Mecklenburg County, NC

Mecklenburg County includes the City of Charlotte and the towns of Cornelius, Davidson, Huntersville, Matthews, Mint Hill, and Pineville (8 NFIP Communities)
Mecklenburg County Over 4 Phases

- Deliver of Non-Regulatory Products
  - PMR 1 – 2 are complete
  - PMR 3 to be delivered soon
  - PMR 4 - TBD
Charlotte-Mecklenburg – A Community At Risk

- More than 4,500 homes and businesses in the floodplain
- Many built before floodplain mapping and floodplain construction regulations
- More than 45 significant events in the past century with at least 20 known deaths and more than $80M in property damage
Flooding History Since 2000

- 2003: $5M losses, 60 avoided
- 2004: Frances, $1.5M losses along Catawba River
- 2005, 2006 (2 floods)
- 2008: 300 buildings flooded, 150 avoided
- 2011: 160 impacted, 100 avoided, 2 deaths
- 2013: 15 major damage, 20 avoided, 8 elevated
Purpose of the Plan

- Recommend specific flood mitigation techniques at a building level
- Assist in planning and prioritizing future mitigation projects
- Use a dynamic and holistic, risk-based approach
What’s Unique About This Plan

- Determine Individualized Flood Risk
- Develop Public & Private Risk Reduction Actions
- Prioritize Flood Mitigation Projects
- Implement Balanced Flood Mitigation Capital Program
Datasets used in the Plan

- Floodplains/Floodways
- Multi-frequency floodzones
- Water surface/depth grids
- High velocity zones
- Elevation Certificates
- Tax, building, & parcel data
- Aerial & Ortho photos
- Local planning data
- Storm drain inventory
Flood Risk Factors

- Finished Floor Elevation (living space)
- Frequency of flooding
- Location within the floodplain (including velocity zones)
- Critical Facility
- Mechanical and electrical systems
- Vehicles
- Ingress/egress from the building and property
- Exterior improvements (detached garages, sheds, pools, etc.)
- Number of dwelling units impacted
19 Mitigation Techniques

1. Acquisition and Demolition
2. Demolition and Rebuild
3. Acquisition and Relocation
4. Acquisition, Demolition/ Relocation, and partial Re-sale
5. Structure Elevation
6. Abandon Basement and Fill
7. Full Dry Floodproofing
8. Full Wet Floodproofing
9. Audible Flood Warning System
10. Storm Water Detention Facilities
11. Storm Water System Control
12. Automated Flood Notifications
13. Public Education
14. Flood Insurance
15. Levee/Floodwall
16. Protecting Service Equipment
17. Partial Dry Floodproofing
18. Partial Wet Floodproofing
19. Ring Levee/Wall/Berm
The RARRT is an ArcGIS extension that automates the evaluation of flood prone properties in Mecklenburg County.
The RAART uses a system of scoring property impacts from several different flood frequencies as well as a location based factor to arrive at a flood risk property score.
### RAART – Flood Impact and Probability

#### Flood Impact + Probability

- **Flood Impact**
- **Location Multiplier**
- **Flood Risk Property Score**

#### Table of Flood Impact and Probability

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>PROPERTY FLOOD IMPACTS</th>
<th>BASE POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Flooding above the lowest finished floor of a building</td>
<td>2800</td>
</tr>
<tr>
<td>B</td>
<td>Flooding of electrical and/or mechanical equipment</td>
<td>1200</td>
</tr>
<tr>
<td>C</td>
<td>Flood water is touching a portion of the building</td>
<td>1000</td>
</tr>
<tr>
<td>D</td>
<td>Property is completely surrounded by flood water (ingress/egress off of flooded property)</td>
<td>1100</td>
</tr>
<tr>
<td>E</td>
<td>Structure is completely surrounded by flood water (ingress/egress from building)</td>
<td>500</td>
</tr>
<tr>
<td>F</td>
<td>Structure is completely surrounded by flood water AND in a critical facility</td>
<td>2700</td>
</tr>
<tr>
<td>G</td>
<td>Structure is completely surrounded by flood water AND is multi-family residential (additional people, vehicles)</td>
<td>1400</td>
</tr>
<tr>
<td>H</td>
<td>Flood water is touching a portion of the building AND has structural damage as a result of cumulative flooding</td>
<td>2000</td>
</tr>
<tr>
<td>I1*</td>
<td>Flooding of SIGNIFICANT exterior property improvements which are deemed functional necessities to reasonable use of single family residential property</td>
<td>600</td>
</tr>
<tr>
<td>I2*</td>
<td>Flooding of MODERATE exterior property improvements which are deemed functional necessities to reasonable use of single family residential property</td>
<td>300</td>
</tr>
<tr>
<td>J</td>
<td>Flooding around area where single-family residential vehicles are typically parked</td>
<td>600</td>
</tr>
<tr>
<td>K</td>
<td>Flooding of any yard</td>
<td>30</td>
</tr>
</tbody>
</table>

25 Years Charlotte-Mecklenburg Stormwater Services
RAART – Location Multiplier

<table>
<thead>
<tr>
<th>Column Header</th>
<th>Multiplier</th>
</tr>
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<tbody>
<tr>
<td>Building located in high danger depth-velocity zone</td>
<td>1.5</td>
</tr>
<tr>
<td>Building located in medium danger depth-velocity zone</td>
<td>1.3</td>
</tr>
<tr>
<td>Building located near area impacted by overland flow path areas</td>
<td>1.3</td>
</tr>
<tr>
<td>Building located Floodway</td>
<td>1.1</td>
</tr>
</tbody>
</table>
### Table 3: Flood Risk Point Scheme

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Base Points</th>
<th>Storm Event Annual Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>50% (2-year)</td>
</tr>
<tr>
<td>A</td>
<td>2800</td>
<td>1400</td>
</tr>
<tr>
<td>B</td>
<td>1200</td>
<td>600</td>
</tr>
<tr>
<td>C</td>
<td>1000</td>
<td>500</td>
</tr>
<tr>
<td>D</td>
<td>1100</td>
<td>550</td>
</tr>
<tr>
<td>E</td>
<td>500</td>
<td>250</td>
</tr>
<tr>
<td>F</td>
<td>2700</td>
<td>1350</td>
</tr>
<tr>
<td>G</td>
<td>N/A</td>
<td>(½ B score + E score) x [units-1]</td>
</tr>
<tr>
<td>G#</td>
<td>N/A</td>
<td>[# units]</td>
</tr>
<tr>
<td>H</td>
<td>2000</td>
<td>1000</td>
</tr>
<tr>
<td>I1</td>
<td>600</td>
<td>N/A</td>
</tr>
<tr>
<td>I2</td>
<td>300</td>
<td>N/A</td>
</tr>
<tr>
<td>J</td>
<td>600</td>
<td>N/A</td>
</tr>
<tr>
<td>K</td>
<td>30</td>
<td>15</td>
</tr>
</tbody>
</table>
RAART – FMDMS Map Viewer
RARRT – Property Specific Risk Score and Management Recommendation
Losses Avoided Tool (LAT)

- Charlotte-Mecklenburg invests a substantial amount of financial resources into projects that are designed to reduce or eliminate future damages from flood events

- Given these investments, it is crucial to
  - Evaluate the cost-effectiveness of completed flood mitigation projects
  - Demonstrate value through cost-effectiveness and the cumulative returns to ensure continued support of flood hazard mitigation
LAT - Measuring the Worth of Mitigation Efforts

- **Total losses avoided over time**
  - Losses avoided for each implementation based on historical floods
  - Cumulative losses avoided updated for new events

- **Return on Investment (ROI)**
  - ROI = total losses avoided divided by implementation cost
  - ROI updated for new events
LAT – Data Needs

- **Building values at the time of the event**
  - Building replacement value lookups
    - Can be imported from RARRT
  - Displacement cost per sq.ft.
  - Emergency responder cost

- **Mitigation Implementation**
  - Updated as new mitigations occur

- **Water Surface Elevation Rasters**
  - 2, 10, 25, 50 and 100 Year Events

- **Vehicle Parking Locations**

- **Property Improvements**

- **Parcel Data**

- **Event Specific High Water Marks**
  - Guidance for HWM locations prepared ahead of time so crews know where to go when an event occurs
Utilize High Water Marks and modeled WSEL rasters to estimate return interval

Return interval then used to estimate elevation

Estimated WSEL for 9/2004 event was 607.93ft
LAT - Depth of Flooding for 9/2004 Event

- Estimated WSEL of 607.93
- Pre-mitigation finished floor elevation of 605.1
- This structure would have been flooded to 2.83 feet if it had been present during the 9/2004 event
LAT - Using WSEL and FFE Losses are Estimated (09/04 Event)

- Building Losses
  - $66,000
- Crawlspace Losses
  - $19,500
- Content Losses
  - $19,350
- Vehicle Losses
  - $10,400
- Property Improvement Losses
  - $7,800
- Displacement Losses
  - $15,500
- Emergency Responder Losses
  - $5000

- Rental Income
  - $2,0000
- Total Losses Avoided Sept, 2004 Event = $145,550
- Second Event in August, 2008 = $73,400

Return on Investment
- Project costs for acquisition = $173,827
- Return on Investment = Losses Avoided / Total Project Cost
  - ROI = $218,950 / $173,827 = 1.26
Potential future buyouts ~750 buildings
Flood Mitigation History

- **INVESTMENT/COST (ACT)**
- **FUTURE LOSSES AVOIDED (EST)**

---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---
36 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
75 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
12 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
13 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
1 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
5 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
5 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
11 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
27 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
42 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
22 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
12 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
15 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
16 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M
33 Buildings | $1M | $2M | $3M | $5M | $8M | $12M | $16M | $27M | $28M | $29M | $30M | $31M | $32M | $33M | $34M | $35M

**25 YEARS**

*Charlotte-Mecklenburg Stormwater Services*
DHS S&T Community Survey

- Share Charlotte-Mecklenburg Concepts and Methodologies
- Collect information about available data and potentially drive funding toward needed data collection efforts
- Better define existing mitigation strategies throughout the U.S.
- Provide context for community mitigation strategies
- Survey located at: Managefloodrisk.org
Response has been very positive...

- Don’t allow your state to be under-represented – Almost 800 responses
- Idaho, Wyoming, Utah and Alaska – We would love to hear from you...
- Please take a reminder card – Survey closes September 12, 2018
Keys to RARR Plan Success

- Quality data
- Active involvement from stakeholders
- Holistic approach to mitigation
  - Define “flood risk” for your community
  - Other important community factors
  - Capitalize on multi-objective projects to achieve other public benefits
  - Opportunities to group properties
- Ability to communicate community scale risk, cost and decision making