

ENGINEERING SERVICES

Raleigh's Flood Early Warning System and Active Flood Control Program

City of Raleigh, North Carolina

Presentation for
APWA-NC Stormwater Education Session
June 8, 2026



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Stormwater's Mission

Manage stormwater to preserve and protect life, support healthy natural resources, and complement sustainable growth for the community



City management, City Council, Stormwater Management Advisory Commission, staff, stakeholders, and people in Raleigh work together to make this happen.

2



Stormwater's Vision

Be the "smartest" stormwater program possible to economically and equitably achieve our mission.

Be Stormwater Smart!

3



Applying "Be Stormwater Smart!" philosophy to all programs supporting our mission

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Goals and Benefits of FEWS


Improved Public Safety and Awareness through:

- Flood Monitoring (Software, Gauges, Sensors, Cameras)
- Flood Predictions
- Advanced Warning
- Alerts and Notifications

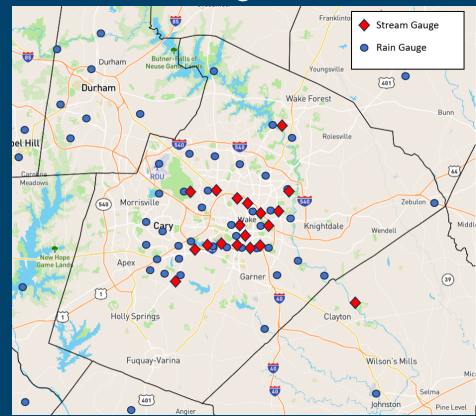
Improved System Planning and Flood Resilience through:

- Historical Flood and Rainfall Data
- Flood and Rainfall Event Reports
- "What if" Scenarios
- Active Flood Control

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FEWS Stream and Rain Gauge Network




Current Network

- 18 Stream Gauges
 - 18 USGS (16 Raleigh)
- 55 Rain Gauges
 - 35 USGS (22 Raleigh)
 - 8 Cary
 - 7 Raleigh Water
 - 5 NWS

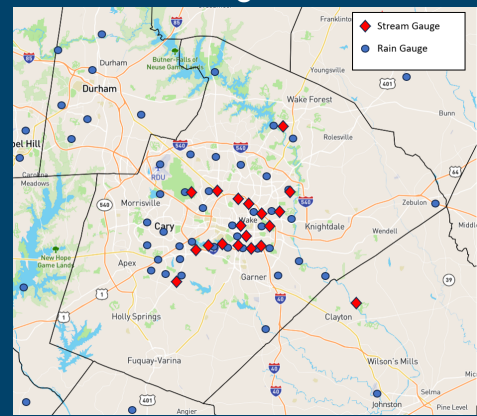
Alert 2 System (Raleigh)

- Radio Frequency Reporting w/ 5-minute updates.

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FEWS Stream and Rain Gauge Network




Gauge Update:

- Raleigh adding
 - 11 USGS Steam
 - 9 USGS Rain
- Wake County adding
 - 10 Lake Level

Data Update:

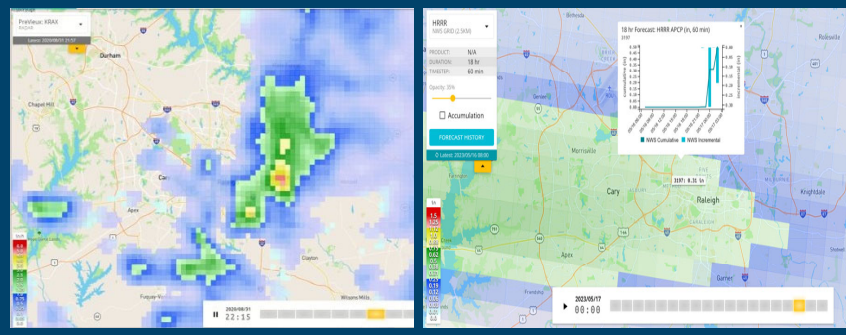
- Moving to cellular
- Back up data systems
- Future satellite back-up reporting

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Flood Early Warning System (FEWS) Software

Radar, Forecasted Radar, and Weather Models



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Flood Early Warning System (FEWS) Software

Raleigh

Radar, Forecasted Radar, and Weather Models

Update:

- Adding Weather Models
 - GFS (7+ days)
 - Euro (7+ days)

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Gauge Adjusted Radar Rainfall (GARR)

Raleigh

- With Gauge Adjusted Radar Rainfall (GARR) we can more accurately estimate rainfall in areas we don't have gauges.

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Flood Early Warning System (FEWS) Software

Raleigh

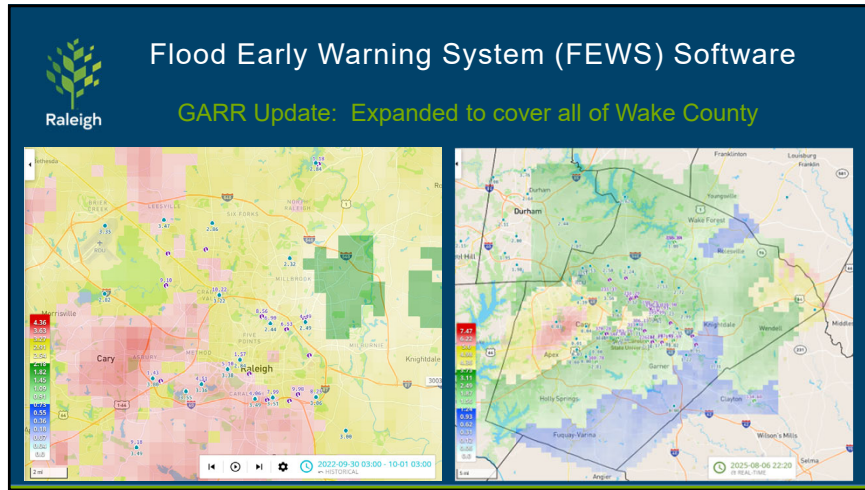
Before and After (GARR)

11

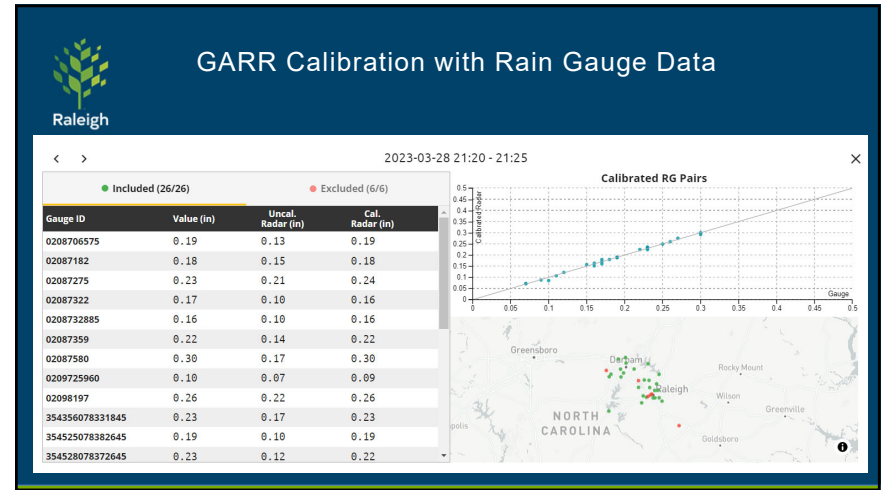
Gauge Adjusted Radar Rainfall (GARR)

Raleigh

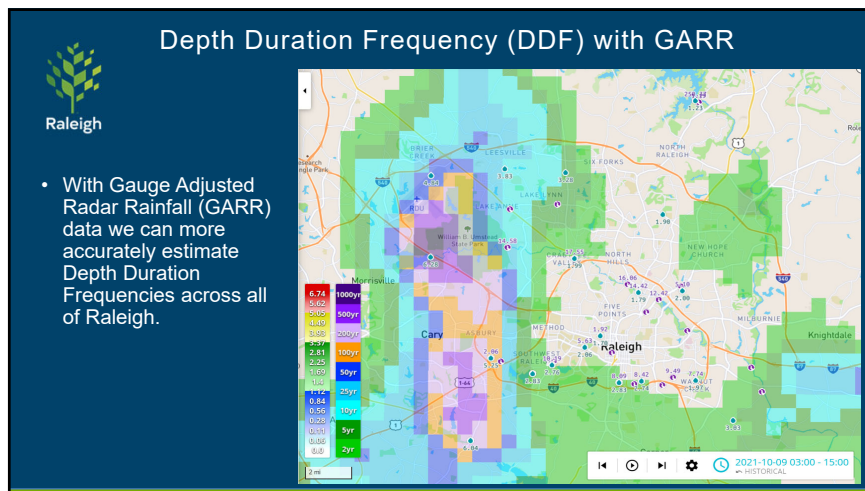
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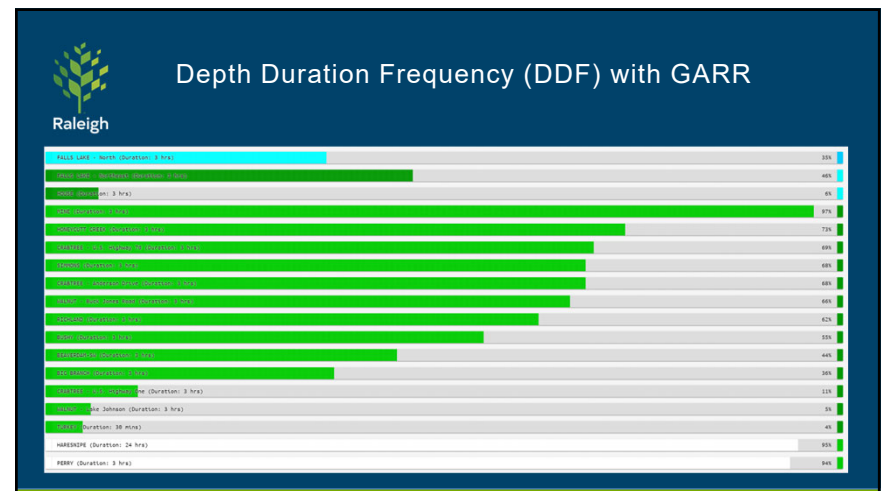
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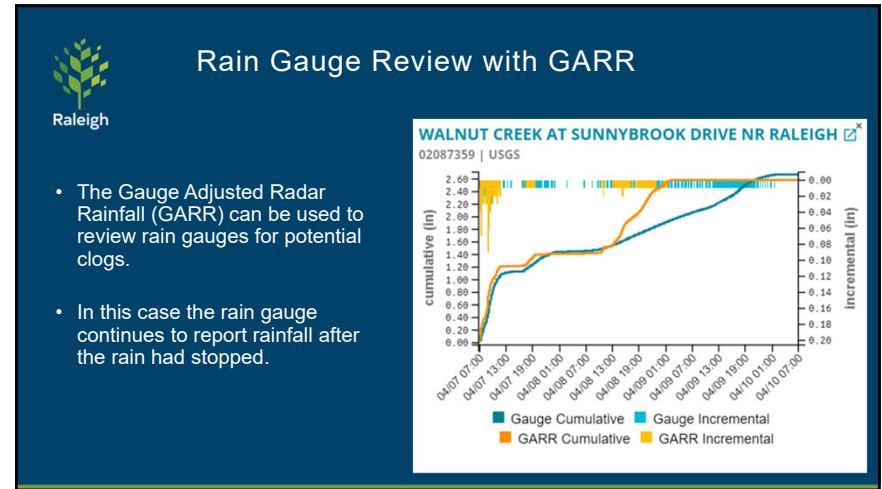
Rain Gauge Data



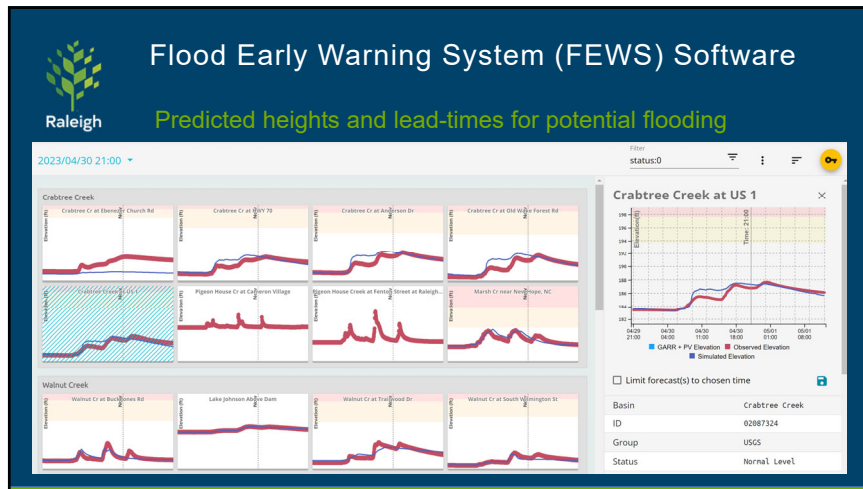
2026/05/26 15:51

Description	Network	ID	1 hr (in)	6 hrs (in)	24 hrs (in)	48 hrs (in)	72 hrs (in)	Filtered	Rate
Sanford Lee County Regional Airport	NWS-AGOS	MTA	0.04	0.21	0.75	1.01	1.01	2026/05/26 15:00	2026/05/26 15:00
FALLS LAKE ABOVE DAM NR FALLS	USGS	02087182	0.00	0.01	0.05	0.31	0.31	2026/05/26 15:30	2026/05/26 15:30
CRABTREE CREEK AT HWY 70 AT RALEIGH	USGS	02087275	0.00	0.00	0.20	0.50	0.50	2026/05/26 15:40	2026/05/26 15:40
CRABTREE CR AT OLD WILKE FOREST RD AT RALEIGH	USGS	02087322	0.00	0.00	0.03	0.28	0.29	2026/05/26 15:40	2026/05/26 15:40
WALNUT CREEK AT SUNNYBROOK DRIVE NR RALEIGH	USGS	02087359	0.00	0.04	0.05	0.25	0.25	2026/05/26 15:40	2026/05/26 15:40
SWIFT CREEK NEAR APEX	USGS	02087580	0.00	0.00	0.04	0.27	0.27	2026/05/26 15:35	2026/05/26 15:35
B. EVERETT JORDAN LAKE AT DAM NR MONCURE	USGS	02098197	0.00	0.00	0.29	0.62	0.63	2026/05/26 15:15	2026/05/26 15:15
BEAVERDAM CREEK AT DAM NEAR CREEDMOOR	USGS	0208706575	0.00	0.00	0.24	0.53	0.53	2026/05/26 15:30	2026/05/26 15:30
MARSH CREEK NEAR NEW HOPE	USGS	020873885	0.00	0.00	0.04	0.31	0.31	2026/05/26 15:40	2026/05/26 15:40
ROCKY BRANCH BELOW PULLEN DRIVE AT RALEIGH	USGS	020873512	0.00	0.00	0.08	0.53	1.91	2026/05/26 15:40	2026/05/26 15:40
THIRD FORK CREEK AT ML KING PARKWAY AT DURHAM	USGS	0209725960	0.00	0.00	0.00	0.08	0.13	2026/05/26 15:35	2026/05/26 15:35
RAINGAUGE AT FIRE STATION 26 NR RALEIGH	USGS	354356078331845	0.00	0.00	0.02	0.03	0.07	2026/05/26 15:40	2026/05/26 15:40
RAINGAUGE AT WALNUT CR 5 WILMINGTON ST AT RALEIGH	USGS	354525078382645	0.00	0.00	0.03	0.31	0.31	2026/05/26 15:40	2026/05/26 15:40
RAINGAUGE AT WALNUT CR SOUTH STATE ST AT RALEIGH	USGS	354528078372645	0.00	0.00	0.02	0.25	0.25	2026/05/26 15:40	2026/05/26 15:40
RAINGAUGE AT WALNUT CREEK AT ROSE LANE RALEIGH	USGS	354537078360045	0.00	0.00	0.02	0.20	0.20	2026/05/26 15:40	2026/05/26 15:40

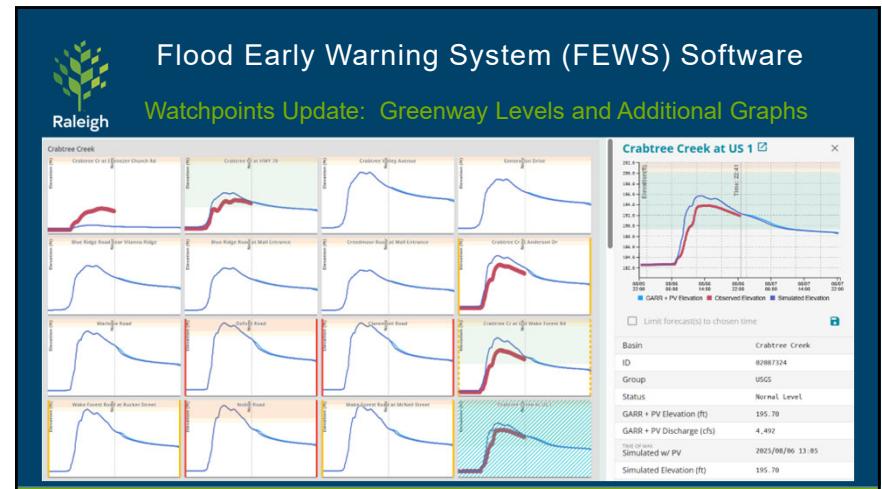
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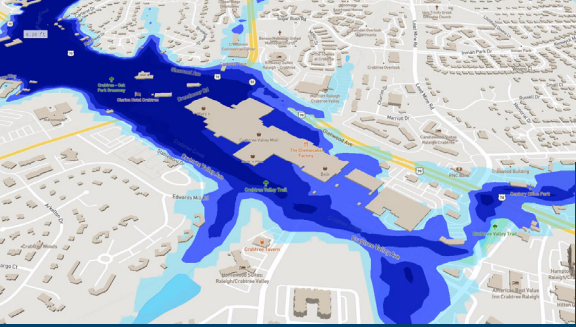
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Raleigh's Flood Early Warning System and Active Flood Control Program




Predictive Inundation Mapping

- Produced in real-time and based on current estimates of GARR
- Has high resolution with individual hydrographs produced for each grid cell



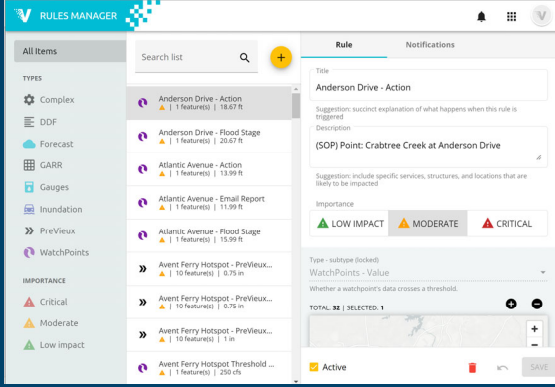
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Flood Early Warning System (FEWS) Software

Alerts and Notifications

- DDF
- Forecast
- GARR
- Gauge
- Inundation
- PreViewx
- Watch Points

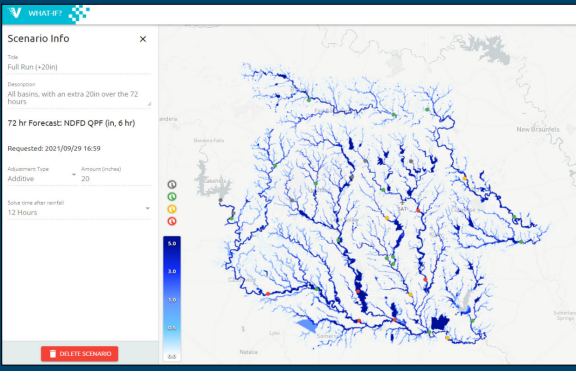


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"What if" Technology

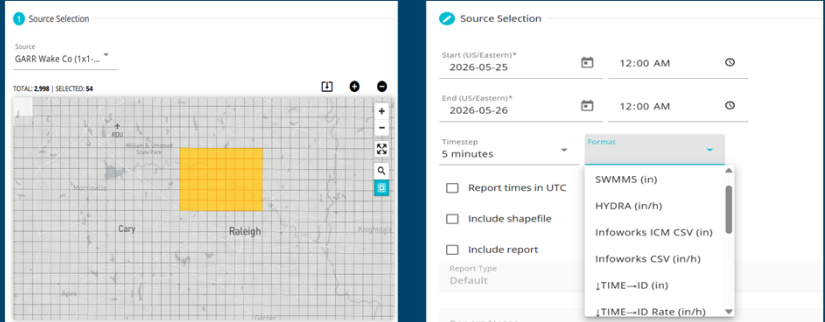
- Application to create & test hypothetical rain events relevant to operational & emergency management



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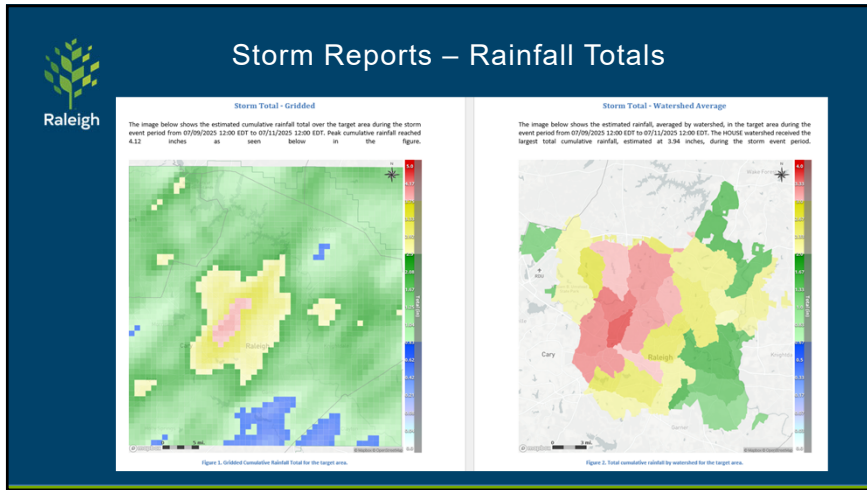


Data Downloads

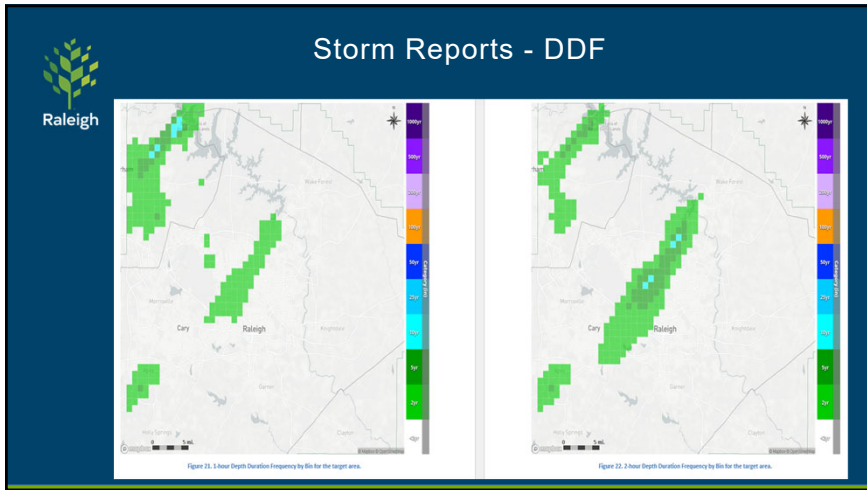


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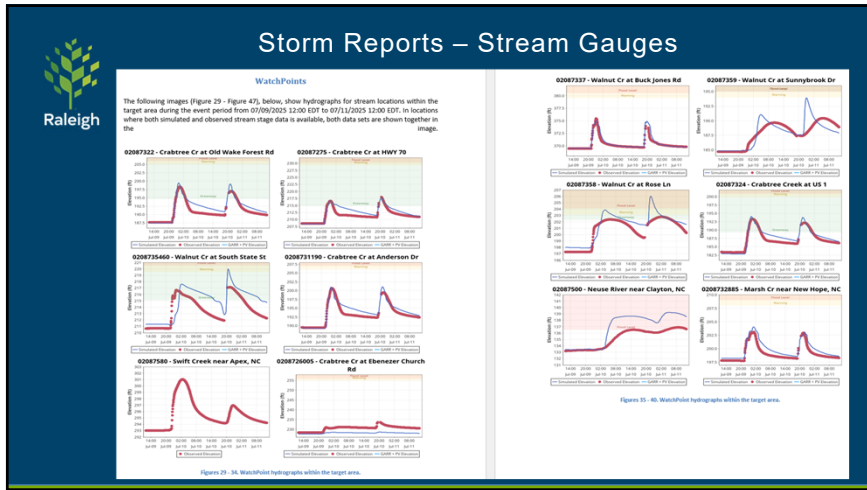
Raleigh's Flood Early Warning System and Active Flood Control Program



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Flood Warning Signs

- 9 sensor/signs systems (roadways)
- 1 sensor only (facility)
- Automated flood warning
- Push notifications (Text/Email)
- Partner with **RDOT**
- **Update:**
 - Gate system at Union Station

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Cameras Supporting Flood Monitoring

Raleigh

21 Flood Cameras
275 Traffic Cameras

- View from the Office or PC
- View Street & Stream Flooding
- Partner with **RDOT**
- Update:
 - 12 more Flood Cameras to install

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Cameras Supporting Flood Monitoring

Raleigh

20 Cellular/Solar Cameras

- Install these anywhere
- View on a Smartphone or PC
- View Street & Stream Flooding
- Partner with **Parks Department (Greenways)**

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Flood Control through Active Lake Level Management

Raleigh

- Remote control of gate
- Tool for storm preparation
- Cellular or option of NOAA Weather alert activated
- Siren and flashing warning light for safety when valve is opened
- Connected to AC power but also solar capable
- Water level sensor
- Partner with **Parks Department**

Lake Johnson Pilot Project

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Lowering Lake Johnson (Hurricane Ian)

Raleigh

Lake Johnson

Lake or reservoir water surface elevation above NAVD 1988, feet
Most recent instantaneous value: 343.14 10-03-2022 12:55 EDT


Date	Elevation (feet)
Sep 26 2022	343.5
Sep 27 2022	343.5
Sep 28 2022	343.5
Sep 29 2022	343.5
Sep 30 2022	343.5
Sep 31 2022	343.5
Oct 01 2022	338.5
Oct 02 2022	338.5
Oct 03 2022	343.14

Rose Lane

Rose Lane Stage Comparison (02087358)

Date	No Drawdown Scenario (feet)	Drawdown Scenario (feet)
Oct 01 2022	180	180
Oct 02 2022	260	240
Oct 03 2022	200	180
Oct 04 2022	180	180


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FEWS Current and Future Improvements

- Increased GARR Coverage (Done)
- Greenway Flood Predictions (Done)
- Additional Gauge and Flood Prediction Locations (Done)
- In-Storm Event Reporting (Done)
- Extended Weather Forecasts and Creek Forecasts (7+ days) (Working)
- Public Alerts and Notifications (Working)
- Public Facing Platform (Working)
- Potential Regional Coordination (Working)

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FEWS Project Partners

Internal

- Raleigh IT Dept
- Raleigh Water
- Raleigh Emergency Communications
- Raleigh Emergency Management
- Raleigh Fire
- Raleigh Parks and Rec

External


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Questions / Discussion

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