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® CLEVELAND METROPARKS

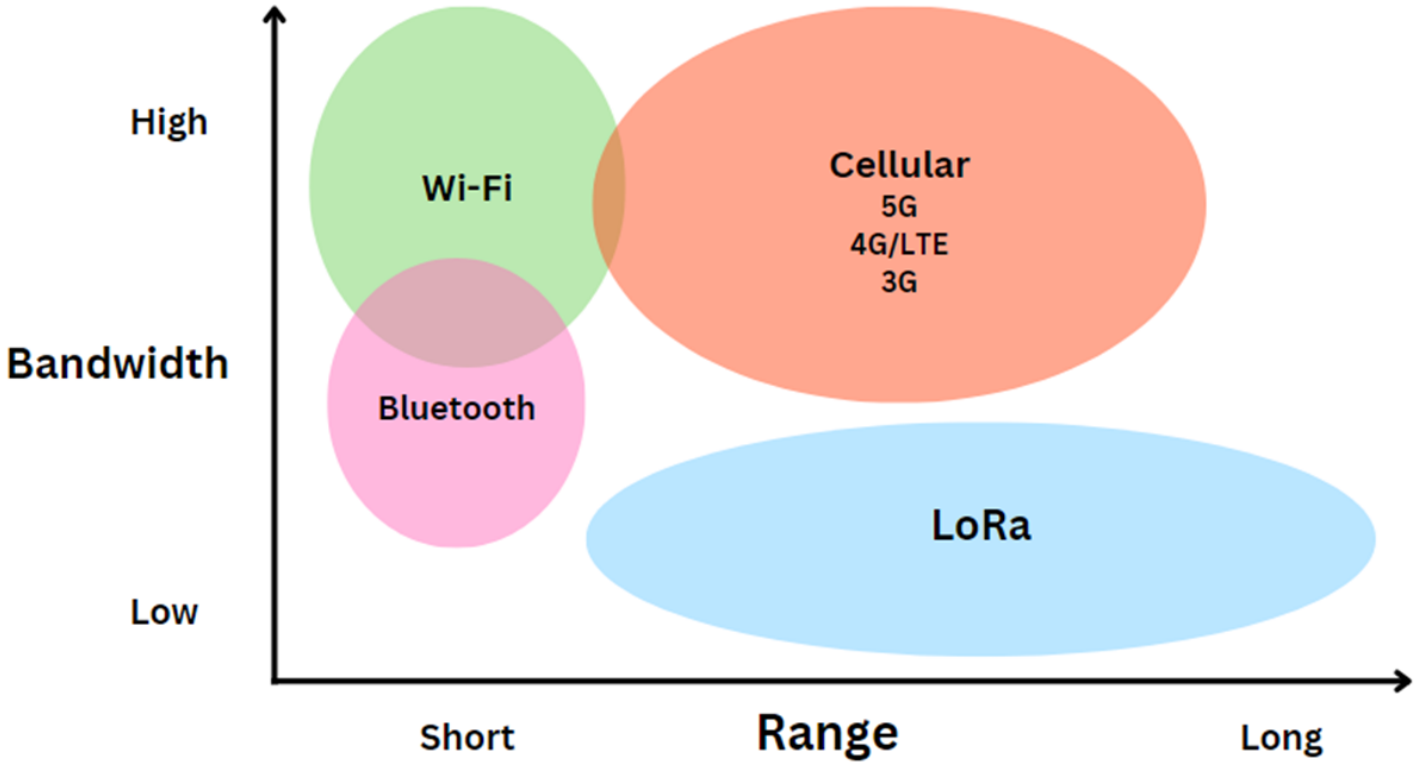
Emerging Technologies: Satellites & LoRaWAN

ITS/NR

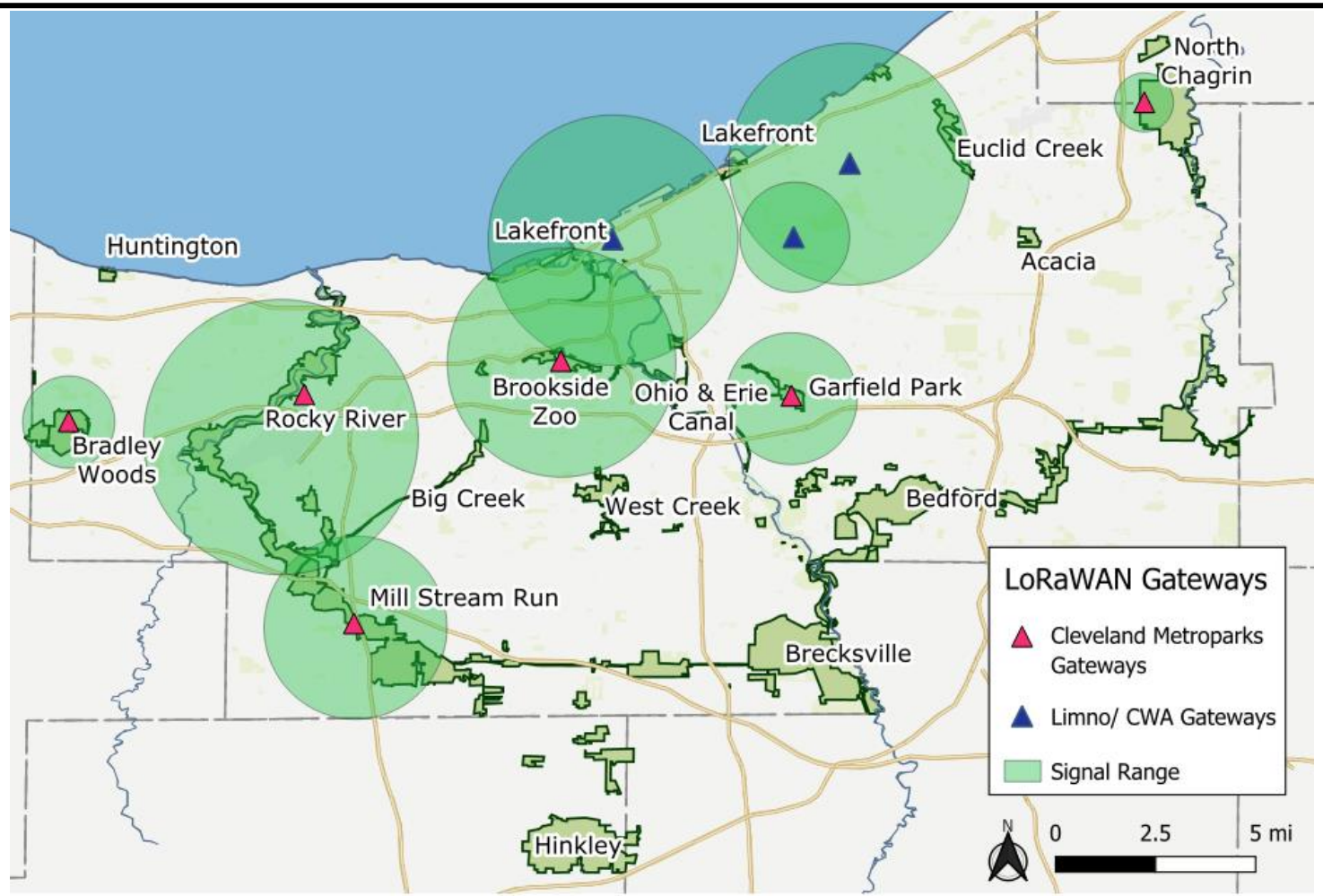
11/21/2024

LoRaWAN Overview

- **Long Range Wide Area Network:** allows for energy-efficient data transmission over long distances
- **Advantages:** low-cost, long battery life, no SIM or data logger needed
- **Limitations:** low bandwidth (cannot transmit photos/videos)
- **Applications:**
  - Environmental monitoring with "in-situ" sensors
  - Utility sensors
  - Trail monitoring

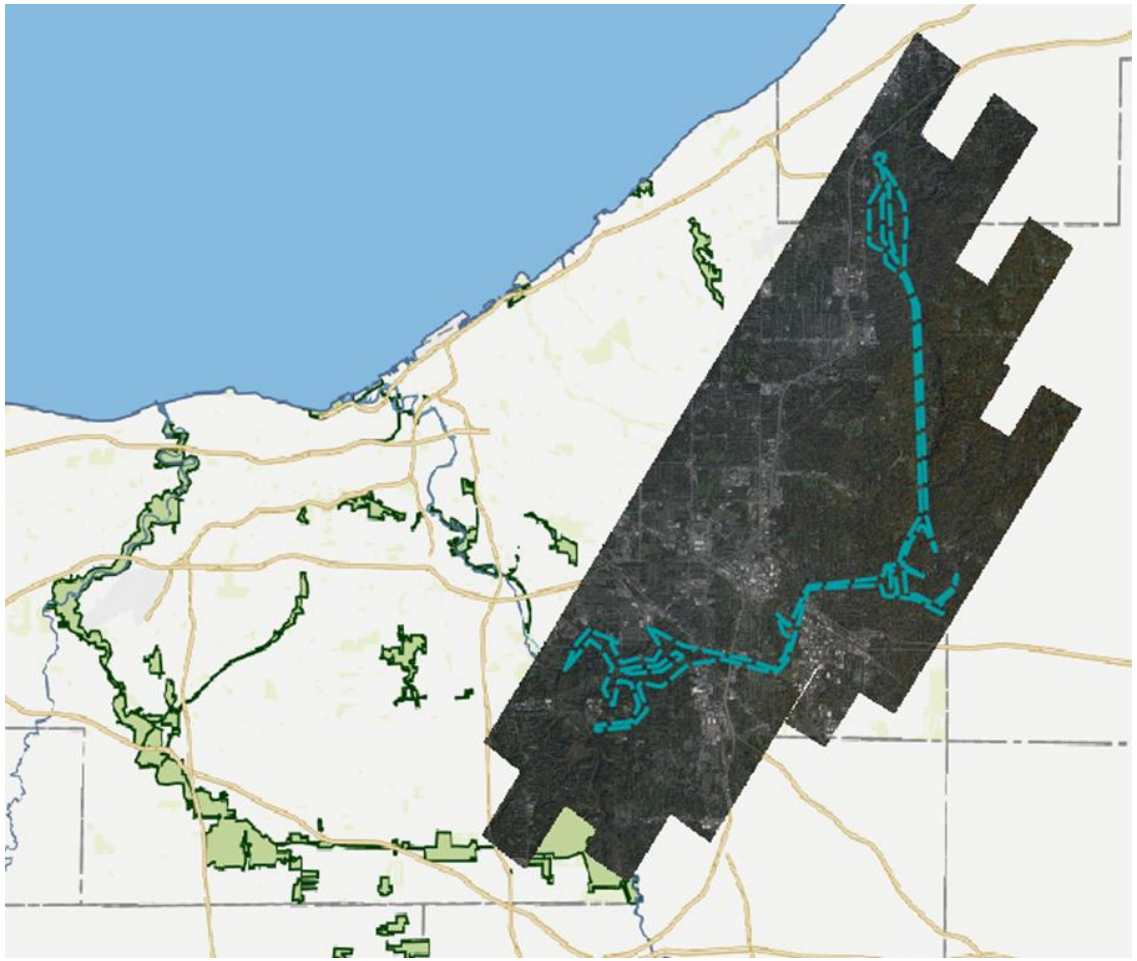


Gateways


North Chagrin
Lakefront
Euclid Creek
Lakefront
Huntington
Acacia
Brookside Zoo
Ohio & Erie Canal
Garfield Park
Rocky River
Bradley Woods
Big Creek
West Creek
Bedford
Mill Stream Run
Brecksville
Hinkley
LoRaWAN Gateways
Cleveland Metroparks Gateways
Limno/ CWA Gateways
Signal Range
N
0
2.5
5 mi

Satellite Overview

- **Planet Labs:** SkySat constellation of 15 satellites launched in 2016
- Advantages of high temporal resolution satellite imagery:
  - Change detection, land management, monitor capital projects (ex: Hinckley dam, CHEERS)
  - Capture imagery when drone flight is not possible (weather, piloting, restrictions)
- Ability to "task" for aerial satellite imagery and delineate areas of interest



Sources of Aerial Imagery

Images courtesy of GIS Department

SkySat Constellation

Natural Resources use of LoRaWan sensors

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- Stormwater retrofits @ Chalet

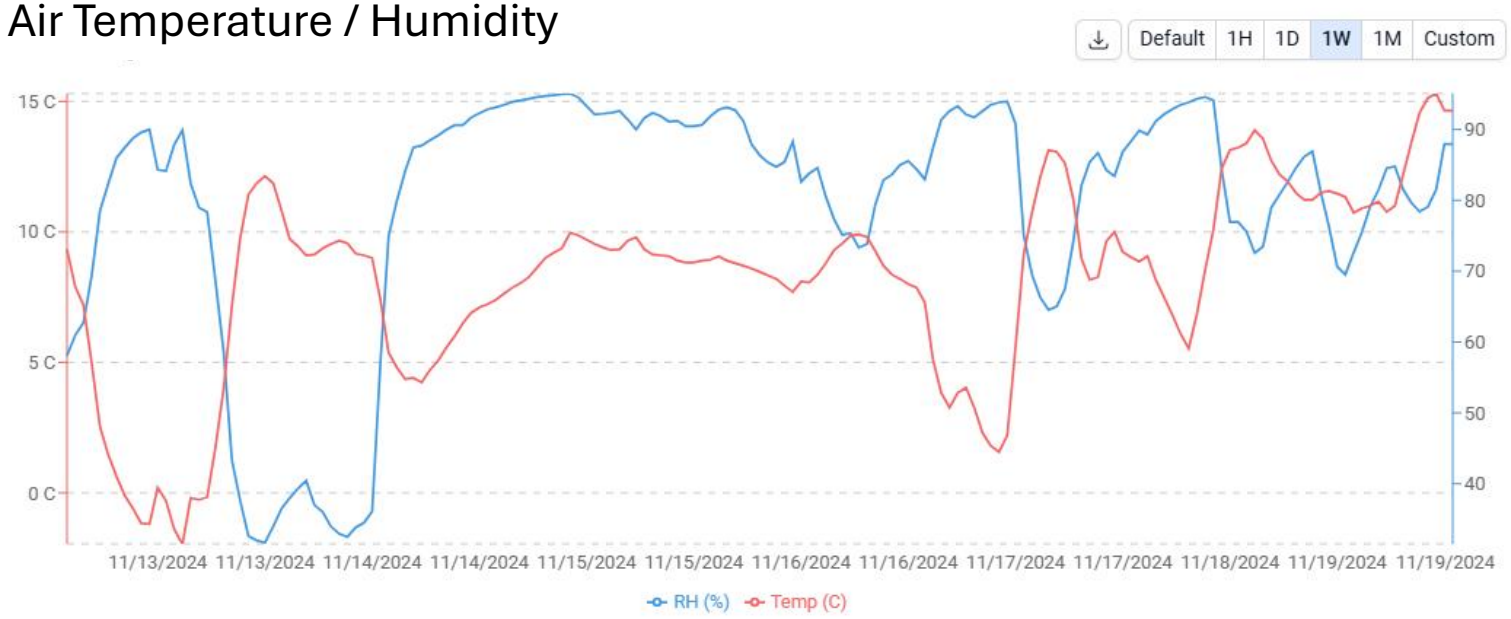
DATACAKE

Dashboards > Chalet Bioretention Cells

Chalet Bioretention Cells

Public

Air Temperature / Humidity



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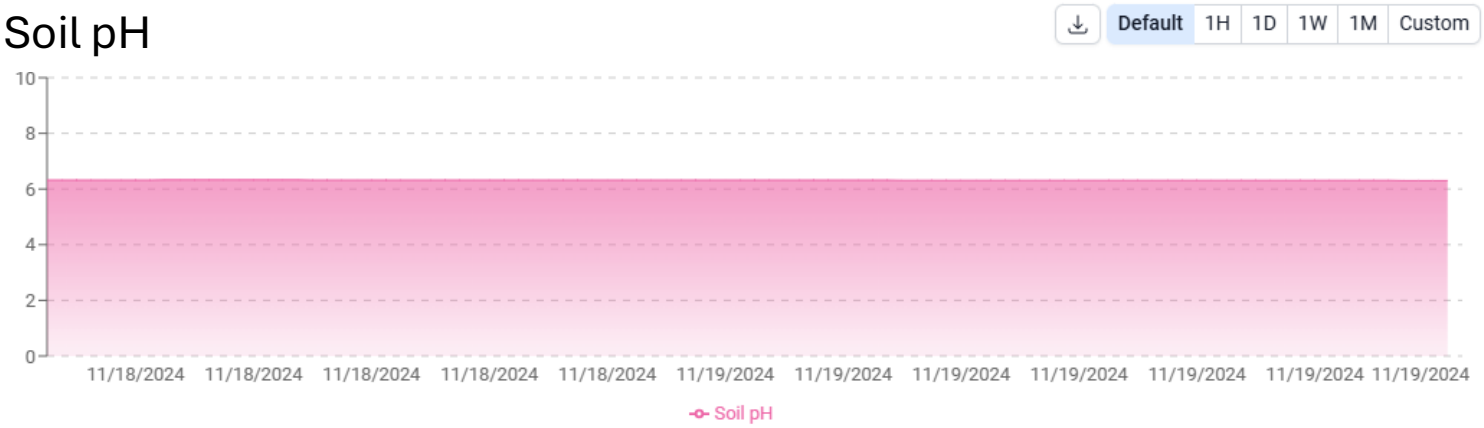
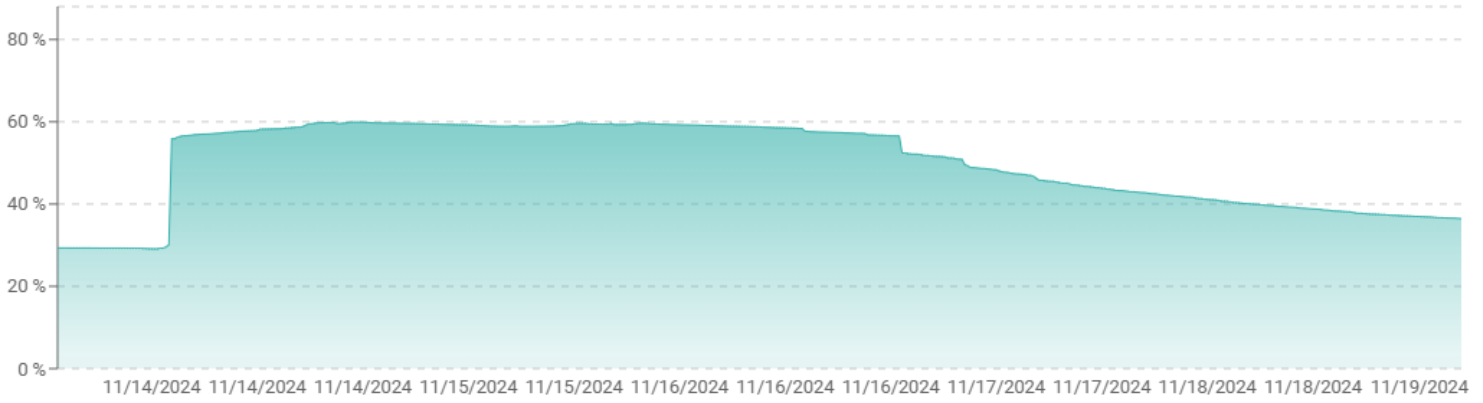
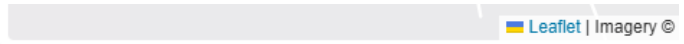
- Stormwater retrofits @ Chalet

Soil pH



Soil moisture





Current Readings:

Air Temperature
20 minutes ago

15
Degrees C

Humidity
20 minutes ago

81.60
% RH

Soil Temperature
18 minutes ago

11.80
Degrees C

Soil pH
18 minutes ago

6.30
pH

Soil Conductivity
19 minutes ago

108.00
uS / cm

Soil Moisture
19 minutes ago

35.31
%

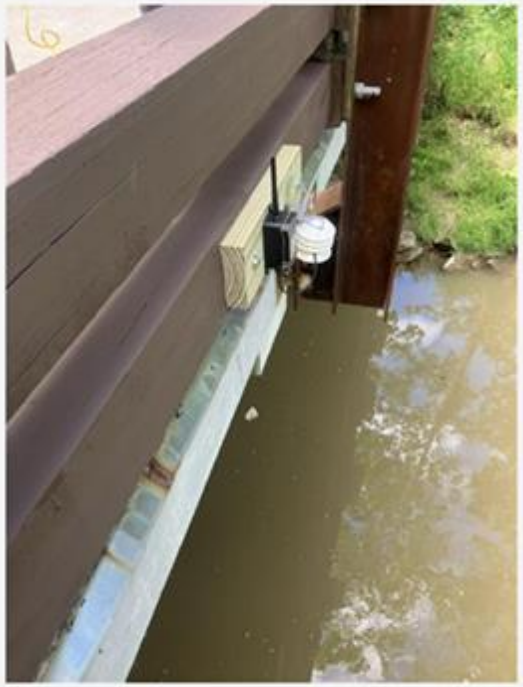
- Stream level

Location: East Branch of Rocky River

Coordinates: 41.324151, -81.816688

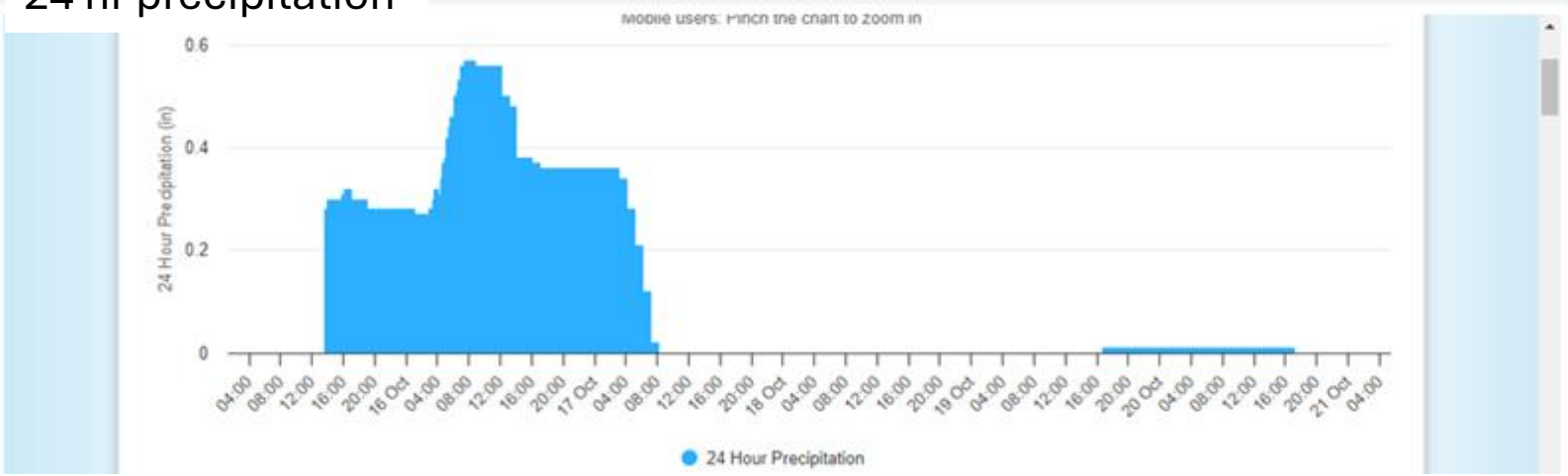
Current River Stage (ft)
14 minutes ago

1.79
ft



River stage

24 hr precipitation



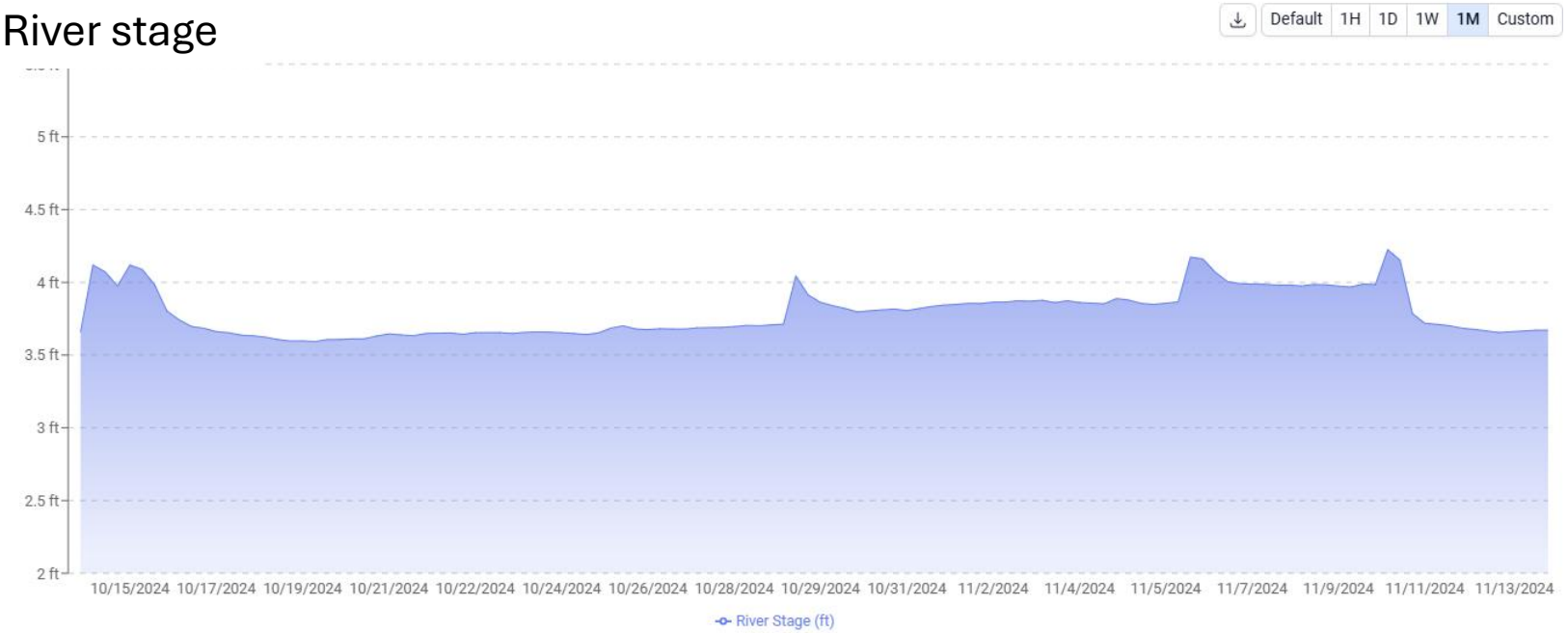
Wolf Creek at Garfield Reservation

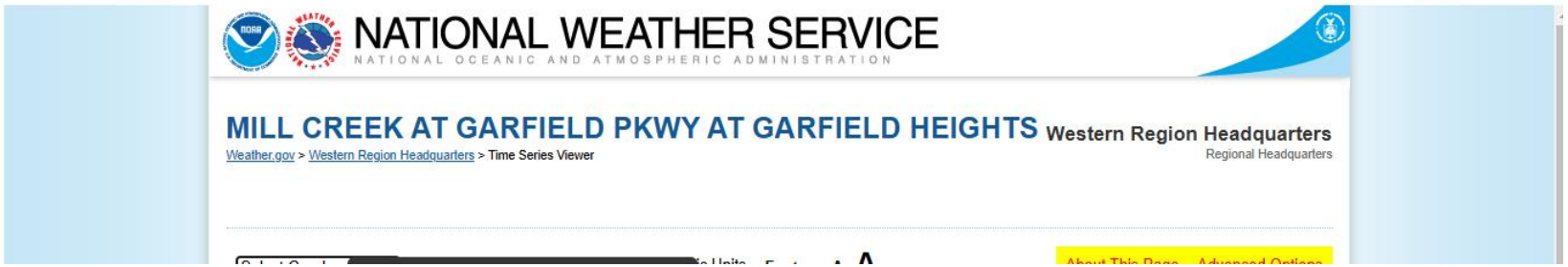
Coordinates: 41.4277573, -81.6042573

Current River Stage (ft)
5 seconds ago

3.67
ft

River stage





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• Wolf Creek @ Garfield Park

Natural Resources plans for satellite imagery

- Storm damage
- Oak wilt
- Invasive plant i.d.

Other Applications & Future Use-cases

- **Air quality sensor network**
  - Collaboration with NR and City of Cleveland
- **Utility sensors**
  - Park Operations
  - Zoo Facilities
- **Zoo**
  - "Mini forest"
  - Water quality monitoring
- **Marketing**
  - Trail monitoring pilot
- **Satellite:** exploring other remote sensing tools
  - Encroachment detection/ monitor land-use
  - Invasive vegetation monitoring, forest health

- Exploring other sites for water level sensors