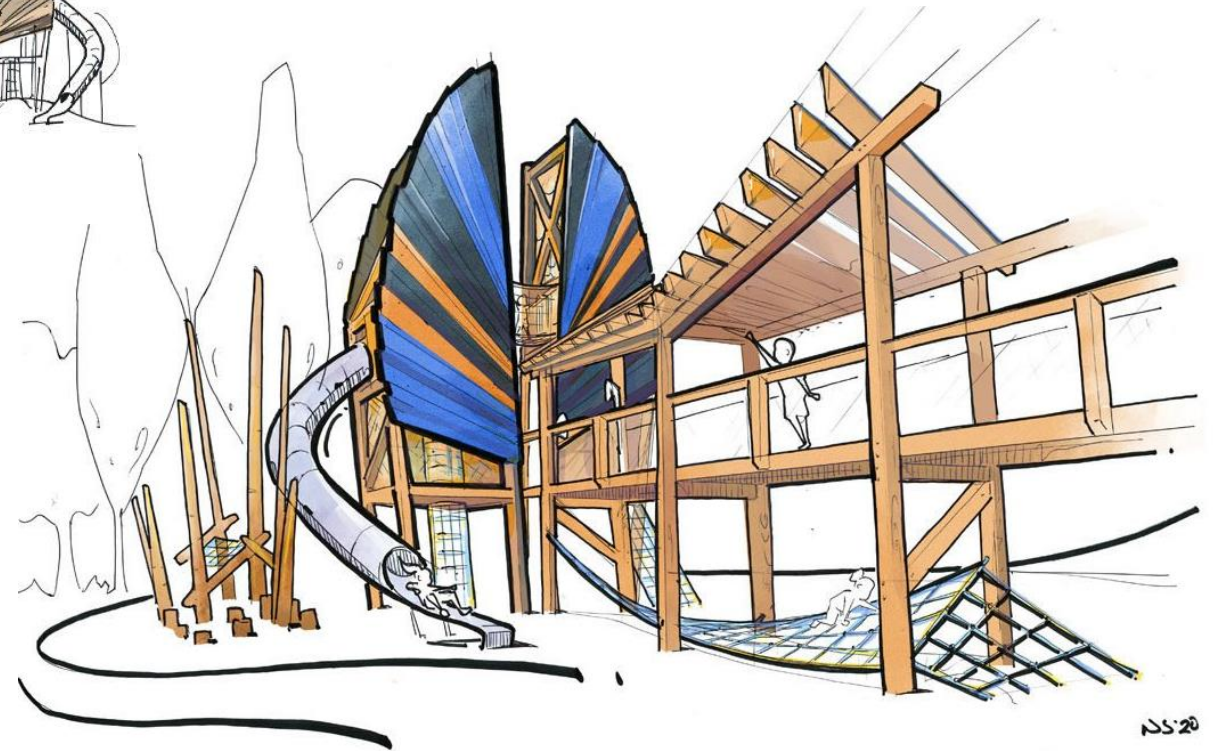


Figure 2.2. Grosbeak Adventure Play Area conceptual render. Source: Earthscape Play



# Methods and Metrics

## METHODOLOGY OVERVIEW

- Data Source: eBird
  - Global biodiversity platform by Cornell Lab of Ornithology
  - Provides bird sighting data compiled by birdwatchers, experts, and organizations
  - Supports large-scale species tracking
- Personal site visit observations
- Time Periods: eBird data collected from pre-implementation, Phase 1, and Phase 2

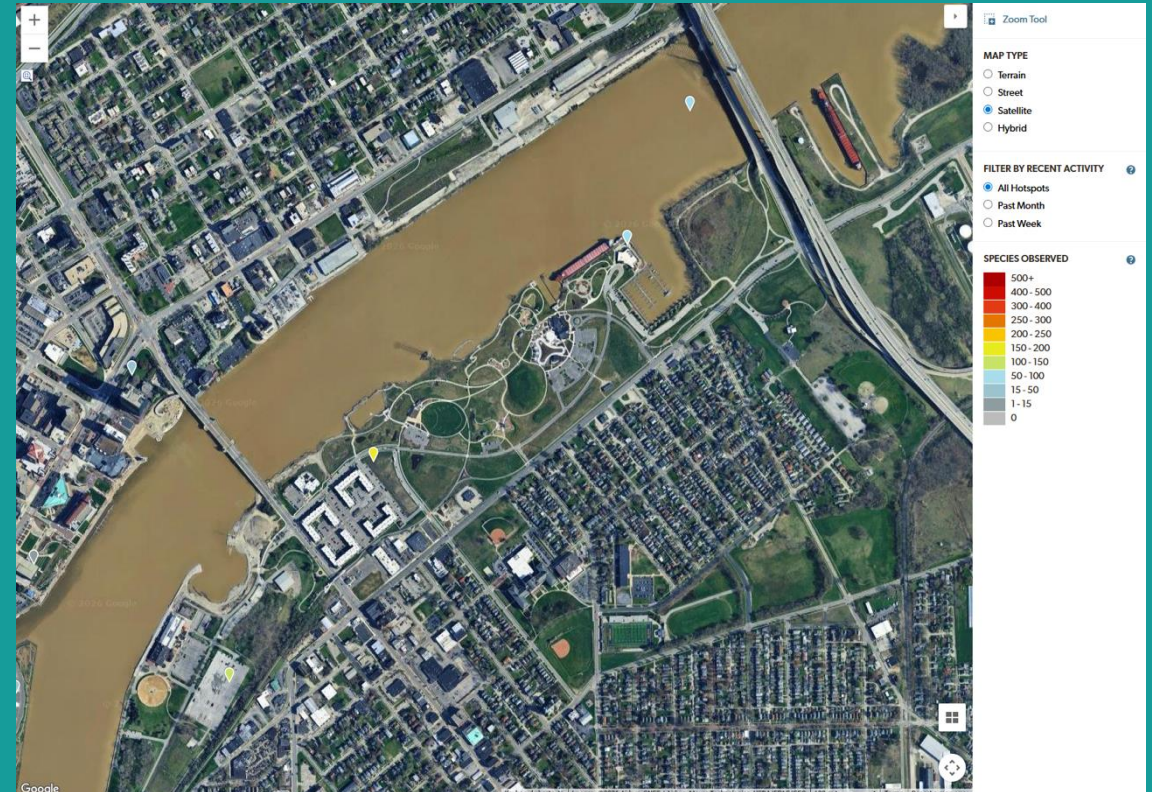


Figure 2.3. eBird Hotspot Map including Glass City Metropark. Source: eBird Hotspot



# Methods and Metrics

## TRACKED METRICS

- Total Species Observed Annually
  - Richness of bird species observed each year (2020-2025)
- Conservation Species Classifications
- Annual Counts of Selected Indicator Species
  - Track key species across each design phase to last full year (2020, 2023, 2025)
- Percent Change in Species Richness



*Figure 2.4. Images of bird species found at Glass City Metropark (in order: left to right, up to down): 1. Barn Swallow, 2. Bald Eagle, 3. Cooper's Hawk, 4. Great Blue Heron, 5. Grayling Goose, and 6. Killdeer. Source: eBird website reference*

# Performance Findings

- **Fastest growth** occurred between **2022–2024** (**76 → 125 species**)
- Slight decline in **2025**, but still above earlier years
- Overall trend shows **increasing species richness over time**, peaking in recent years

\*Phase 1 open in December 2020  
\*\*Phase 2 open in June 2023

Number of Observed Species vs. Year

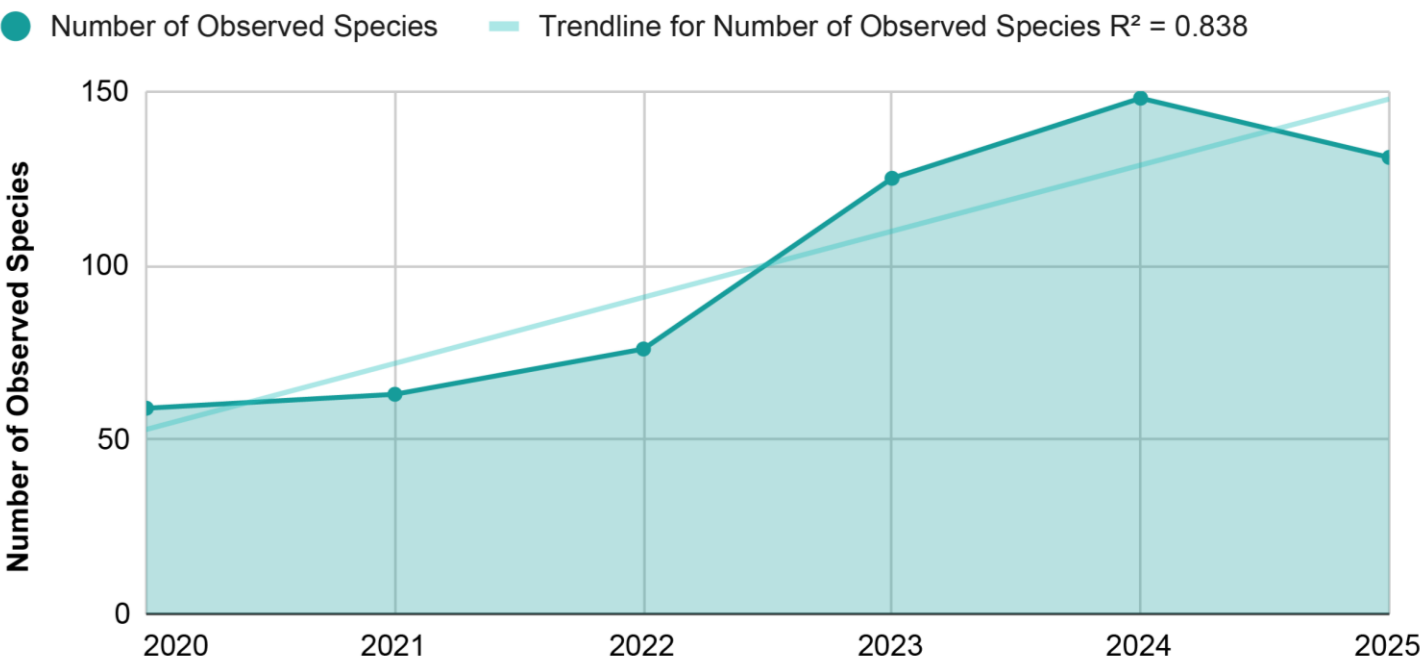


Figure 2.5. Total species observed annually within Glass City Metropark (2020–2025). Source: eBird Bar chart with adaptations

| Hotspot Observed Data                                            | 2020* | 2021 | 2022 | 2023** | 2024 | 2025 |
|------------------------------------------------------------------|-------|------|------|--------|------|------|
| Bird Observations: Total avian species observed within each year |       |      |      |        |      |      |
| Glass City Metropark                                             | 59    | 63   | 76   | 125    | 148  | 131  |

Table 2.1. Total species observed annually within Glass City Metropark (2020–2025). Source: eBird Bar chart with adaptations

# Performance Findings

- Percents calculated from **159 total observed species (2013–2026)**
- Includes species across **multiple conservation categories**
- Indicates presence of **higher-priority conservation species** alongside common birds

Table 2.2. Distribution of bird species by conservation status within Glass City Metropark. Source: IUCN Red List

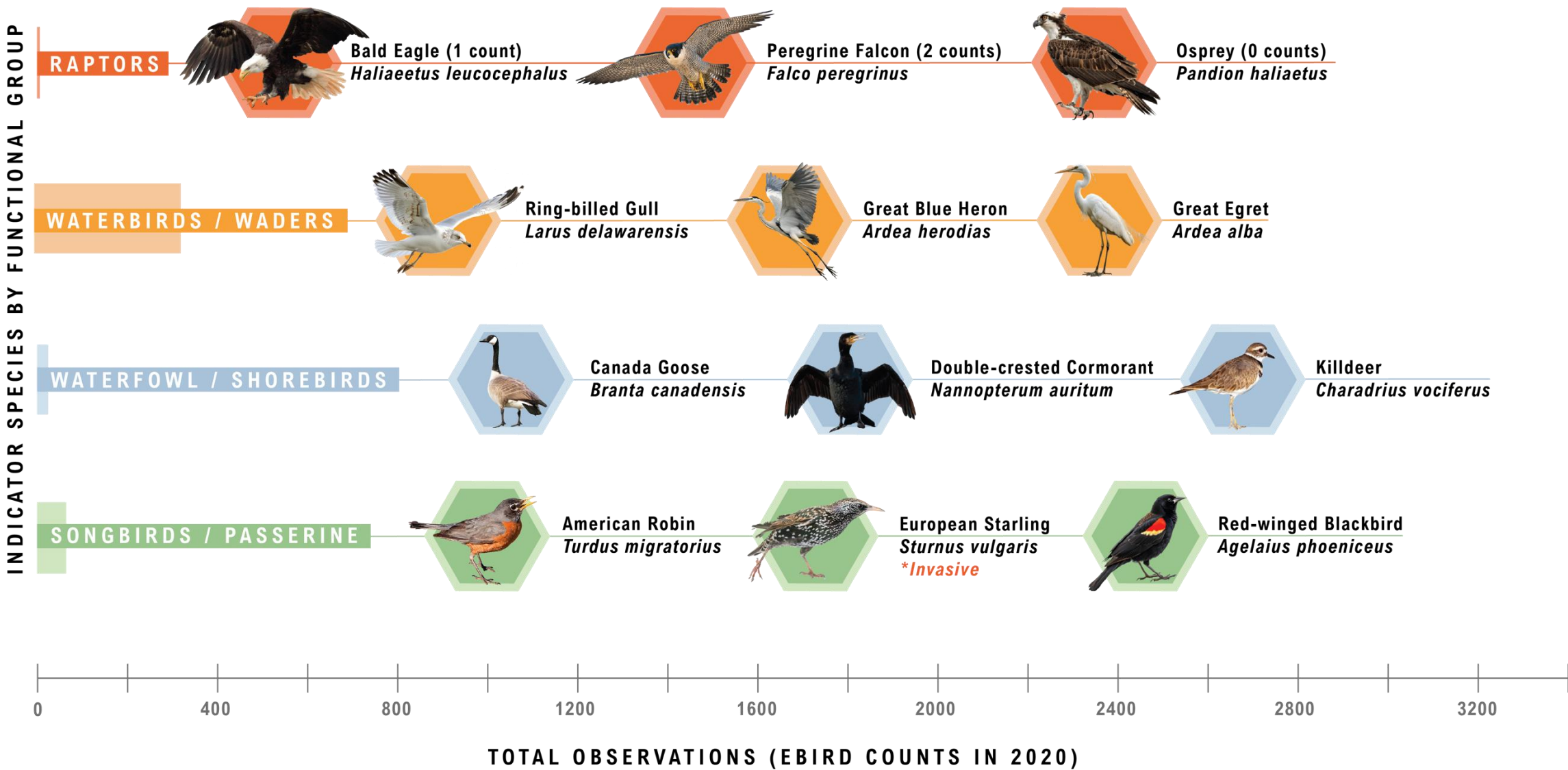
| Species Classification | Count | Percent* (%) |
|------------------------|-------|--------------|
| Species of Concern     | 9     | 5.7          |
| Threatened             | 2     | 1.3          |
| Endangered             | 2     | 1.3          |

\*Percentage of all observed sightings in all years



# Performance Findings

Figure 2.6. Total annual sightings of selected indicator species within Glass City Metropark. Species were selected based on suitability to represent avian functional groups. Source: eBird Bar chart with adaptations



# Performance Findings

Figure 2.6. Total annual sightings of selected indicator species within Glass City Metropark. Species were selected based on suitability to represent avian functional groups. Source: eBird Bar chart with adaptations

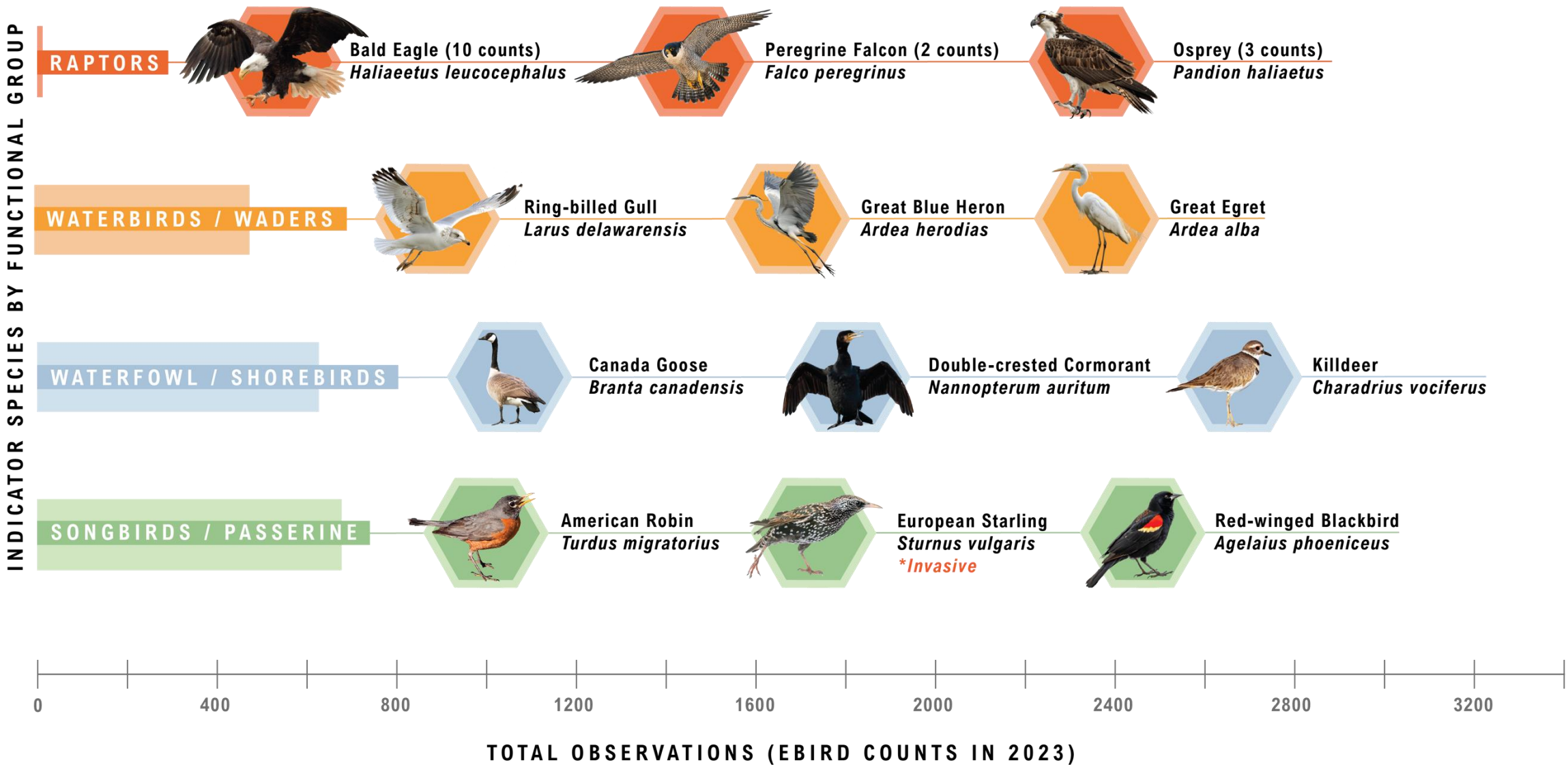
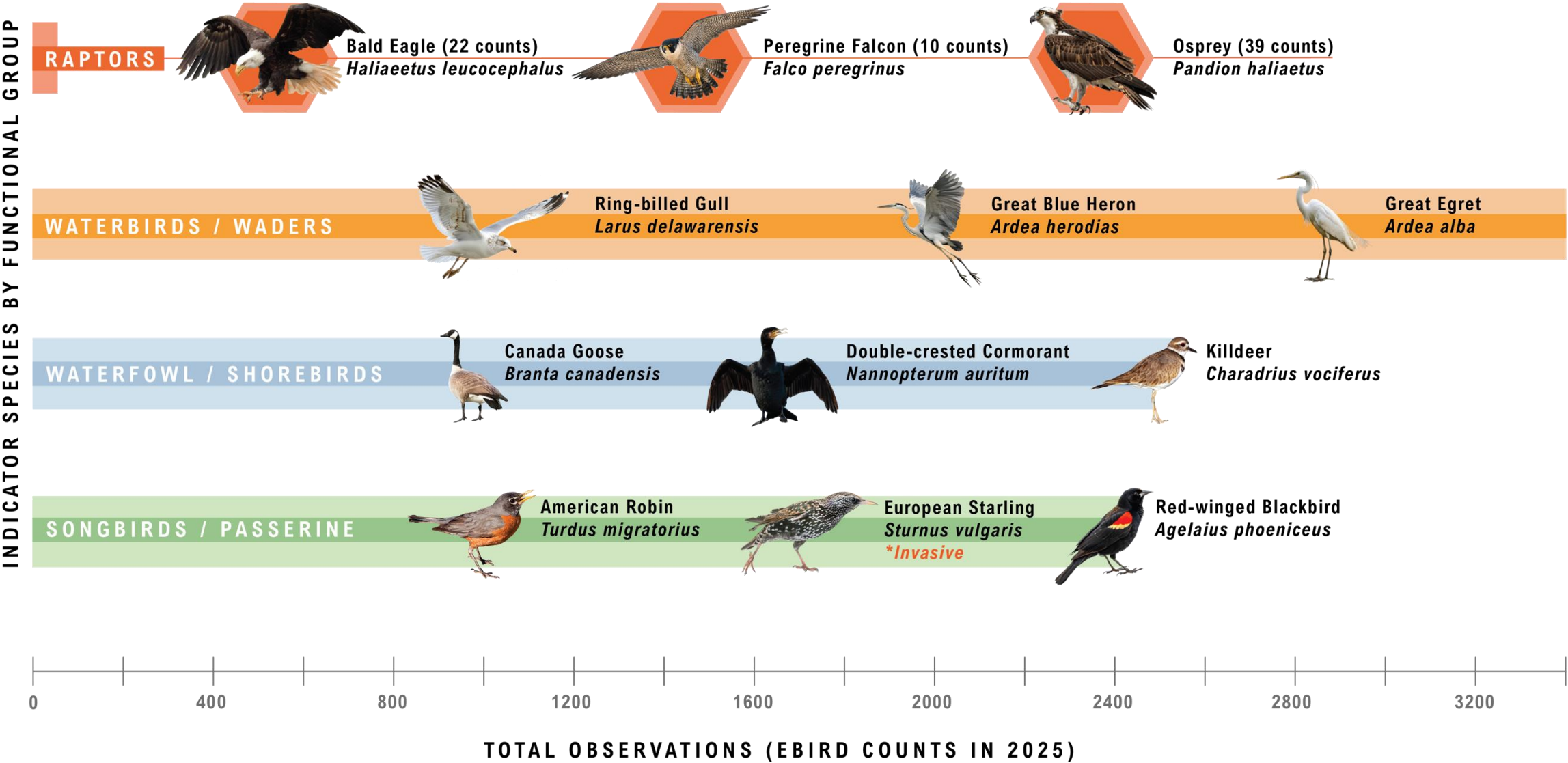


Figure 2.6. Total annual sightings of selected indicator species within Glass City Metropark. Species were selected based on suitability to represent avian functional groups. Source: eBird Bar chart with adaptations

# Performance Findings





# Performance Findings

- Field session collected qualitative observations to support eBird trends
  - Direct Observation
  - Merlin Bird ID (audio)
- Data recorded in 15-minute intervals across grassland/open field and riverfront edge habitats
- 15 total species observed across multiple functional groups

| Time (Approx.) | Habitat Type           | Observed Species                                        | Number Observed | Observed Behavior          |
|----------------|------------------------|---------------------------------------------------------|-----------------|----------------------------|
| 2:00–2:15 PM   | Grassland / Open Field | Red-winged Blackbird ( <i>Agelaius phoeniceus</i> )     | 9               | Perching, foraging         |
| 2:00–2:15 PM   | Riverfront Edge        | Canada Goose ( <i>Branta canadensis</i> )               | 2               | Flying, swimming, walking  |
| 2:00–2:15 PM   | Riverfront Edge        | Ring-billed Gull ( <i>Larus delawarensis</i> )          | 18              | Flying                     |
| 2:00–2:15 PM   | Grassland / Open Field | Horned Lark ( <i>Eremophila alpestris</i> )             | 4               | Flying                     |
| 2:00–2:15 PM   | Grassland / Open Field | American Robin ( <i>Turdus migratorius</i> )            | 8               | Flying, perching, foraging |
| 2:15–2:30 PM   | Grassland / Open Field | Killdeer ( <i>Charadrius vociferus</i> )                | 7               | Flying, nesting, resting   |
| 2:15–2:30 PM   | Riverfront Edge        | Double-crested Cormorant ( <i>Nannopterum auritum</i> ) | 5               | Flying, foraging           |
| 2:15–2:30 PM   | Riverfront Edge        | Bald Eagle ( <i>Haliaeetus leucocephalus</i> )          | 1               | Flying, perching, nesting  |

Figure 2.7. Field observations of avian and wildlife presence and behavior recording in 15-minute intervals during site visit to Glass City Metropark. Site Observations taken on April 10, 2026.

# Performance Findings

- Raptors observed in low numbers with wide-ranging movement across habitats
- Terrestrial mammals present, indicating edge habitat supports broader ecological activity

| Time (Approx.) | Habitat Type           | Observed Species                                    | Number Observed | Observed Behavior             |
|----------------|------------------------|-----------------------------------------------------|-----------------|-------------------------------|
| 2:15–2:30 PM   | Grassland / Open Field | Peregrine Falcon ( <i>Falco peregrinus</i> )        | 1               | Flying, foraging, vocalizing  |
| 2:30–2:45 PM   | Grassland / Open Field | House Sparrow ( <i>Passer domesticus</i> )          | 6               | Flying, perching, Socializing |
| 2:30–2:45 PM   | Grassland / Open Field | European Starling ( <i>Sturnus vulgaris</i> )       | 1               | Vocalizing                    |
| 2:30–2:45 PM   | Riverfront Edge        | Great Blue Heron ( <i>Ardea herodias</i> )          | 1               | Flying, wading                |
| 2:30–2:45 PM   | Grassland / Open Field | American Crow ( <i>Corvus brachyrhynchos</i> )      | 1               | Flying                        |
| 2:30–2:45 PM   | Grassland / Open Field | Groundhog ( <i>Marmota monax</i> )                  | 1               | Foraging                      |
| 2:30–2:45 PM   | Grassland / Open Field | Eastern Cottontail ( <i>Sylvilagus floridanus</i> ) | 1               | Foraging                      |
| 2:30–2:45 PM   | Grassland / Open Field | House Sparrow ( <i>Passer domesticus</i> )          | 6               | Flying, perching, Socializing |

Figure 2.8. Field observations of avian and wildlife presence and behavior recording in 15-minute intervals during site visit to Glass City Metropark. Site Observations taken on April 10, 2026.

# Performance Findings

## PERCENT CHANGE FORMULA

$$\text{percent change} = \frac{\text{final} - \text{initial}}{|\text{initial}|} \times 100$$

Percent change between phases:

Pre-implementation → Phase 1 = +74.4%

Phase 1 → Phase 2 = +41.3%

Bird Species Richness by Project Phase

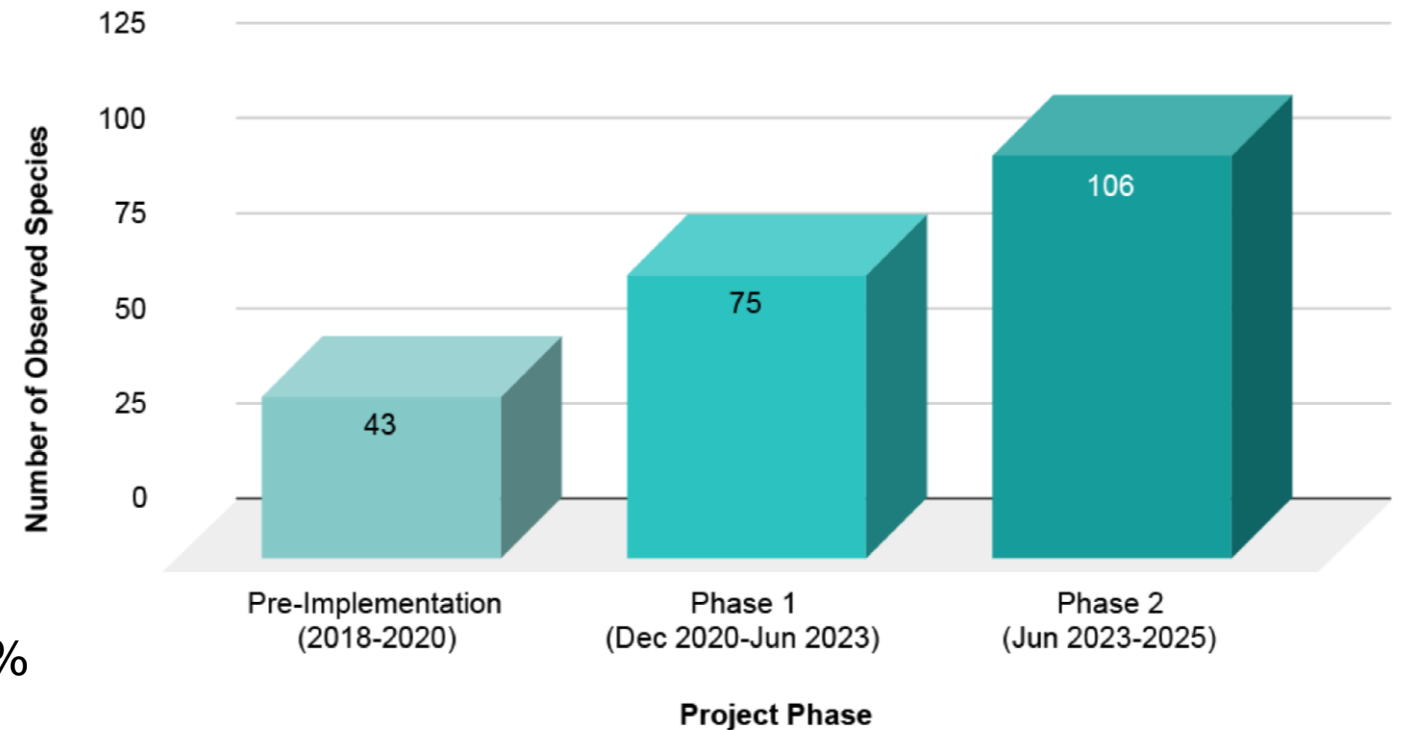


Figure 2.9. Overall growth of total observed bird species between years. Source: eBird Bar chart with adaptations



# Limitations

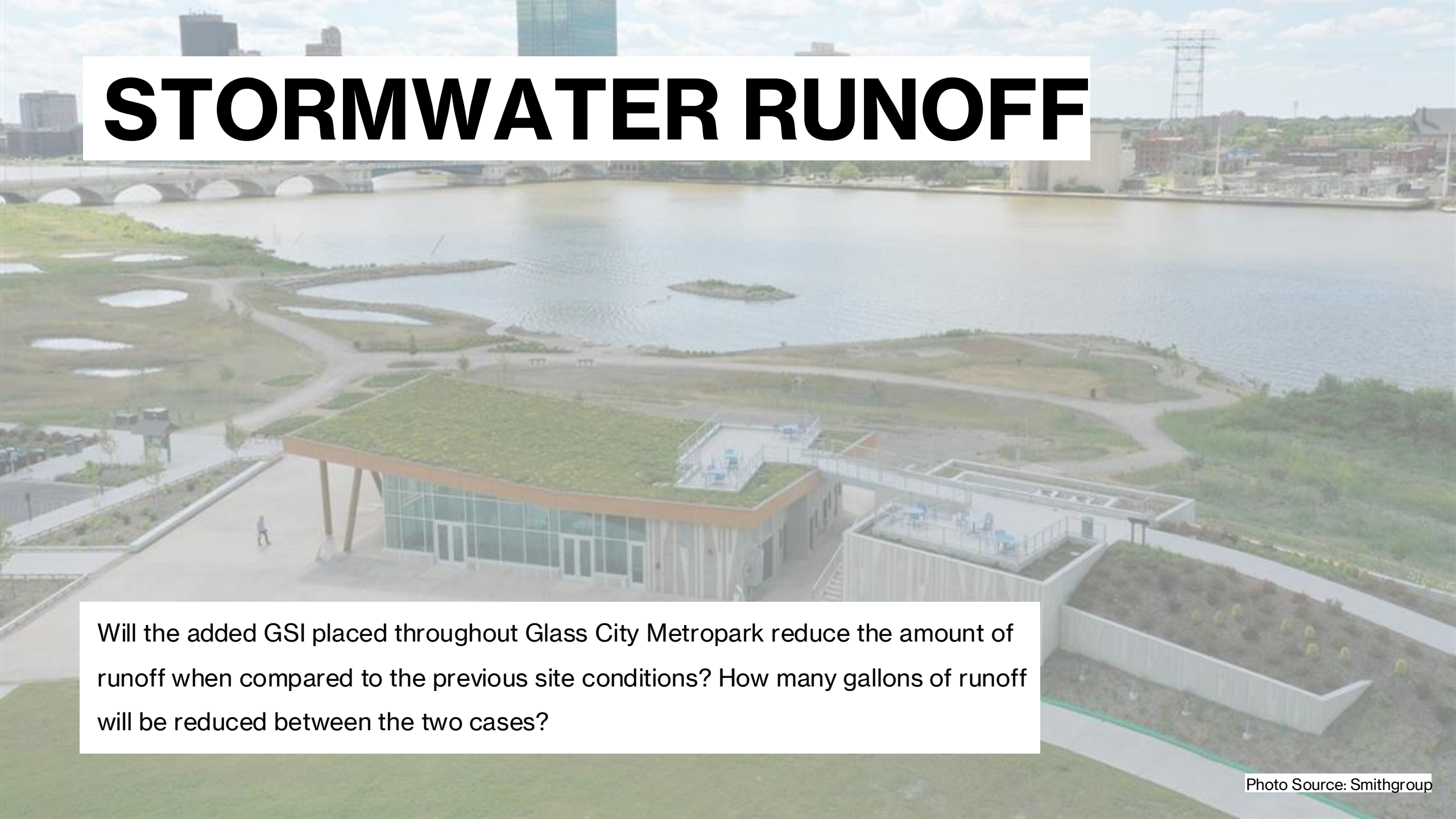
- Bird observations are **based on citizen science data**, which may introduce some **sampling bias** and affect the accuracy of species records.
- The **increasing popularity of birdwatching** may lead to more observations being reported over time on platforms like eBird, which can influence trends.
- The **COVID-19 pandemic** may have reduced outdoor activity, leading to fewer observations and lower reported species counts beginning in 2020.
- **Public access was limited during construction** of Phase 1 and Phase 2, resulting in fewer recorded observations during these periods.

# Discussion

- eBird + field data show **more species and more diverse activity**
- **Mixed habitats** support broader functional bird groups
- Rise in **water-associated species** indicates effective river restoration
- Presence of **raptors** signals a stronger, more stable ecosystem
- Results highlight the value of **phased ecological design, habitat diversity, and long-term monitoring**



# STORMWATER RUNOFF

An aerial photograph of Glass City Metropark. In the foreground, a modern building with a large glass facade and a green roof is visible. The roof has several rooftop gardens and a small outdoor seating area. The building is situated on a grassy area with winding paths. In the background, a large body of water, likely the Maumee Bay, stretches across the middle ground. A multi-arched bridge is visible in the distance. The city skyline is visible in the far background under a blue sky with scattered clouds.

Will the added GSI placed throughout Glass City Metropark reduce the amount of runoff when compared to the previous site conditions? How many gallons of runoff will be reduced between the two cases?



# Methods and Metrics

## METHODOLOGY OVERVIEW

- Source: ArcGIS Pro
  - Find different land cover types between the current park and previous industrial site
    - Traced site, separating it into 6 different categories
      1. Turf
      2. Garden beds
      3. Stormwater infrastructure (GSI)
      4. Pervious paths
      5. Impervious paths
      6. Dense tree plantings



Figure 3.1: Different land cover types (in order: left to right, up to down): 1. Turf, 2. Garden Beds, 3. Stormwater Infrastructure (GSI), 4. Pervious Gravel Paths, 5. Impervious Concrete/Asphalt Paths, and 6. Dense Tree Plantings. Source: 1-5 taken on site April 10, 2026, Photo 6 Source: Google Earth

# Methods and Metrics

## METHODOLOGY OVERVIEW

### CURRENT METROPARK:



Figure 3.2: Digitized GIS map displaying boundary of study and the separate land cover categories of the Current Metropark. Source: ArcGIS Pro.

### FORMER INDUSTRIAL:



Figure 3.3: Digitized GIS map displaying boundary of study and the separate land cover categories of the Former Industrial area. Source: ArcGIS Pro.

# Methods and Metrics

## METHODOLOGY OVERVIEW

- Apply the NRCS Curve Number Method
  - o This method is a widely used planning-level model that estimates the direct runoff from a rainfall
  - o Equation:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

- Separate the method into finding 3 distinct factors:
  1. **Weighted Curve Number (CN)**
    - Estimation for the **volume of direct runoff or infiltration** from rainfall a site can handle
    - Based off soil hydrologic type
  2. **Potential Maximum Retention (S)**
    - **Max amount of water the site can retain** after a rainstorm begins
  3. **Storm strength (P)**
    - **How many inches of water will fall** during the simulated test



# Methods and Metrics

## TRACKED METRICS

- Finding both Curve Numbers
  - Multiplied the percentage of land cover type by its respective curve number
    - Got each curve number type from the "urban hydrology for small watersheds" manual
    - Higher the curve number = higher runoff
  - The Current Metropark CN = 78
  - Former Industrial CN = 95

Table 3.1: Calculations of the current site's land cover percentage, curve number under soil type 'C', and Weighted curve number.

| Calculated Curve Weight and Soil CN |                  |            |                                |
|-------------------------------------|------------------|------------|--------------------------------|
| Land Cover Type                     | Soil Type 'C' CN | Percentage | Weighted Curve Number (% x CN) |
| Impervious                          | 98               | 18.14%     | .1814 x 98 = 17.7772           |
| Pervious                            | 74               | 2.67%      | .0267 x 74 = 1.9758            |
| Garden Bed                          | 74               | 3.95%      | .0395 x 74 = 2.923             |
| Retention Basin                     | 70               | 6.12%      | .0612 x 70 = 4.284             |
| Forested                            | 70               | 19.28%     | .1928 x 70 = 13.496            |
| Turf                                | 74               | 50.17%     | .5017 x 74 = 37.1258           |
| Current                             |                  |            | 77.5818 = 78                   |

Table 3.2: Calculations of the former site's land cover percentage, curve number under soil type 'C', and Weighted curve number.

| Former Industrial: Calculated Curve Weight and Soil CN |                  |            |                                |
|--------------------------------------------------------|------------------|------------|--------------------------------|
| Land Cover Type                                        | Soil Type 'C' CN | Percentage | Weighted Curve Number (% x CN) |
| Impervious                                             | 98               | 49.12%     | .4912 x 98 = 48.1349           |
| Turf/open land                                         | 91               | 50.88%     | .5088 x 91 = 46.3033           |
| Previous                                               |                  |            | 94.4382 = 95                   |

# Methods and Metrics

## TRACKED METRICS

- Finding Maximum Retention (S)
  - Using the Weighted Curve Numbers, solve for 'S' with this equation:

$$S = \left( \frac{1000}{CN} \right) - 10$$

- Current Metropark =  $(1000 / 78) - 10$   
= **2.8205 in**
- Former Industrial =  $(1000 / 95) - 10$   
= **0.5263 in**

- Setting the rain fall amount for the simulation (P)
  - A 1-inch rainfall event was chosen to be calculated in
  - Ensures an even measurement between both calculations

# Performance Findings

- For the current metropark, it was found that only **0.05 in of runoff** enters the Maumee River on the current metropark
  - Compared to the former industrial site which had **0.5 in of runoff**
- To better visualize, the inches of runoff was converted into gallons
  - 1-inch storm spread across 63.44 acres = 27,154 gallons
    - Current Park =  $0.0538 \times 63.44 \times 27,154 = 92,679$  gallons of runoff
    - Former Industrial Site =  $0.5291 \times 63.44 \times 27,154 = 911,453.988 = 911,454$  gallons of runoff

Table 3.3: Findings of the study between the current metropark and former industrial area. The graph displays each steps findings throughout the process, showing the curve numbers, amount of water retained (in), amount of runoff (in), and the amount of runoff converted to gallons.

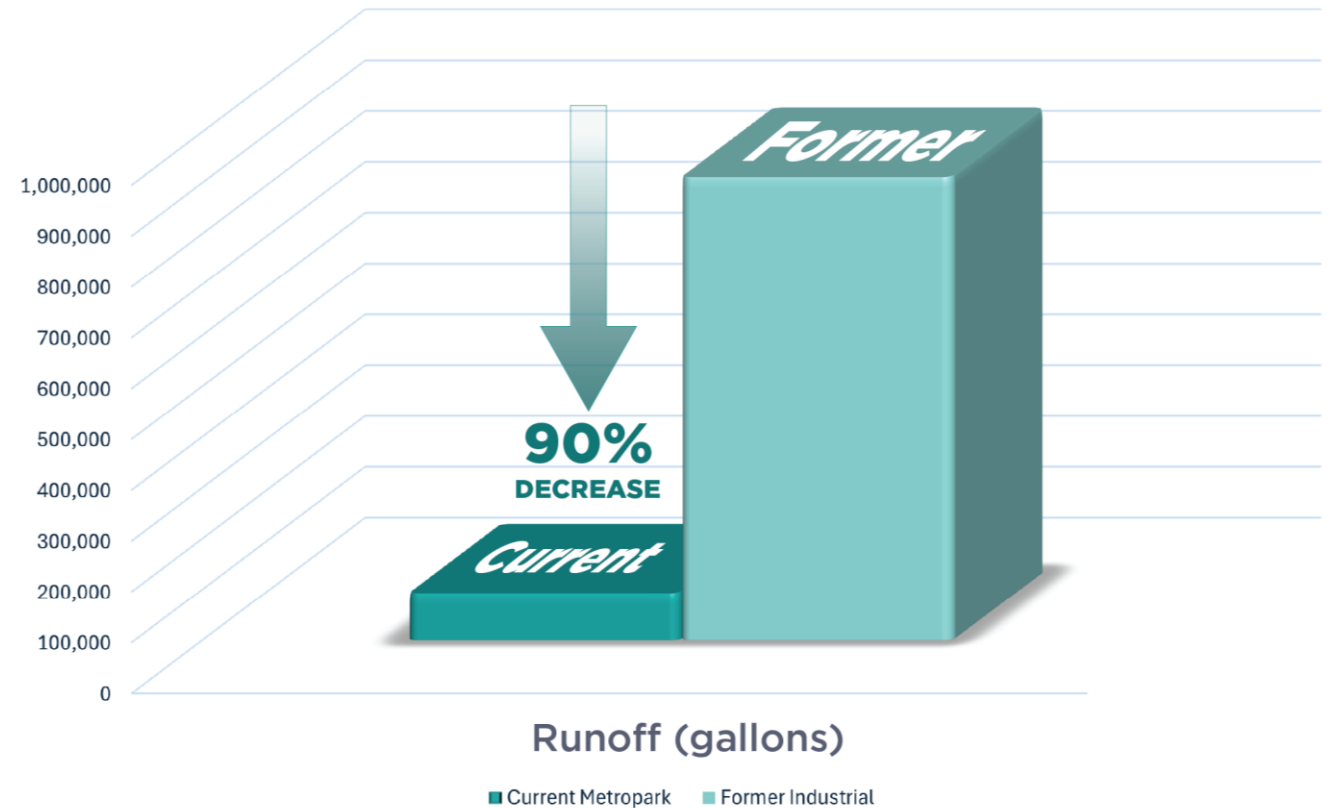
| Findings: Industrial versus Current Conditions |              |                |             |                  |
|------------------------------------------------|--------------|----------------|-------------|------------------|
|                                                | Curve Number | Water Retained | Runoff (in) | Runoff (gallons) |
| Current Metropark                              | 78           | 2.8205         | 0.0538      | 92,679           |
| Former Industrial                              | 95           | .5263          | 0.5291      | 911,454          |
| Results                                        | -17          | +2.29 in       | -.4753 in   | -818,775 gallons |



# Performance Findings

In total, the redesign of Glass City Metro Park allowed for a **90% decrease** in runoff during a 1-inch rainstorm event, preventing **818,775 extra gallons of water runoff** from entering into the Maumee River, compared to the previous site's conditions.

**Industrial vs. Current Conditions: Runoff Amount (gallons)**



*Figure 3.4: Graph displaying the variance in runoff (gallons) of the current metropark and the former industrial site.*

# Limitations

- **Former industrial land-cover conditions** were modeled based on historic site use rather than detailed archival mapping.
- Though cross checked with modern imagery, **land-cover for current site was mapped off of older imagery**, meaning some areas labeled as one land cover could have changed.
- Curve numbers describe average conditions that are useful for design purposes. **If the rainfall event used is a historical storm, the modeling accuracy decreases.**
- **Soil conditions** were interpreted from publicly available mapping and **may vary locally.**
- The model estimates runoff volume only and **does not account for peak flow timing, water quality treatment, or subsurface drainage** infrastructure.
- Rainfall event chosen **does not reflect extreme or historical storm events**; the site's runoff amount varies on storm size.

# Discussion

- This study demonstrates the in reducing runoff. **importance of green spaces and green infrastructure**
  - When GSI is implemented, and runoff is reduced, **less pollution** enters important waterways like the Maumee River.
- **Reclaiming former industrial sites** helps to reduce both pollution and runoff
  - This helps protect ecosystems and create necessary community spaces for people.



Figure 3.5: Community gathering to use Glass City Metropark Source: Metroparks Toledo

# Conclusion

- **Habitat quality improved significantly**
  - 159 total bird species; **+41% increase** post-Phase 2
  - Greater diversity across **functional groups + trophic levels**
- **Stormwater management highly effective**
  - **~90% runoff reduction** during 1-inch storm
  - **~818,775 gallons prevented** from entering the Maumee River
- **Carbon sequestration provides long-term benefit**
  - **33,180 lbs CO<sub>2</sub>/year** captured by 1,149 trees
  - **663,600+ lbs CO<sub>2</sub> projected** over 20 years

- **Design strategies are working**
  - Habitat diversity, GSI, and reforestation drive performance
  - Transforms former industrial site into **high-functioning ecological system**
- **Key takeaway**
  - **Phased ecological design + long-term planning = measurable environmental impact**
- **Future focus**
  - Continue **monitoring, adaptive management, and maintenance**



# References

## *Carbon Storage and Sequestration:*

- City of Portland. (n.d.). *How to measure a tree*. Portland.gov. <https://www.portland.gov/trees/tree-care-and-resources/how-measure-tree>
- iTree Eco v6.1.57. Accessed April 2026 <https://www.itreetools.org/tools/i-tree-eco>
- Fatimah, H., Farooq, S., Anwar, T., Qureshi, H., Hashmi, F., Ahmad, T., Ullah, N., Munazir, M., Naseem, M. T., & Soufan, W. (2024). Assessment of growth, biomass, and carbon sequestration potential of urban tree species in greenbelts. *BMC Plant Biology*, 24(1). <https://doi.org/10.1186/s12870-024-05935-3>
- Nowak, D. J., Greenfield, E. J., Hoehn, R. E., & Lapoint, E. (2013). Carbon storage and sequestration by trees in urban and community areas of the united states. *Environmental Pollution*, 178, 229–236. <https://doi.org/10.1016/j.envpol.2013.03.019>
- SmithGroup. (2024). *Glass city metropark | Smithgroup*. SmithGroup. <https://www.smithgroup.com/projects/glass-city-metropark>
- U.S. Department of Agriculture. (1993). *Principles of measuring trees*. [https://www.fs.usda.gov/im/directives/fsh/2409.12/2409.12\\_10.pdf](https://www.fs.usda.gov/im/directives/fsh/2409.12/2409.12_10.pdf)
- Woodle, B. (2026). *Glass city metropark | catalyzing change: Building community and environmental sustainability*.
- Yiesla, S. (2026). *London planetree*. The Morton Arboretum. <https://mortonarb.org/plant-and-protect/trees-and-plants/london-planetree/>

# References

## Species Biodiversity:

- Earthscape Play. "Grosbeak Playground Towers at Glass City MetroPark." Earthscape Play, 2022, <https://www.earthscapeplay.com/projects/glass-city-metropark-bird-inspired-playground-towers-toledo/>
- eBird. (n.d.). Bar chart for location L2173651. Cornell Lab of Ornithology. Retrieved April 20, 2026, from <https://ebird.org/barchart?r=L2173651>
- eBird. (n.d.). Hotspot L2173651. Cornell Lab of Ornithology. Retrieved April 20, 2026, from <https://ebird.org/hotspots?hs=L2173651>
- International Union for Conservation of Nature. (2025). The IUCN Red List of Threatened Species. Retrieved April 24, 2026, from <https://www.iucnredlist.org/fr/search?query=birds&searchType=species>

## Stormwater Runoff:

- Environmental Systems Research Institute. (2024). ArcGIS Pro (Version 3.x) [Geographic information system software]. <https://www.esri.com/arcgis>
- "Glass City Metropark| SmithGroup." SmithGroup, 2024, [www.smithgroup.com/projects/glass-city-metropark](http://www.smithgroup.com/projects/glass-city-metropark).
- United States Department of Agriculture. (1986). Urban hydrology for small watersheds (Technical Release No. 55). Soil Conservation Service. <https://www.nrc.gov/docs/ML1421/ML14219A437.pdf>
- Woodle, B. (2026). Glass city metropark | catalyzing change: Building community and environmental sustainability.

## Assorted Images

- Grosbeak Playground Towers at Glass City MetroPark - Earthscape Play Inc. (2026, February 4). Earthscape Play Inc. <https://www.earthscapeplay.com/projects/glass-city-metropark-bird-inspired-playground-towers-toledo/>
- MetroparksToledo. (2025, August 21). Glass City Metropark - Metroparks Toledo. Metroparks Toledo. <https://metroparkstoledo.com/explore-your-parks/glass-city-metropark/>
- "Glass City Metropark| SmithGroup." SmithGroup, 2024, [www.smithgroup.com/projects/glass-city-metropark](http://www.smithgroup.com/projects/glass-city-metropark).



# THANK YOU





# Glass City Metropark, Toledo, Ohio

## Landscape Performance Assessment - Social Performance

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**Name:** Samia Tasnim Faiza, Adam Hershner

**Course:** LA 883, Spring 2026

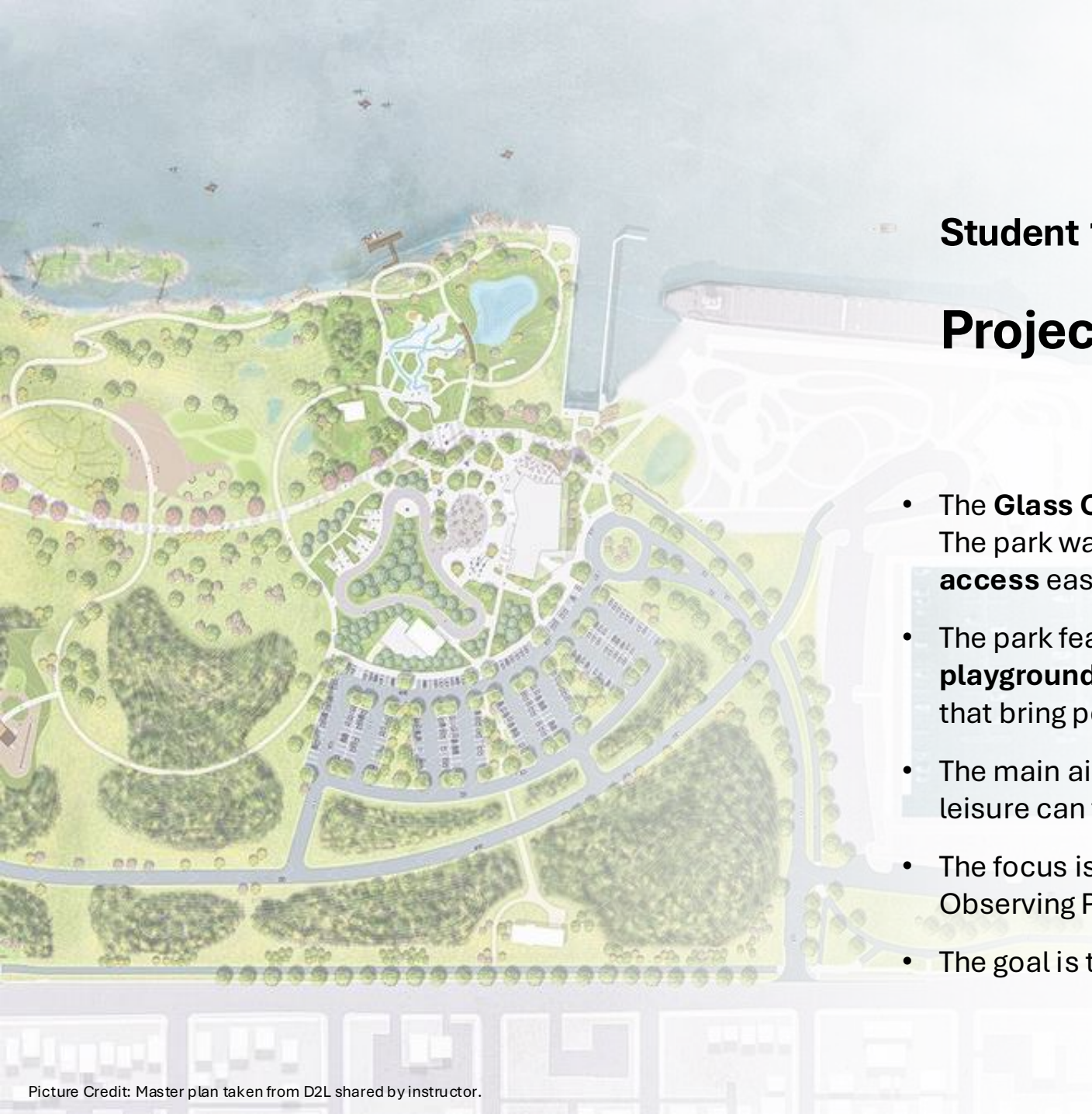
**Course instructor:** Dr. Haoyue Yang

**School:** Michigan State University



Picture Credit: <https://metroparkstoledofoundation.org/projects-and-programs/gc-riverwalk/>





**Student 1:** Samia Tasnim Faiza

## Project Overview:

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- The **Glass City Metropark** is a large public park situated in Toledo, Ohio. The park was created to allow **outdoor activities** and make **waterfront access** easier for everyone.
- The park features **open lawns, walking paths, benches, and children playground**. It offers splendid views of the river and allows gatherings that bring people closer together.
- The main aim of the design is to create a place where socialization and leisure can take place safely and comfortably.
- The focus is on behavioral observation using **SOPARNA** (System for Observing Physical Activity and Recreation in Natural Areas)
- The goal is to understand how people use different park spaces.

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# Project **Goals** and **Objective**:

- The goal of this project is to focus on social performance analytics and evaluate how well “Glass City Metropark” supports community gathering, recreation, social interaction, and user activity through behavioral observation.
- It also focuses on how people use different spaces, what activities they do, and how they interact with each other.
- The goal is to create a welcoming space for all users.



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## Methods – SOPARNA Toolkit:

- **SOPARNA** was used for this behavioral observation study.
- The observation was focused on three zones (**Glass City Metropark Slides, Metropark Riverwalk, and Prairie and Pollinator Discover Play Area**).
- SOPARNA toolkit was used to systematically observe and record user behavior, activity types, and social interactions across different park zones.
- Observations were conducted at a specific time of the day, and behavior mapping was used to identify patterns of use and social engagement.



# Data Collection: Behavioral Observation Data

| Observation Zone                                      | Group Size  | Activity Type                 | Age Range Group (y/o) | Interactive Level                      | Duration (minutes/seconds) | Notes                                                                                                                                                                                             |
|-------------------------------------------------------|-------------|-------------------------------|-----------------------|----------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Glass City Riverwalk ( Boardwalk across Pavilion) - 1 | 2 adults    | Playing, Socializing          | (18 - 20)             | Interaction: High, Active              | Recorded time: 4:53        | Two young adults were playing and running after one another on the boardwalk bridge. The interactive rope bridges are an attraction of the park which is used by all age groups of people.        |
| Glass City Riverwalk ( Boardwalk across Pavilion) - 2 | 2 adults    | Dog strolling                 | (30 - 35)             | Interaction: Medium, Moderately active | Recorded time: 9:11        | One man and a woman were strolling a dog near the boardwalk area. They both took a break after 9 minutes 11 seconds, hence that was the amount of time I could record.                            |
| Glass City Metropark Slides                           | 11 children | Playing, Socializing, Running | (2 - 12)              | Interaction: High, Active              | Recorded time: 7:53        | Three groups of families were present in the area where each of the families were busy playing and interacting with their children. Family 1: 4 members, Family 2: 4 members, Family 3: 3 members |
| Prairie and Pollinator Discover Play Area             | 9 children  | Playing, Socializing, Running | (2 - 10)              | Interaction: High, Active              | Recorded time: 5:23        | A total of 9 children were playing, waiting for their turns to use the slides, eating, running , and socializing with each other.                                                                 |

Fig: Table shows overall data collection during the entire observation time



# Data Collection: Using Bar Chart

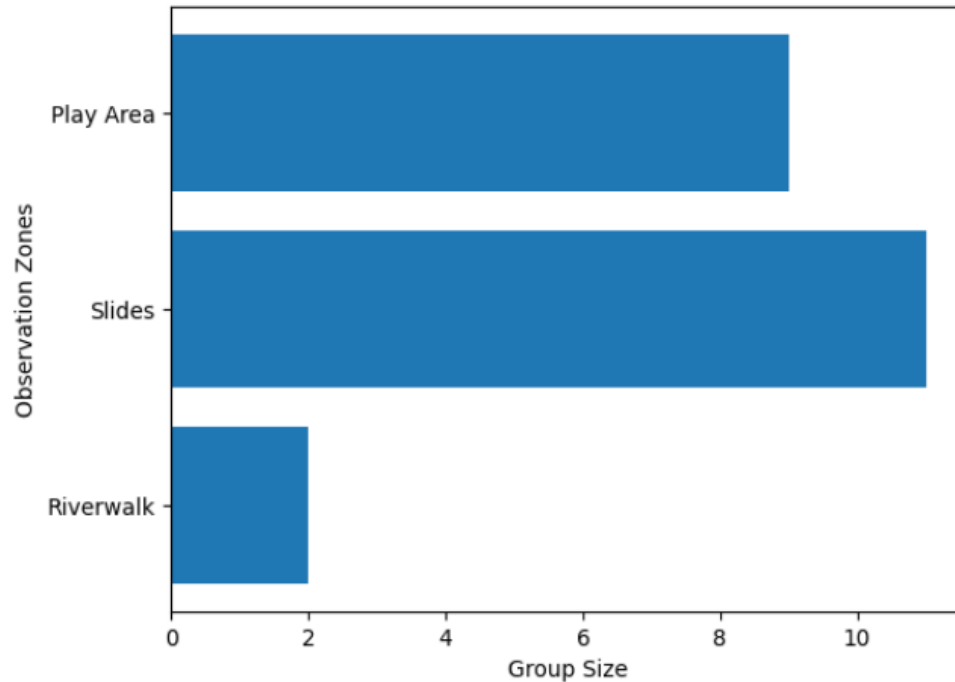


Fig: Bar graph showing Group Size vs Observation Zones

- Metropark Slides and Prairie and Pollinator Discover Play Area have larger group sizes, while Glass City Riverwalk has smaller group size.

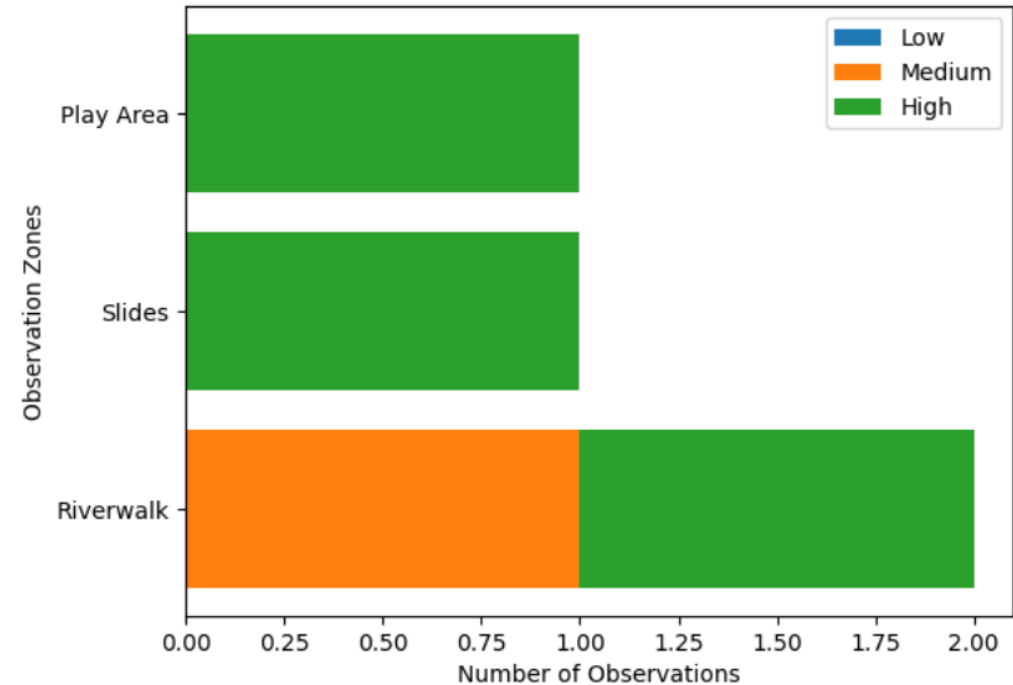


Fig: Bar graph showing Social Interaction Levels vs Observation Zones

- Prairie and Pollinator Discover Play Area and Metropark Slides show only high interaction, meaning these spaces strongly support social activity.

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# Performance Findings:

I have observed areas at the **Boardwalk (Across the Glass City Pavilion), Prairie and Pollinator Discover Play Area**, and **Glass City Metro Park Slides**. The observed areas were engaging and interactive. Since they were playground areas, it was mostly occupied with children and parents.

- All the observation zones shows high levels of social interaction, especially among children and families.
- Riverwalk areas show mixed interaction levels, supporting both movement and casual social use.
- Larger group sizes are concentrated in play zones, while smaller groups dominate linear spaces.



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# Limitations

- The observations were done for a **limited period of time** so it may not show full patterns.
- Findings show at **only one** time and day of the week which is challenging as it may not fully understand visitor reasons just by observing.
- Weather conditions such as **temperature, wind, or rain** can significantly also affect how people use the park.
- Behavioral observation did not **capture user opinions, motivations, or satisfaction**.
- Observations are **limited to only three selected zones** and did not represent the entire park equally.

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## Conclusion:

- The study shows that Glass City Metropark supports **strong social interaction**, especially in play areas where group activities are common.
- Spaces like the riverwalk provide more **flexible use**, allowing both **movement** and **casual interaction**.
- The findings highlight that design elements such as **play structures, seating, and spaces** influence how people gather and interact.
- Overall, the park successfully **promotes social engagement**, but further data collection would provide a more complete understanding of **user behavior**.







**Student 2: Adam Hershner**

**Proposed Further Research**

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# Project Objectives

- Create a variety of amenities for all seasons.
- Return waterfront access to Toledo.
- Create an extension of Toledo's existing and vibrant culture within the site.
- Create unique opportunities that are not found in other parks; the "best" riverside park.
- Focus on Discovery Play, Water Play, and Winter Play as the three most critical program elements.
- Create regional interconnectivity within both surrounding neighborhoods and all of northwest Ohio.
- Establish a strong foundation for future phases of the Riverwalk project.



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# Performance Questions

**Has community engagement and visitor numbers increased across different phases of development?**

**Which amenities are being most utilized, and which are being underutilized?**

**Do users of Glass City Metropark have a positive opinion of the park?**







**Proposed Benefit: Year-Round and Diverse Programming**

**Offers a range of recreational activities throughout all seasons of use.**



# Background

Due to the project site originally being an industrial brownfield without usable amenities, there is little existing data on whether the site experienced much social recreational before construction completion. Prior visit and use numbers were not obtained.

As the metropark is a phased project, attention was paid to the divisions of times open, with Phase I being opened to the public on December 10<sup>th</sup>, 2020, and Phase II being opened to the public on June 9<sup>th</sup>, 2023.

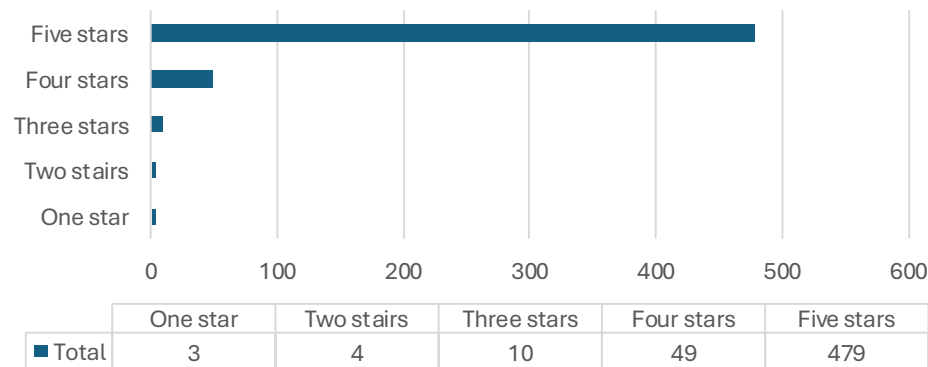


# Methods

The chosen method of initial research was through the analysis of Glass City Metropark's Google Reviews.

The final collection date being April 22<sup>nd</sup>, 2026. In total, **545 reviews** were analyzed, with the earliest being from December 11<sup>th</sup>, 2020, exactly one day after the Phase I project was opened. The latest review was from April 22<sup>nd</sup>, 2026. The five-star rating average was 4.8.

Rating of Existing Reviews



## Glass City Metropark

1505 Front St, Toledo, OH 43605, United States

[Write a review](#)

4.8 ★★★★★ 545 reviews ⓘ

All

river views 27

splash pad 21

Glass City Riverwalk 14

ice skating 25

roller skating 12

skate rentals 8

walking trails 13

fire pits 6

picnic areas 10

playground 47

Sort by

Most relevant

Newest

Highest rating

Lowest rating



Joe Thourot

Local Guide · 33 reviews · 2344 photos

★★★★★ a day ago

NEW

Great place for walk or a skate!!! 🏡 🚲

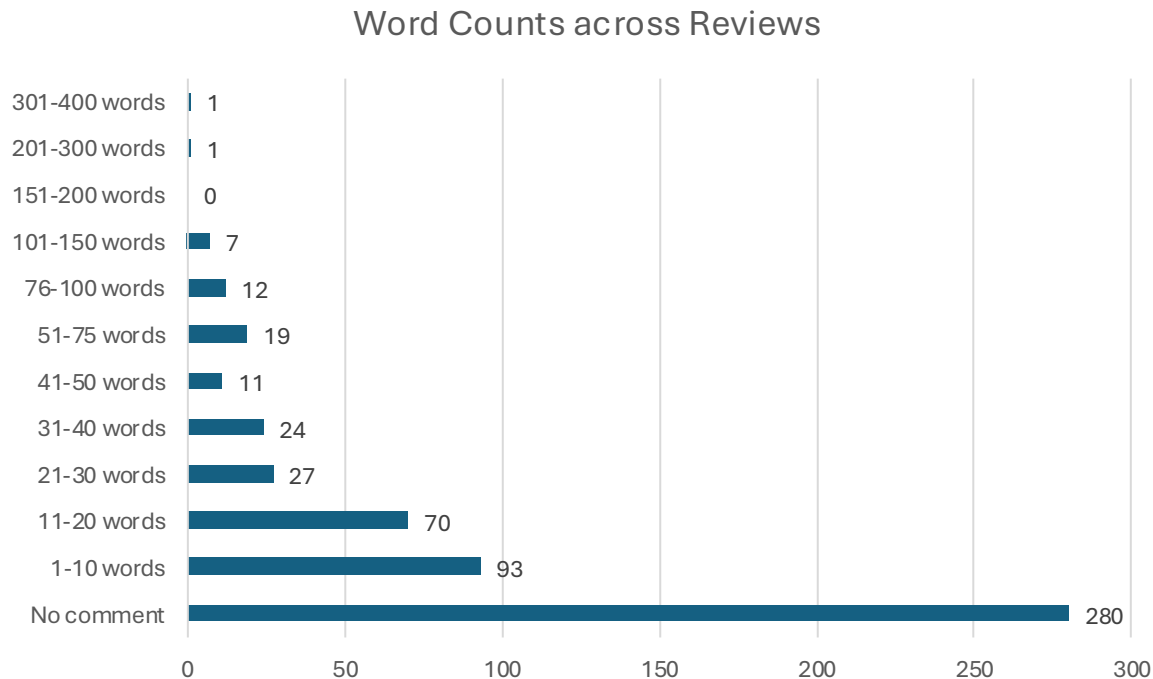


Hover to react



# Comment Analysis

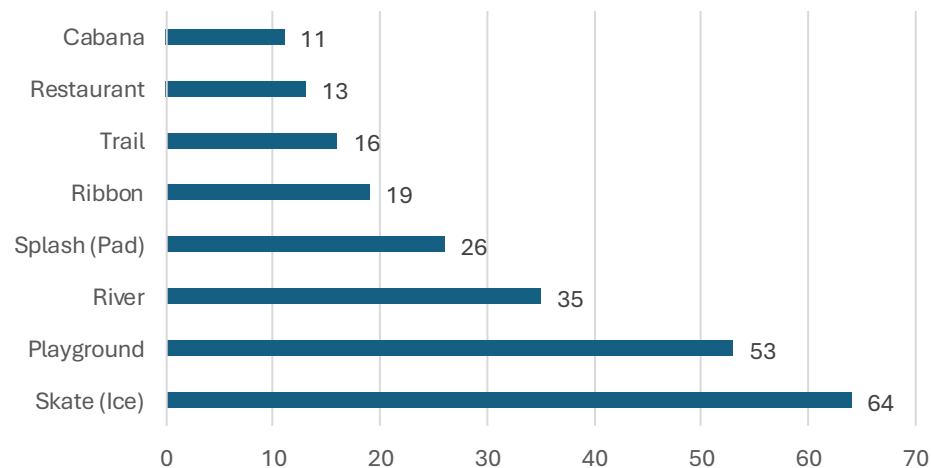
Calculations were completed in Excel, utilizing Pivot Tables and graphs to best visualize the collected data. Straight data counts were completed based on data input. Additional data was collected through comparable case studies, research papers, and information provided by SmithGroup during their project brief.



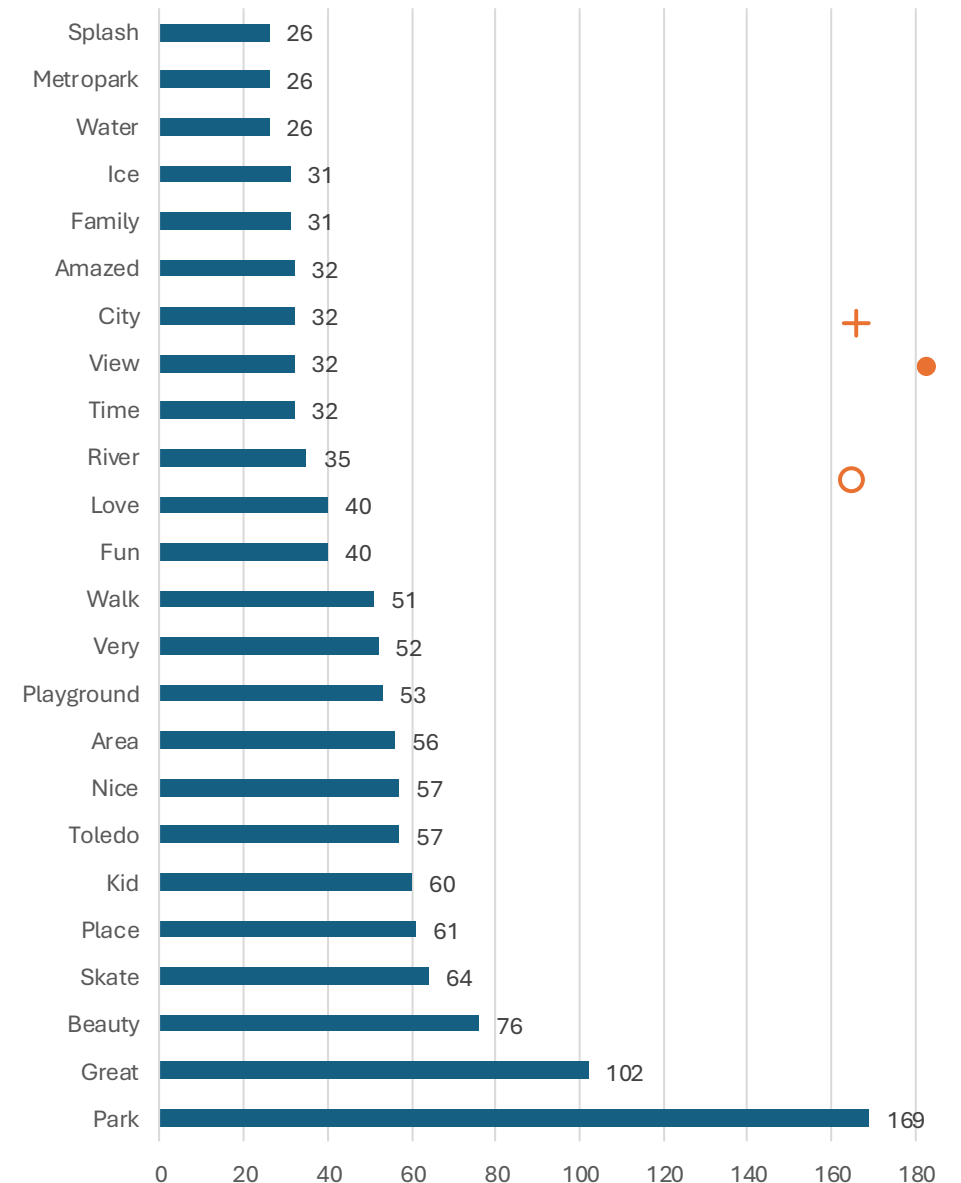
A third-party cloud program was utilized to seek out all repeating words, assembling them into a notated list per mention.

Mentions of specific amenities by name were grouped into a secondary list.

Specific Amenities Mentioned by Name



Consolidated Words from Google Reviews



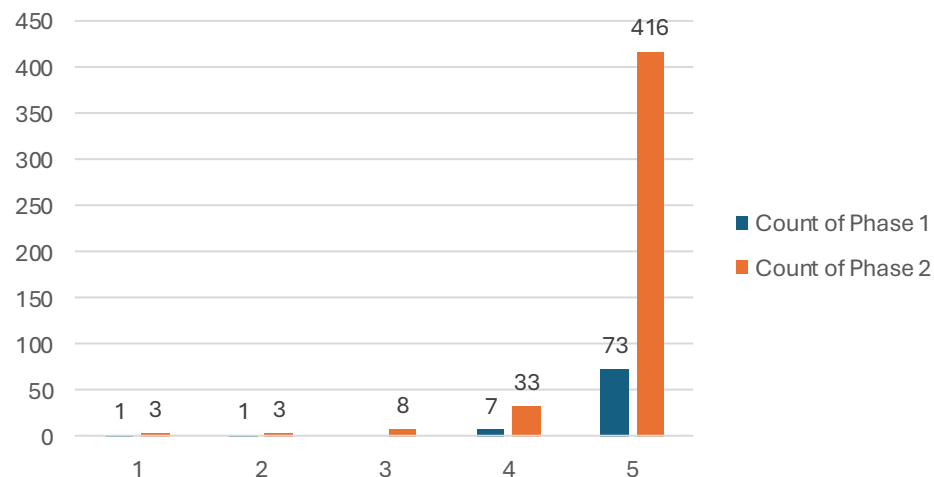


# Phasing Analysis

A secondary analysis was done through dividing reviews into those published while the project had released only Phase I (being all reviews before June 9<sup>th</sup>, 2023) and those in Phase II, where multiple additional amenities were introduced. As seen, the number of reviews increases from 82 within a two and a half year period to 463 within a nearly two years period, showcasing a dramatic increase in overall users of the site through phasing changes.



Division of Ratings Across Project Phases



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# Sources

“Case Study Briefs.” *Landscape Performance Series*, [www.landscapeperformance.org/case-study-briefs](http://www.landscapeperformance.org/case-study-briefs).

<https://www.facebook.com/MetroparksToledo>. “Glass City Metropark - Metroparks Toledo.” *Metroparks Toledo*, 21 Aug. 2025, [metroparkstoledo.com/explore-your-parks/glass-city-metropark/](http://metroparkstoledo.com/explore-your-parks/glass-city-metropark/).

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“Outscraper - Business Data Platform.” *Outscraper Platform*, 2026, [scraper.systems/services](http://scraper.systems/services).

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<https://www.facebook.com/MetroparksToledo>. “Common Ground - Metroparks Toledo.” *Metroparks Toledo*, 2026, [metroparkstoledo.com/common-ground/](http://metroparkstoledo.com/common-ground/). Accessed 27 Apr. 2026.

“Glass City PARK, Toledo, OH - Reviews, Ratings, Tips and Why You Should Go – Wanderlog.” *Wanderlog*, 2025, [wanderlog.com/place/details/8205864/glass-city-metropark](http://wanderlog.com/place/details/8205864/glass-city-metropark).

“Glass City Riverwalk | Toledo OH.” *Facebook.com*, 2026, [www.facebook.com/glasscityriverwalk/](http://www.facebook.com/glasscityriverwalk/).

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# Limitations

- All Google Reviews are self-initiated, which necessitates outside factors to inspire someone to leave one; this tends towards either highly positive or highly negative responses, which is not indicative of the average experience of the site.
- Reviews can be completed at any time; as such, while it can be consolidated to roughly the correct time period for when the review was left, it is equally likely that the collected dates are inaccurate to when the user actually visited the site.
- The number of reviews (545) is incomparable to the number of estimated visitors to the site within the past two years (500,000), leading to probable differences to the average user.



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## Proposed Further Research

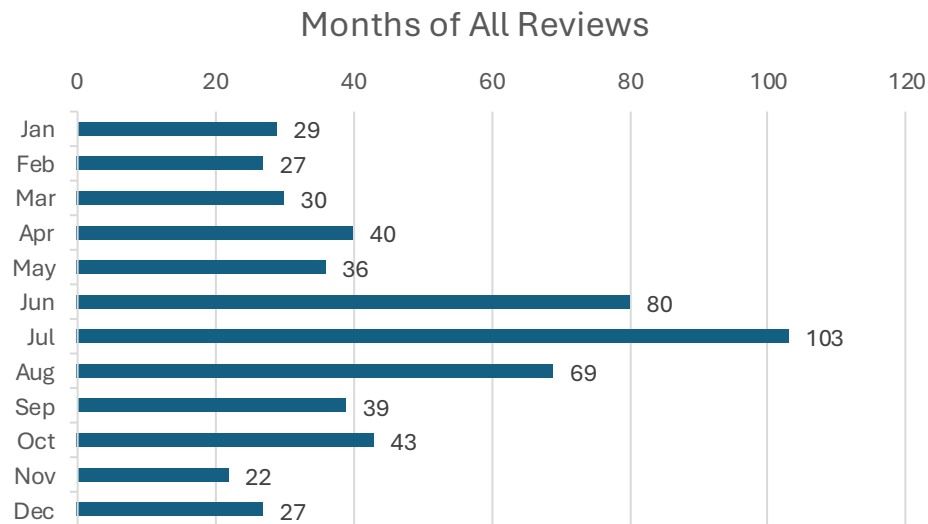
Due to all data currently gathered being insubstantial in terms of raw numbers and accurate scaling, additional will need to be gathered. While one visit to the site was made, it was of a limited timeframe and did not involve interaction with users of the site. As such, the suggested continuation of this study would be that of an intrapersonal anonymous survey.

In taking directive from a similar CSB study done at Rainier Beach Urban Farm and Wetlands, they noted an exceptionally higher rate of completion for paper surveys over digital, with a ratio of 57 completed paper surveys and 3 digital surveys. As such, it would be advantageous to offer both options, ideally in combination with an on-site activity, such as one of their numerous festivals or volunteering events. The digital survey can be shared online, such as the existing *Glass City Riverwalk* or *Metroparks Toledo* Facebooks.



# Optimal Time Analysis

To further increase potential answers, Glass City Metropark's existing Google Reviews were analyzed for periods of high activity, utilizing the days and months of posting. As shown, there is a significant spike during the months of June, July, and August, increasing potential for answers, with the next highest months being September and October.



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# Survey Questions

According to a research study by Brent Chudoba with additional research from PubMed Central, a public-facing survey should be under ten minutes to maximize completion and responses rate, with a potential question range of 11-25.

With that question limit in mind, the category of social benefits to focus on is the previously-analyzed, being ***Year-Round and Diverse Programming***. Notable questions to consider include:

- How often do you visit the site?
  - With answers divided into first visit, a few times per year, a few times per month, and a few times per week.
- When did you first visit the site?
  - With answers divided into first visit, since the release of Phase II, or prior to Phase II.
- What amenities do you most often use?
- What are your favourite parts of the site?
- Do you feel that the site has a good variety of amenities?
- How would you rate your overall experience at the site?



To consolidate experiences with those of the Google Reviews for attempted clarity, the most-repeated words can be assembled into a word cloud attached to the survey, with a question asking if these words are equivalent to what the survey taker feels about Glass City Metropark. This question could also be limited to the digital version to save on size and ink costs for the paper version.



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# Sources

“Rainier Beach Urban Farm and Wetlands.” *Landscape Performance Series*, 22 July 2025, [www.landscapeperformance.org/case-study-briefs/rainier-beach](http://www.landscapeperformance.org/case-study-briefs/rainier-beach).

Chudoba, Brent. “How Long Should a Survey Be? What Is the Ideal Survey Length?” *SurveyMonkey*, 2019, [www.surveymonkey.com/curiosity/survey\\_completion\\_times/](http://www.surveymonkey.com/curiosity/survey_completion_times/).

Sharma, Hunny. “How short or long should be a questionnaire for any research? Researchers dilemma in deciding the appropriate questionnaire length.” *Saudi journal of anaesthesia* vol. 16,1 (2022): 65-68. doi:10.4103/sja.sja\_163\_21

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**Thank you.**

An aerial photograph of Glass City Metro Park at sunset. The park features a large green field with winding paths, a playground with colorful equipment, and a parking lot filled with cars. In the background, the city skyline is visible, including several tall skyscrapers, with the sun setting behind them, casting a warm orange glow over the scene.

# **Glass City Metro Park Economic Performance**

*Evaluating Revenue*

Isaiah Ramsey



## Glass City Metropark

Glass City Metropark, being a large-scale waterfront park that offers public recreational space, generates a lot of revenue.

- Skating rentals
- Event spaces
- Restaurants

## Goals and Design Intent

Focusing on how the park generates revenue, how efficiently it operates relative to visitation, and how design strategies influence long-term financial outcomes.



## Performance Question

- *What is the total annual revenue generated by the park?*
- *How much revenue is generated per visit?*

## Sub Questions

- *Which revenue streams contribute the most?*
- *How much money is saved through design decision?*





## Datasets

This study uses multiple data sources to evaluate the economic performance.

- Financial Documents
- Financial Quotes
- Rental Fee Brochures
- Event Pricing Guide
- PLACER Visitor Data
- Maintenance Sheet Guide

Focusing on **direct revenue** retained by Glass City and estimated **cost savings**.



# PLACER Visitor Data

Daily Visits (2025)

| Day       | Daily Visit |
|-----------|-------------|
| Monday    | 66887       |
| Tuesday   | 65522       |
| Wednesday | 67204       |
| Thursday  | 62282       |
| Friday    | 100796      |
| Saturday  | 150060      |
| Sunday    | 115212      |

[1]

- 657,963 total visits in the year
- This is strictly **visits** not unique visitors

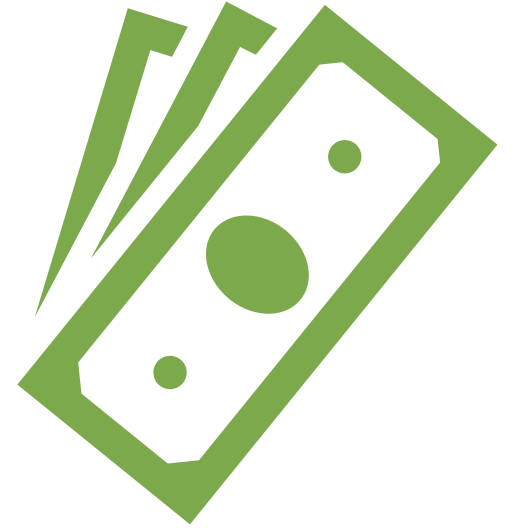


## Revenue Categories

To better understand how Glass City Metropark generates income, the revenue was **divided into categories** based on how money is produced/managed.

- Facility Rentals
- Concessions and Vendors
- Programs and Recreation

This also allows for an easier breakdown and analysis of where majority of revenue is being generated.





# Facility Rentals Revenue

(Direct User Fees For Space)

- Glass City Pavillion
- Grosbeak Shelter
- Pollinator Shelter
- Kayak Share Locker Rental
- Permit Fees



| Rental                    | Apx. Generated Revenue (Yearly) |
|---------------------------|---------------------------------|
| Glass City Pavillion      | \$100,000                       |
| Grosbeak Shelter          | \$4,000                         |
| Pollinator Shelter        | \$1,000                         |
| Kayak Share Locker Rental | \$10,000                        |
| Permit Fees               | \$50,000                        |
| Total                     | \$165,000                       |



# Concession/Vendor Revenue

(Partnership-Based Revenue Sharing)

- Restaurant and concessions
- Catering Services
- Marina Services
- Merchandise Licensing

| Concession/Vendor             | Apx. Revenue Generated (Yearly) |
|-------------------------------|---------------------------------|
| The Garden                    | \$100,000                       |
| Hajjar Hospitality (Catering) | \$30,000                        |
| Brenner 75 Marine             | \$10,000                        |
| Jupmode                       | \$5,000                         |
| Total                         | \$145,000                       |

(This total represents the amount the park makes through agreement)



[2]

# Program and Recreation Revenue

(Activity-Based Fees)

- Ice Skating
- Roller Skating
- Tours
- Workshops

| Recreation/Program Type        | Apx. Revenue Generated (Yearly) |
|--------------------------------|---------------------------------|
| Ice Skating Rental & Admission | \$150,000                       |
| Roller Skating Rental          | \$20,000                        |
| Modest Program Fees            | \$2,000                         |
| Total                          | \$172,000                       |

[2]

## Revenue Breakdown

Program & Recreation contributes to majority of the revenue at Glass City Metropark.



## Total Annual Revenue

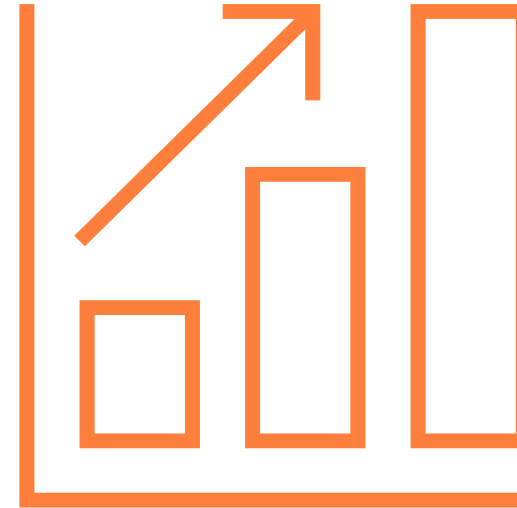
### Total Revenue

$$\begin{array}{r} + 165,000 \\ + 145,000 \\ + 172,000 \\ \hline = \$482,000 \end{array}$$

The total direct revenue made by Glass City Metropark.

### Revenue Per Visit

$$\frac{\$482,000}{657,963 \text{ visits}} = \$0.73 \text{ per visit}$$



## Savings Through Design

Glass City Metropark uses naturalized landscapes to reduce maintenance, which allow the park to save money. Out of the 23.6 mowable acres the park is on, only 5 acres gets mowed. These few acres consists of a buffer near pathways and high-use areas.

This design **minimizes intensive maintenance** while **supporting ecological functions** like habitat creation and stormwater management

## Maintenance Finance Breakdown

Total mowing cost = 35,036 (annually) <sup>[3]</sup>

Total mowing area = 5 acres

Cost per acre =  $\$35,036 / 5 \text{ acres} = \$7,007 \text{ per acre}$





## Savings Through Design

Glass City Metropark uses naturalized landscapes to reduce maintenance, which allow the park to save money. Out of the 23.6 acres the park is on, only 5 acres gets mowed. These few acres consists of a buffer near pathways and high-use areas.

This design **minimizes intensive maintenance** while **supporting ecological functions** like habitat creation and stormwater management

### Full Maintenance Scenario

Expense for Full Mow = \$7,007 x 23.6 acres = **\$165,371**

### Savings

\$165,371 - \$35,036 = **\$130,335** avoided



# Discussion

## Low Revenue per Visit Reflects Design Intent

The park generates  $\approx \$0.73$ , which is consistent with the park's role as a publicly accessible landscape where many amenities are free to use.

## Primary Revenue Driver

Majority of direct revenue is generated through recreational experiences and programming.

- Economic activity is concentrated in specific programmed nodes
- Partnerships with private operators are essential to financial performance



# Discussion

## Ecological Design as Cost-Reduction Strategy

The parks use of naturalized landscape reduces maintenance costs  $\approx$  \$130,000 annually.

- Design decisions can function as long-term financial strategies
- Economic performance is not only influenced by income, but also cost avoidance



# Limitations

## Revenue Constraints

- Revenue values are approximate, not financial records.
- Complete revenue was not attained.(Parking lot, etc.)

## Visitor Data Interpretation

- This study is based on visits data not unique visitor data. This leads to lower per-visit revenue amount.

## Limited Scope of Maintenance Costs

- The savings is only focused on mowing. Potentially more costs avoided through invasive species management, infrastructure upkeep (material).

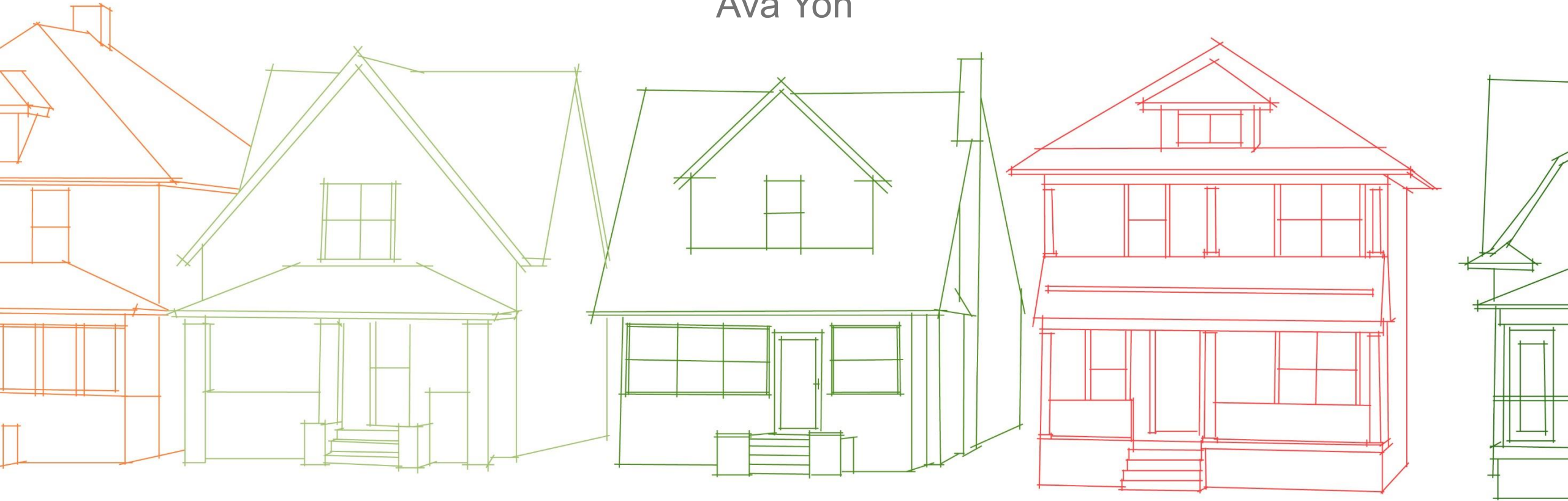




# Glass City Metropark Economic Impacts

## Property Value Assessment

Ava Yon





## Background

East Toledo used to be home to industrial employers such as railroads, oil refineries, utilities, and shipyards [6].

Many businesses were abandoned in the later half of the 20th century, leaving a long-lived impact on Toledo's neighborhoods and economy [7].

Garfield neighborhood had a consistent history of low incomes, housing burdens, and service fragmentation [8].



**Toledo Shipyards, Front Street, early Postcard View.** Shipbuilding was an important industry, dating back to the 1800s, with several companies operating at different times along the river on Front Street.



**Maumee Rolling Mill, Front Street, 1890s.** It went into business in 1884, and became one of the East Side's largest pre-1900 industries, employing as many as 500 workers. Nearby streets of Steel, Carbon, and Licking took their names from the rolling mill. It was torn down in the early 1900s to make way for the Toledo Railway & Light Company, which later became the Toledo Edison Acme Plant.





## Design Intent

Glass City Metropark's role as a catalyst for new private investment and economic activity in adjacent neighborhoods.



## How it can be Measured

Identifying changes in surrounding property values [4].







## Performance Question

How has the development of Glass City Metropark in Toledo, Ohio, affected local economy through property values?



## Datasets

- Parcel Boundaries and Numbers [1]
- Zoning Ordinances [2, 3]
- AREIS Lucas County Real Estate Property Values [5]
- Bureau of Labor Statistics Inflation Rate [9, 10]
- Zillow Housing Data [11]







## Considered Timeline

- Property Values are taken from 2020 and 2026
- Glass City Metropark opened phase one in 2020



## Property Value Definition

- Property values assessed in the Lucas County Real Estate Website, AREIS, are the combined value of land and building within the parcel area [5].
- Full market property values from 2020 and 2026 were used in this study.

### Value Change History (100%)

| Land   | Building | Total  | Tax Year | Reason     | Change Date |
|--------|----------|--------|----------|------------|-------------|
| 17,700 | 41,700   | 59,400 | 2024     | REVAL      | 09-SEP-2024 |
| 16,000 | 32,900   | 48,900 | 2021     | TRI UPDATE | 09-AUG-2021 |
| 9,500  | 37,000   | 46,500 | 2020     | COMB       | 26-MAR-2020 |
| 8,400  | 37,000   | 45,400 | 2018     | REVAL      | 13-DEC-2018 |
| 8,200  | 36,200   | 44,400 | 2015     | TRIENNIAL  | 13-JUL-2015 |
| 8,200  | 36,200   | 44,400 | 2015     | TRIENNIAL  | 13-JUL-2015 |
| 8,200  | 36,200   | 44,400 | 2015     | TRIENNIAL  | 13-JUL-2015 |





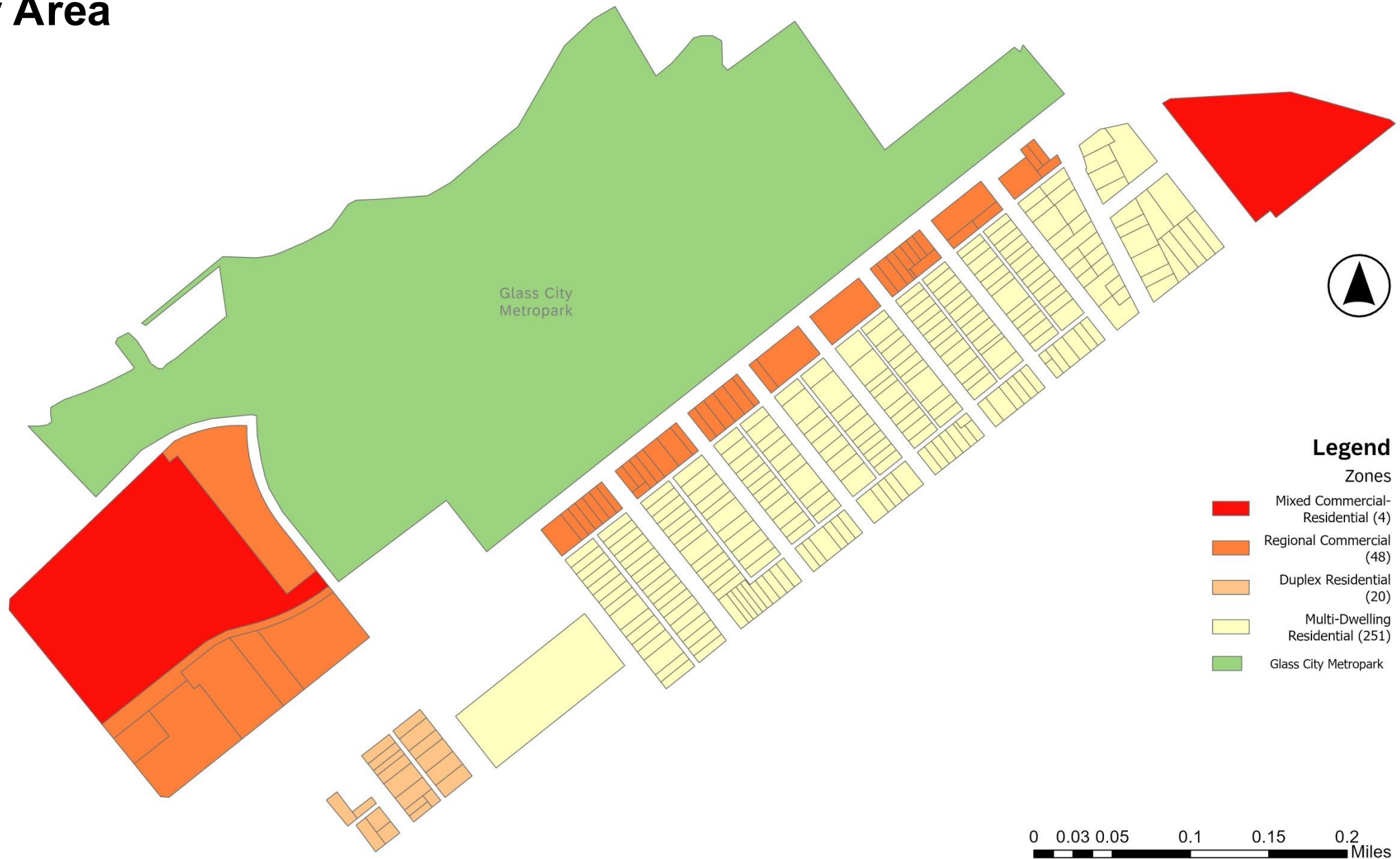
## Surrounding Context

# Glass City Metropark – Toledo, Ohio





# Study Area



# Determining Property Values

1

Using AREIS Real Estate Data Website, the property report card was downloaded for each parcel.

2

The 100% total market values from 2020 and 2026 were recorded.

| Parcel ID: 17-03434                                                                                                                                                     |                     | KATIE MOLINE - LUCAS COUNTY AUDITOR |                        | RESIDENTIAL/AGRICULTURAL                                                                               |                     |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Owner: JONES CRYSTAL D ETAL (OR SURVTC)<br>136 OSWALD ST                                                                                                                |                     | Card 1 of 1<br>Assr #: 08292014     |                        | Market Area: 802R<br>DTE #: 00300 - TOLEDO CITY - TOLEDO CSD<br>Tax Year: 2026<br>LUC: 520 - 2FAM-PLAT |                     |        |        |        |        |        |        |        |        |
| <b>GENERAL INFORMATION</b>                                                                                                                                              |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| Topo: 1 - Paved                                                                                                                                                         |                     | Spec Use: 520-2 Family-Plat         |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| Street: 22 - City Water / City Sewer                                                                                                                                    |                     | Traffic: 6-Resside                  |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| Utilities: 22 - City Water / City Sewer                                                                                                                                 |                     | Corner Lot: No                      |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| Legal: YONDOTA NEW PLAT LOT 167 NE 36 FT & 168...S                                                                                                                      |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| <b>ADMINISTRATIVE</b>                                                                                                                                                   |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| DATE                                                                                                                                                                    | SOURCE              | ENTRY                               | ADMIN                  | DATA ENTRY                                                                                             | REVIEWER            |        |        |        |        |        |        |        |        |
| 02/29/12                                                                                                                                                                | 7-lfr               | 8-Road                              | 237-Final Value Review | 9990                                                                                                   | 670                 |        |        |        |        |        |        |        |        |
| 09/09/09                                                                                                                                                                |                     | 0-Missing                           | 240-Bor/Appeal Review  | 920                                                                                                    | 670                 |        |        |        |        |        |        |        |        |
|   |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| 1703434 2/8/2024                                                                                                                                                        |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| <b>LAND INFORMATION</b>                                                                                                                                                 |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| TYPE                                                                                                                                                                    | CODE                | FRONT                               | DEPTH                  | SQFT                                                                                                   | AC                  |        |        |        |        |        |        |        |        |
| 1                                                                                                                                                                       | 01-Residential Land | 30                                  | 80                     | 2,400                                                                                                  | .0551               |        |        |        |        |        |        |        |        |
| INFL1: 1-None INFL2: 1-None                                                                                                                                             |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| Total SF: 2,400 Total AC: .0551                                                                                                                                         |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| <b>PERMITS</b>                                                                                                                                                          |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| DATE                                                                                                                                                                    | TAXYR               | PERMIT #                            | PURPOSE                | STATUS                                                                                                 | % COMP              |        |        |        |        |        |        |        |        |
|                                                                                                                                                                         |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| <b>SALES/TRANSFER HISTORY</b>                                                                                                                                           |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| DATE                                                                                                                                                                    | CONV #              | # OF PARCELS                        | DEED                   | VALIDITY                                                                                               | TYPE                | PRICE  |        |        |        |        |        |        |        |
| 08/11/21                                                                                                                                                                | 21204154            | 1                                   | FD                     | X - Exempt Transfe                                                                                     | 2 - Land & Building |        |        |        |        |        |        |        |        |
| 08/22/00                                                                                                                                                                | 00203857            | 21                                  | WD                     | 8 - Unrevd                                                                                             | 2 - Land & Building |        |        |        |        |        |        |        |        |
| 08/14/96                                                                                                                                                                | 96106793            | 1                                   | ST                     | 0 - Validvac / L&B                                                                                     | 2 - Land & Building | 5,000  |        |        |        |        |        |        |        |
| <b>CONDO COMPLEX</b>                                                                                                                                                    |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| COMPLEX #                                                                                                                                                               | COMPLEX NAME        | YR DECLARED                         | # BLDGS                | # UNITS                                                                                                |                     |        |        |        |        |        |        |        |        |
|                                                                                                                                                                         |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| <b>VALUE HISTORY</b>                                                                                                                                                    |                     |                                     |                        |                                                                                                        |                     |        |        |        |        |        |        |        |        |
| CLASS                                                                                                                                                                   | 2026 R              | CLASS                               | 2025 R                 | CLASS                                                                                                  | 2024 R              | CLASS  | 2023 R | CLASS  | 2022 R | CLASS  | 2021 R | CLASS  | 2020 R |
| 100% L                                                                                                                                                                  | 8,200               | 100% L                              | 8,200                  | 100% L                                                                                                 | 8,200               | 100% L | 6,800  | 100% L | 6,800  | 100% L | 6,800  | 100% L | 5,600  |
| B                                                                                                                                                                       | 34,300              | B                                   | 34,300                 | B                                                                                                      | 34,300              | B      | 23,100 | B      | 23,100 | B      | 23,100 | B      | 19,000 |
| T                                                                                                                                                                       | 42,500              | T                                   | 42,500                 | T                                                                                                      | 42,500              | T      | 29,900 | T      | 29,900 | T      | 29,900 | T      | 24,600 |
| 35% L                                                                                                                                                                   | 2,870               | 35% L                               | 2,870                  | 35% L                                                                                                  | 2,870               | 35% L  | 2,380  | 35% L  | 2,380  | 35% L  | 2,380  | 35% L  | 1,960  |
| B                                                                                                                                                                       | 12,010              | B                                   | 12,010                 | B                                                                                                      | 12,010              | B      | 8,090  | B      | 8,090  | B      | 8,090  | B      | 6,650  |
| T                                                                                                                                                                       | 14,880              | T                                   | 14,880                 | T                                                                                                      | 14,880              | T      | 10,470 | T      | 10,470 | T      | 10,470 | T      | 8,610  |



# Adjusting for Inflation

**3** **Determining the Infaltion Rate**  
Consumer Price Index (CPI)  
 $(CPI_{2026}-CPI_{2020})/CPI_{2020}$  = Inflation rate  
CPI 2020 = 258.8 [9]  
CPI 2026 = 318 [10]  
Inflation rate = 22.9%

**4** **Apply inflation multiplier to all 2020 property values**  
Multiplier = 1.229

| Parcel ID | 2020 Property Value | Inflation Multiplier | 2020 Property Value Adjusted for Inflation |
|-----------|---------------------|----------------------|--------------------------------------------|
| 1703531   | 45,800              | 1.229                | 56288                                      |
| 1703634   | 800                 | 1.229                | 983                                        |
| 1017171   | 39,200              | 1.229                | 48177                                      |
| 400397    | 40,600              | 1.229                | 49897                                      |
| 1016954   | 40,900              | 1.229                | 50266                                      |
| 1017311   | 30,700              | 1.229                | 37730                                      |
| 1016864   | 36,200              | 1.229                | 44490                                      |
| 1016781   | 34,300              | 1.229                | 42155                                      |
| 1016957   | 37,000              | 1.229                | 45473                                      |
| 1017341   | 26,900              | 1.229                | 33060                                      |
| 966821    | 15,300              | 1.229                | 18804                                      |
| 1016877   | 11,200              | 1.229                | 13765                                      |
| 1887756   | 346,000             | 1.229                | 425234                                     |
| 400337    | 34,700              | 1.229                | 42646                                      |

Table 1.0 Sample of inflation calculation table.

# Calculating Changes

5

## Percent Value Change

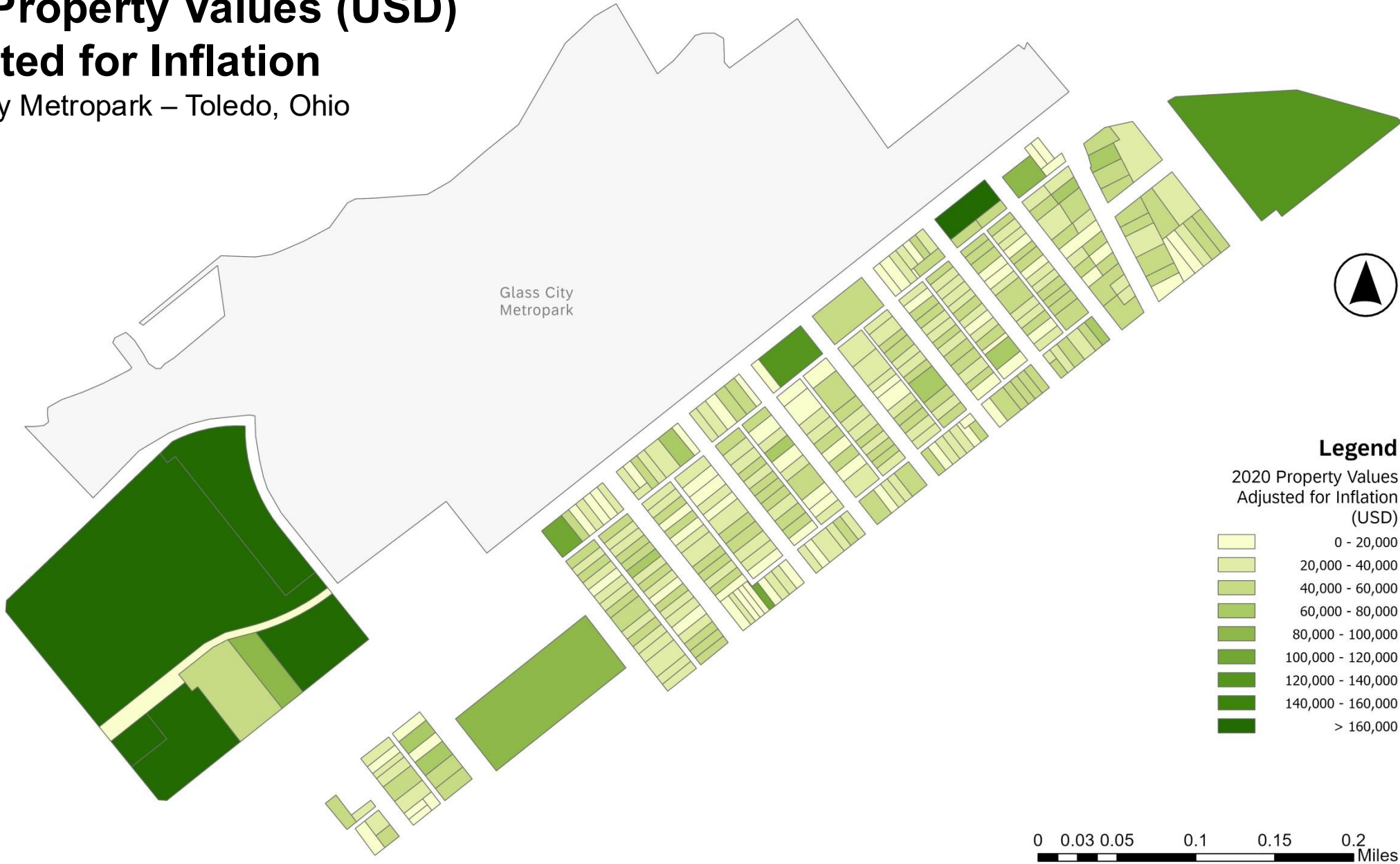
$[(2026 \# - 2020 \text{ Inflation } \#) / 2026 \#] * 100 = \text{Percent Value Change}$

| Parcel ID | 2020 Property Value | 2020 Property Value Adjusted for Inflation | 2026 Property Value | Absolute Change | Percent Value Change |
|-----------|---------------------|--------------------------------------------|---------------------|-----------------|----------------------|
| 1703531   | 45,800              | 56288                                      | 75,300              | 19,012          | 33.8                 |
| 1703634   | 800                 | 983                                        | 6,500               | 5,517           | 561.1                |
| 1017171   | 39,200              | 48177                                      | 51,300              | 3,123           | 6.5                  |
| 400397    | 40,600              | 49897                                      | 44,500              | -5,397          | -10.8                |
| 1016954   | 40,900              | 50266                                      | 56,200              | 5,934           | 11.8                 |
| 1017311   | 30,700              | 37730                                      | 54,100              | 16,370          | 43.4                 |
| 1016864   | 36,200              | 44490                                      | 50,400              | 5,910           | 13.3                 |
| 1016781   | 34,300              | 42155                                      | 39,000              | -3,155          | -7.5                 |
| 1016957   | 37,000              | 45473                                      | 56,200              | 10,727          | 23.6                 |
| 1017341   | 26,900              | 33060                                      | 34,800              | 1,740           | 5.3                  |
| 966821    | 15,300              | 18804                                      | 37,500              | 18,696          | 99.4                 |
| 1016877   | 11,200              | 13765                                      | 27,000              | 13,235          | 96.2                 |
| 1887756   | 346,000             | 425234                                     | 346,000             | -79,234         | -18.6                |
| 400337    | 34,700              | 42646                                      | 54,300              | 11,654          | 27.3                 |

Table 2.0 Sample of change calculation table.

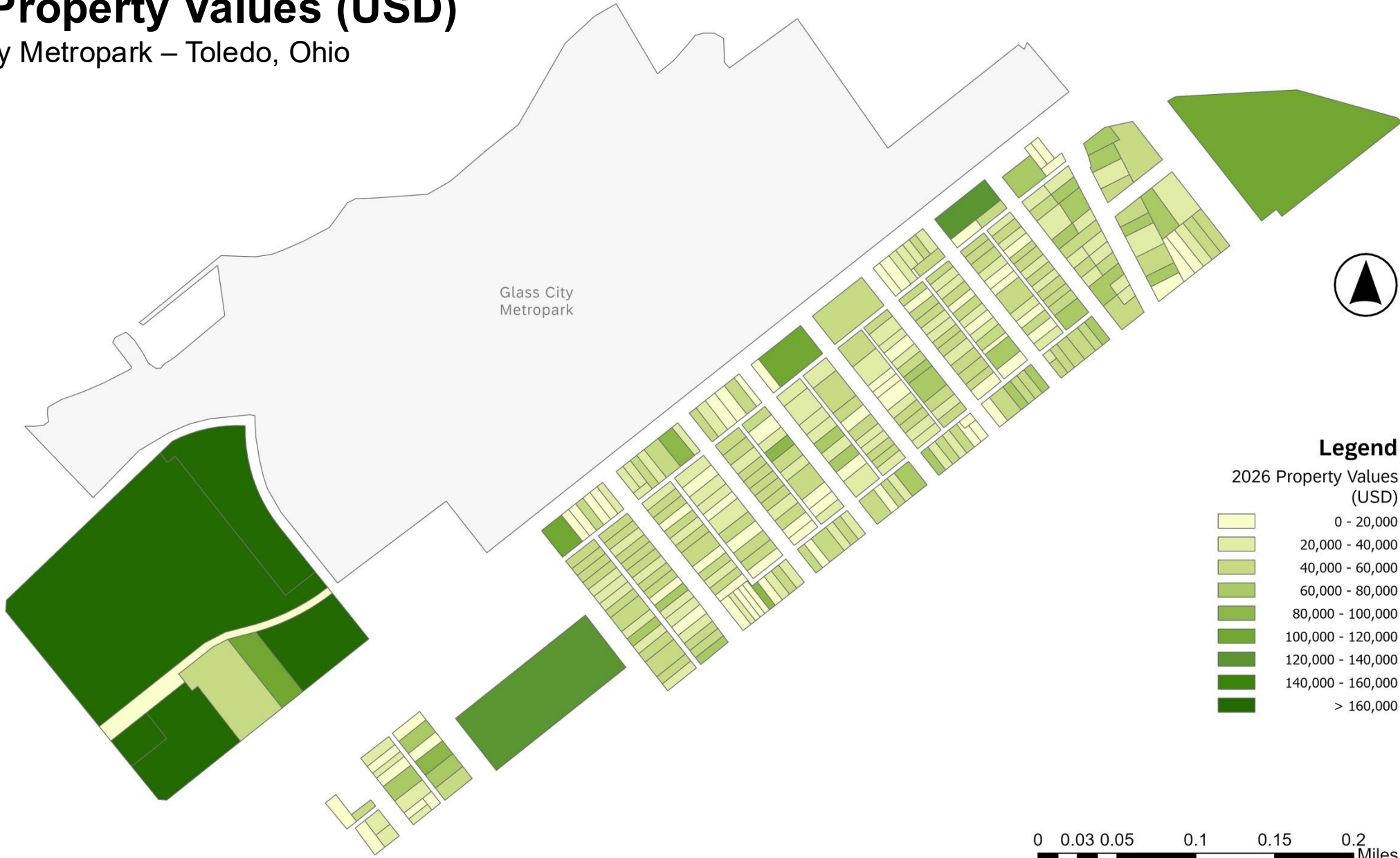
# 2020 Property Values (USD) Adjusted for Inflation

Glass City Metropark – Toledo, Ohio



# 2026 Property Values (USD)

Glass City Metropark – Toledo, Ohio



### Legend

2026 Property Values (USD)

|  |                   |
|--|-------------------|
|  | 0 - 20,000        |
|  | 20,000 - 40,000   |
|  | 40,000 - 60,000   |
|  | 60,000 - 80,000   |
|  | 80,000 - 100,000  |
|  | 100,000 - 120,000 |
|  | 120,000 - 140,000 |
|  | 140,000 - 160,000 |
|  | > 160,000         |

0 0.03 0.05 0.1 0.15 0.2 Miles



# Findings

***Glass City Metropark contributed to the surrounding property value increase of 23.5% from 2020 to 2026 when adjusted for inflation.***

Number of Parcels: **323 Commercial or Residential**

Average Parcel Size: **0.22 acres**

2020 Median Property Value (with inflation): **\$36,256**

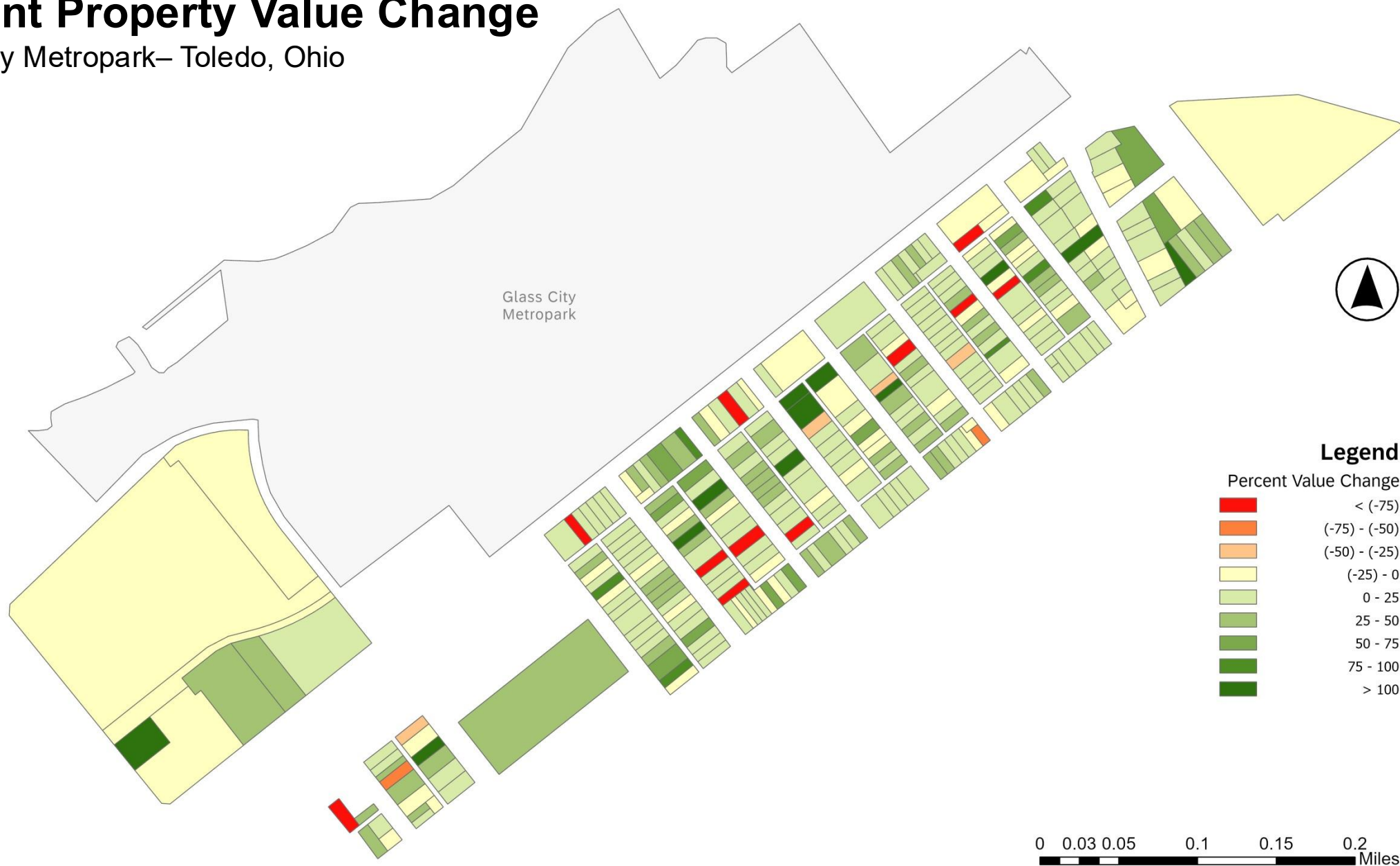
2026 Median Property Value: **\$39,800**

Average Percent Property Value Change: **23.5%**



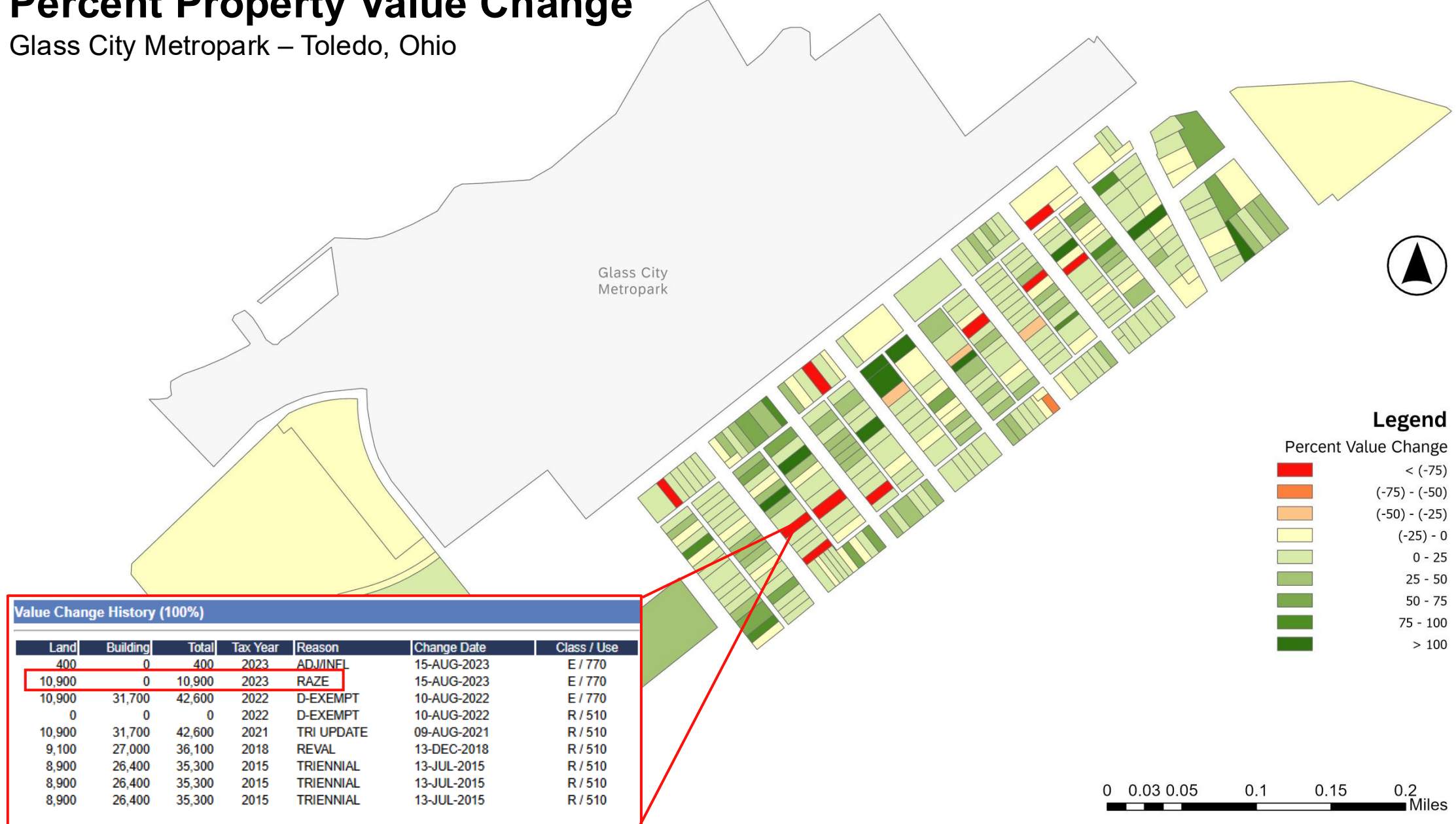
# Percent Property Value Change

Glass City Metropark– Toledo, Ohio



# Percent Property Value Change

Glass City Metropark – Toledo, Ohio



# Relevance

The Zillow Home Value Index (ZHVI) for all zip codes in Toledo when adjusted for inflation has an average increase of **13.3%**



The study area’s assessed value increased faster than the average market trend measure.

| ZIP Code     | 2020 ZHVI    | 2020 ZHVI Adjusted for Inflation (1.229) | 2026 HVI     | Percent HVI Change |
|--------------|--------------|------------------------------------------|--------------|--------------------|
| 43615        | 128701       | 158173                                   | 178327       | 11.3               |
| 43613        | 106026       | 130306                                   | 156540       | 16.8               |
| 43612        | 74158        | 91140                                    | 117053       | 22.1               |
| 43614        | 141124       | 173442                                   | 199500       | 13.1               |
| <b>43605</b> | <b>45202</b> | <b>55553</b>                             | <b>63674</b> | <b>12.8</b>        |
| 43606        | 130481       | 160361                                   | 191112       | 16.1               |
| 43609        | 47724        | 58653                                    | 69826        | 16.0               |
| 43607        | 51532        | 63333                                    | 76377        | 17.1               |
| 43623        | 143218       | 176015                                   | 205185       | 14.2               |
| 43611        | 101671       | 124954                                   | 152371       | 18.0               |
| 43608        | 35595        | 43746                                    | 48149        | 9.1                |
| 43604        | 55675        | 68425                                    | 63243        | -8.2               |
| 43617        | 239719       | 294615                                   | 326534       | 9.8                |
| 43610        | 40934        | 50308                                    | 61334        | 18.0               |



# Limitations

- ① Property values collected from 2020 may be impacted by covid-19 pandemic
- ② Commercial properties were found to have much larger property values than residential parcels, which may have skewed or lessened the average property value change.
- ③ Parcels with building loss had significantly lower or negative property value change, which may have skewed or lessened the average property value change.



# Discussion

- 1 Findings from this study support SmithGroup's design intent: Project plays a role as a catalyst for new private investment and economic activity in adjacent neighborhoods.
- 2 Although parcel property values are trending upward, the median property value remains very low making the neighborhood susceptible to gentrification challenges.
- 3 23.5% Average increase in property values within one block of Glass City Metropark supports the idea of urban parks as community assets.



# References

- [1] City of Toledo. (n.d.). *Property dataset (Toledo, Ohio)*. <https://data.toledo.gov/datasets/>
- [2] City of Toledo. (December, 2025). *Toledo municipal code § 1102.0100*. American Legal Publishing. <https://codelibrary.amlegal.com/codes/toledo>
- [3] City of Toledo. (n.d.). *Zoning maps*. <https://toledo.oh.gov/business/> (Accessed April 20, 2026.)
- [4] Delcambre, C., & Dominguez, M. (2023). *Moore Square methods*. Landscape Architecture Foundation. <https://www.landscapeperformance.org/sites/default/files/2024-01/Moore-Square-Methods.pdf>
- [5] Lucas County Auditor's Office. (n.d.). *AREIS real estate information system*. <https://www.lucascountyohioauditor.gov/areis> (Accessed April 20, 2026.)
- [6] Michaels, L. R., & Mauter, R. J. (2006). *East Toledo at work: A history of business & industry of East Toledo*. Ohio Memory. <https://ohiomemory.org/digital/collection/p16007coll33/id/96639>
- [7] Peng, E. (2021, August 5). *Restoration and renewed connection for Toledo's riverfront*. Midstory. <https://www.midstory.org/restoration-and-renewed-connection-for-toledosriverfront/>
- [8] University of Toledo, Center for Urban & Regional Studies. (2019). *Toledo and Lucas County poverty report presentation*. <https://www.utoledo.edu/centers/>
- [9] U.S. Bureau of Labor Statistics. (2021). *Consumer price index: 2020 in review*. <https://www.bls.gov/eag/>
- [10] U.S. Bureau of Labor Statistics. (n.d.). *Consumer price index news release*. <https://www.bls.gov/news.release/>
- [11] Zillow. (n.d.). *Housing data*. Zillow Research. <https://www.zillow.com/research/data/>