Stormwater Management
within the City of Ann Arbor

by the Systems Planning Unit

City of Ann Arbor, Michigan

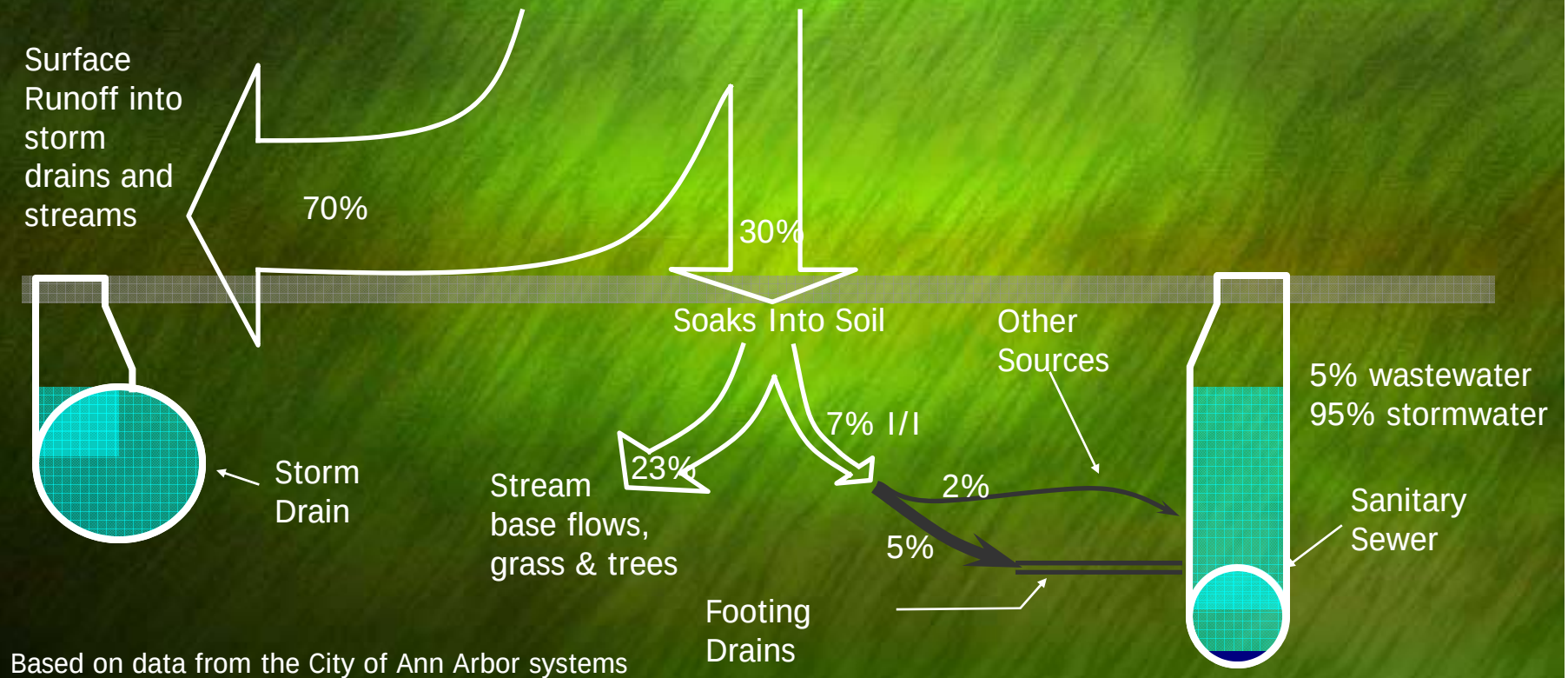
Timing / Purpose

- Recent heavy rain events
- Stormwater concerns raised to City Council
- Upcoming stormwater policy issues

Stormwater vs. Wastewater

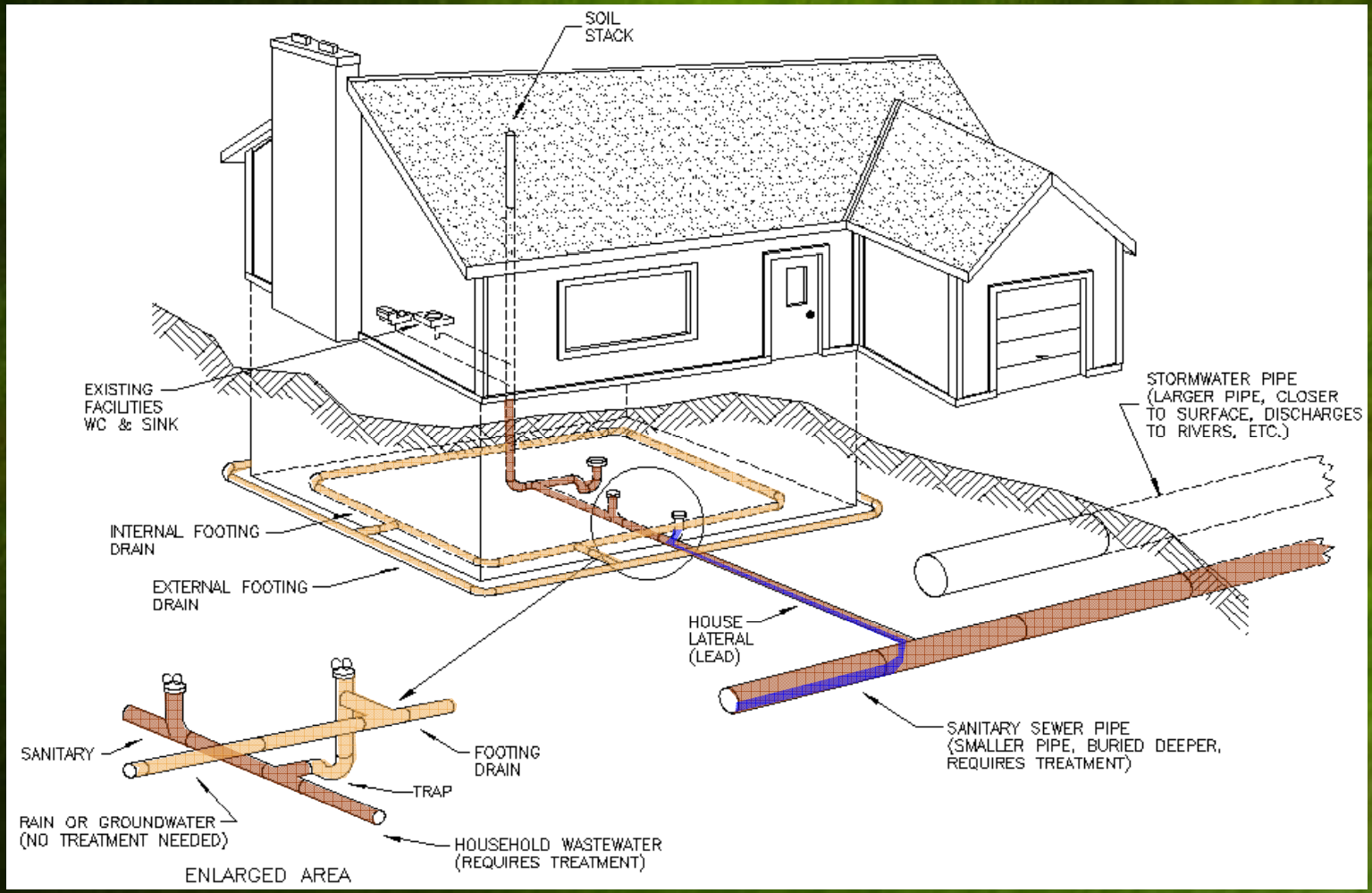
- Combined vs. Separated Systems
- City has a separated system
- Stormwater goes ultimately to river
  - Most of it untreated
- Sanitary goes directly to WWTP
- Footing Drain Flow

Where Does the Rain Go?

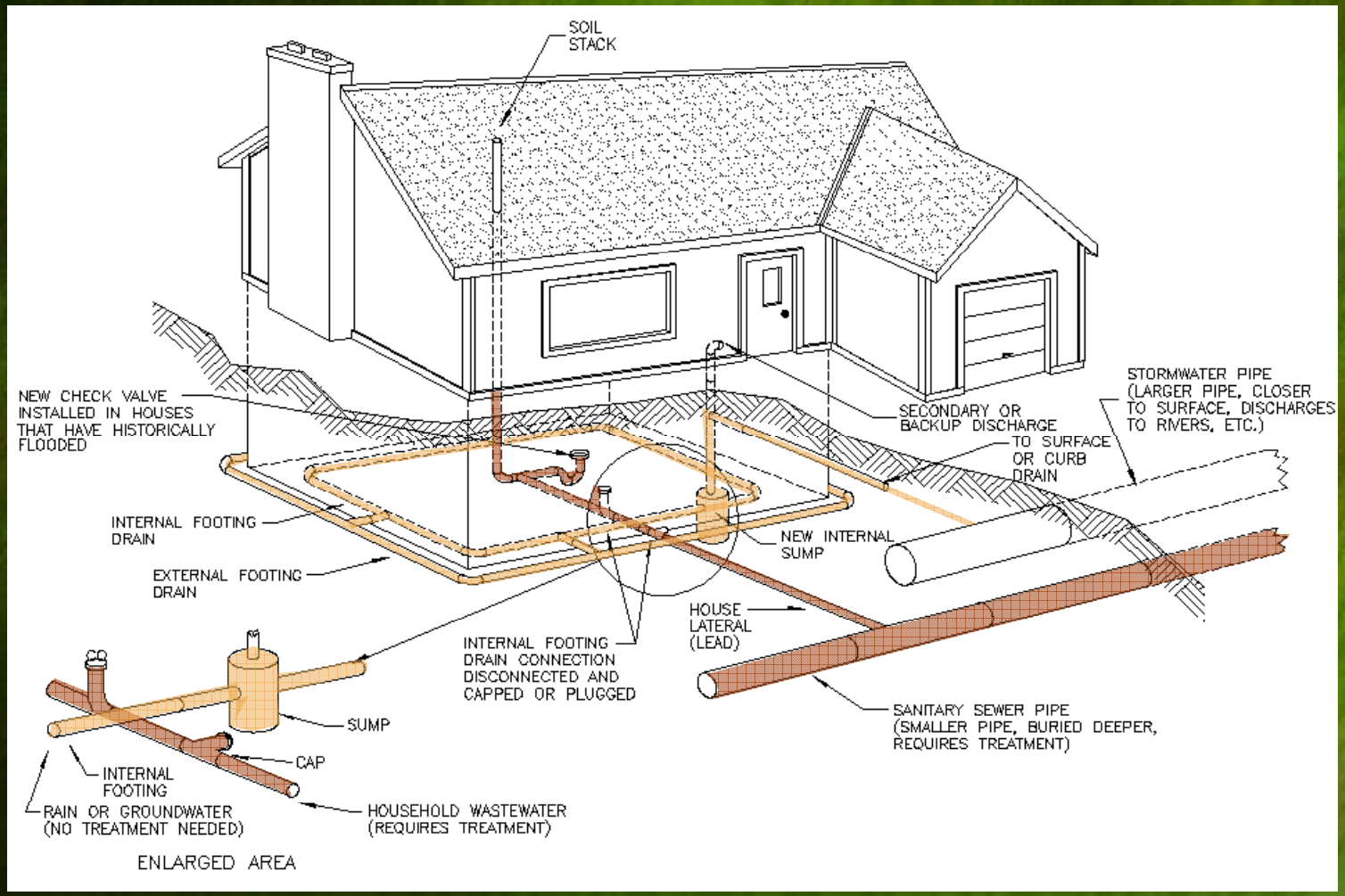


Based on data from the City of Ann Arbor systems

Connected Footing Drain Disconnection

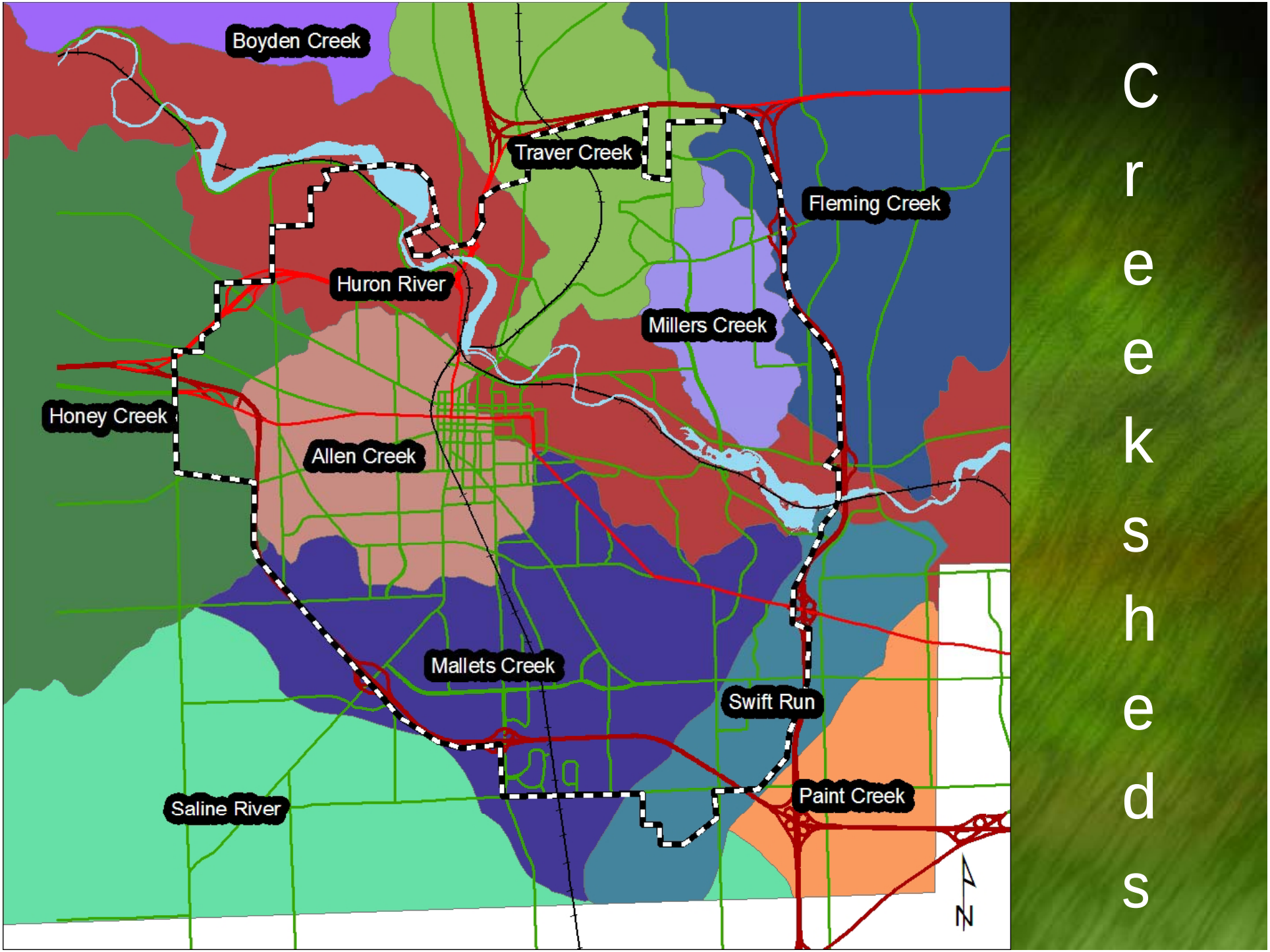


Construction with Internal Sump



Stormwater Runoff Rate affected by:

- Impervious area
- Land cover
- Soil type
- Soil saturation and slope
- Size of storm (Intensity and duration)
- Variability/uniqueness/distribution of storm event across the City


Boyden Creek
Traver Creek
Fleming Creek
Huron River
Millers Creek
Honey Creek
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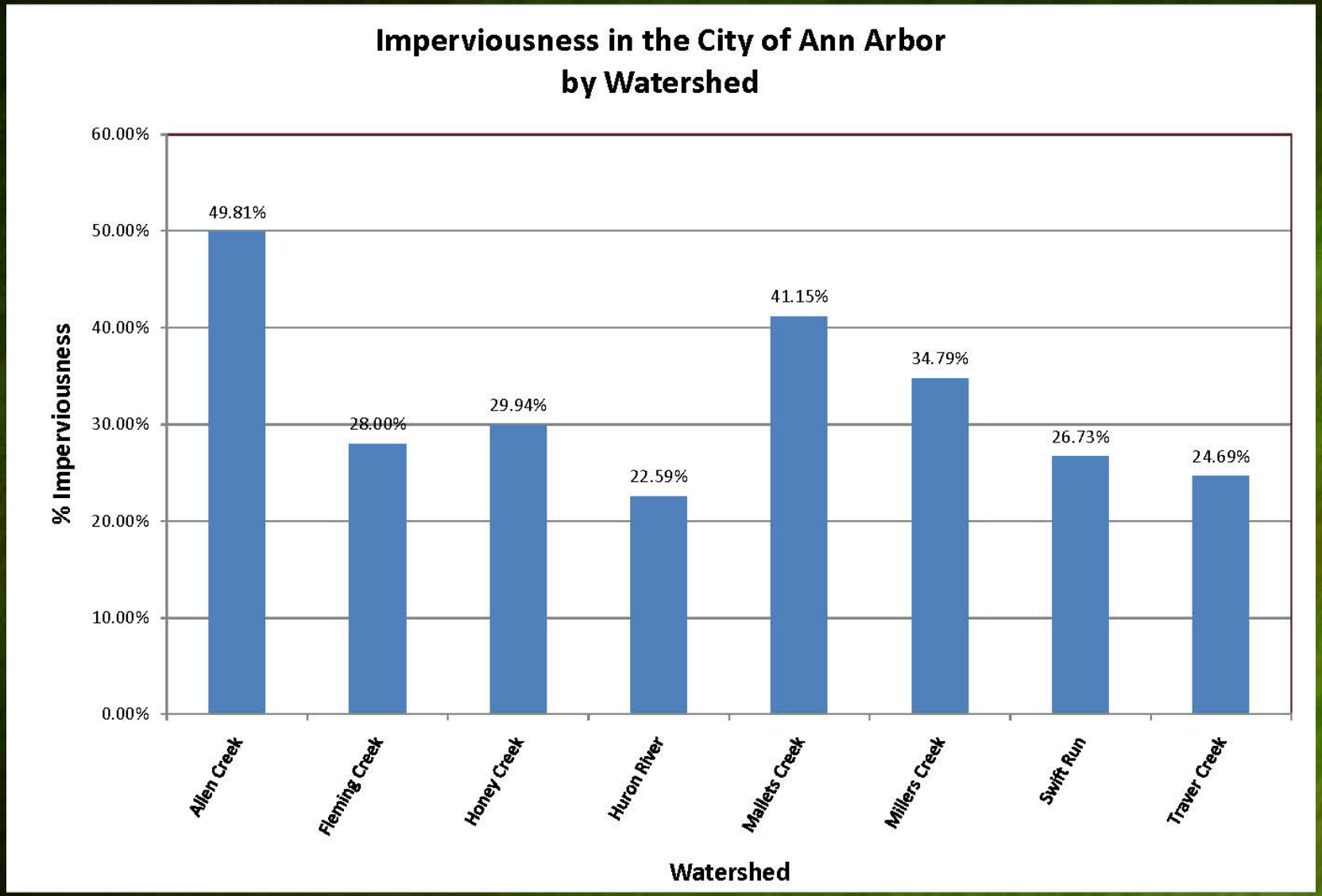
Paint Creek
Saline River
N
Creeksheds

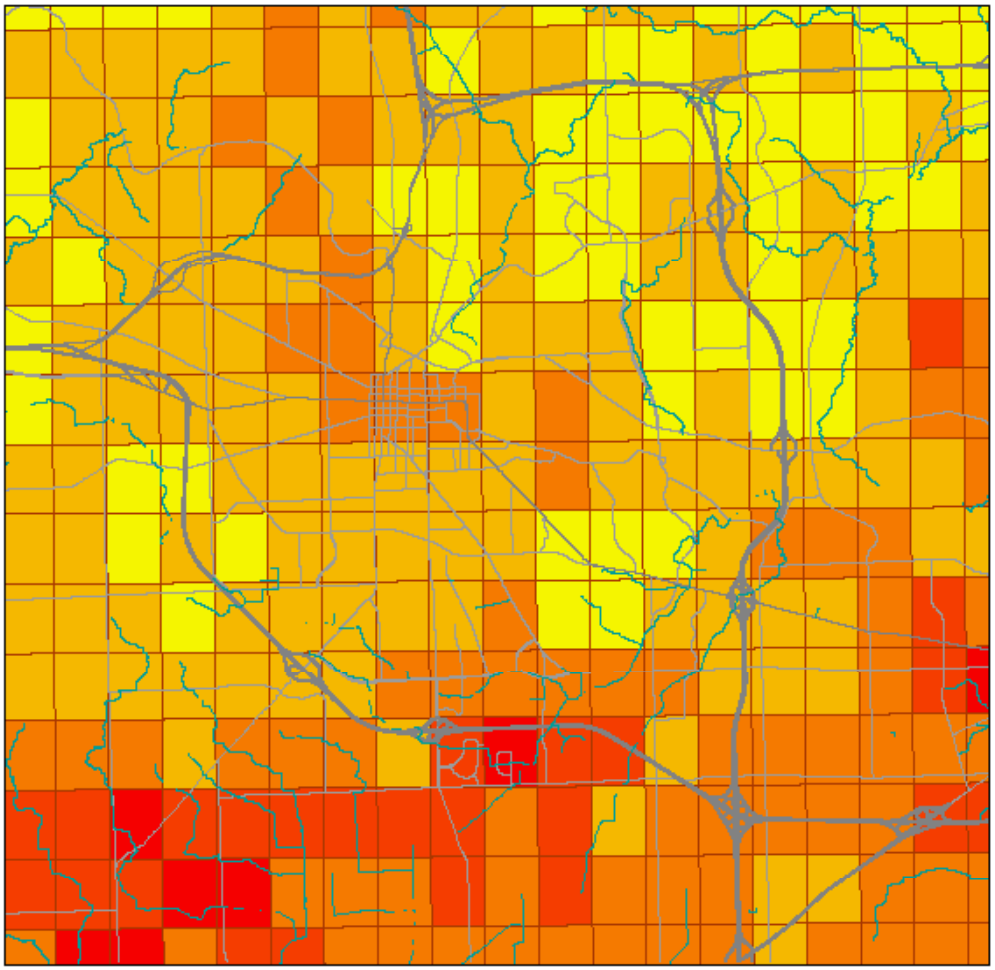
Impervious by Creekshed



Stream degradation begins at when only 8% of the watershed is impervious.

City of Ann Arbor, Michigan

June 5-6, 2010 Storm Event
Radar Rainfall Data*

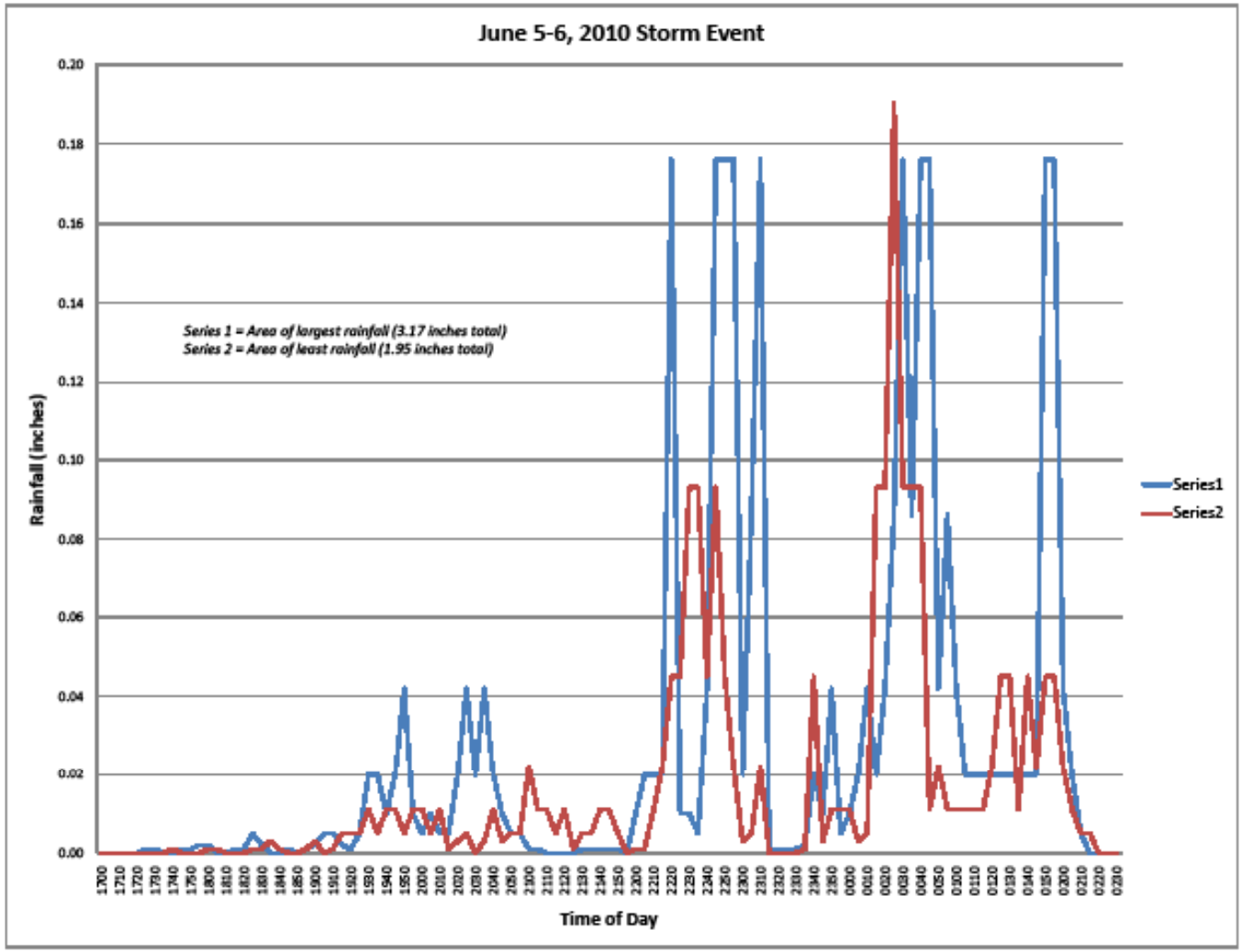


Rainfall Total (in)

- 1.95 - 2.25
- 2.26 - 2.50
- 2.51 - 2.75
- 2.76 - 3.00
- 3.01 - 3.17

* Rainfall Total Shown is for Duration of Storm Event (5:00 p.m. to 2:30 a.m.)

Radar Data Obtained From OneRain, Inc.
1 km x 1 km Pixel Data

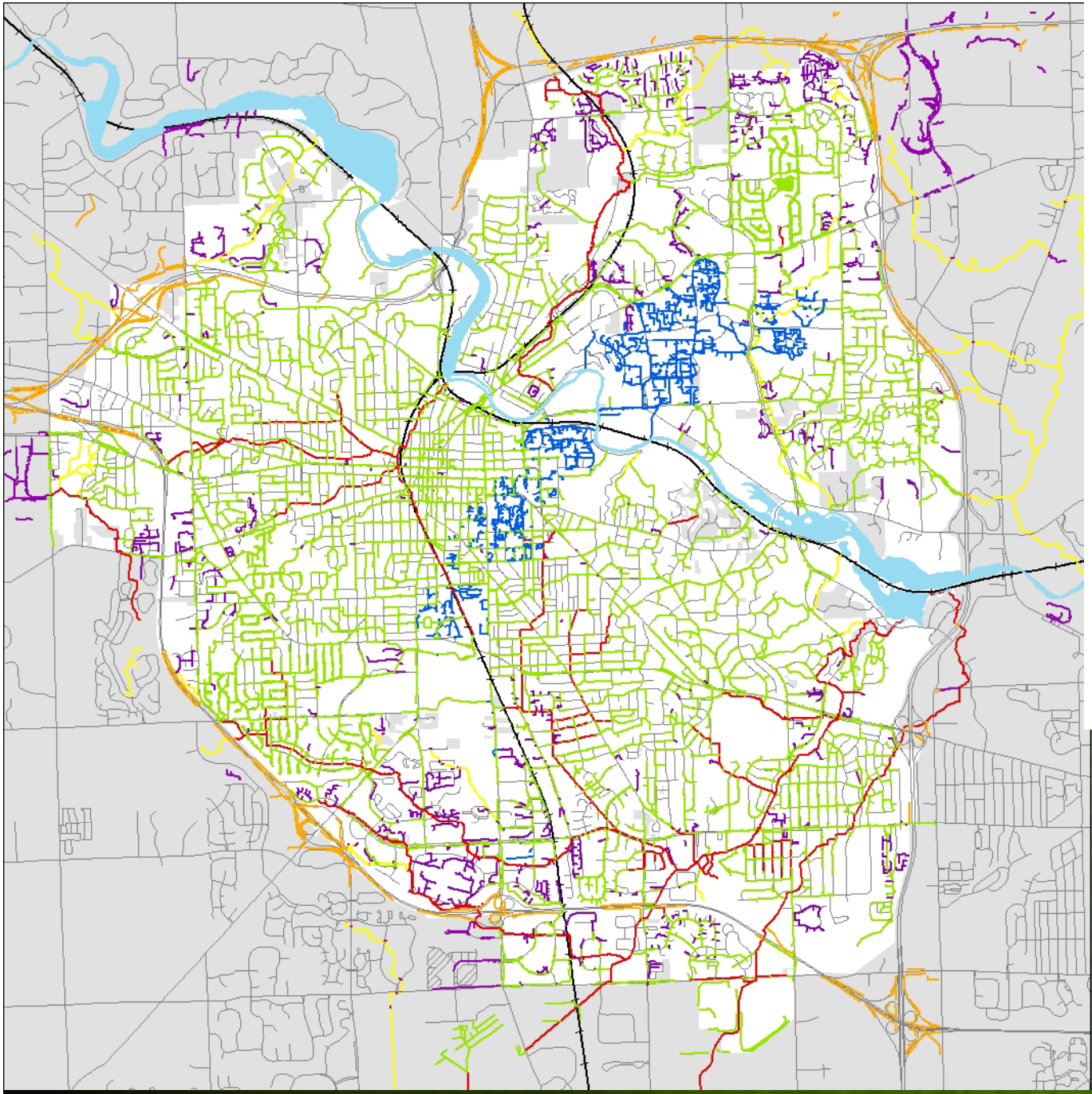

June 5-6, 2010 Storm Event
Series 1 = Area of largest rainfall (3.17 inches total)
Series 2 = Area of least rainfall (1.95 inches total)
Rainfall (inches)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1700 1710 1720 1730 1740 1750 1800 1810 1820 1830 1840 1850 1900 1910 1920 1930 1940 1950 2000 2010 2020 2030 2040 2050 2100 2110 2120 2130 2140 2150 2200 2210 2220 2230 2240 2250 2300 2310 2320 2330 2340 2350 0000 0010 0020 0030 0040 0050 0100 0110 0120 0130 0140 0150 0200 0210 0220 0230
Time of Day
Series1
Series2

Components of Stormwater Management Systems

- Streets (incl. curb and gutter, street pavement, street trees)
- Pipes & Inlets
- Ditches & Creeks
- Wetlands
- Lakes
- Trees

Components of Stormwater Management Systems cont.

- In-line storage (e.g., Mary Beth Doyle Park)
- Offline storage (typical detention basin)
- Water quality units (swirl concentrators)
- Infiltration (permeable pavement)
- Low Impact Development practices (rain barrels, rain gardens, green roofs, trees, etc.)



Legend

- Rivers, Lakes & Ponds
- Street

Boundary

- Outside of City of Ann Arbor
- City of Ann Arbor

Storm Network

Ownership

- City
- U of M
- County Drains
- State/Interstate Highways
- Water of the State
- Private

- Not pictured: private property drainage, private detention basins

City of Ann Arbor, Michigan

Stormwater Management Systems

- Storm drains not designed to pass all storms
  - 1980's to current: pipes constructed to pass the 10% annual chance storm (prior was 20% annual chance storm)
  - 1998 Study - $41,000,000 to get Allen Creek to current standards
  - Surcharging into street expected
  - Effect on downstream communities
  - Feasibility

History of Storm Water Regulation

- Pre-1970: No regulation
- 1970: Clean Water Act
  - Point source control
  - Control runoff from large developments during large storm events
- 1979: City Stormwater Ordinance
  - Control the 1% annual chance event
  - Applies to “Site Planned” Development

History of Storm Water Regulation cont.

- 1990s: Clean Water Act reauthorization
  - Changed focus to quantity and quality
  - Municipal Stormwater Permits
- 1998: City Stormwater Ordinance
  - Quality control added
- Current: Low Impact Development (LID)
  - Control stormwater at source instead of at a system level

No Single Drainage Law in Michigan

- **Private property Issue**
- **Tort Law – Court Case History**
- **Riparian Rights**
- **No specific law for City to enforce**
- **Messy**

Overlapping Regulatory Jurisdictions

- **Federal**
  - **Clean Water Act & reauthorizations**
- **State**:
  - **Grants**
  - **Mandates**
    - **Total Maximum Daily Load**
      - **Phosphorous, E. coli, Total Suspended Solids, etc.**
  - **Regulations**
    - **Lakes, Streams, Wetlands and Floodplains**
  - **Michigan Building Code**

Overlapping Regulatory Jurisdictions cont.

- **County**
  - **Rules of the Washtenaw County Water Resources Commissioner**
- **City**
  - **Chapter 63**
    - **Stormwater**
    - **Soil Erosion and Sedimentation Control (SESC)**

Basics of City Stormwater Ordinance

Chapter 63 – Stormwater Management and Soil Erosion and Sedimentation Control

- Part of SESC Ordinance
- Relies on Rules of the Washtenaw County Water Resources Commissioner
- Applies to “site planned projects”
- Establishes maintenance responsibility for the property owner

Stormwater Ordinance Thresholds

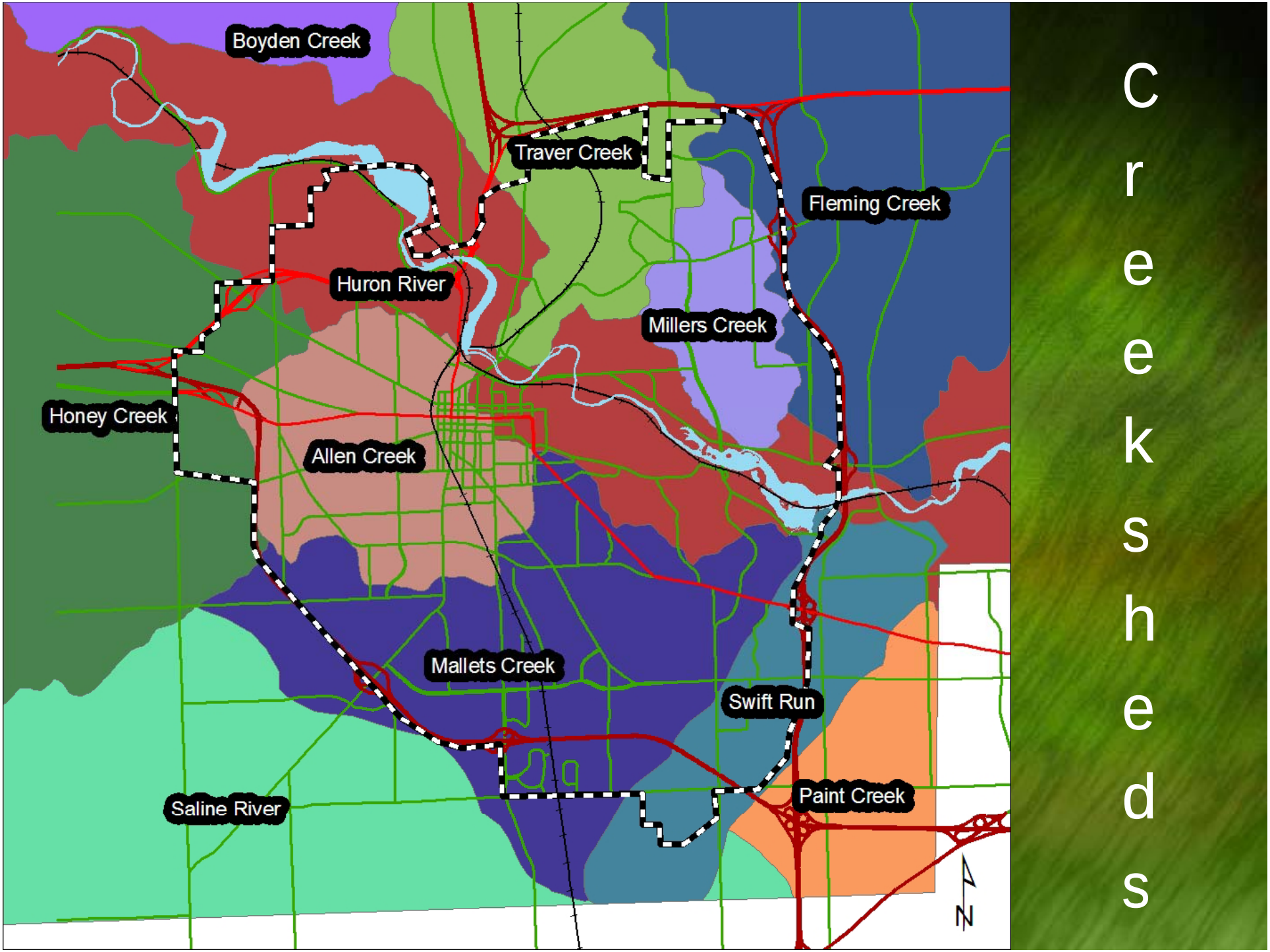
- 5,000 to 10,000 sf of impervious surfaces
  - First Flush
- 10,000 to 15,000 sf of impervious surfaces
  - First Flush
  - Bankfull
- Greater than 15,000 sf of impervious surfaces
  - First Flush
  - Bankfull
  - 1% annual chance event

Regulated Storm Events

- First Flush = Runoff from the first ½ inch of rain
  - 85% of all rain events
  - 90% of pollutant load
- Bankfull – 50% annual chance ~ 2.4” in 24 Hr.
  - Fills a natural channel to the top of the bank.
  - Controls the shape and form of natural channels
- 1% annual chance = 100-year storm ~ 4.7” in 24 Hr.
  - Same event used by FEMA on flood maps

Stormwater Utility

- Formed in early 1980's; updated 2007
- Rates based on Impervious Area
- Revenue can only be used for capital, O&M, permit requirements
  - Regulatory
  - Proportionate to cost of service
  - Property owners able to limit use of service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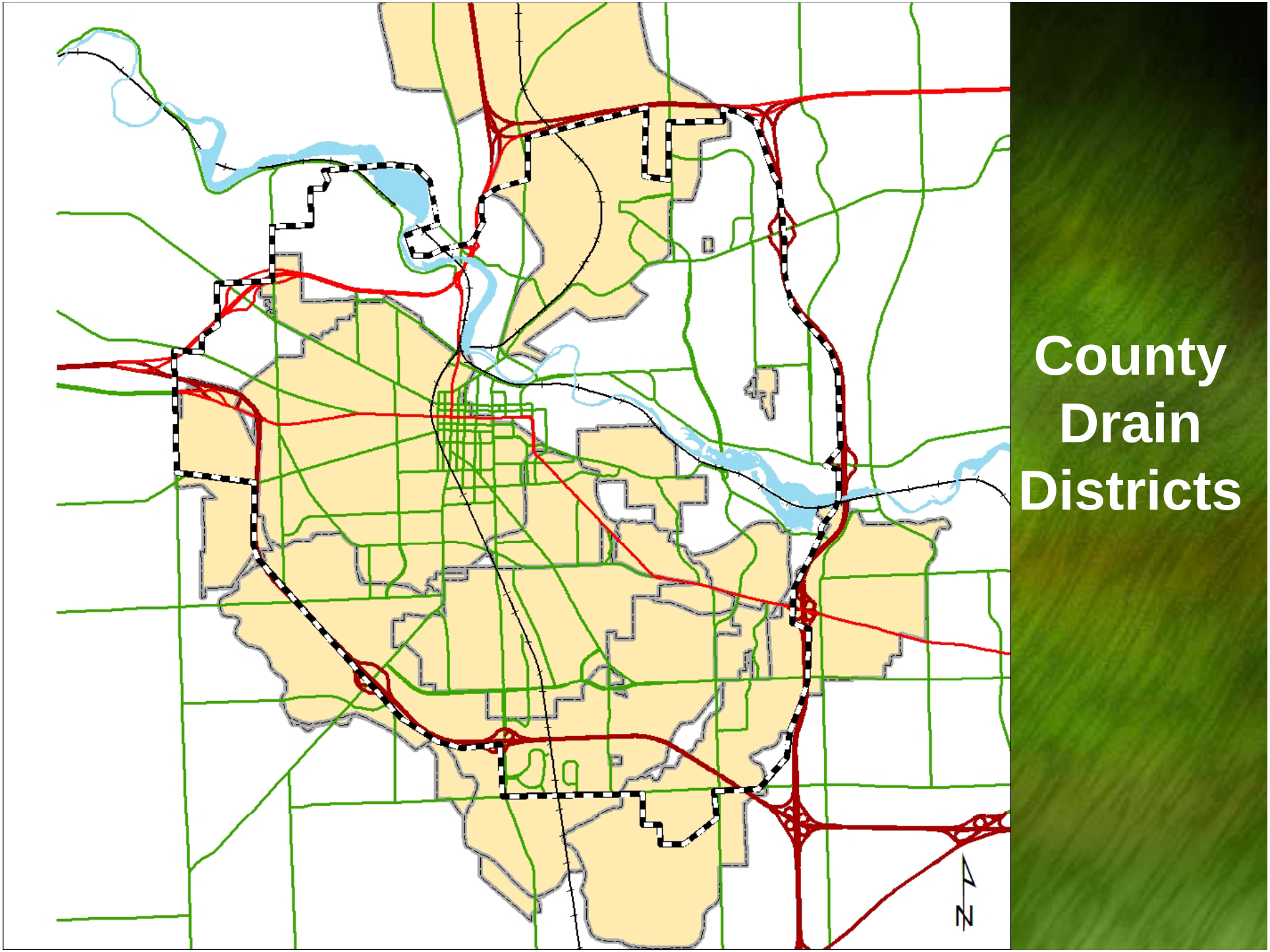

County
Drain
Districts
N

Stakeholders

Active Creekshed Groups

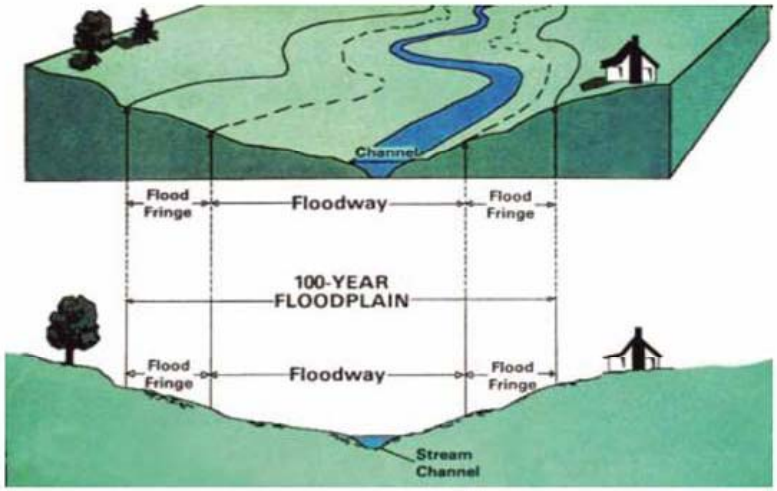
- Malletts Creek Coordinating Committee
- Malletts Creek Association
- Millers Creek Action Team
- Allen's Creek Watershed Group

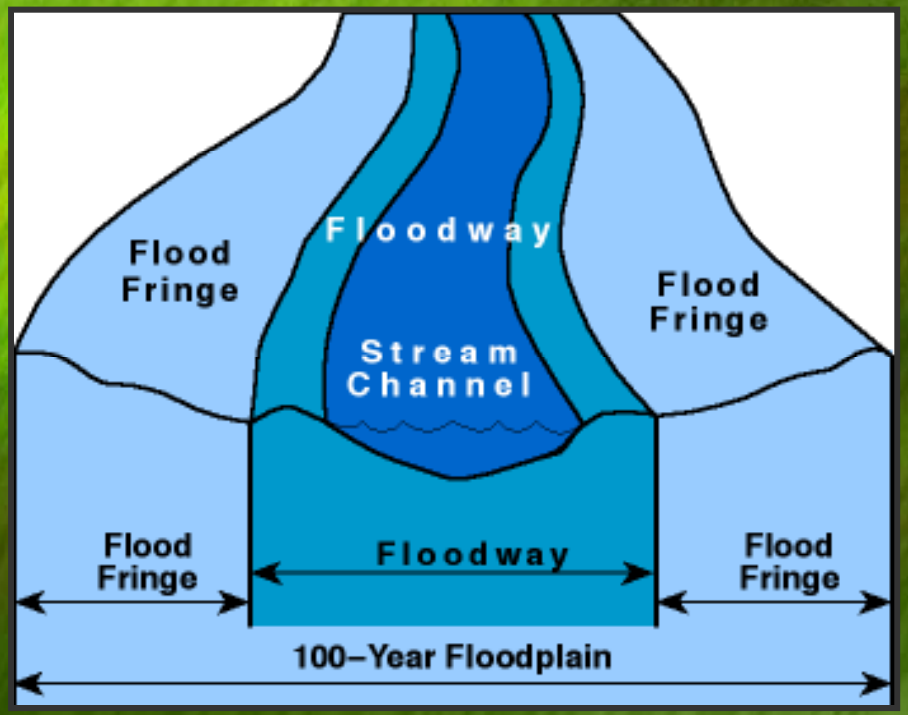
Other Stakeholders

- Washtenaw County Water Recourses Commissioner
  - Drain Districts
- Michigan Department of Natural Resources and Environment
- Huron River Watershed Council
- University of Michigan
- Ann Arbor Public Schools
- Allen Creek Greenway Conservancy
- Areas without drain districts

What is a Floodplain?

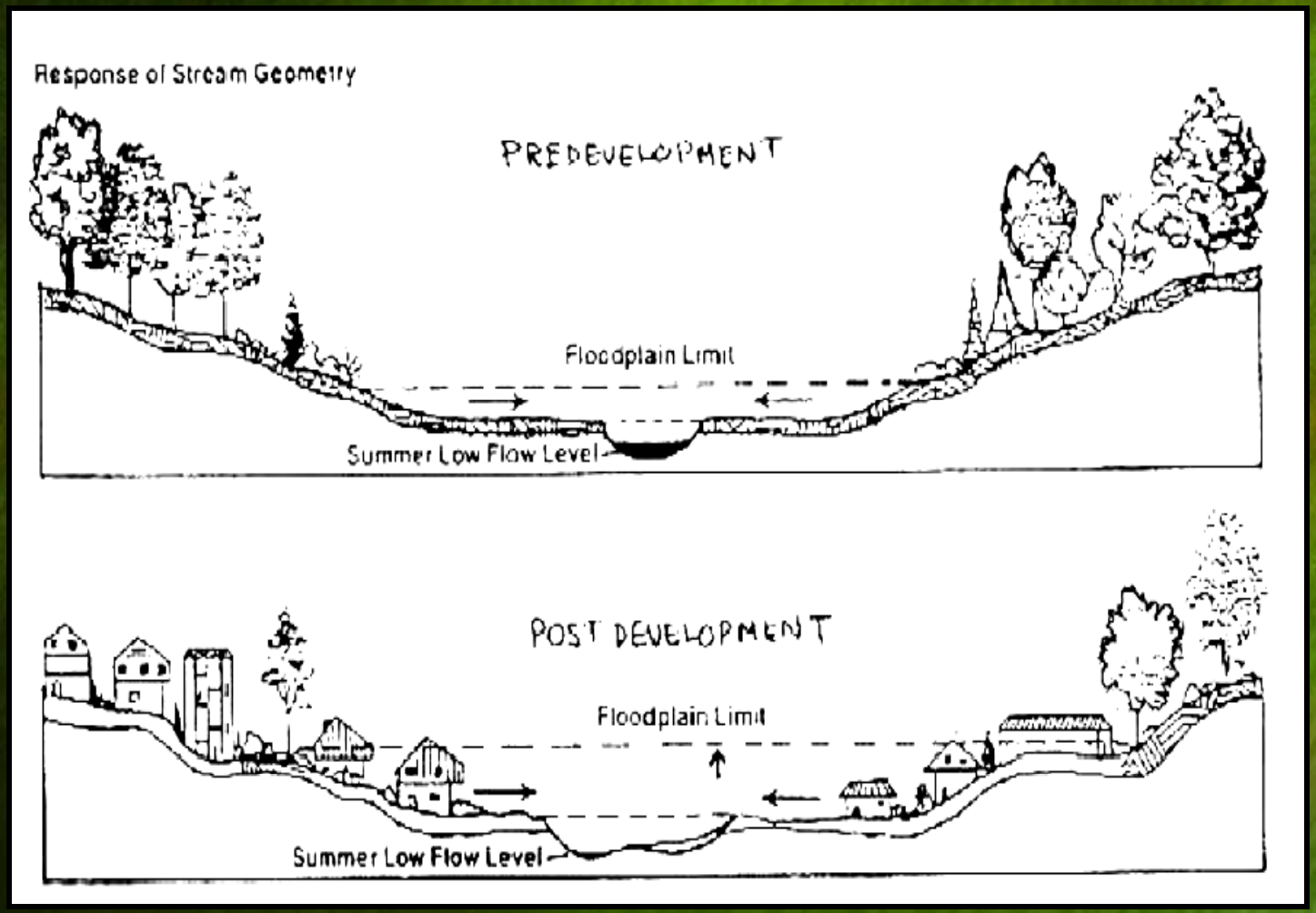
- Floodway
- Flood Fringe
- Mapped Floodplain = 1% annual chance
- 1% chance of filling the floodplain every year
- Doesn't mean once every hundred years





What is a Floodplain?

- The Base Flood Elevation (BFE) increases as the watershed is developed



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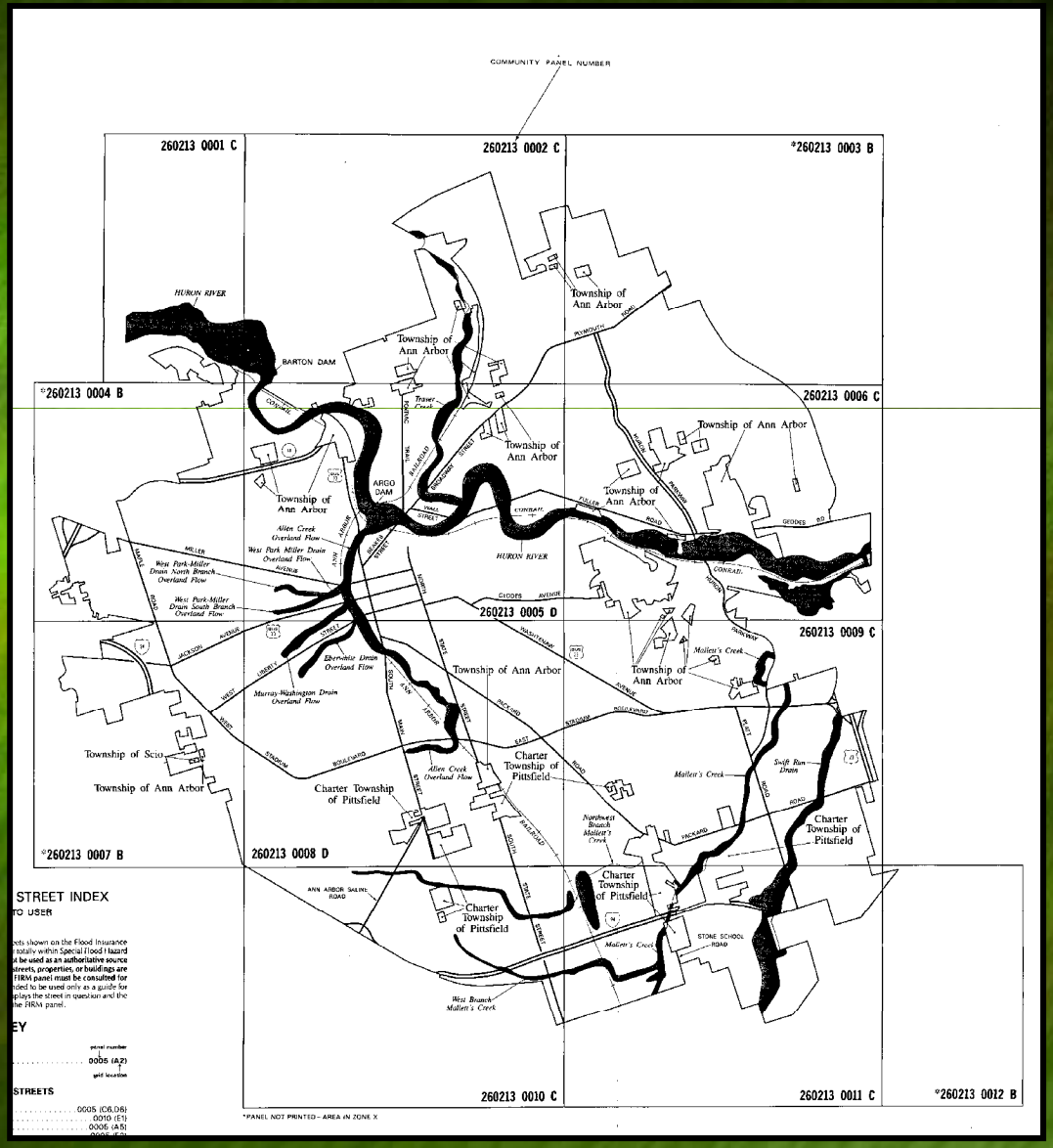
Floodplain Maps and Regulation

- FEMA provides Flood Insurance Studies and Maps
- Computer Modeling
- Ann Arbor studies 1982, 1985, 1992
- Current 1992
- Preliminary 2007
- New maps expected 2011



City of Ann Arbor, Michigan

Floodplains are here to stay

- Naturally occurring
- Can’t manage 100% of stormwater 100% of the time
- Overland flow will occur
  - There will always be a bigger storm
  - Cost
  - Feasibility

Stormwater Studies and Information for the City of Ann Arbor

Numerous watershed studies and ongoing sources of data

(see handout)

"The Huron River is the most studied river in the State of Michigan"
– Huron River Watershed Council

Stormwater Studies and Information for the City of Ann Arbor

- Stormwater GIS/Model (SGM) Project began in 2004
  - *Phase I*: Collect GIS data (completed)
  - *Phase II*: Integrate GIS data with stormwater model information and gather general monitoring data (completed)

Stormwater Studies and Information for the City of Ann Arbor

- Stormwater GIS/Model (SGM) Project
  - *Phase III*: Engage public & perform preliminary model calibration
  - *Phase IV*: Gather comprehensive monitoring data and final model calibration
  - *Phase V*: Analyze modeling result and engage creekshed groups/neighborhoods

Upcoming Stormwater Policy Action

Single Family Residential Stormwater Management - Oct. 2010

- Proposed revision to Ch. 63
- Require control of First Flush for increase in impervious area
- Improved water quality and phosphorous reduction
- Help City meet federal and state stormwater requirements
- Assist in controlling private drainage issues

Upcoming Stormwater Policy Action cont.

Revision to Landscape Ordinance (Ch. 62) – Early 2011

- Require a portion of the landscape islands to be depressed for bioretention
- To improve water quality and reduce the impact of impervious surface s by requiring that a greater amount of stormwater is retained on the site where it is generated.

Upcoming Stormwater Policy Action cont.

Adoption of new Flood Maps – Mid 2011

- FEMA provided, more detailed, more accurate, digital maps
- Public review period complete
- More properties removed than added
- Revise Chapter 100
  - Adopt Flood maps in same ordinance as the Michigan Building Codes
- City Council adoption is necessary for continued participation in the National Flood Insurance Program (NFIP)

Upcoming Stormwater Policy Action cont.

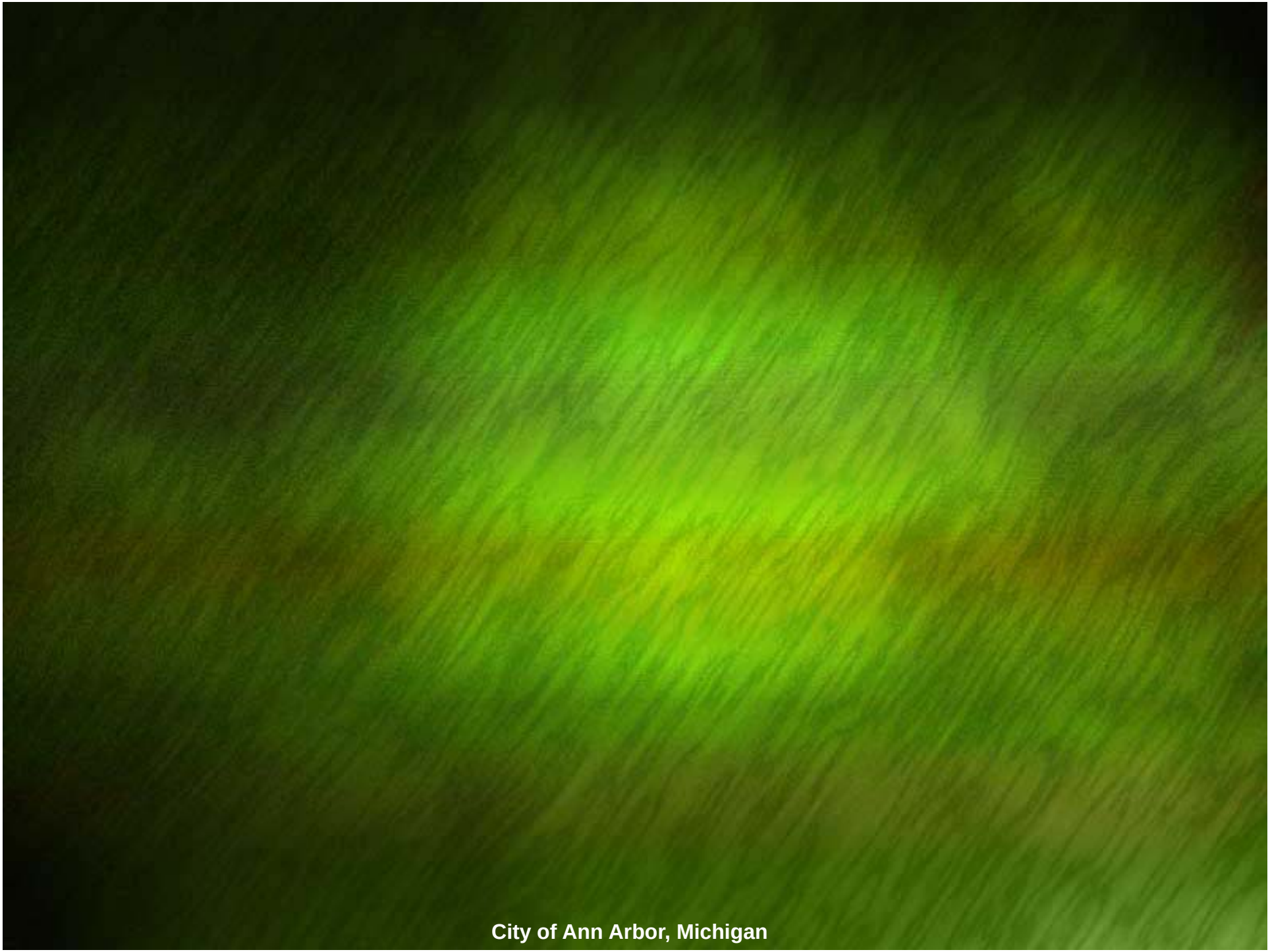
Proposed Floodplain Management Ordinance - 2011

- Zoning style ordinance that indicates what uses are allowed and prohibited.
  - Floodway
    - Prohibit new structures, additions, Residential uses.
    - Exemption section for redevelopment.
    - No parking where depth greater than 2 feet.
- Reduce risks (Public Safety, Property Damage).

Upcoming Stormwater Actions cont.

Stormwater GIS/Model (SGM) Project – Over next 3 years

- *Phase III*: Engage public & perform preliminary model
- *Phase IV*: Gather comprehensive monitoring data and finalize
- *Phase V*: Analyze modeling result and engage creekshed groups/neighborhoods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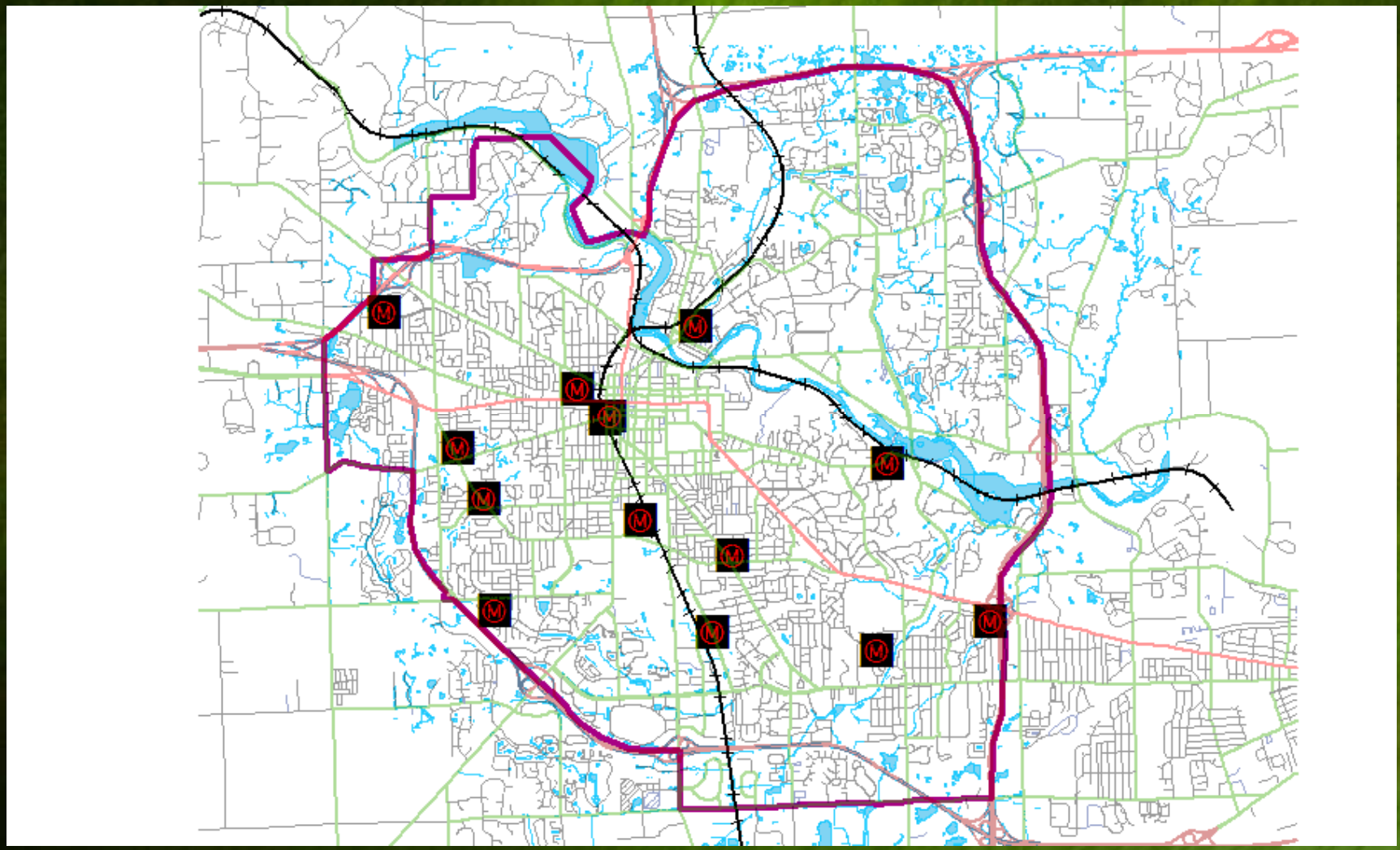
Monitoring Locations from SGM Project



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