Twin Creeks Watershed Management Plan
Project Overview and Discussions

December 6, 2017



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KC WATER SERVICES

Project To-Date

There are 9 (10) Key task Areas focused on:

Task 1	Data Collection and Development
Task 2	Regulatory and Standard Practices Audit
Task 3	Hydrology Assessments
Task 4	Hydraulic Assessments
Task 5	Stream Stability Assessment
Task 6	Scientific justifications, Risk Analysis & Associated Products

Presented in Previous Stakeholder's Meeting

Task 7	**Risk Assessment Report and Database to FEMA/City**
Task 8	**Process & Procedures Integration Plan**
Task 9	**Final Master Plan Report**
Task 10	**A Plan for Development of Workflows, Tools & Integration into City Process**

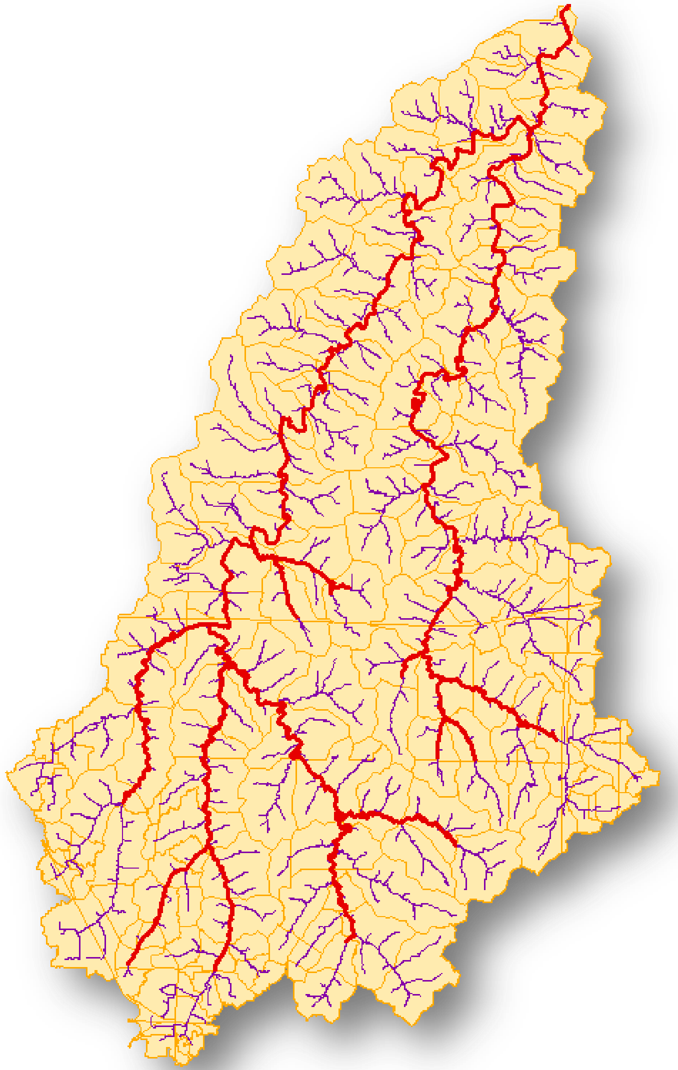
Today's Detailed Discussions

Task 10 budget requested for 5-1-18!

Project Overview - Watershed

- Straddles the border of Platte and Clay Counties in Missouri
- Flows North into Little Platte River
- Approximately 31 square miles of drainage area
  - First Creek accounts for 10 square miles
  - Southern 22 square miles are within Kansas City
- Primarily rural, with urban development along the perimeter

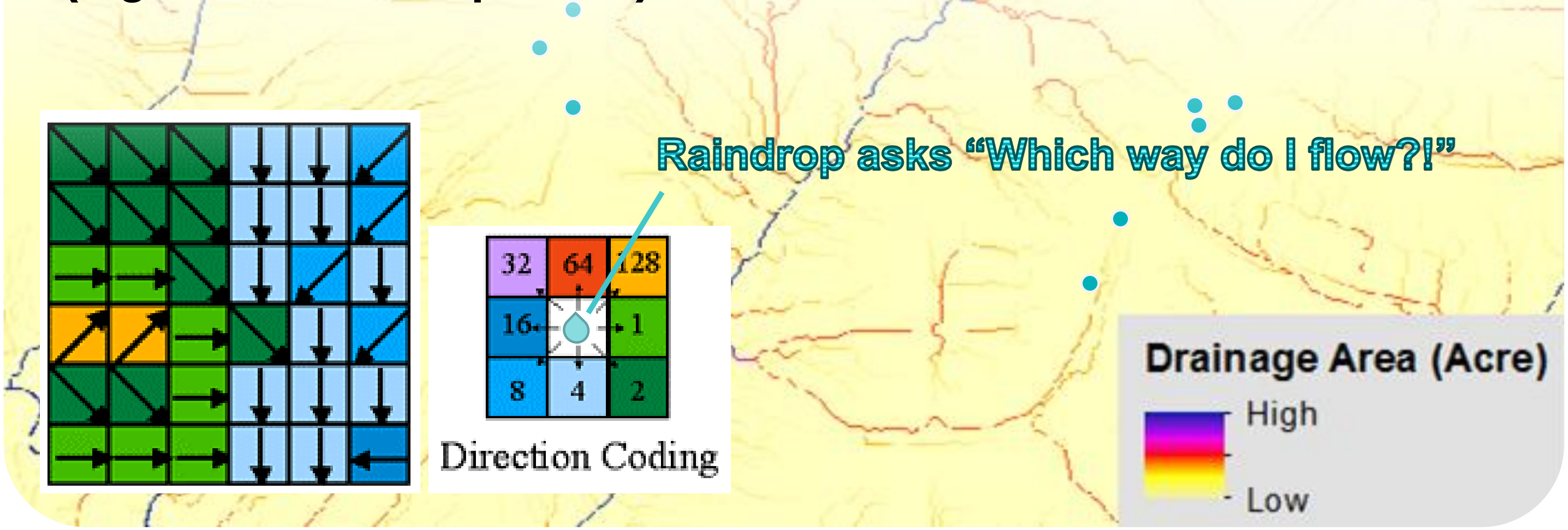
Floodplain Data Extents



- **22% of conveyance paths (FEMA Floodplains) of this watershed have flood risk defined.**
- **78% of watershed area did not have flood risk defined (up to 10-acre drainage area)**

Review of Hydrology
Flow Accumulation & Drainage Area

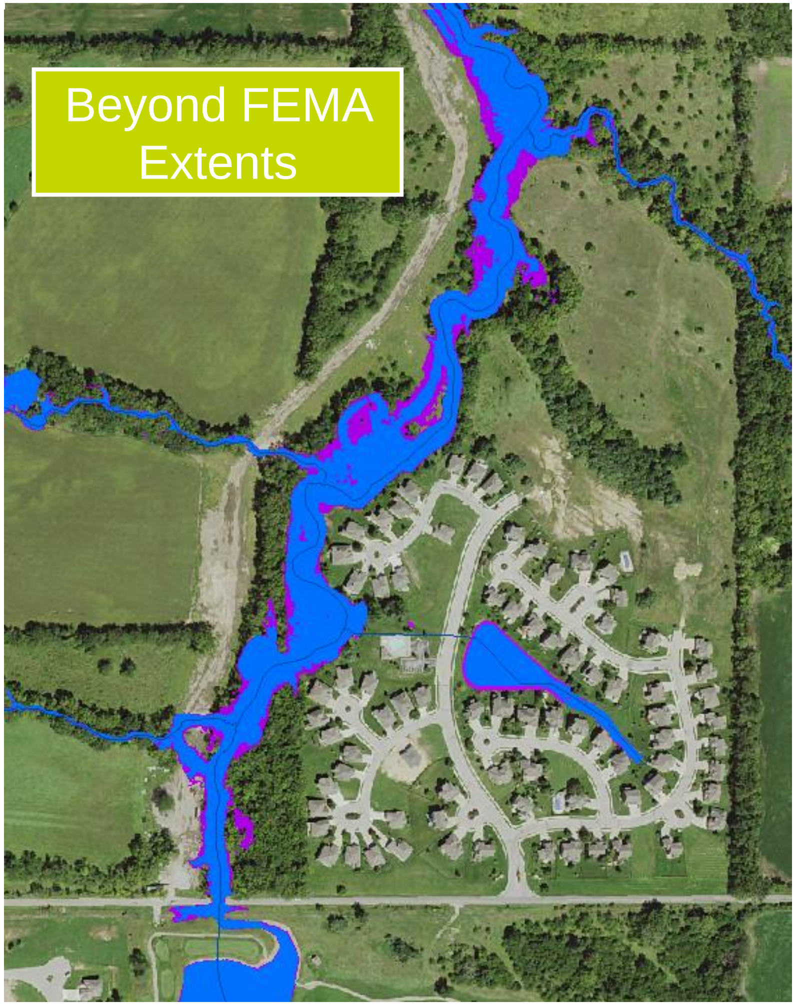
- **Developed from Hydrologically-Corrected LiDAR once Flow Direction is Determined**
- **Calculates the number of cells that drains to each individual cell**
- **Provides the ability to calculate contributing drainage area.**
- **Can be calculated such that raster cells are weighted differently (e.g. Landuse, Slope, etc.)**



Hydraulics

Modeling:

- Closed and open channel systems
- Show frequency and severity of flooding
- Study First and Second Creek areas beyond one square mile extents
- Models evaluate velocity distributions identifying areas susceptible to high velocity and potentially erosions.
- Hydraulic models serve as the basis of most risk indices identified in future tasks



Hydraulics
HEC-RAS Derived Products - Floodplains

- Performed Up To Ten-Acre Drainage Area

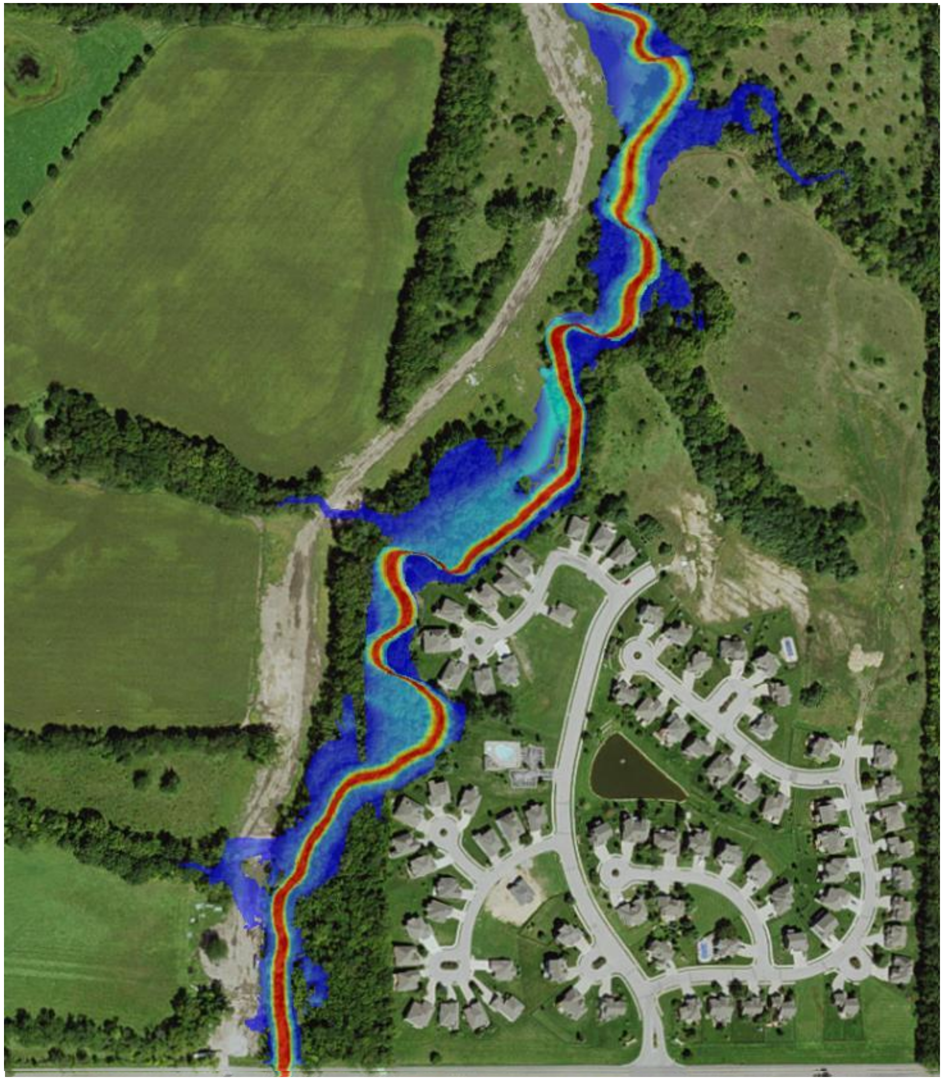
Hydraulics
HEC-RAS Derived Products – WS Grids

- Water Surface Elevation Grids across extent of Floodplains

Hydraulics
HEC-RAS Derived Products – Depth Grids

- Depth of Flooding for Each Raster Grid Cell
- Areas within deeper flood depths (darker blue & purple) are at higher risk than those outside in shallower depths (lighter blue)
- Depth across the floodplain area also represents volume of the water within floodplain

Hydraulics
HEC-RAS Derived Products – Velocity Grids



- Highest Velocities Typically Occur within the Channel, while Overbank Velocities are Typically Lower
- Areas near higher velocities and shear stress are at higher risk than those outside in shallower depths

Hydraulics
HEC-RAS Derived Products – Shear Stress

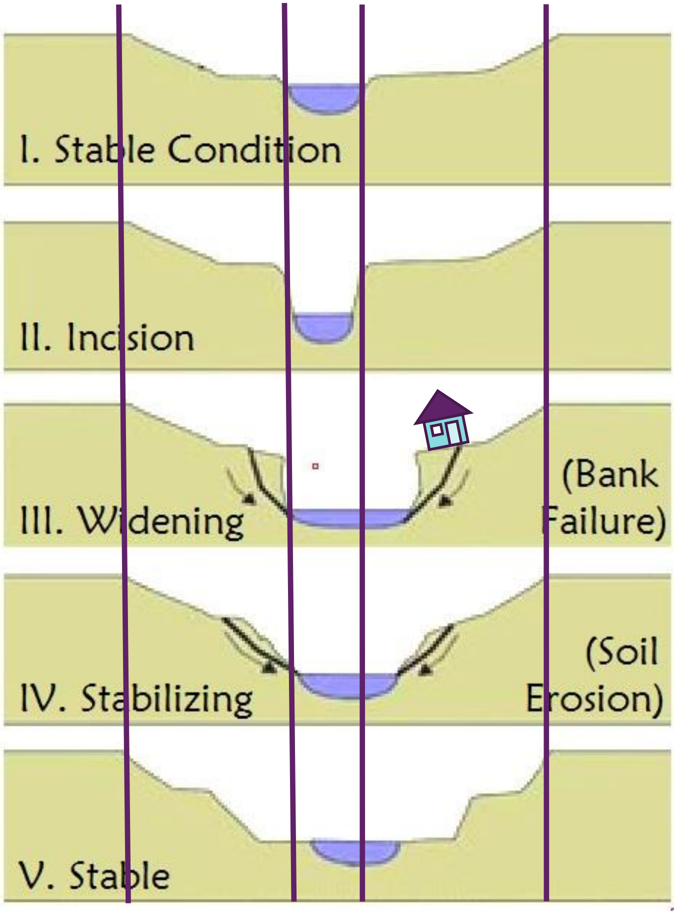
- Shear Stress is Directly Dependent on Velocity
- Highest Stress Typically Occur within the Channel, while Overbank Stresses are Typically Lower
- Areas near higher velocities and shear stress are at higher risk than those outside in shallower depths

Risk Analysis
Stream Geomorphology

The study of the origin and evolution of features created by physical or chemical processes at the earth's surface

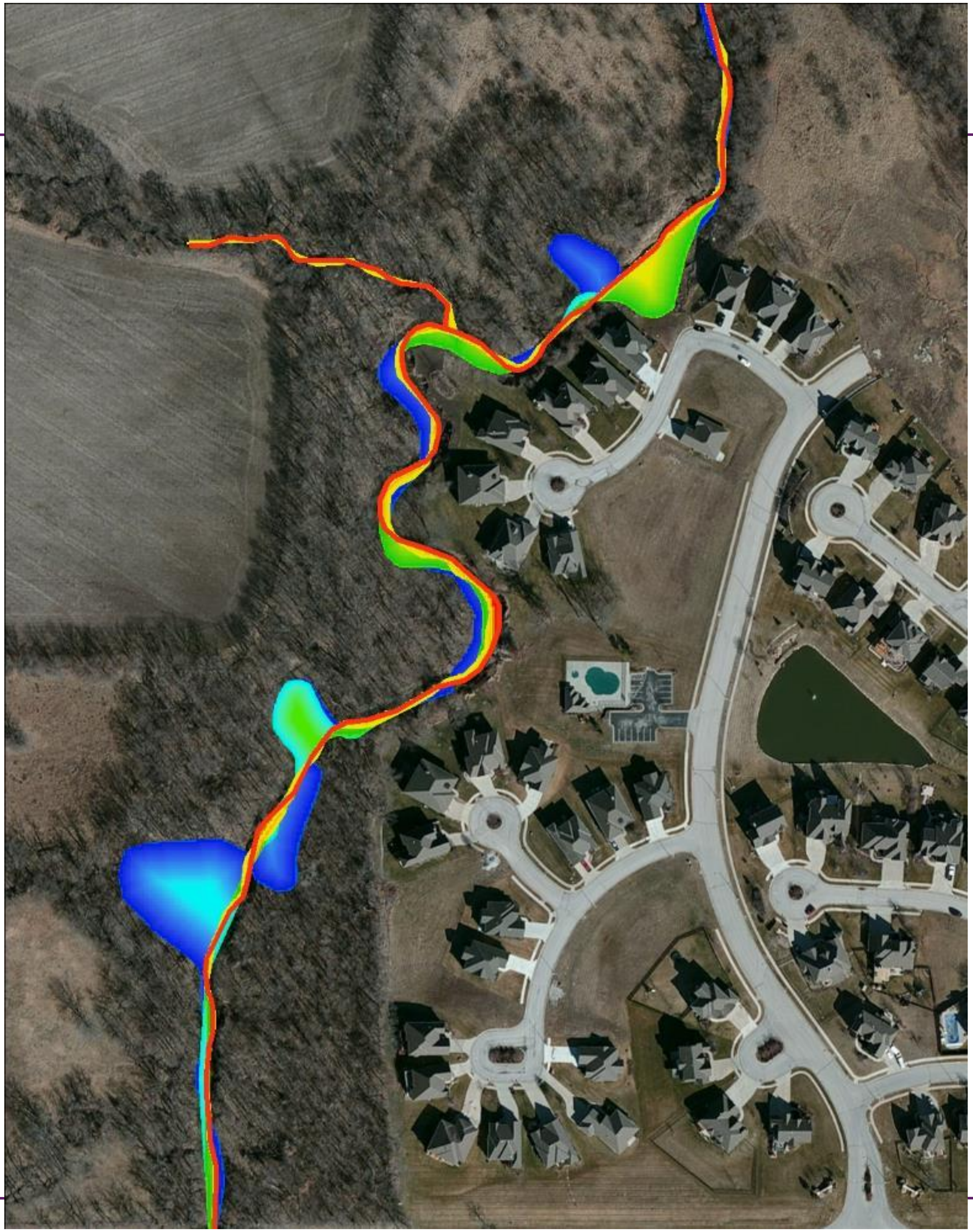
- Native Conditions = I
- Existing Conditions = II
- Future Non-Regulated = III

KCMO Stream Stability
CIP Project$$



Risk Analysis
Stream Sinuosity

- Quantifying Movement over Time



Risk Analysis
Risk Overlay

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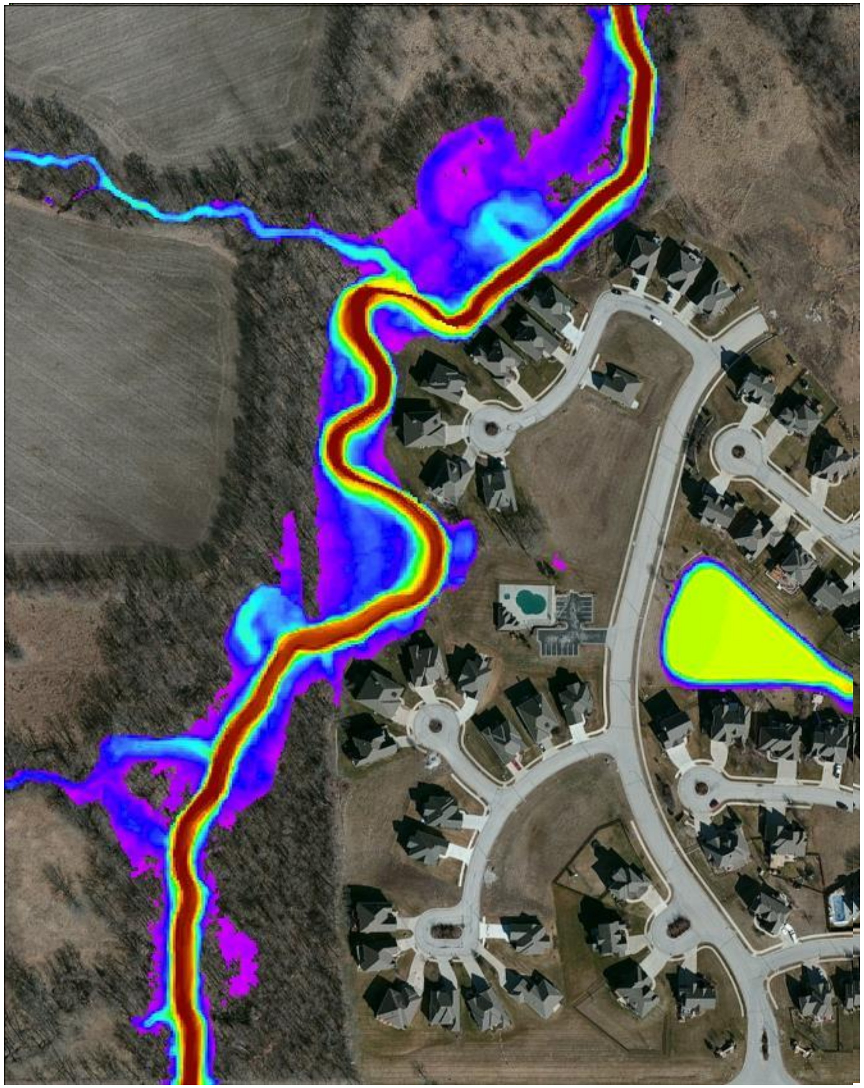
Combination of Risk Analyses

- Maximum Flood Depth
- Maximum Velocity
- Ground Slope
- Soil Erosion Index
- Sinuosity Movement Rate

- Combine into overall Risk
- Weight each parameter
  - Can be adjusted for individual watersheds based on characteristics

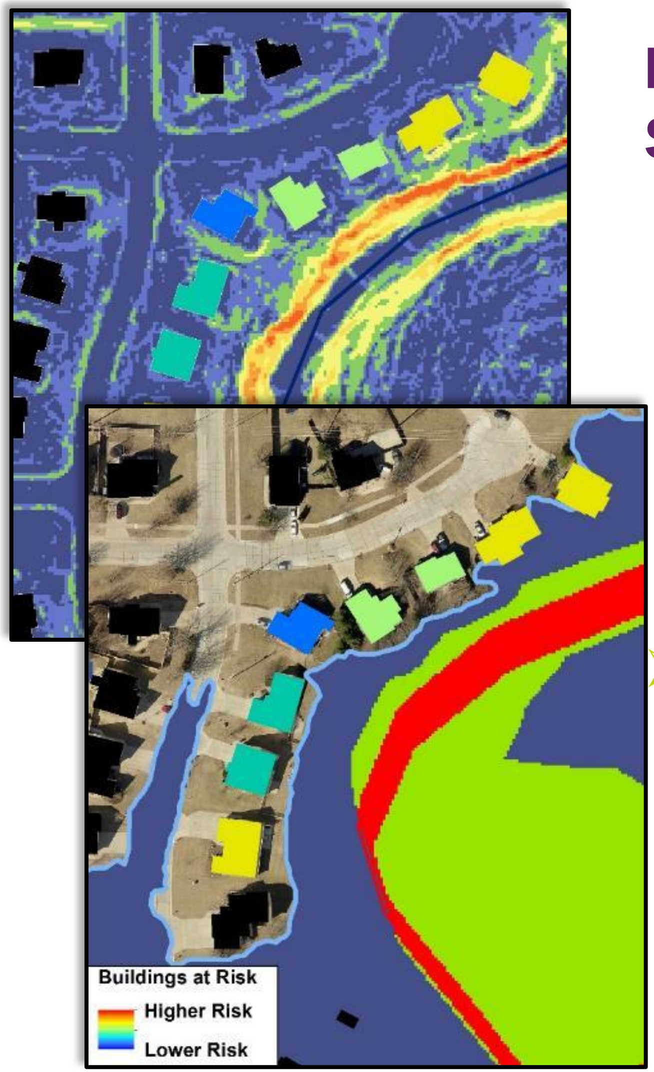


Assessment Tools
Science-Based Stream Setback

Automated Process to Develop Setback

- Magnitude of Setback is determined by Overall Risk along stream, direction of flow, and minimum bank offset
- Creates Stream flow projection lines based on the Overall Risk

Stream Stability – Building Proximity Analysis

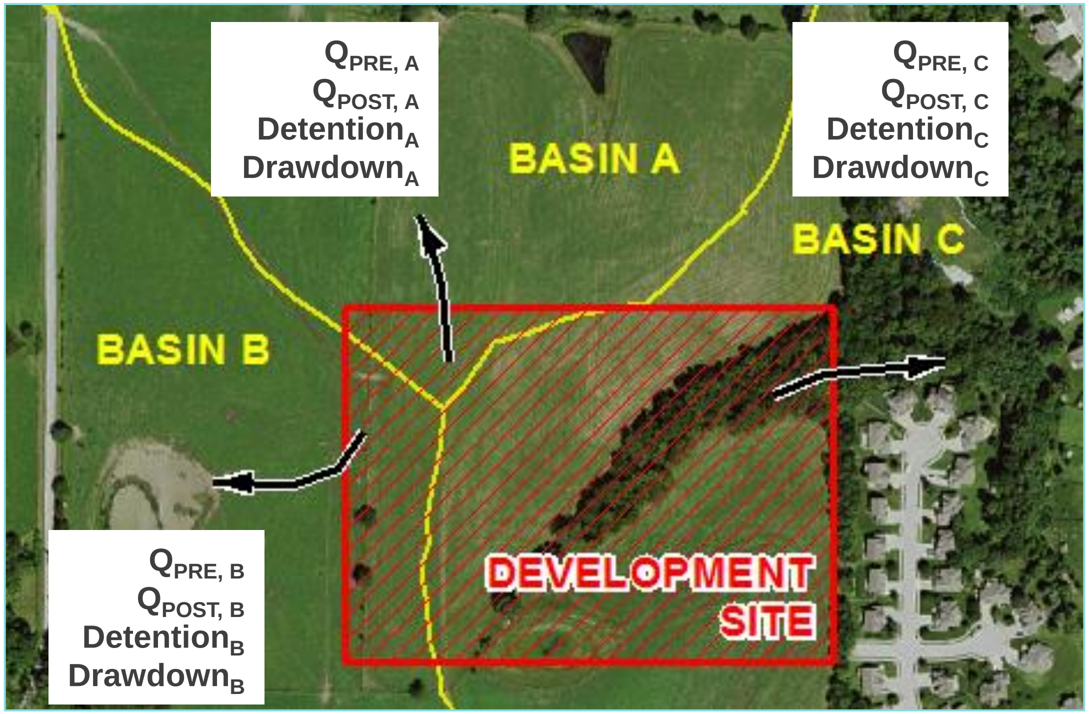


Buildings at Risk from Stream Stability Issues are identified

- Ground Slope Calculated from LiDAR
- Velocities taken from Hydraulic Model
- Buffer Applied
- Slope and Velocity Evaluated to Identify Areas at Risk from Stream Stability Issues

- **Concept can be applied to produce adjustment or scientifically based stream buffer**

Risk Index Discussion Example Development Site

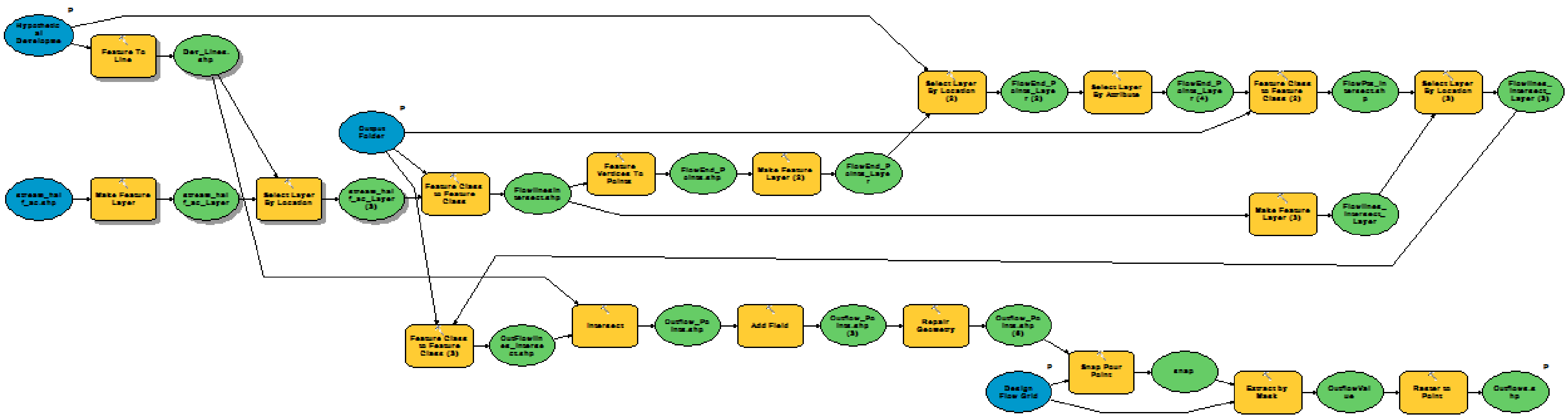


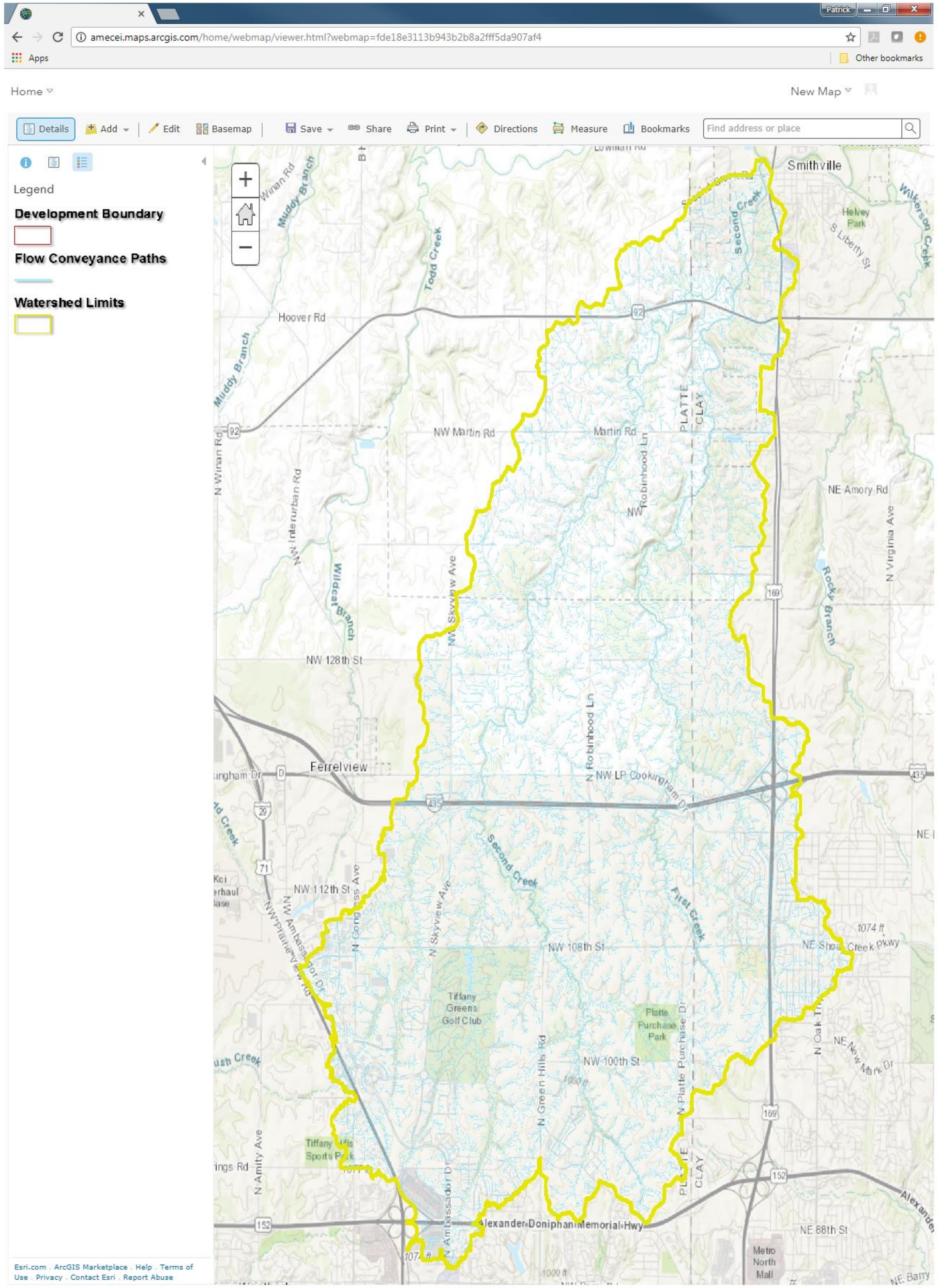
- Developer Provides extent of Development
- Pre-Development Flows are Provided
- Post-Development Flows, Detention, and Drawdown Times are Provided

- Example Site: Development is Located on Basin Divide Between Three Basins

Risk Analysis
Risk Overlay

- Preliminary GIS-based tool to calculate combined Watershed Risk
- Developer provides polygon of extents
- Tool provides Site Inflows, Outflows, Volume
- Predicted CN is used to determine required development storage
- Location in watershed determined allowable drawdown time for storage

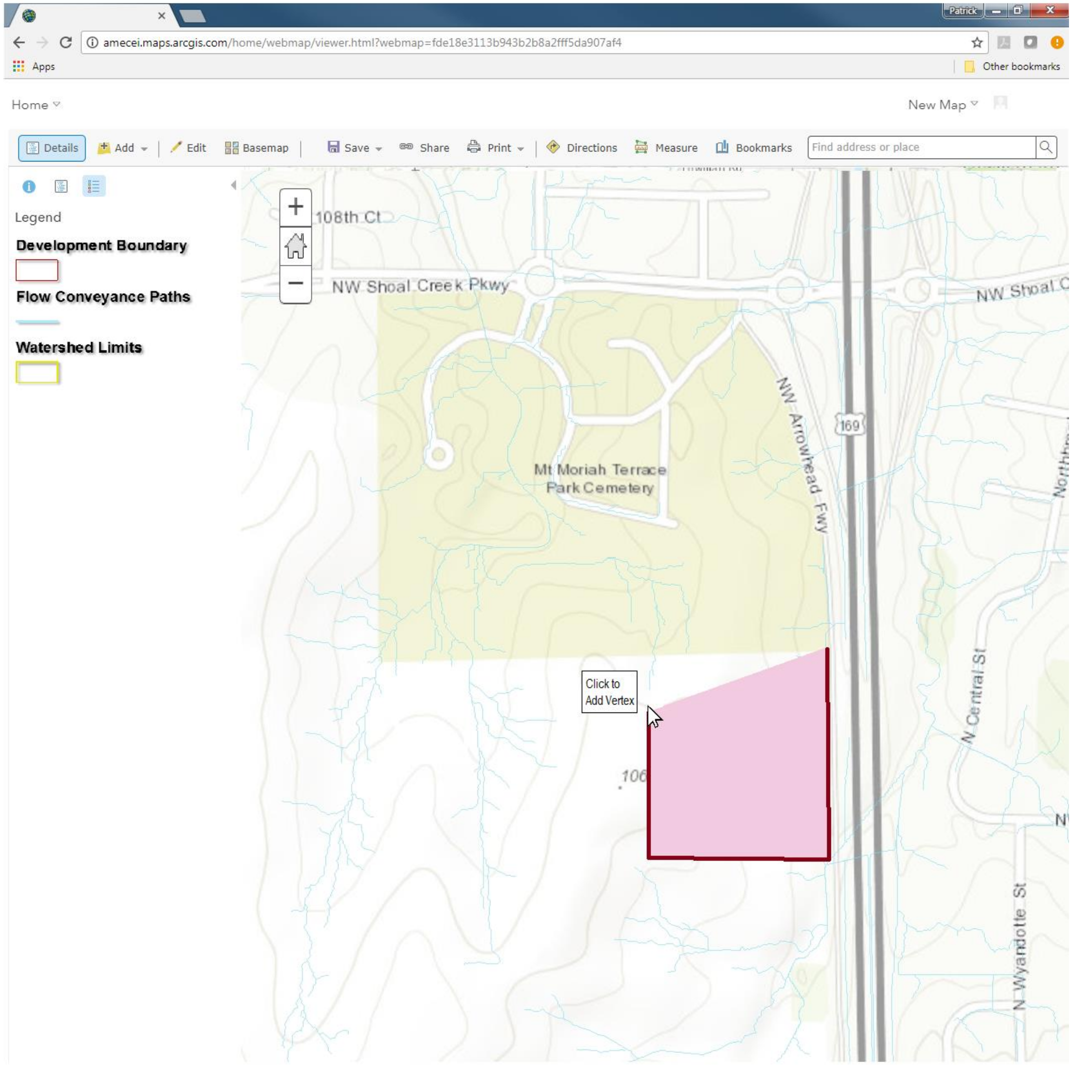




Web-Based Stormwater Development Tool

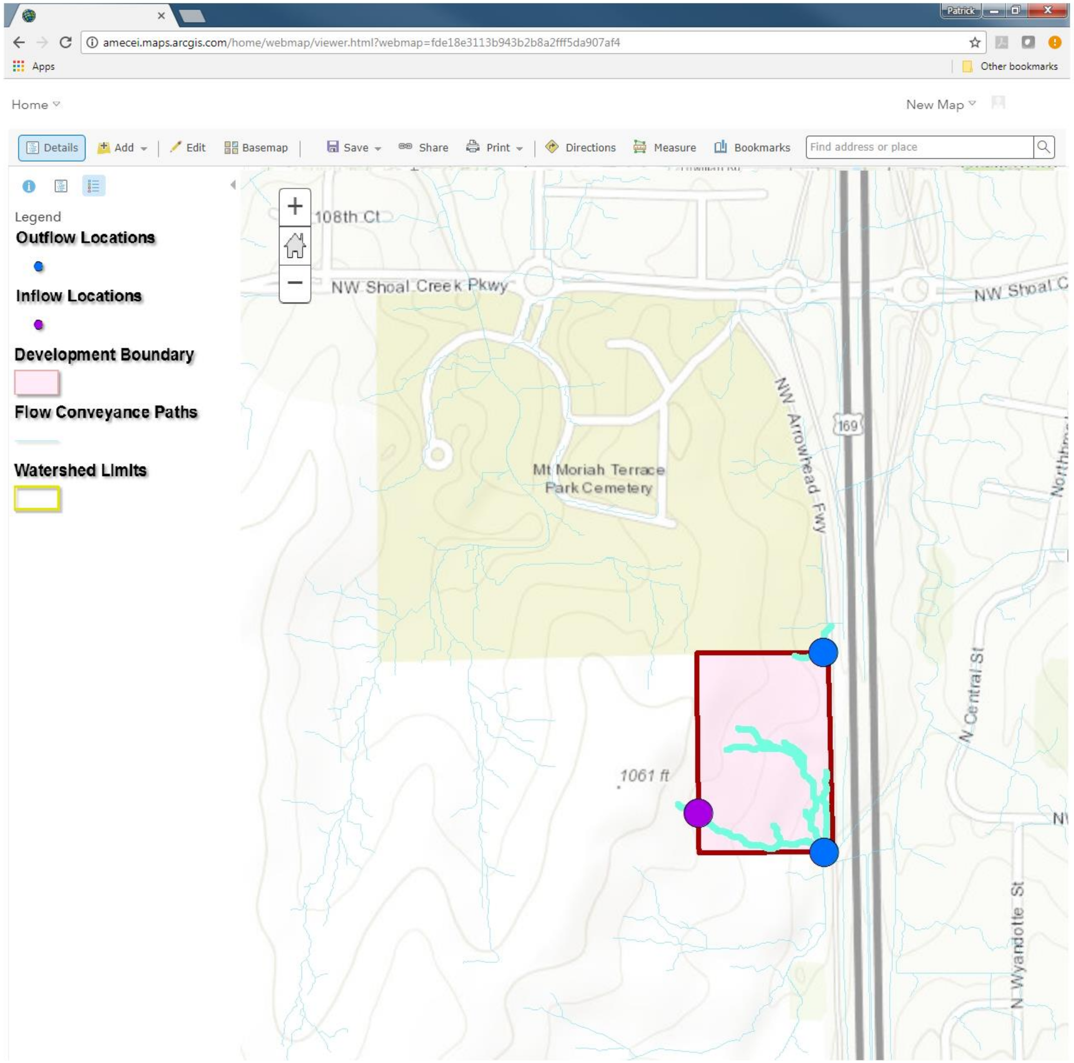
- Interactive Online Web Map would allow both Developers and City Employees Access to Tool
- Utilizing the same, science-backed tools on both sides of the process would help with efficiency

Web-Based Stormwater Development Tool



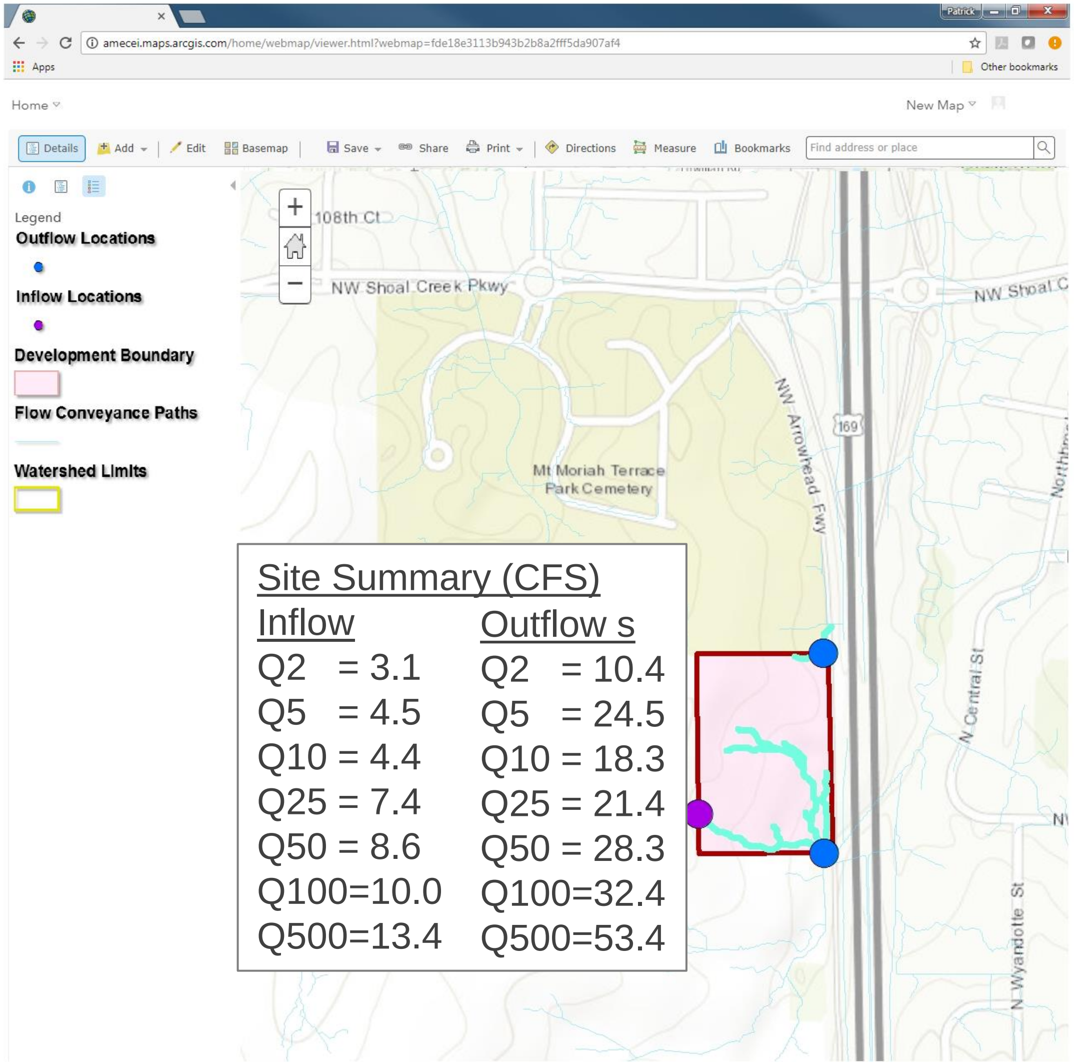
- User Adds outline of Development Site, Either interactively or through an import process
- Utilizing the same, science-backed tools on both sides of the process would help with efficiency

Web-Based Stormwater Development Tool



- Tool Automatically Flags Conveyance Paths that move through the Site
- Inflow and Outflow Locations are Identified

Web-Based Stormwater Development Tool



- Total Peak Inflows and Total Peak Outflows are Returned to User

The Science & Engineering must be used 1st to reduce regulatory process, improve quality and save time.

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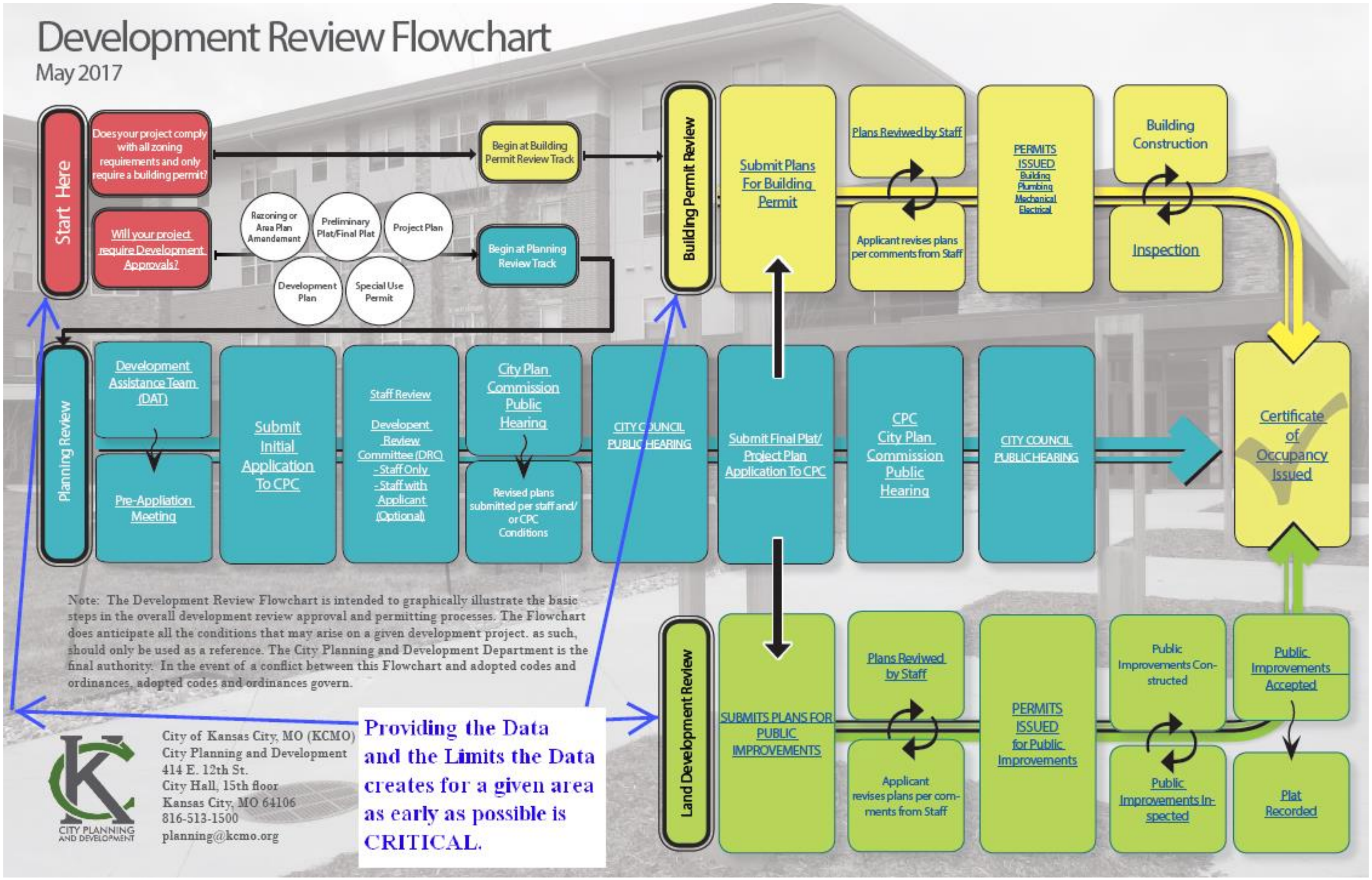

Questions/Discussion ?