

# Monitoring differences in street tree installation practices for stormwater runoff reduction

## *Urban Waters Federal Partnership*

National Water Quality Monitoring Council  
March 2019

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*New York Water Science Center*



Bronx Council for Environmental Quality



# Urban Waters Federal Partnership

- Initiated in 2011
- 19 locations throughout the country
- 15 Federal agencies
- Revitalize watershed
- Improve water quality
- Connect community with their natural resource



# Monitoring to inform decisions

- Actionable Science—Monitoring should be focused on the needs of community and local partner agencies and be usable for making decisions
- Open Data—Publicly accessible data allows city agencies, researchers, and community organizers to better inform studies, outreach, and management plans within the watershed
- Green infrastructure performs differently at each locations, understanding affects on water-quality requires pre- and post-development assessments

# Green Infrastructure being monitored

- **Street trees in the Bronx River and Harlem River watersheds**
- Novel stormwater retention structures along a major highway along the Harlem River
- Green roof, swales, and intertidal areas at a State Park
- Combined sewer outfalls—pathogens and their sources along the rivers
- Geothermal study at Bronx Riverhouse (ongoing)

# Street trees

UWFP—Bronx River and Harlem River watersheds

# Street trees in NYC



NYC Parks



Environmental Protection

- Over the past 10 years, NYC Parks and community expanded the number of trees in NYC to 1 million
- Planted for aesthetics, provide shade and reduce urban heat island
- City partners interested in understanding additional value of trees with respect to stormwater capture



## New York City Street Tree Map

Explore and Care For NYC's Urban Forest

### NYC's Street Trees

The New York City Street Tree Map brings New York City's urban forest to your fingertips. For the first time, you have access to information about every street tree in New York City. Learn about the trees that make up our city's urban forest, mark trees as favorites and share them with your friends, and record and share all of your caretaking and tree stewardship activities. [Learn more About The Street Tree Map.](#)

#### Citywide Statistics

|                          |   |                        |
|--------------------------|---|------------------------|
| <b>Mapped Trees</b>      | <b>Activities Reported</b>                                | <b>Trees Favorited</b> |
| 678,699                  | 41,576  | 4,692                  |
| <b>Number of Species</b> | <b>Most Common Species</b>                                |                        |
| 322                      | London Planetree<br>86,239 trees, 13% of trees on the map |                        |

#### Recent Tree Care Activities

- The [Unknown near 323 East 4 Street, New York, NY 10009](#) was Cleared Litter/Waste on 12/05/2018
- The [Callery Pear near 322 East 4 Street, New York, NY 10009](#) was Cleared Litter/Waste on 12/05/2018
- The [Callery Pear near 320 East 4 Street, New York, NY 10009](#) was Cleared Litter/Waste on 12/05/2018

#### Learn

Visit the tree care Library for tree care tips, stewardship groups in your area, a printable watering calendar, and more. [Caring for Street Trees](#)

#### Find Events

Join others in caring for NYC's urban forest by attending a tree planting or care events. [View Events](#)

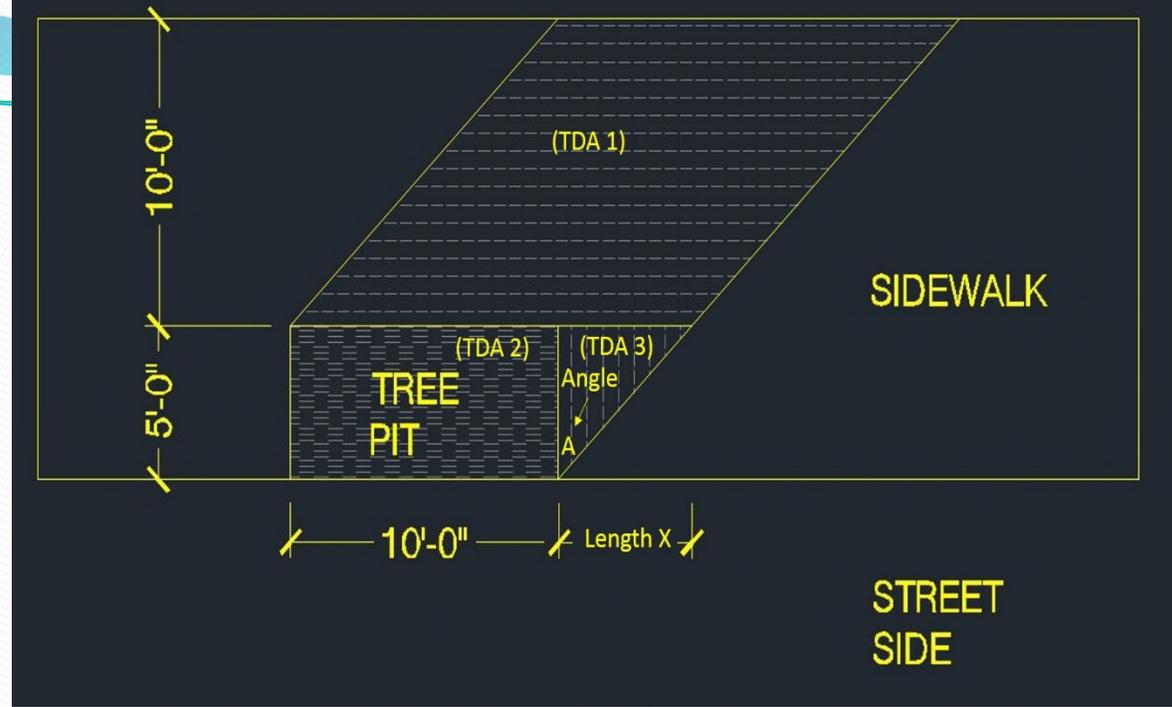
#### Ecological Benefits



# Street trees stormwater modeling



- Current study is a coordinated effort to assess the capacity of water capture by newer tree pits
- New design to reduce soil compaction in tree pits: tree guards
- Models used to monetize potential for stormwater capture according to EPA guidelines



|   | Sidewalk Width (ft) | Stormwater Captured (gal per year) | Cost    | \$/Gal Stormwater Captured |
|---|---------------------|------------------------------------|---------|----------------------------|
| New tree without guard                          | 25                  | 9,205                              | \$1,650 | \$0.18                     |
|   | 20                  | 7,729                              | \$1,650 | \$0.21                     |
|   | 15                  | 6,037                              | \$1,650 | \$0.27                     |
|   | 10                  | 4,112                              | \$1,650 | \$0.40                     |
| New tree <u>with</u> guard                      | 25                  | 11,180                             | \$2,850 | \$0.25                     |
|   | 20                  | 8,919                              | \$2,850 | \$0.32                     |
|   | 15                  | 6,618                              | \$2,850 | \$0.43                     |
|   | 10                  | 4,285                              | \$2,850 | \$0.67                     |
| Difference between tree with guard and no guard | 25                  | 1,975                              | \$1,200 | \$0.61                     |
|   | 20                  | 1,191                              | \$1,200 | \$1.01                     |
|   | 15                  | 580                                | \$1,200 | \$2.07                     |
|   | 10                  | 173                                | \$1,200 | \$6.92                     |

Graphic of model and estimate created by NYC Parks



# Street tree monitoring



NYC Parks

**NYC**

Environmental  
Protection

- Objective—Compare similar trees with and without guards; provide data that can be useful for NYC Parks and DEP
- Approach—Monitor 5 pairs of trees in the Harlem River and Bronx River watersheds
  - Soil moisture reading twice-daily
  - Seepage tests and tree health metrics
  - Correlate with weather data



# Street tree monitoring

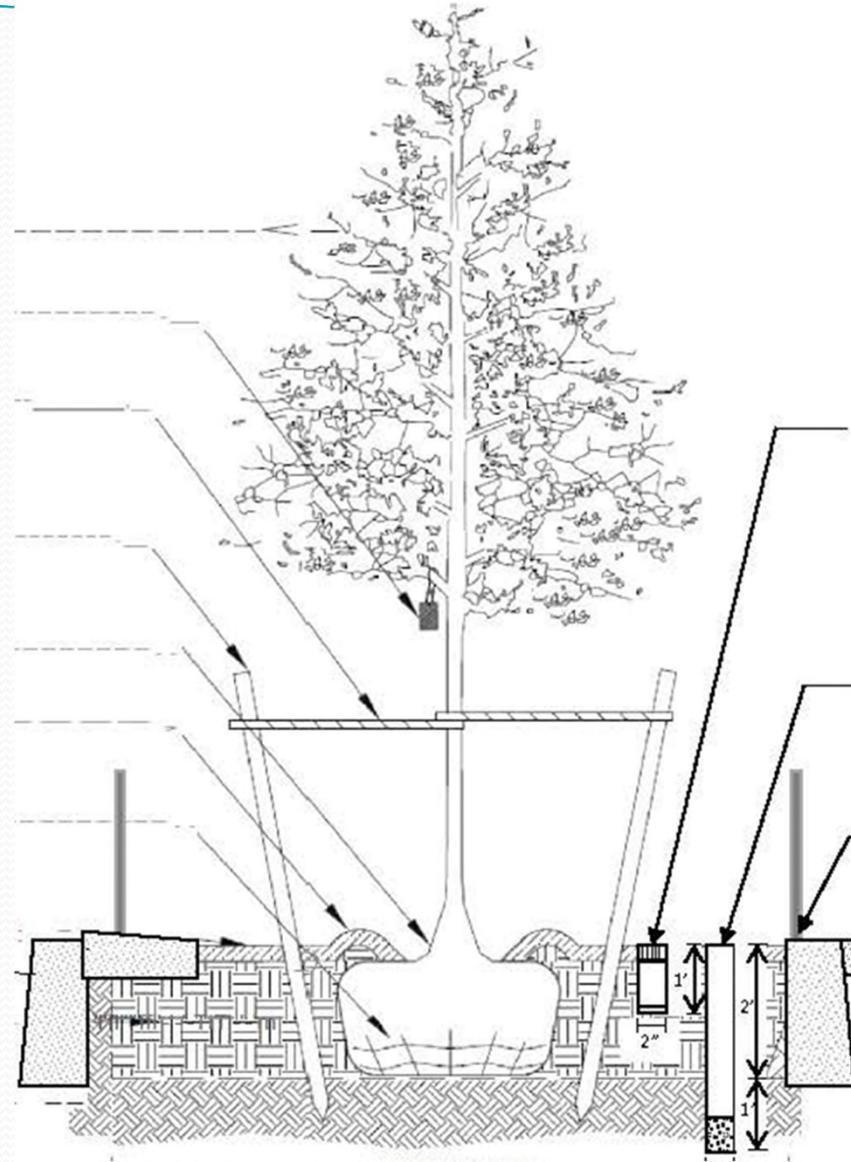


NYC Parks

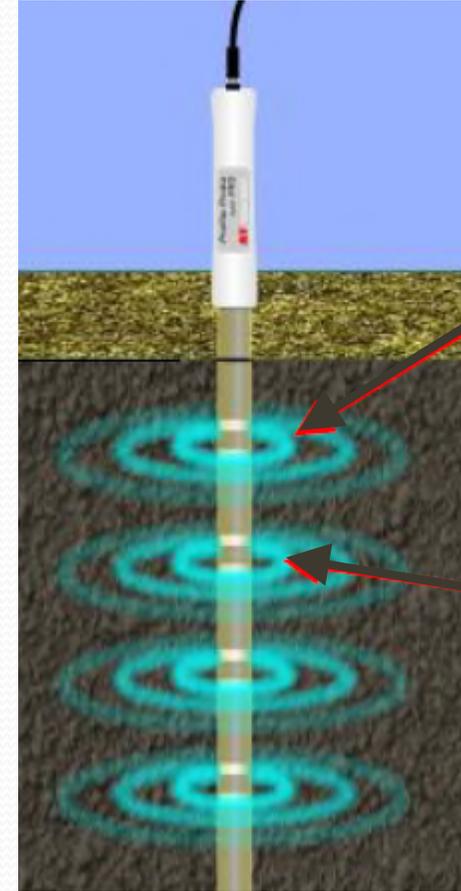


## Soil moisture depth profiles

- Challenges include security of equipment and shallow depth to bedrock in most areas
- Manual profiler selected with electromagnetic bands for relative moisture content at four depths: 10, 20, 30, and 40 centimeters (cm)
- Ancillary data collected, including air and soil temperature and weather

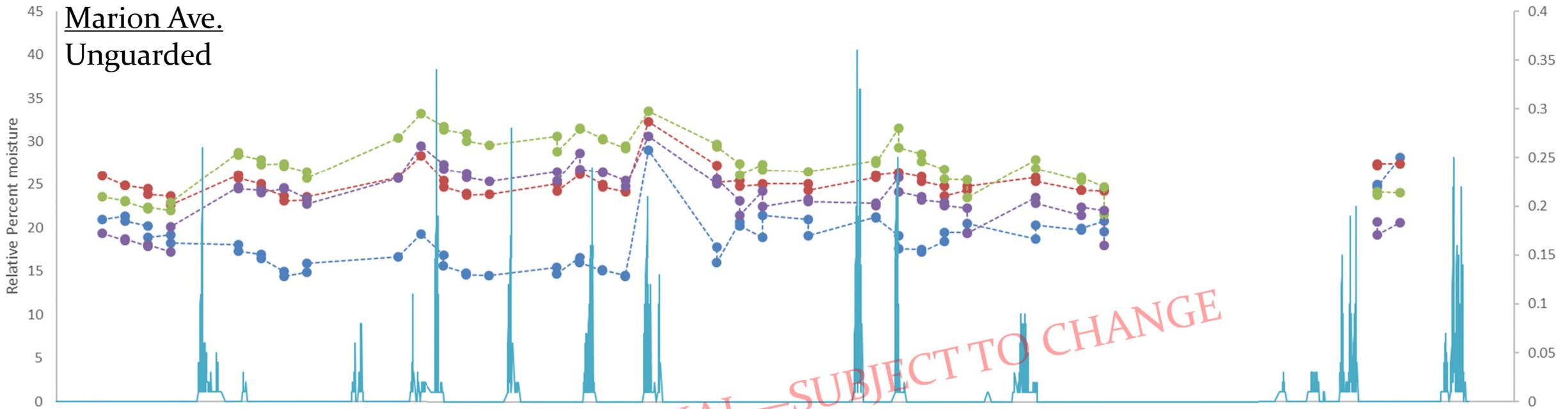


*Schematic from NYC Parks*

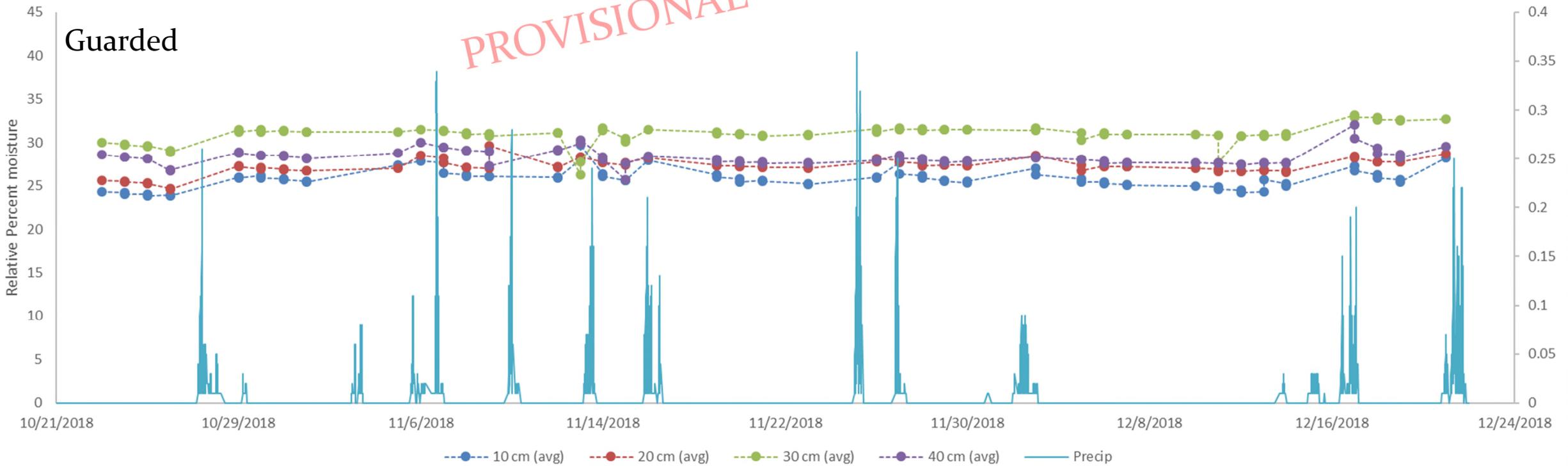


[www.dynamax.com](http://www.dynamax.com)

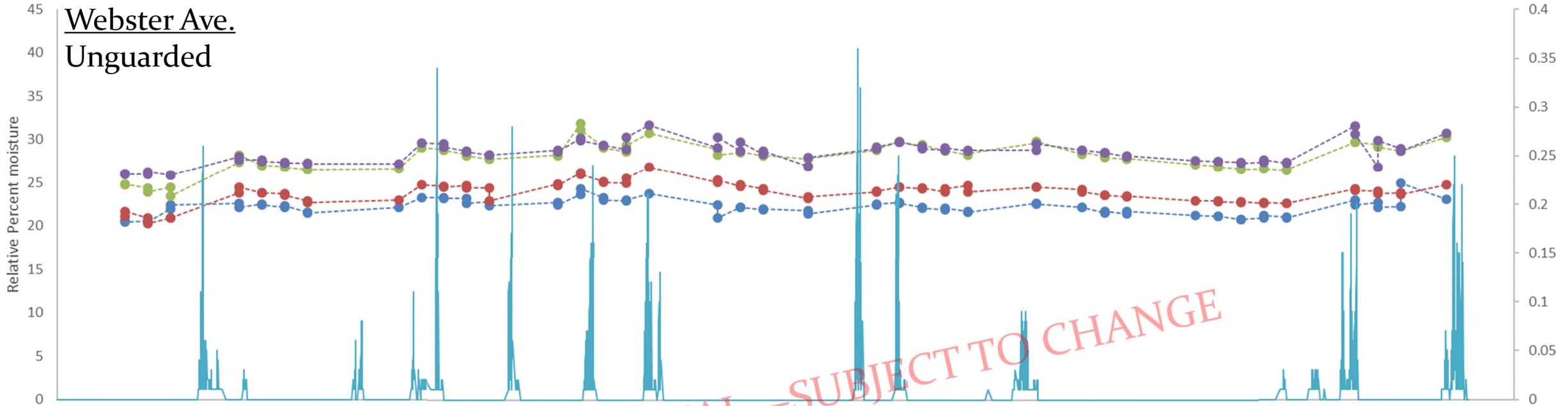
# Marion Ave. Unguarded



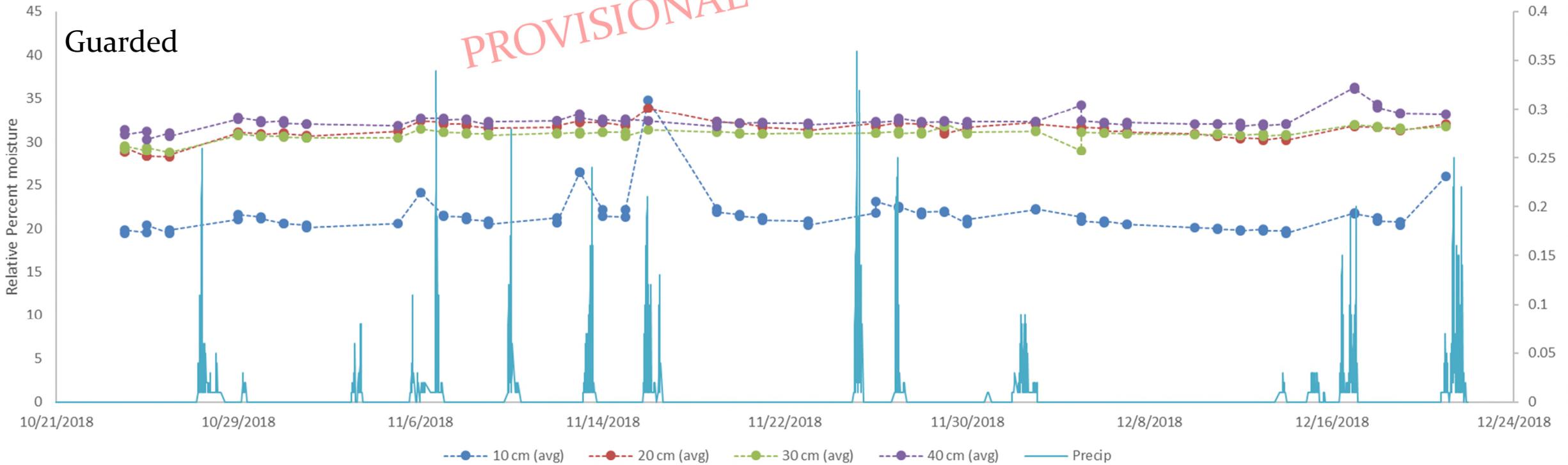
# Guarded



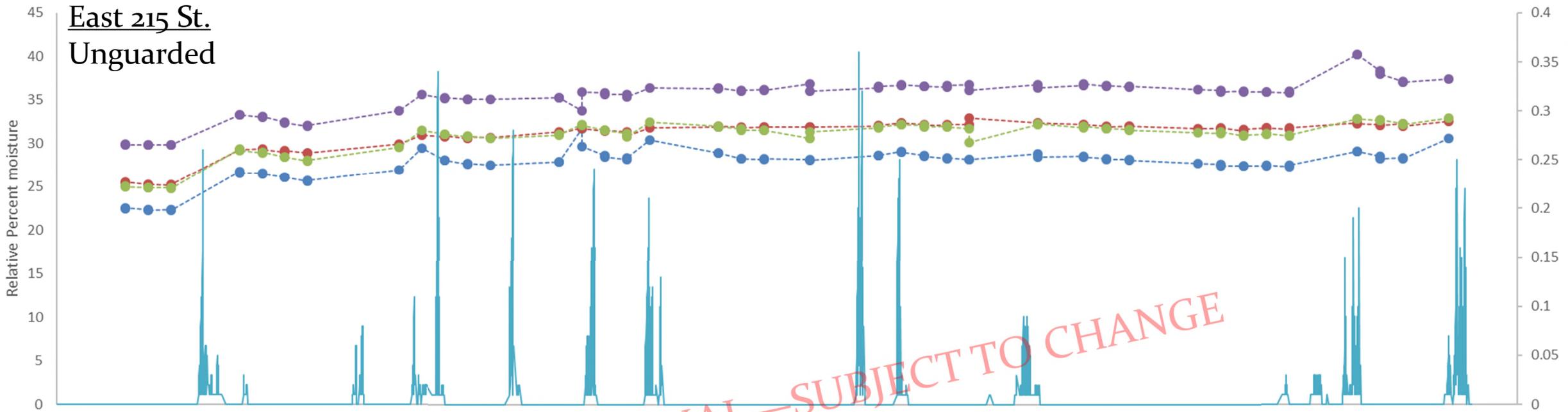
# Webster Ave. Unguarded



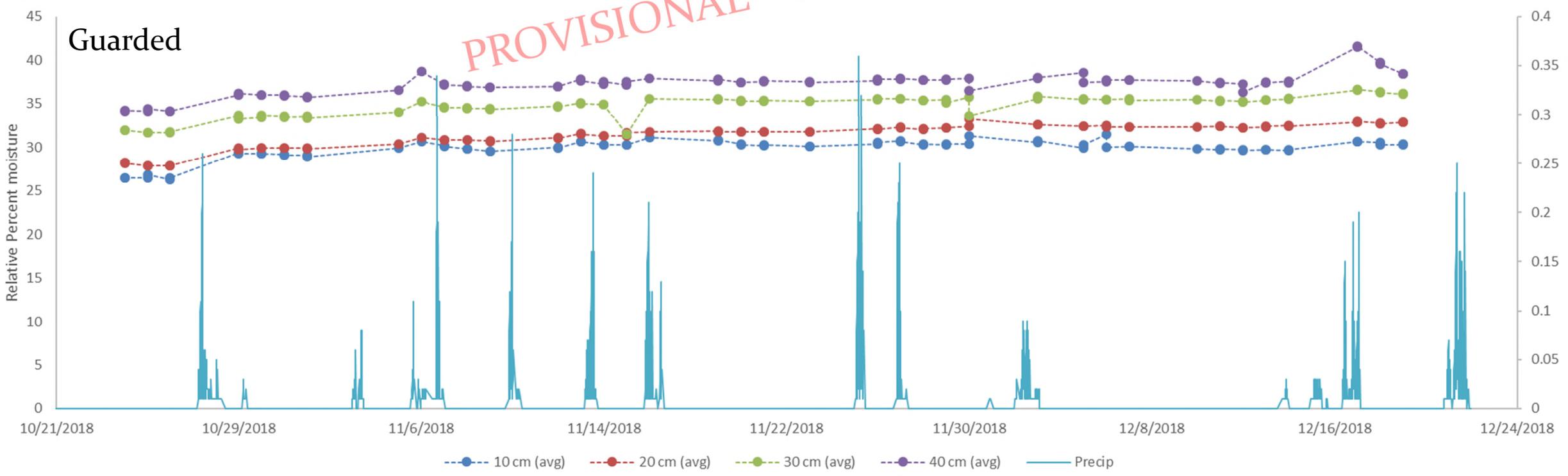
# Guarded



# East 215 St. Unguarded



# Guarded



# Continued coordination and analysis

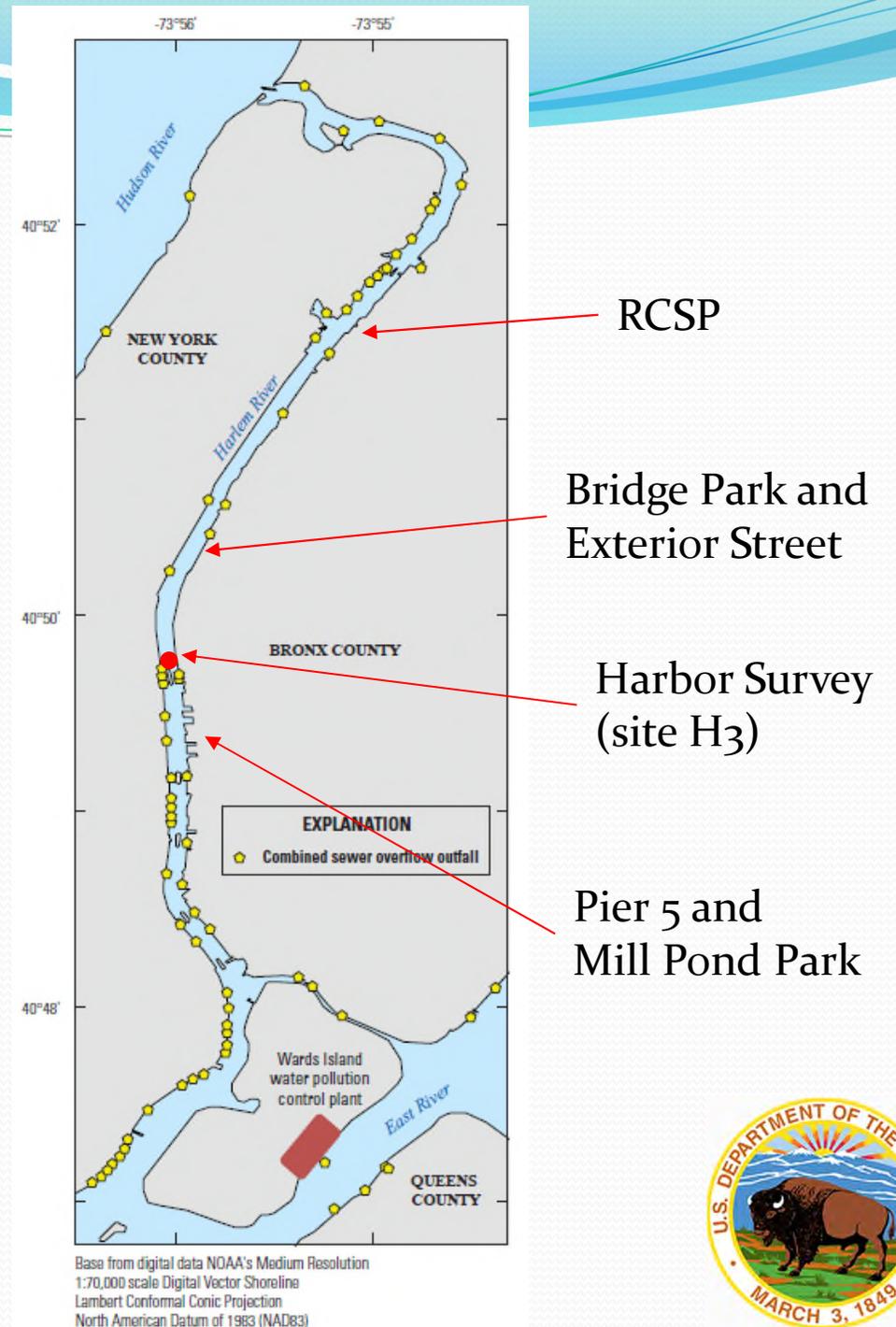
- Work with NYC Parks for tree health metrics following a full year of data collection
- Incorporate soil properties and percolation test results when available from DEP
- Determine relative differences in capture effectiveness of tree guards

# Other GI monitoring

UWFP—Harlem River

# Water-quality sampling along the Harlem River

- Roberto Clemente State Park (2017-18)
- Bridge Park South / Exterior Street (2017)
- Harlem River transects (2017)
- Earlier studies
  - Compilation of data: Harbor Survey (1914-present)
  - Pier 5 and Mill Pond Park (2014)



# Roberto Clemente State Park



2017

- Assess differences in stormwater quality with newly constructed green infrastructure
  - Intertidal pool
  - Rain garden, tree pits, and permeable pavers
  - Green roof
- Water-quality sampling
  - VOCs, mercury, nitrogen, stable isotopes
  - Wastewater compounds, metals
- Real-time water-quality monitoring–NYCDEP
  - Temperature, pH, Salinity, dissolved oxygen, turbidity mid-depth in water column
  - NYCDEP hopes to get the data online soon
- Storm-surge sensor bracket–USGS

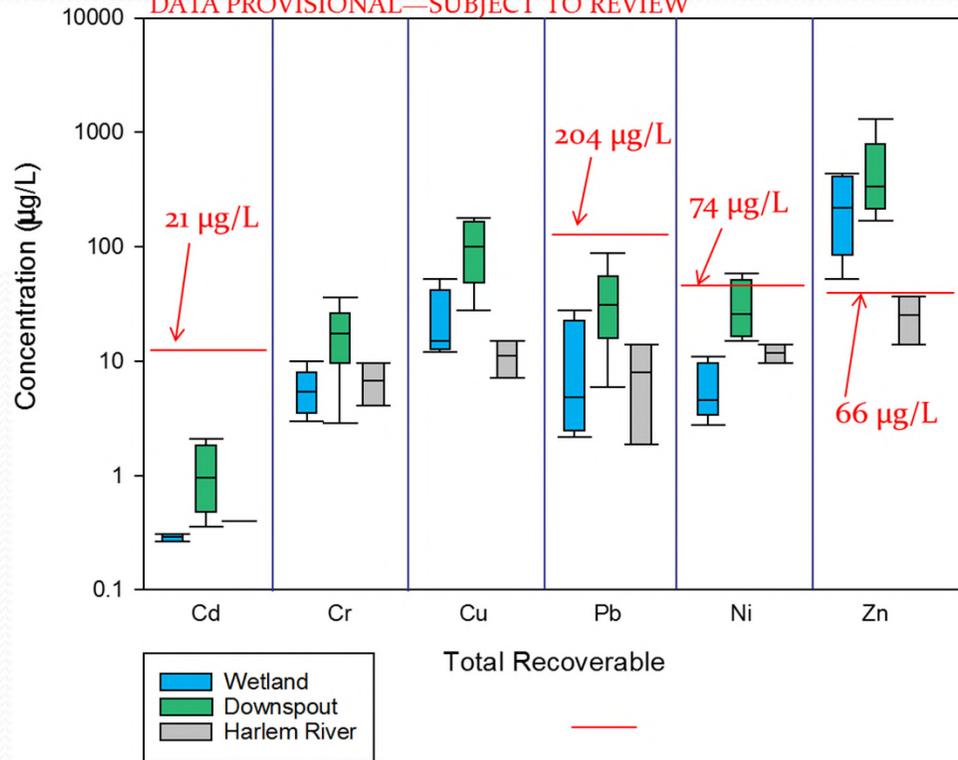


# Pier 5 and Mill Pond Park



2014

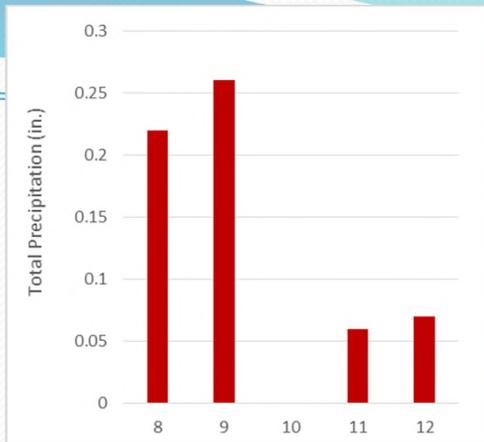
DATA PROVISIONAL—SUBJECT TO REVIEW



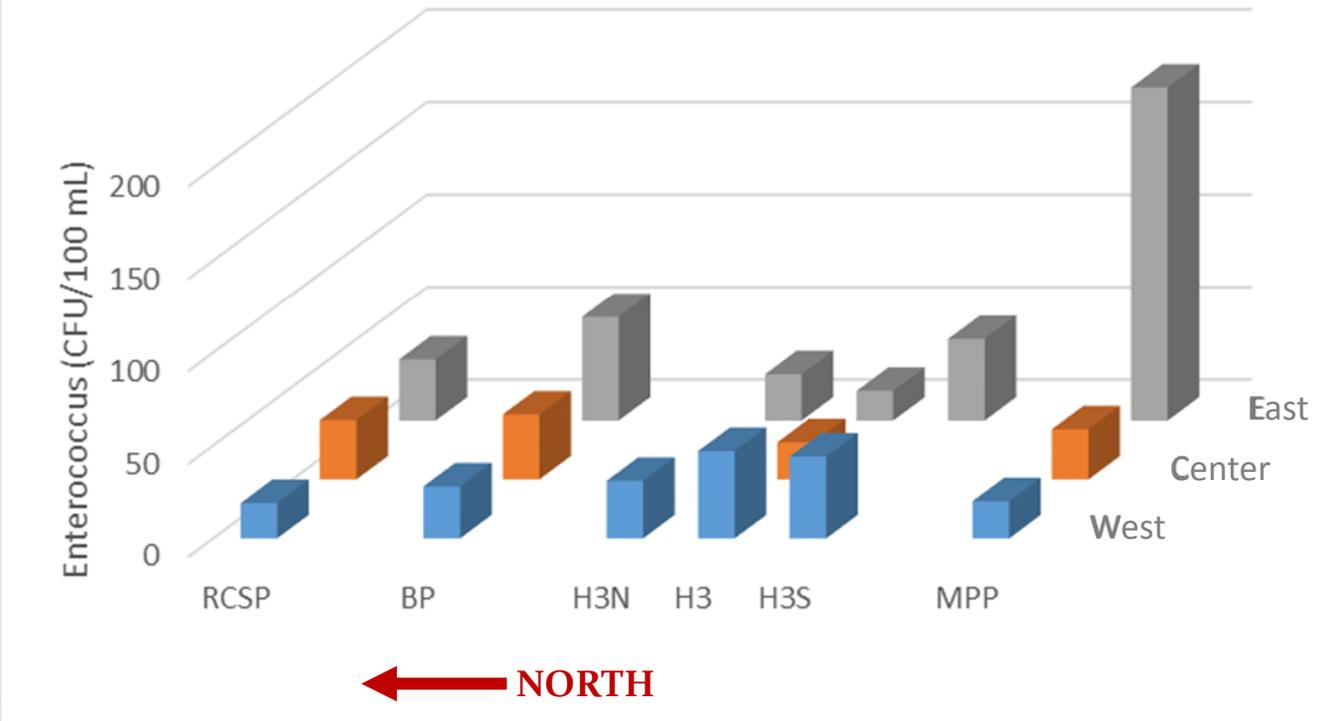
# Harlem River transects



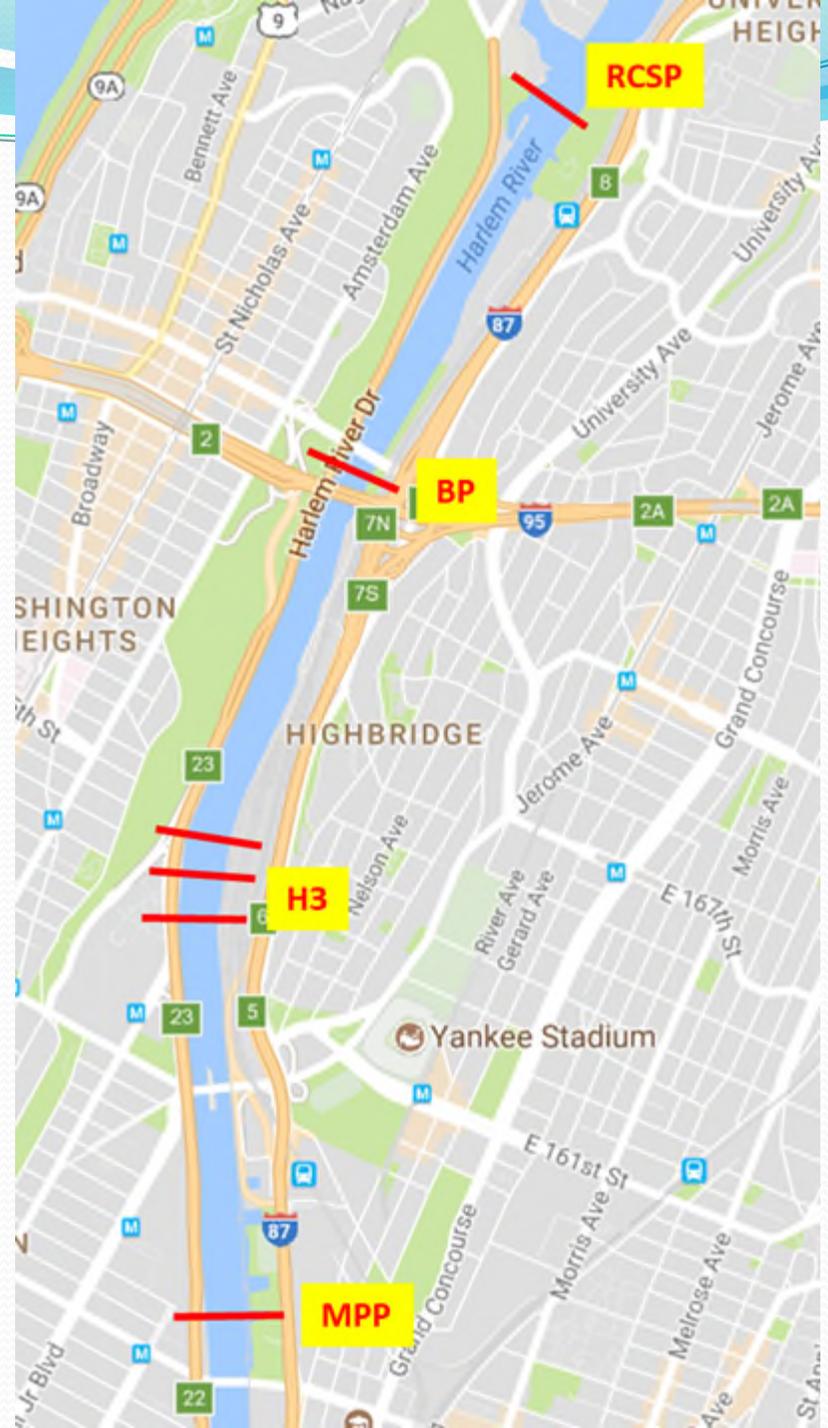
October 12, 2017



IEC laboratory, EPA method 1600



CFU: colony forming units



# Connection to Harlem River Watershed and Natural Resources Management Plan



- Street-tree and water-quality monitoring provides data relevant to ecological health of the Harlem River and baseline data for future changes to stormwater management
- Help inform uses of and access to the Harlem River at locations of proposed parkland according to established water-quality standards
- Future studies to consider stormwater and green infrastructure relative to other areas of the country

# Thank you

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