Flood-Prone Area Storm Water Initiatives

October 17, 2019
City Focus Areas

- System Maintenance and Repair
- Program Funding
- Capital Project Implementation
- Long-Range Planning
Why Does This Take So Long?

- Hydrological analysis for each storm event (10, 25, 100 year):
  - How much water do we need to convey?
  - Where does it flow?
  - What capacity does the existing system have?
  - What conditions have changed since previous analyses? (i.e.: new development, failures of structures, additional parking/impervious, changes in climate/average rainfall)

- System Analysis
  - What pipes, inlets and other structures exist?
  - What condition are they in? Can they continue to stay in service?

- Preliminary Engineering
  - Which storm event (5, 10, 25, 100 yr) does the City want to design & construct for?
  - Based on data above, what new or replaced structures should be installed to resolve the problem?
  - What alternatives exist? (i.e.: buyouts, flood proofing, stream reclamation)
Why Does This Take So Long?

- Cost Estimating
  - How much will new structures cost?
  - What are stormwater billpayers willing to pay?
  - What rates and fees is Council willing to set?

- Final Engineering
  - Based on all information above, the City hires contract engineers to design systems

- Implementation
  - Based on Final Engineering, the City begins construction
System Maintenance and Repair

- Repair failed section of storm sewer pipe on Oxford Avenue, west of Santa Fe Drive, Nov. 2019
- Clean out accumulated debris in the Oxford pipe, from Santa Fe Drive to the South Platte River, Feb. 2020
- Repair the existing storm sewer pipe under Jason Ct., Feb. 2020
- Develop a proactive maintenance plan; June 2020
- Complete a system-wide pipe cleaning program; July 2020
Long-Range Planning

- Complete a city-wide storm water Master Plan; April 2020
- Update Drainage Criteria Manual; January 2020
Program Funding

- Loaned $3 million from the General Fund Long Term Asset Reserve (LTAR) to the Storm Drainage Fund; **COMPLETE**
- Evaluate state and federal grant opportunities; on-going
- Complete a rate & fee analysis to develop storm water utility rates which support the city’s desired level of funding; March 2020
- Identify & implement an increased storm water fee; May 2020
- Issue bonds for desired level of capital funding, Summer 2020
Capital Project Implementation

• Conduct a Stormwater Analysis and Alternatives Feasibility Study of flood-prone areas **COMPLETE**

• Evaluate the feasibility of an alternative alignment for new storm sewer pipe along Radcliff Ave. to the South Platte River, Nov. 2019

• Issue a Request for Proposals and award a contract for preliminary and final design of selected capital projects; Feb. 2020

• Begin construction on some aspects of a project or projects, October 2020
3-Phase Approach

Life Safety and Flood-Proofing
Give the City staff a quick method of responding to urgent need for life safety improvements.

1. Identify homes in danger
2. Engage owners
3. Determine methods and costs
4. Budget for improvements and implement

OSP Update and Prioritization
Use the 1999 OSP hydrology and hydraulics to the greatest extent practicable. This component spends time verifying the previous project, developing other alternatives, and preparing a prioritized list of projects.

1. Data gathering
2. Project verification & mapping
3. Prioritization
4. Budget and implement

Pipe Conditions Assessment
Perform pipe conditions assessment and rehabilitation.

1. Investigation & review
2. Conditions assessment
3. Evaluation of repair methods
4. Recommendations

Sample Flood Proofing
Flooding of properties along Mahoosuc Street in July 2014

Photos confirm urgent need for flood hazard protection in the subject basins

Significant life safety risk
Conditions assessment to start from the river and extend upstream as needed

Estimated flooding areas from the 1999 TCB study are early need to be verified and accuracy increased to target homes in imminent danger

North Englewood Basin
North-East & Bellewood Basin
Central Englewood Basin
South-Central Englewood Basin
South Englewood Basin
Oxford Culvert

Inflow from Oxford and Santa Fe

Xerox the wrong cover

Sample Flood Proofing
Study Goal & Objectives

Identify both short-term and long-term solutions to flooding, as well as to determine the largest flood hazard reduction for City investment.

- Identify areas of potential flooding at various rainfall/runoff levels
- Determine and define ways of reducing flood damage through floodproofing techniques
- Assess the current conditions of the stormwater pipeline beneath Oxford, identify dangers, and describe remediation techniques
- Update the existing Outfall Systems Plan (OSP) and capital projects with budgets and a prioritized list of storm drainage projects
Study Scope

- Flood-prone areas, identified in 1998 study
- Comprises about 3.4 square miles of total 6.6 square miles of city
Study Website

- City webpage under Public Works:

- Study link:
  www.calibre-engineering.com/cityofunglewoodoutfallsystemsplan
Existing Pipe Capacity
Project Alternatives

- Storm sewers throughout the study area were sized to convey the 5, 10, 25 and 100-year storm events, both including and excluding the effect of the proposed detention facilities on the peak flows

- 4 ALTERNATIVES; 7 OPTIONS
  - 1A: 5-year Storm Sewer Design - No Detention
  - 1B: 5-year Storm Sewer Design - With Detention
  - 2A: 10-year Storm Sewer Design - No Detention
  - 2B: 10-year Storm Sewer Design - With Detention
  - 3A: 25-year Storm Sewer Design - No Detention
  - 3B: 25-year Storm Sewer Design - With Detention
  - 4: 100-year Storm Sewer Design - No Detention
Number of Flooded Buildings & Structures, by Alternative

EXISTING CONDITIONS
- # of All Structures: 2151
- # of Habitable Buildings: 1104
- # of All Structures: $75,940,000
- # of Habitable Buildings: $66,717,000

ALT. 3B (25-YR STORM SEWER, WITH DETENTION)
- # of All Structures: 1203
- # of Habitable Buildings: 635
- # of All Structures: $75,940,000
- # of Habitable Buildings: $37,269,000

ALT. 3A (25-YR STORM SEWER, NO DETENTION)
- # of All Structures: 1344
- # of Habitable Buildings: 714
- # of All Structures: $66,717,000
- # of Habitable Buildings: $40,362,000

ALT. 2B (10-YR STORM SEWER, WITH DETENTION)
- # of All Structures: 1615
- # of Habitable Buildings: 835
- # of All Structures: $40,362,000
- # of Habitable Buildings: $37,269,000

ALT. 2A (10-YR STORM SEWER, NO DETENTION)
- # of All Structures: 1801
- # of Habitable Buildings: 947
- # of All Structures: $40,362,000
- # of Habitable Buildings: $37,269,000
Proposed Projects
Project Prioritization

- According to these criteria; the proposed project segments are prioritized as follows:
  - South Englewood Basin Segment 1 (S1)
  - South Englewood Basin Segment 2 (S2)
  - South Englewood Basin Segment 3 (S3)
  - South Englewood Basin Segment 4 (S4)
  - South-Central Englewood Basin Segment 1 (SC1)
  - South-Central Englewood Basin Segment 2 (SC2)
  - Central Englewood Basin Segment 1 (C1)
  - Yale Avenue Basin Segment 1 (Y1)
  - North Englewood Basin Segment 1 (N1)
  - North Englewood Basin Segment 2 (N2)
  - North Englewood Basin Segment 3 (N3)
  - North Englewood Basin Segment 5 (N5)
  - North Englewood Basin Segment 4 (N4)
## Project Costs

<table>
<thead>
<tr>
<th>Segment</th>
<th>Description</th>
<th>Total Est. Construction Cost - No Detention</th>
<th>Total Est. Construction Cost - With Detention</th>
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<tbody>
<tr>
<td></td>
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<td>10-year Capacity</td>
<td>25-year Capacity</td>
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<tr>
<td>S1</td>
<td>South Platte River to Navajo St</td>
<td>$11,861,000</td>
<td>$19,622,000</td>
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<tr>
<td>S2</td>
<td>Oxford St to Rotolo Park</td>
<td>$10,435,000</td>
<td>$20,489,000</td>
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<td>S3</td>
<td>Cherokee St to Clarkson St</td>
<td>$5,380,000</td>
<td>$7,408,000</td>
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<td>S4</td>
<td>Union Ave to Chenango Ave</td>
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<td>$688,000</td>
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<td><strong>South Englewood Basin Total Cost</strong></td>
<td><strong>$28,128,000</strong></td>
<td><strong>$48,207,000</strong></td>
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<td>SC1</td>
<td>Navajo St to Bannock St</td>
<td>$1,673,000</td>
<td>$3,714,000</td>
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<td>SC2</td>
<td>Oxford St to Clarkson St</td>
<td>$1,109,000</td>
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<td><strong>South-Central Englewood Basin Total Cost</strong></td>
<td><strong>$2,782,000</strong></td>
<td><strong>$6,733,000</strong></td>
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<td>C1</td>
<td>Hampden Ave to Mansfield Ave</td>
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<td>$3,843,000</td>
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<td><strong>Central Englewood Basin Total Cost</strong></td>
<td><strong>$2,405,000</strong></td>
<td><strong>$3,843,000</strong></td>
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<td>N1</td>
<td>Dartmouth Ave to Bates Ave</td>
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<td>Elati St to Acoma St (Bates Ave)</td>
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<td>N3</td>
<td>Lincoln St to Emerson St</td>
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<td>N4</td>
<td>Elati St to Acoma St (Dartmouth Ave)</td>
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<td>N5</td>
<td>Lincoln St to Logan St</td>
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<td><strong>North Englewood Basin Total Cost</strong></td>
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<td><strong>$5,543,000</strong></td>
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<td>Y1</td>
<td>South Platte River to Amherst Ave</td>
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<td><strong>Yale Ave Basin Total Cost</strong></td>
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<td><strong>$2,391,000</strong></td>
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<td></td>
<td><strong>Total Est. Construction Cost - All Basins</strong></td>
<td><strong>$37,269,000</strong></td>
<td><strong>$66,717,000</strong></td>
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Questions & Discussion