

APPENDIX KEY INITIATIVES

STORMWATER MANAGEMENT PROGRAM MASTER PLAN





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INTRODUCTION

The following key initiatives were identified as part of the Stormwater Management Program Master Plan Update. The identified policy needs and refinements will need to be thoroughly vetted to determine the preferred direction for the City. Peer community review data, stakeholder and public feedback, and future considerations have been compiled to help inform the vetting process. Policy development and refinement of key initiatives will provide the City and stakeholders with clear direction to streamline decision-making and focus stormwater resources on the tasks that will most efficiently and effectively protect people and property from the harmful effects of stormwater.

The information contained within this document is to be used by City staff as a starting point to begin the implementation of each key initiative. It should not be considered final recommendations or a commitment for how the initiative will be implemented. This document compiles information regarding the strategic direction, purpose, background, feedback received to date, future considerations and references for each key initiative into one location giving City staff, appropriate stakeholders, and other City departments a quick reference to kick-off each initiative.

Table: Priorities of Key Initiatives

Level 1 Priority	Level 2 Priority	Level 3 Priority
A. Local Floodplain Policy	G. Resource Programming Normalization Framework	K. Public Channel Maintenance
B. Storm Drain Rehabilitation Program	H. Voluntary Buyout Policy	L. Mitigation Banking
C. Private Property Channel Erosion Policy	I. Opportunistic Construction of Small CIPs	M. Natural Area Preservation, Conservation, and Restoration
D. Prioritization of Critical Maintenance Functions	J. Program Wide Communication Plan	
E. Flood Preparedness (warn, respond, recover)		
F. Level of Development Oversight Policy		

A. Local Floodplains

Strategic Direction

Improve identification, communication, and planning for flood hazards that exist beyond the limits of the FEMA floodplain maps.

Purpose

Evaluate policies that consider whether local floodplains should be regulated and if so, how this would be handled during the development review process.

Background

Local floodplains (Non-FEMA floodplains) are those flood prone areas that are located outside of mapped effective Federal Emergency Management Agency (FEMA) flood zones shown on Flood Insurance Rate Maps (FIRM). These local flood zones have several names, including “urban floodplains”, “residual floodplains”, and “Zone X floodplains”, and often represent significant challenges to floodplain administrators and floodplain managers. Although many of these flood areas are identified and are known by the City’s residents and staff due to the extent and frequency of flooding, the areas remain unmapped on FEMA flood hazard maps. Although not regulated by the FEMA criteria, these areas represent a significant portion of the known flooding hazards within the City of Fort Worth. Approximately 75% of the City’s repetitive flood insurance claims are outside of FEMA floodplains. The City has performed a repetitive loss analysis to evaluate and understand the flooding problem for each location where multiple flood related insurance claims have occurred.

Traditionally, detailed FEMA floodplain mapping of the 100-year (1% annual exceedance probability) flood was cut off at about a one square-mile drainage area, with flood prone areas upstream either unidentified or mapped as non-detailed flood zones. In much of the City, especially older neighborhoods, creeks were replaced with inadequate storm drain systems. These storm drains were sized for smaller storms and typically there was not sufficient conveyance for overflows that exceed the capacity of the underground pipes. The results are frequent and damaging floods that inundate streets and existing structures that can be devastating to the economy as well as public safety. Local floodplains are known through a number of avenues including local knowledge and historical flood events. These flood risks are often unknown by residents new to the City or to a specific neighborhood.

Current Practices at City of Fort Worth

For limited areas, the City has assessed these local flood hazards using modeling, resulting in detailed local floodplain mapping delineations that equal or exceed the accuracy of FEMA mapping. This floodplain information is not currently shown on FEMA floodplain mapping or regulated. Currently there is no written City policy or criteria that addresses the “Local Floodplain” problems and issues. FEMA studies typically included open channels with one or more square miles of upstream contributing drainage area. Local flood areas, in contrast, are usually less than one square mile of contributing drainage with some as small as 10 to 20 acres. The City continues to identify these local floodplain areas through ongoing and future studies and modeling.

The City has developed planning level citywide mapping for *areas of potential high water*. These areas can be identified through the City’s *One Address* online system. The *areas of potential high water* are approximations of flood risk areas and not the same level of detail as the FEMA floodplain maps or the City’s more detailed area specific mapping. While the City does regulate the FEMA floodplains during the development review process, the local floodplain data is utilized for informational and planning purposes. Regulations have not been established for the local floodplain data.



Peer Community Review

	Fort Worth	Arlington	Austin	Dallas	Oklahoma City, OK	Raleigh, NC	San Antonio	Charlotte, NC
Does your community regulate local floodplains outside of the FEMA floodplains?								
Yes								
No								
I don't know								
<i>FTW requirements include no adverse impacts for all development, but the City does not have specific criteria to regulate local floodplains outside of the FEMA floodplains.</i>								
If so, are the regulations the same as for FEMA floodplains?								
Yes								
No								
N/A								

Arlington

- City uses the latest study (such as Fish & Cottonwood Creek) as the best available data since the latest study is not effective yet on FEMA floodplain maps.

Austin

- City regulates on streams up to 64-acre drainage area; City regulates to fully developed condition floodplains
- City regulates to fully developed condition floodplains rather than FEMA existing condition and uses the 25-year fully developed condition floodplain in place of floodways.

Oklahoma City

- Small creeks not mapped. Any development along these creeks require drainage study to establish minimum finished floor elevation. Any development within 200' of a flooding source would require a drainage study. Require developer to provide easement in these areas. City will provide completed drainage studies to other developers to use for adjacent properties.
- Studies driven by development and performed by development. City uses the drainage studies to regulate subsequent developers along these small creeks.
- No floodplains delineated in City GIS files outside of FEMA floodplains.

Raleigh

- County soils maps are used to identify floodplain areas upstream of FEMA floodplains. Very specific process on how BFEs are determined or required to build 2 feet from outer limit of floodprone soils layer. Developer can also choose to perform flood study. Drainage areas of approximately 35 acres will start to become evident based on the floodprone soils. Not sure whether future watershed plans will include mapping updates.

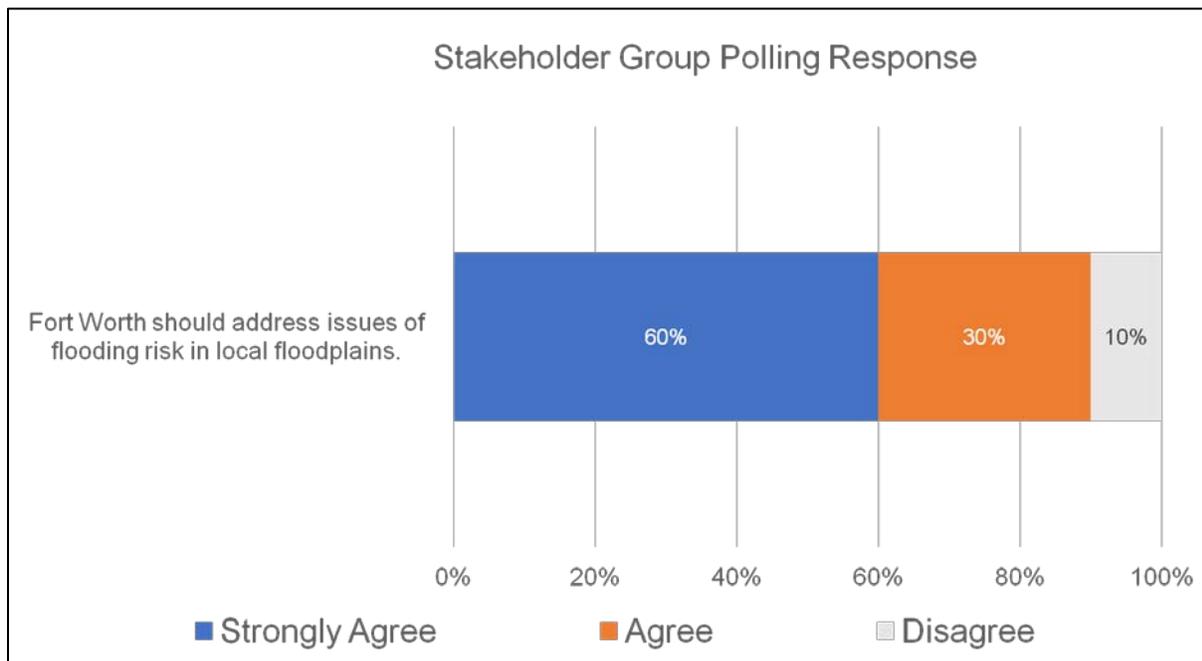
Charlotte

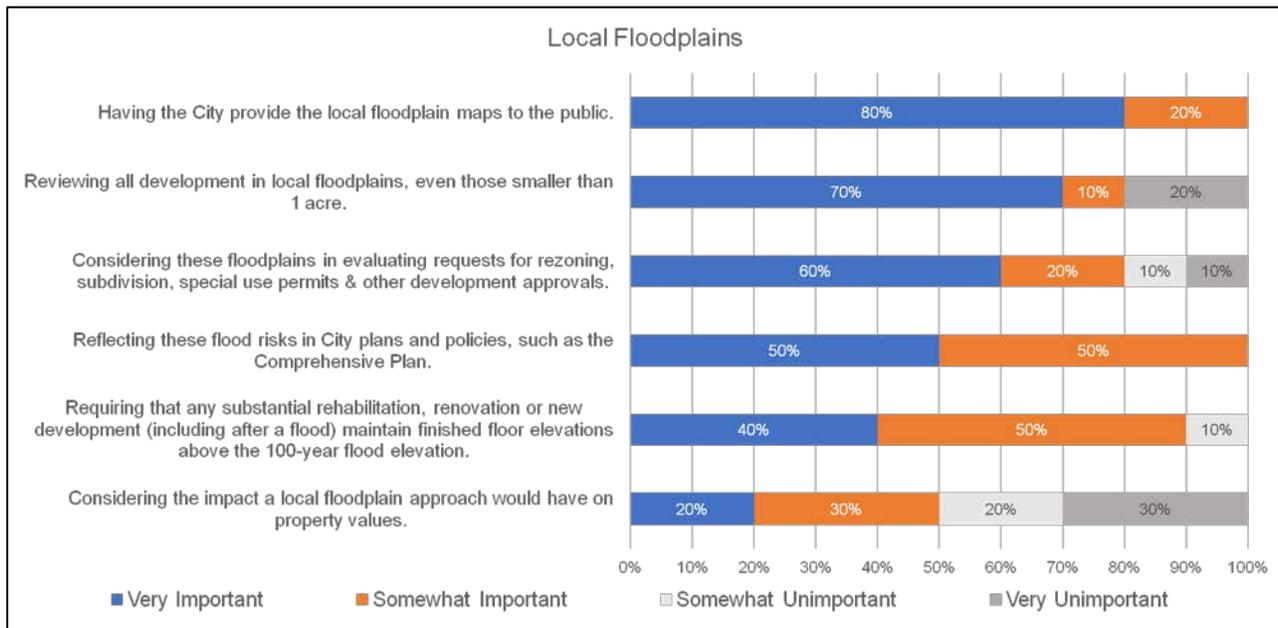
- Local floodplains are based on a 20-year old mapping study of non-FEMA streams. The mapping has some limited value but it is not a detailed study and is not shared publicly.
- The City will perform more detailed studies as part of CIP projects. The mapping developed for these studies is shared with developers but is not regulated.

Stakeholder Feedback

The following polling responses were provided by stakeholders through the Master Plan Update process. Public polling responses are also available and were generally similar in nature with the stakeholder responses.

Stakeholder Polling Responses





Stakeholder comments:

1. Piecemeal rezoning in local floodplain areas must be reviewed carefully – not just impact on new structure but impact of new structure on diversion of surface waters.
2. Refer to local floodplains as non-FEMA local floodplains to eliminate confusion.
3. FEMA floodplains make development difficult. Process takes too long. Development timing can be potentially impacted by local floodplains. It's a balancing act between harming development by overregulating and helping development by letting them better plan their future development.
4. Some people may be disappointed if they know their neighborhood floods but those flood risks are not shown in the local floodplain maps. Problems are infinite, resources are finite, so what is the criteria for mapping and what is the priority for mapping? What is the timeline for developing mapping?
5. What level of contributing drainage area begins to be defined as a local floodplains? Is there an opportunity for the flow of information from the public to the City? What if I know there is flooding in my neighborhood?
6. Who is coming to you now looking for this info and what are they wanting?
7. Special local floodplain overlay zoning with appropriate lot coverage development standards.
8. Is it a 1% storm event that is typically the focus of local floodplains?
9. Does Fort Worth have a floodplain regulation for local floodplain? But the City does maintain general no adverse floodplain impact policy. Is that the same thing?
10. What kind of effort would it take to reproduce this local floodplain analysis across the City?
11. Why would the City review local floodplain developments smaller than one acre?

12. Will the local floodplains address the actual problem? Or will the problem be transferred somewhere else once the developed property is elevated? Need to make sure the problem is addressed holistically.
13. After an area has been named/labeled a local floodplain, can it be reversed after it no longer applies? Like, if it's been determined that it no longer floods there?
14. Generally, I think we are headed in the right direction with the future actions.
15. Most people know they are already in a floodplain. Would like to know how we move forward. What are the next steps? What are the implications? Need education to understand how local floodplains impact me if I am in one.
16. To what level is the City going? Will there be a base flood elevation determined? What is the liability of the City with adding a floodplain? How does this affect existing floodplain? What do we as the City need to communicate?
17. The written policy would also establish what information is communicated externally and internally.
18. When new development occurs, you have surveys and you know where the FEMA floodplains are located. We need to get the local floodplain maps out to the people as they are purchasing property. It's more difficult for residential properties that do not always thoroughly research the flood risk.
19. Are we really asking the question of whether we should show maps with the local floodplains?

Future Considerations

The following future actions for Local Floodplains have been identified as part of the Stormwater Management Program Master Plan Update:

- **Develop a written City policy, vetted by public, City staff and Council**
- **Communicate existing local floodplain information externally and internally**
- **Undergo a separate evaluation to determine how local floodplain information should be used based on current development regulation**

The written policy will need to be thoroughly vetted to determine the preferred direction for the City. The policy should support the established City goals and be consistent with the City adopted Floodplain Management Plan and the overall Stormwater Management Program Master Plan. The following are additional considerations that will need to be evaluated as part of the policy development process.

The following pertinent facts should be considered as the City evaluates potential policy and procedures to identify, communicate, and plan for local floodplain hazards outside of FEMA designated floodplain:

- 75% of repetitive flood loss properties are outside the delineated FEMA floodplain
- FEMA floodplains do not adequately define the true flooding risk
- Some flood risk areas are currently unidentified by the City and cannot be communicated until the appropriate detailed analyses are conducted
- Some flood risks are currently known to the City through various studies but are not well known to stakeholders
- Local floodplains are not regulated by the City. Therefore, property owners are not provided the opportunity to request FEMA Increased Cost of Compliance grant funds (\$30k) to help elevate, relocate, demolish, or flood-proof (non-residential only)

- Development and homeowners can be put at risk by the lack of a formal policy to communicate and plan for local floodplain flood risk
- Consider how local floodplains could impact zoning and landuse

Policy Development

The goal of a local floodplain policy is to protect people and property from the impacts of flooding. The identification of local floodplain hazards provides an opportunity to inform current and future property owners and developers of the existing flood risk. The mapping of local floodplain risk creates the potential for negative impacts to existing property values, and should be considered during the policy development process. The following items should also be considered as part of the local floodplain policy.

Communication Plan

The local floodplain policy should be accompanied by a communication plan that will be implemented by the City to assist in the transition to a new policy. The communication plan should consider the following topics:

- Local floodplain identification/mapping and locating affected properties
- Impacts to property within a local floodplain boundary
 - Regulatory impacts that guide the development and redevelopment requirements for these areas
 - Flood insurance impacts
- Revisions to a local floodplain delineation
- Resources available to property owners within a local floodplain
 - Flood resiliency, flood proofing, etc.
 - ICC grant program information (depending on policy)
 - Flood warning, preparedness, flood response, flood recovery
 - Flood models and data
 - Grant funds and voluntary buyout options

Regulations

Development and redevelopment regulations are intended to manage flooding risk for existing property and future property investments. Local floodplain risks are more extensive in older areas of the City that were developed under outdated drainage criteria. Regulatory criteria should consider the impacts to redevelopment initiatives and how the criteria can be coordinated with ongoing City planning.

The following regulatory options should be considered as part of the future policy decisions:

- Option 1 - No Local Floodplain Regulations – Mapping only
 - Local floodplain mapping and risks will be communicated to the public. In the absence of regulations, the existing and future property owners will be responsible for making informed decisions regarding safety and investment in at risk properties based on the available mapping and risk information.
 - Increased FEMA Cost of Compliance grant funds (up to \$30k currently) would not be available to property owners.
- Option 2 - Regulate Local Floodplains but less than FEMA Floodplains in the City of Fort Worth
 - Regulations for local floodplains can be developed that differ from the FEMA floodplains. It is likely that the City would want to consider many of the same regulations as the FEMA requirements but perhaps at a less stringent standard. Here are several possible examples.



- Require finish floors to be above base flood elevation but could be less than what City requires for FEMA floodplains. In the urban areas of the City, elevation of buildings can be challenging due to the surrounding property constraints.
- Revise or remove the requirements for floodplain easements (many of the local floodplains exist in already developed areas that would make dedication and administration of the easement more challenging than greenfields).
- Floodplain revisions could be reviewed as part of the City of Fort Worth development services reviews without a submittal to FEMA. While this would require dedication of additional City staff, the review times would have the potential to be more streamlined than the FEMA reviews.
- Modeling software could provide flexibility to use existing models developed by the City instead of submitting only FEMA approved modeling software.
- The City would be required to administer the floodplain mapping, review proposed revisions, and incorporate changes to floodplain mapping.
- Increased Cost of Compliance (ICC) coverage is one of several resources for flood insurance policyholders who need additional help rebuilding after a flood. It provides up to \$30,000 to help cover the cost of mitigation measures that will reduce flood risk. ICC coverage is a part of most standard flood insurance policies available under FEMA's National Flood Insurance Program (NFIP). ICC funds would likely be applicable to help bring structures into compliance with local regulations but this will need to be evaluated further as this initiative moves forward. More information can be found at the following link: <https://www.fema.gov/media-library/assets/documents/1130>
- Option 3 - Regulate Local Floodplains the same as FEMA Floodplains in the City of Fort Worth
 - The City has adopted floodplain regulations to meet or exceed the minimum requirements of the National Flood Insurance Program (NFIP) administered by the Federal Emergency Management Agency (FEMA). These regulations are applied to the 1% annual chance flood (also known as the 100-year floodplain). It is possible for the City to adopt the same regulations for the local floodplains. Some examples of the FEMA floodplain regulations include:
 - Minimum finish floor requirements
 - Substantial damage to a property requires that it must be brought up to current code
 - Floodplain easements are required to be dedicated at time of platting
 - Floodplain revisions must go through formal review and adoption
 - No rise in flood levels resulting from development in a floodplain
 - Regulating the same as FEMA would provide the opportunity to map local floodplains on FEMA maps. This is also other opportunities to map with FEMA floodplains that are considered in Option 4.
 - This would be very cumbersome for the City of Fort Worth due to the nature of the detailed models developed by the City that FEMA will not currently review for acceptance.
 - Mapping local floodplains on the FEMA maps would require revisions to be submitted through the FEMA review process which requires a review fee and can take significant time for review, appeals period, and acceptance.
 - Increased Cost of Compliance (ICC) coverage is one of several resources for flood insurance policyholders who need additional help rebuilding after a flood. It provides up to \$30,000 to help cover the cost of mitigation measures that will reduce flood risk. ICC coverage is a part of most standard flood insurance policies available under FEMA's National Flood Insurance Program (NFIP). ICC funds would likely be applicable to help bring structures into

compliance with regulations under Option 3. More information can be found at the following link: <https://www.fema.gov/media-library/assets/documents/1130>

- Option 4 – Map the local floodplains on FEMA Digital Flood Insurance Rate Maps as Zone X, without additional regulations.
 - The State of Georgia and the City of Lubbock appear to map some local 100-year flooding as Zone X on their respective FEMA flood maps. This provides access to the mapping through the current FEMA resources but has different flood insurance impacts than mapping as Zone AE. Mapping. Without additional regulations, this mapping would be a communication tool but would not result in any changes to criteria or development standards. FEMA mapping changes would still be required to go through the typical FEMA submittal process to update, which can also result in fees. It's possible that without additional regulations that it may be difficult to keep the maps updated by developers and others that make changes to the inundation limits through development and redevelopment activities.

Mapping

The local floodplain policy will need to be supported by the definition of local flood risk through mapping.

- Available Local Floodplain Mapping – The City has existing local floodplain mapping available. The adequacy of these datasets will depend on the future regulatory requirements of the local floodplain policy. The two existing data sets are as follows:
 - *Areas of Potential High Water* – This data set was developed using approximate methods and can be accessed through the City of Fort Worth One Address website based on a property address search. While the approximate mapping is not shown, residents can type in an address and learn if the property has the potential to have high water. The *Area of Potential High Water* is a City-wide dataset. This data set was developed for planning and information purposes. It was not developed for regulatory purposes and is not intended to be used for this type of policy implementation.
 - Option 1 – Continue to utilize One Address as the primary method of identifying local floodplain data for a property.
 - Option 2 – Provide mapping datasets and exhibits for identification of local floodplain data.
 - Detailed watershed assessments – A limited number of watersheds (approximately 10) within the City have been analyzed using detailed modeling to determine the existing flood risk and potential flood reduction alternatives in local floodplains. These models provide a level of detail that equals or exceeds that of the FEMA floodplains. These detailed watershed assessments are adequate for informational and regulatory purposes.
- New Local Floodplain Mapping
 - Utilize local floodplain mapping from detailed studies prepared by developers. These detailed studies are sealed by a professional engineer, but they are not fully reviewed by the City and may need additional detail before they can be utilized for regulatory purposes.
 - Determine the adequacy of existing floodplain data to support the local floodplain policy.
 - Evaluate criteria for prioritization of additional local floodplain data modeling and mapping efforts.
 - Determine schedule for any additional City development of local floodplain data.
 - Establish level of detail and modeling criteria for local floodplain data.



Data Maintenance

The City will be responsible for the maintenance of local floodplain data, unless the City decides to include local floodplain mapping on the FEMA maps. Assuming that the City is responsible for the data, the following maintenance and updates should be considered regarding the future policy:

- Include completed capital projects
- Changing watersheds and floodplain conditions as a result of development or redevelopment
- Better data such as new topography or more detailed analysis

The City's regulatory policy and mapping decisions will help inform the frequency of updates and the process for City approval of revisions.

City Resources

A local floodplain policy will impact the City resources. Depending on the developed policy, the following resource implications may need to be considered:

- Development reviews may require more effort for city staff and may increase the time/cost for developers to go through the development review process
- Data management and updates need resources and a system in place to store/share floodplain models and GIS and update it based on new development, mitigation projects, etc.
- Communication efforts and coordination with residents
- Additional Local floodplain mapping efforts

Complimentary Initiatives

- E. Flood Preparedness – Communication of local flood hazards can help warn of the risks.
- F. Level of Development Oversight – The local floodplain policy could impact development oversight in these areas.
- H. Property Buyouts – Local floodplain are often costly to mitigate and property buyouts may be one of the options to be considered.

Action Plan

- Process Lead: Jennifer
- Technical Lead: Clair
- Staff Involvement: Stormwater Development Services, Stormwater Planning, City Legal, Linda S.
- Stakeholder Involvement: Development Advisory Committee, Stormwater Stakeholder Group, Working Subgroups, Planning Commission
- Next Steps: Use Master Plan report and Key Initiative documentation to develop schedule, process, and milestones.

Additional Reference

- City of Fort Worth Floodplain Provisions Ordinance excerpts applicable to preventing flood damages in flood-prone but unmapped areas (Clair Davis) - <https://goo.gl/FPrHHK>
- 2017 TFMA Fall Conference Plenary Session Presentation and Polling Results
- FEMA is currently evaluating local / urban floodplains and it was reported that they held forums in Houston in late 2017. This was reported by an attendee at the 2017 Fall TFMA Conference. No additional information has been found yet regarding the initiative or the forums.



- ASFPM is developing an Urban Flood Zone White Paper expected to be completed in mid-2018 and the outline is available. The City has offered case studies that can be referenced by ASFPM as part of this initiative.
- The State of Georgia and the City of Lubbock appear to map some local 100-year flooding as Zone X on their respective FEMA flood maps. This provides access to the mapping through the current FEMA resources but has different flood insurance impacts than mapping as Zone AE. http://georgiadfirm.com/HTML_snapshot/HTML_snapshot.html?stNum=580&stAddress=SIMMONS ST NW &zipAddress= 30318

B. Storm Drain Rehabilitation Program

Strategic Direction

Increase emphasis on pipe rehabilitation

Purpose

The Storm Drain Rehabilitation Program will identify, prioritize, and implement storm drain rehabilitation projects. This initiative will develop and maintain a criticality ranking of city storm drains and inlets. Two key factors in the advancement of this rehabilitation initiative are the progression of the stormwater pipe assessments and increased understanding of the magnitude and scope of citywide storm drain problems. The storm drain rehabilitation initiative will include these components:

- Prioritize CCTV inspection/cleaning needs and frequency to provide a better understanding of the system needs
- Update the criticality assessment of the existing stormwater system based on actual CCTV condition information
- Program, identify, and prioritize storm drain rehabilitation projects
- Balance the strategies of assessment needs, prioritization of rehab with other initiatives, and resource allocations towards preventative and rehab needs.

Background

Over 60 miles of pipe in the City are over 70 years old and much of it may need to be rehabilitated over the coming years in order to avoid large scale system failures that could create damaging sinkholes and flooding during heavy rains. Age is not the only criteria, as pipe material, reinforcement (or lack thereof) and soil conditions can also have a significant impact on the rehabilitation needs of a storm drain. Additional pipe assessment is needed to better understand the actual condition of the storm drain system and funding needs of the pipe rehabilitation program. It is expected, though, that the funding needs in this area could easily be \$50 - \$100 million.

Current Practices at City of Fort Worth

Currently the City spends less than 1% of the stormwater budget on pipe rehabilitation and less than 1% of the City pipes have been assessed. Some assessments have been performed through consultant contracts for flood reduction studies, such as the Zoo Creek and Arlington Heights planning efforts. The City also completed a pilot program in 2017 to assess approximately 34,000 linear feet of storm drain. The recommendation of this pilot program was to repair or rehabilitate over 45% of the pipes that were assessed. Current CCTV inspection and cleaning is generally performed through consultants but the City has considered acquiring the equipment and performing inspections through the maintenance program.

Although the City has historically rehabilitated stormwater infrastructure for critical needs and as funding was available, the SWMP Master Plan includes a reallocation of available SWMP funding resources with increased emphasis on rehabilitation projects. This level of emphasis on rehabilitation will require a reduction in capital project spending. This reallocation has been vetted through the SWMP Master Plan update process with stakeholders during the public meetings.

The prioritization component of this rehabilitation initiative will inform CCTV inspection and cleaning needs, acceptable levels of flood risk, and the programming of future rehab projects. The City has developed a high level planning of criticality data that estimates the condition of the storm drain system based primarily on the estimated probability of failure and consequence of failure. This criticality framework will be utilized and more detailed assessment data will be utilized to refine the estimated

probability of failure. Refer to the SWMP Appendix for Prioritization Tools – Criticality Stormwater Infrastructure for more information.

Peer Community Review

10. Storm Drain Rehabilitation	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your community have a storm drain rehabilitation program?								
Yes								
No								
<i>FTW has a storm drain rehabilitation program that is focused on addressing critical needs. The desire is to become more proactive.</i>								
How proactive is your community in addressing storm drain rehabilitation before a pipe fails?								
Very proactive								
Somewhat proactive								
Mostly reactive to failures								
How does your community prioritize storm drain rehabilitation locations?								
Age of pipe								
CCTV inspection								
Prioritization method using multiple factors								
Other								
N/A								
Which rehabilitation method is most preferred?								
Cured-in-place pipe lining								
Slip lining								
Open cut replacement								
N/A								
What percentage of the capital budget is dedicated to storm drain rehabilitation?								
Less than 5%								
5-15%								
15-25%								
25% or more								
Does your community have a systematic CCTV program with routine inspection?								
Yes								
No								
I don't know								



If so, who performs the CCTV inspections?								
City staff								
Subcontractor								
N/A								
What is the goal for frequency of CCTV inspections?								
1-5 years								
6-10 years								
Greater than 10 years								
N/A								
Does your community have an asset management program for stormwater?								
Yes								
No								
If so, what elements are included? (Check all that apply)								
Detailed inventory of assets								
Maintenance activities								
Work orders								
Resolutions								
Criticality assessment of assets								
Programmed replacement								
Service life depreciation								
Other								
N/A								

Stakeholder Feedback

Arlington

- CCTV performed by City in advance of project or in response to a reported problem.
- Looking to create/use a more robust database for asset management. City has been using Cartegraph since 2006.

Austin

- Much of rehabilitation occurs in areas with severely undersized pipes. Typically prefer to upgrade such systems. Have used cured-in-place pipe lining in some situations.
- The program is fairly new, so City is playing catch-up. The focus to date has been a comprehensive evaluation of the central business district with inspections in other areas upon request.
- City's asset management program is in development.

Dallas

- City is working towards being more proactive. More than 1,800 miles of storm drainage in system.

- The goal for frequency of CCTV inspections are actually once per permit term which is five years; however, a 10 year time frame might be more ideal for this volume of storm drainage.

Oklahoma City

- Case-by-case on storm drain rehab. No plan for anticipating areas of needed rehab. Primarily reactive.
- City highlighted Programmed Replacement in reference to bond projects, not rehab.

Charlotte

- Assumed to mean proactive maintenance, the stormwater program is getting started now as a resolution to many system failures. We do consider rehabilitation first before deciding to replace or upsize.
- About 1.5% of the budget goes towards preventative maintenance currently. 40% goes to point repairs, 45% to capital flood control and condition based failures, 13% to stream restoration.
- Based on threat level (city street safety, house flooding, erosion). Most of our request for service are prioritized by severity or risk, public or private, and then date of call.
- Any and all rehabilitation methods are used, and the solution is case dependent. We use CIPP, Spin casting, sectional CIPP, exterior concrete collars.
- Our Asset Management Team is starting CCTV as part of collecting this data.
- City staff will perform CCTV inspections in the near future. The plan is to conduct systematic routine inspections. Subcontractor does CCTV on demand for project locations.
- The intent is to vary CCTV inspection frequency based on age, criticality, and condition eventually to prioritize areas of need.
- The asset management program for stormwater has just started.

Stakeholder Feedback

Stakeholder comments:

1. What do you need to allocate to storm drain rehab to meet your goal? If I knew how much you needed for rehab then I could make a better decision. For instance, rehab might just need a little more investment to make big impact.

Future Considerations

The following actions have been identified through the SWMP Master Plan update for future consideration:

- Complete an initial condition assessment on a limited portion of the stormwater pipe infrastructure
 - Refine the existing criticality assessment based on the CCTV assessment findings
- Research and provide feedback on preferred rehabilitation methods for typical rehab scenarios in the city
- Utilize the findings of the recent pilot projects testing of specific pipe rehabilitation technologies for the implementation strategy for the rehabilitation program
 - Canyon Creek is one of the recent pilot rehabilitation projects
- Utilize Woolpert repair and replacement strategy to help establish prioritization and budget plan for rehab program
- Prioritize CCTV inspection/cleaning and frequency
 - Consider pipes under existing structures

- Consider areas of potential high water and other identified/mapped floodprone areas identified in planning efforts
- Consider streets projects and needed coordination
- Consider water/sewer projects coordination
- Consider pipe capacity and flood incidents
- Determine if the future CCTV program that will be done in house needs to be supplemented with a consultant contract.
 - Consider life cycle costs and efficiencies of in-house versus consultant assessments
 - Evaluate the preferred technology for future assessments.
 - 3D imaging allows a complete picture of the pipe that is less dependent on the operator identifying a deficiency and zooming into the area for viewing. This can be a lot of data to manage.
 - Conventional CCTV equipment is proven and integrates well with the City's recently purchased IT Pipes software.
- Provide completed rehab projects' construction plans to GIS asset inventory
- Stormwater system criticality – Refine Stormwater System Criticality. This will be a more detailed assessment of the current storm drain criticality and CCTV program, addressing the following issues and questions:
 - Where are the known critical areas of the city, based on historical records, where failures have occurred or impending failures have been identified?
 - How frequently are the pipes inspected? Is this adequate?
 - What methods are being used to rehab old storm drains?
 - Is it better for the city to proactively rehab stormwater pipes or to focus only on fixing pipes as they fail?
- Develop rehabilitation prioritization program budget, schedules, process, and milestones
- Based on prioritization and criticality results, program and implement CIP storm drain rehabilitation projects in systematic order
- Review the prioritization order and programming at specified intervals for needed revisions
- Maintain GIS asset inventory data and track work orders for storm drain rehabilitation
- Communicate the benefits of the rehabilitation prioritization program to city management, council, and the public

City Resources

The storm drain rehabilitation program will require additional resources to assess, prioritize, and implement rehab projects. It is anticipated that these resources will be transferred from flood mitigation projects. A further evaluation of the initial assessment data will hopefully help to better project the resource needs over the next 5 to 10 years.

Complimentary Initiatives

- D. Prioritization of Critical Maintenance Tasks – Stormwater maintenance staff may be utilized to assist in the storm drain assessments.
- I. Opportunistic Construction of Small CIPs – Stormwater maintenance staff may be utilized to assist in the implementation of small rehab projects.

Action Plan

- Process Lead: Chris Johnson

- Technical Lead: Cannon Henry
- Staff Involvement: GIS criticality tool support, Kiran, Field Ops, Darich
- Stakeholder Involvement: N/A
- Next Steps: Use Master Plan report and white paper to develop schedule, process, milestones...

Additional Resources

- Woolpert - Level of Service Recommendation Memo dated December 2016
- Woolpert – Repair and Replacement Strategy dated April 2017
- City of Fort Worth - Risk Assessment and Criticality: Pipes and Inlets dated July 2016
- Business Risk Exposure – Criticality analysis for Pipes, Inlets, Outfalls, and Infalls
- Prioritization Tools - Criticality Stormwater Infrastructure (Refer to SWMP Prioritization Tools Appendix)

C. Private Property Channel Erosion Policy

Strategic Direction

Develop a consistent City policy regarding private property erosion resulting from streams and channels that are not located within a public drainage easement.

Purpose

Evaluate a policy that considers both prevention of future potential erosion risk and how to handle situations where erosion risk is currently presenting a hazard to adjacent land uses.

Background

The City is being asked to assist property owners affected or threatened by erosion resulting from streams or channels that are outside of a public drainage easement. This erosion can often threaten property, fences, utilities, and structures. These threatened or damaged properties often have explicit maintenance responsibilities designated to the private property owners or HOAs at the time of platting. The issue of private property erosion is complicated and has become a challenge for residents and communities across the DFW Metroplex and the nation. The following are some of the complicating factors of private property erosion:

- Erosion can be a global issue that is difficult to address on a site-by-site basis
- Erosion mitigation projects can be expensive and often exceed the cost of the threatened/impacted structures.
- Localized erosion stabilization measures can alter channel flow hydraulics upstream and downstream of the affected area and potentially exacerbate erosion in other areas.
- Property owners are often unable to afford a solution.

Participation of the City in an erosion project would require public benefits as a result of any investment of City resources. These public benefits could include:

- Maintained conveyance of waterways to reduce likelihood of overtopping creating additional flood risk to the public
- Protection of public infrastructure such as roads and utilities
 - Improvements to water quality
 - Reduction of sedimentation / blockage improvements
- Lowered risk of future erosion damages for the overall stream and corridor
- Enhanced public use potential, aesthetics, and habitat

Current Practices at City of Fort Worth

The City currently requires property owners to maintain floodplains and channels located on private property and not within a public drainage easement. The City does not have a documented policy that establishes criteria for participation or explicit non-participation.

Citywide Erosion Hazard Potential

The City has developed a high level planning tool to assess the erosion hazard potential of streams and channels across the City. This is a planning tool for information purposes. More information can be found under the SWMP Master Plan Appendix Prioritization Tools – Citywide Erosion Hazard Potential.

The City is undertaking an update of the Erosion Risk Analysis to develop a methodology for the City to locate erosion areas. The implementation of this methodology will occur in the future and may provide additional information to assist the City with this key initiative.



Peer Community Review

Most cities have established private property erosion policies that specify if, when, and how the City will participate. Peer communities were mostly split on whether they will consider participation in capital erosion protection projects. Generally, participation is more likely if public infrastructure is threatened (utilities, streets, other publicly owned infrastructure).

Channel Maintenance	Fort Worth	Arlington	Austin	Dallas	Oklahoma City, OK	Raleigh, NC	San Antonio	Charlotte, NC
Does your community have a private property erosion policy?								
Yes								
No								
I don't know								
What actions will your community consider if a privately owned creek/channel begins to threaten private property, life, or safety and a private property owner is unable to fund a solution? (check all that apply)								
Participation in a voluntary buyout program								
Participation in a CIP								
Other means to address the problem								
The community will not participate in private erosion issues								
What types of channels does your community maintain?								
Engineered channels								
Natural channels								
Both								
Neither								
<i>FTW along with many of the other communities maintain natural channels but only to clear significant blockages.</i>								
To what extent are natural channels maintained? (Check all that apply)								
Mowing								
Clearing signific. blockages								
Erosion								
Other								
<i>The CHA program functions in coordination with Mecklenburg County. Since the County does have a streambank restoration program, the response for CHA was updated to include erosion.</i>								

Arlington

- Will not address private property erosion issues.
- Reach based erosion mitigation pilot program recently initiated that is considered public.

Austin

- Has a policy for prioritizing and repairing erosion within drainage easements on private properties.
- Will fund erosion repair on private property based on priority only within dedicated drainage easements. Projects are typically construction based but buyouts are considered during alternatives analysis.

Dallas

- Open channels are owned by the City. City will participate in capital erosion projects when an easement has been dedicated to the City.

Oklahoma City

- Unless public infrastructure is at risk the City does not participate in private property erosion control projects.
- Ordinance for erosion control for new development.
- Requires language on final plats that states maintenance responsibilities.
- Requires floodplains to be shown as common areas or drainage easements on plats.
- Typically, advises property owners to hire an engineer to evaluate stabilization options. City reviews and approves recommended projects.
- City maintains certain natural channels if they are in public drainage easements indicated on plats. Limited to a few historical agreements and the City is no longer taking responsibility for public maintenance of drainage easements.

Raleigh

- Drainage assistance policy is a cost share program where City will review severe erosion when there is runoff from public streets or land. Projects are taken to a separate advisory board that reviews and makes decisions on whether to fund the project. Policy is geared towards smaller scale projects. Historically there was a 50/50 cost share for capital projects on private property.
- Program is funded at \$1.25 million per year.
- Eligible projects must have a public contribution of water involved and typically meet one or more of the following criteria:
 - Structural flooding
 - Severe/active stream bank erosion (particularly impacting a structure or right-of-way)
 - Failed drainage infrastructure
 - Blocked or clogged drainage pipes on private property (resulting in severe erosion or structural flooding)
 - Sinkholes over drainage pipes
- Non-eligible Projects
 - Nuisance yard flooding;
 - Drainage problems caused by poor landscaping or yard grading;
 - Standing water from groundwater;



- Minor stream bank erosion;
- Roof/gutter drain problems;
- Runoff from adjacent, private properties;
- Pipes/fill that should not have been permitted when installed
- Program Requirements
 - Any landowner of subdivided and developed property, including residential, commercial or public entities, who pay the City's stormwater utility fee.
 - The land must receive stormwater runoff from a public street, right-of-way or other City property.
 - Qualifying projects including those involving structural flooding, severe erosion, and blocked/clogged pipes due to inadequate or failing infrastructure on private property.
 - Property owners must be willing to donate the necessary temporary and/or permanent, public drainage easements at no cost to the City to complete the improvements.
- Application Process
 - Staff assesses eligibility, severity, and priority of the issue by scoring and ranking it within the division's projects prioritization list.
 - Projects are presented to the Stormwater Management Advisory Commission. SMAC reviews projects up to 6 times per calendar year and makes recommendations for Council consideration.

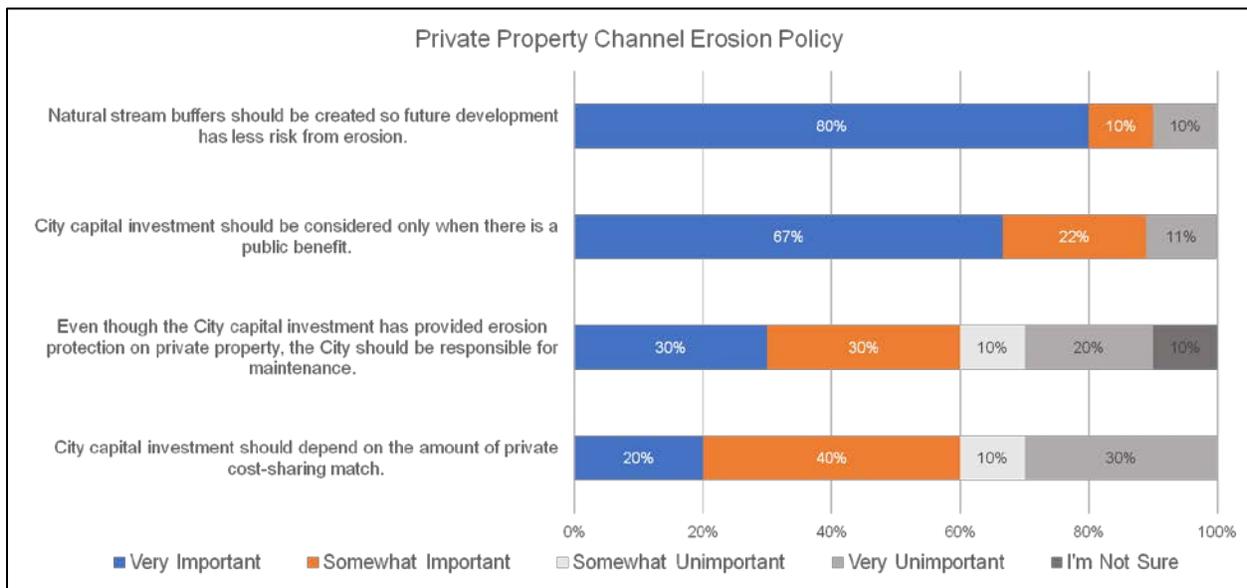
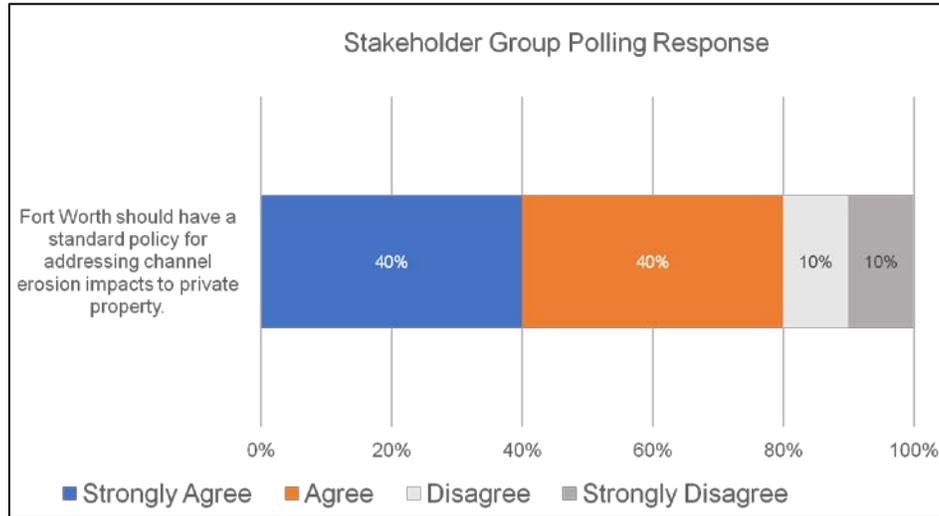
Charlotte

- City has a private property erosion control policy that is limited to focus on threats to homes and streets.
- City no longer qualifies erosion problems as a Storm Water service, unless property is subject to loss.
- City will participate in private property erosion control project but only after a structure is severely threatened. Yard and property erosion stabilization projects are not prioritized.
- City requires the property owner to maintain private channels (vegetation, cleaning, etc.) except for FEMA channels.

Stakeholder Feedback

The following polling responses were provided by stakeholders through the Master Plan Update process. Public polling responses are also available and were generally similar in nature with the stakeholder responses.

Stakeholder Polling Responses



Stakeholder comments:

1. Do we really want to establish hard and fast policies and take the decision away from people? The geography of the City has so many different areas to look at, I think it's almost impossible to set hard standards that the people have to follow. I think you have to give people the discretion that are in charge of these things to make some decisions.
2. Maintenance – policy should state criteria for public expenditure for maintenance – when public will maintain.
3. Caution should be exercised in drawing up erosion policy as to not “rescuing” private property.
4. Maintenance of erosion prevention structures should be assigned based on the benefitting entity’s ability to maintain.



5. From past meetings, we understand we need to do something. Concerned that if the City does something for one property owner that we have to do it for all.
6. Is there something we can do besides buffer zone?
7. There is a development issue. Maybe we should consider whether development oversight should

Prevention

- **Communicate internally and externally about high erosion risk areas**
- **Investigate the potential for a written buffer zone policy vetted by public and City staff to protect future development particularly within greenfield developments.**

Mitigation of Existing Private Property Erosion Issues

- **Develop a written City policy, vetted by public, City staff and Council**

try to prevent causes of erosion.

8. Cautious of buffer zone. We need to recognize that it's very difficult to accurately estimate channel erosion and horizontal/vertical shifting of the channel.
9. Properties threatened by erosion is a bad thing. It appears we are going straight towards a buffer zone policy and I'm concerned about the number of streams in the City and the impacts this could have on development. In other communities, it takes out developable property and negatively impacts the cohesiveness of the property. All for preservation, but this may take it too far.
10. Private channel erosion policy – may engage, not will engage.

Public Comments

11. Permanent erosion control will be needed
12. Warn & Inform can be controversial – Flood insurance doesn't cover erosion.

Future Considerations

The following future actions for Private Property Channel Erosion have been identified as part of the Stormwater Management Program Master Plan Update:

The written policies will need to be thoroughly vetted to determine the preferred direction for the City. The policies should support the established goals/objectives of the City Comprehensive Plan and be consistent with the City adopted Floodplain Management Plan and the overall Stormwater Management Program Master Plan.

Policy Development

Prevention

The City is currently allowing the development of property at risk of erosion with the condition that the private property owners will accept responsibility for the risk and future maintenance costs that result. This conditional acceptance of risk has allowed for potentially unmanageable situations because of the

excessive costs and complexity of the maintenance solutions. The costs often exceed the resources of the property owners. The private property erosion policy should consider opportunities that reduce the likelihood of these situations. The following options could be considered as part of an erosion risk prevention policy.

- Option 1 - No action / Status Quo
 - Continue to allow platting and development of property contingent upon the agreement that private property owners will be responsible for the maintenance and costs associated with erosion risks.
- Option 2 - Erosion Potential Mapping without Regulation
 - Utilize approximate erosion risk identification methods to locate and map areas with a potential erosion hazard that could result in horizontal or vertical migration of nearby streams and channels.
 - Communicate erosion to public and make data easily accessible through the City website or other reasonable means.
 - In the absence of regulations, the existing and future property owners will be responsible for making informed decisions regarding safety and investment in at risk properties based on the available mapping and risk information. There is a need to make sure that future property owners fully understand what they are responsible for. Evaluate how this is being performed currently and whether there should be changes if this option is selected.
 - Additional contingencies could be considered as a requirement at the time of platting or development as part of the erosion risk mapping such as:
 - Require maintenance plan and estimated costs for erosion protection
 - Require detailed analysis of erosion risk and mapping
 - Require erosion mitigation measures to be constructed
- Option 3 - Stream Buffer Zone with Regulation
 - Stream buffers allow streams adequate room to migrate over time. These buffers can help maintain good water quality, reduce flood impacts, reduce channel erosion, reduce operation and maintenance costs, and contribute to other community benefits such as parks and recreational use (trail corridors) plus aesthetics.
 - These buffers often vary in width based on the contributing drainage areas and location. Buffer zones can vary between 10 feet and over 100 feet from the streams and channel banks depending on the erosion potential of the stream and the criticality of the location. These buffer zones can at times extend beyond the fully developed 100-year floodplain and the floodplain easements.
 - Buffer zones can be varied for greenfield and urban areas and by actual channels. Buffer zones may not be one size fits all channels/parts of town.
 - Buffers are often not applied to previously modified drainage features or closed storm drain systems.
 - The stream buffer zone would act to limit or prevent development or redevelopment of property within the delineation boundary.
 - Mapping
 - Identification of buffer zones could be an outcome of this policy. Buffer zone areas (regulating and/or communicating them) should be based on science for where these areas are needed, the appropriate size, opportunities for revisions, etc.
 - The City would need to evaluate the development of stream buffer mapping. The mapping would need to consider priority areas, which are often in greenfield or developing areas of the City.

- If the stream buffer zone is a predictive buffer zone based on future stream conditions, the buffer zones are typically static and do not require significant updates or maintenance on behalf of the City.
- Revisions to the stream buffers are often considered along with development and a process would need to be established for review of revisions.
- Review and recommend changes, if needed, to the City Stormwater Management Design manual that deal with erosion and sediment control
- Identification of buffer zones could come out of the private property erosion mitigation policy. Buffer zone areas (regulating and/or communicating them) should be based on science for where these areas are needed, size, etc.
- May need to have different policies/criteria for infill areas and greenfield areas

Existing Private Property Erosion Issues

Properties in the City are currently threatened by erosion and property owners have requested City assistance. It is possible that future properties will also be threatened by erosion and request assistance. The City needs a defined policy to objectively clarify City participation in erosion issues threatening private property. Participation of the City in an erosion project would require public benefits as a result of any investment of City resources. The following options could be considered as part of an erosion policy to address existing issues.

- Option 1 - No involvement in private property erosion issues
 - A written policy that states no City involvement in private property erosion issues would further enforce property owner responsibilities for project and maintenance costs associated with erosion.
 - This policy can be heavily scrutinized following a catastrophic event or imminent threat to an existing structure. Some communities have changed their policy to allow for City involvement following these types of events.
- Option 2 – Involvement in emergency situations
 - Access to emergency funds for limited involvement may be considered. This would allow the City to participate in an emergency situation when City involvement is in the best interest of the public.
 - Define emergency threshold and conditions for City participation. These definitions may require the involvement of a geotechnical engineer and/or stream geomorphologist to quantify when the threat reaches an emergency threshold. Often the emergency threshold is identified following a major storm or erosion event. These critical situations may include:
 - Potential blockage of conveyance or a waterway
 - Severe water quality impacts due to pollutants or significant sediment deposition
 - Impending threat to public infrastructure
 - Consider private investment of matching funds to compensate for private property benefits as a result of an emergency project. Due to the timing of these emergency events, administration of private matching funds may be challenging.
 - Consider including properties threatened by erosion in a voluntary buyout program.
 - The voluntary buyout program can often provide a more desirable benefit to cost ratio.
 - The voluntary buyout effectively reduces the threat, especially if the threat is limited to a small number of properties.
 - The voluntary buyout can help reduce long-term maintenance costs and liability of the City if a capital project does not perform.

- Option 3 – Involvement in critical / imminent threats
 - Through an evaluation process, the City would determine an established amount of budget that would be set aside annually to address critical or imminent erosion threats. This would allow the City to participate in a critical or imminent threat when City involvement is in the best interest of the public. Based on peer communities, a budget of \$1 - 1.5 million might be considered. These projects would need to be prioritized against other stormwater capital needs across the City.
 - Define critical and imminent threat thresholds and conditions for City participation. These definitions may require the involvement of a geotechnical engineer or stream geomorphologists to quantify when the threat reaches a critical threshold. A critical / imminent threat can be difficult to identify based only on visual inspection. These critical / imminent situations may include:
 - Potential blockage of conveyance or a waterway
 - Severe water quality impacts due to pollutants or significant sediment deposition
 - Impending threat to public infrastructure
 - Evaluate potential for drainage easement acquisition in high risk areas along with synergies to park and trail master plan (are there opportunities to acquire drainage easements that will also allow for expansion of City's trail network?)
 - Prioritize problem areas that have high public safety risk.
 - Consider private investment of matching funds to compensate for private property benefits as a result of an erosion mitigation project.
 - Consider including properties threatened by critical / imminent erosion in a voluntary buyout program.
 - The voluntary buyout program can often provide a more desirable benefit-to-cost ratio.
 - The voluntary buyout effectively reduces the threat, especially if the threat is limited to a small number of properties.
 - The voluntary buyout can help reduce long-term maintenance costs and liability of the City if a capital project does not perform.

City Resources

Some options for consideration would require additional City resources. It has not yet been determined the level of additional resources or where those resources would come from.

Complimentary Initiatives

- D. Prioritization of Critical Maintenance Tasks – Stormwater maintenance staff may be utilized depending on the selected option.
- F. Level of Development Review – This initiative could impact future regulatory changes related to avoidance of erosion hazards.
- H. Property Buyouts – Buyouts have been considered as a potential mitigation alternatives for private property erosion issues.
- L. Mitigation Banking – Channel stabilization projects may be considered as a type of mitigation banking activity.
- M. Natural Area Preservation, Conservation, and Restoration – This initiative would assist in the avoidance and prevention of future channel erosion issues.



Action Plan

- Process Lead: Jennifer
- Technical Lead: Ranjan
- Staff Involvement: Field Ops, PLN, Field Engineering, Legal, Parks, ENV, SDS, Floodplain Admin., Linda S.
- Stakeholder Involvement: TRWD, S&V, SW Stakeholder Group Small Group, DAC, PLN Commission
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional References

- TFMA Fall Conference 2017 San Antonio – *Grand Prairie's Approach towards addressing Creek Erosion – From Hard Armoring to Voluntary Buyout* – Romin Khavari, PE, CFM, Stephanie Griffin, PE, CFM. Potential point of contact for future private property channel erosion policies and buyout program coordination.
- Charlotte-Mecklenburg Stream and Lake Buffer Requirements
- City of Garland Drainage Improvement District - The City of Garland has established a Drainage Improvement District program to assist residential and commercial property owners who are experiencing property damage due to erosion from creeks or other bodies of water within the City.
- Zoning Practice, American Planning Association, March 2017
- Freese and Nichols – GIS Erosion Potential Map, May 2017



D. Prioritization of Critical Maintenance Tasks

Strategic Direction

Evaluate current levels of service for maintenance programs to prioritize resource allocations to areas of greatest benefit in serving the community needs.

Purpose

Service levels for many aspects of the maintenance program will be reviewed to determine if reallocation of resources from other maintenance services such as concrete, channel, vegetation, and inlet cleaning to pipe rehabilitation or other critical needs are warranted.

This initiative should be considered in the context of the overall resource programming and prioritization to establish a process for prioritization of critical maintenance tasks in context of the overall program funding resources and needs.

Background

A specific Field Operations Section has been established within the SWMP to implement a prioritized, scheduled, and proactive program for channel and vegetative maintenance. Maintenance of high priority areas help prevent future failures and expensive replacement or rehabilitation costs.

At this time, service levels for maintenance and rehabilitation for inlets, infalls, outfalls, channels, and culverts are assessed to be adequate in consideration of overall program needs, priorities, and resources.

Current Practices at City of Fort Worth

The City currently utilizes a Stormwater Channel Rating Form to help rank and prioritize channel maintenance needs across the City. A comprehensive channel inventory and assessment task is underway to help identify and quantify the maintenance needs across the City related to channels.

Accela work order system used to track work orders, cost of service, etc. The City's stormwater maintenance section has utilized Accela and other tools to track performance goals and metrics for nearly all of the maintenance tasks.

Peer Community Review

8. Level of Service	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your community have a targeted level of service for maintenance planning?								
Yes								
No								
I don't know								
<i>FTW does have a targeted frequency for mowing and inlet clearing. FTW does not have a targeted level of service that specifies channels must be functioning to convey the original design frequency.</i>								
9. Nuisance Issues	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
How have mosquito threats impacted your maintenance program in recent years?								
Significantly								
Moderately								



Not significantly I don't know								
Has your community been successful utilizing sprays or non-construction techniques for mosquitos?								
Yes								
No techniques to eliminate mosquitos have been attempted								
What types of nuisance issues will your community address? (Check all that apply)								
Groundwater seepage								
Ponding water in streets								
Mosquitos								
Natural channel maintenance								
Other								

Arlington

- No targeted level of service for maintenance planning.
- City does not address groundwater seepage (constant water flow in gutter line).

Austin

- City is in the process of developing a comprehensive asset management plan that will include consideration of level of service, so the answer is really more that we will have this relatively soon.
- Tend to use more natural techniques such as introducing gambusia to help control mosquito populations in wet ponds.
- Typically encourage the establishment of natural channel vegetation and try to limit maintenance to clearance of significant debris especially near culvers and bridges.

Dallas

- Natural channel maintenance limited to blockages on City property are only nuisance issues our community will address.

Oklahoma City

- Target is to maintain to design as best as possible. Many phone calls from citizens for channel maintenance.
- Mosquito plan to treat public property only. No spray.
- Field phone calls on nuisance issues and perform site visits but street department performs any improvement work.

Charlotte

- City is primarily involved in maintenance planning when infrastructure fails or creates flooding to roads and structures. Refer to this practice more as repair than maintenance.
- No longer inspecting inlets as it was an inefficient process. The City maintains based on observations of staff, street department, or citizens.
- Health department services mosquito threats.
- Techniques to eliminate mosquitoes have been attempted.
- City will perform stream stabilization or restoration on a large scale when the conditions are right. The City is currently conducting 5 miles of stream restoration at a cost of \$8M. The City recently stopped the practice of stabilizing creek banks on a single property in short distances.

Stakeholder Feedback

Stakeholder comments:

1. Asset management and maintenance is something that the program is starting to explore more deeply. Land development activity constructs more storm drain infrastructure than the city. However, there is a misalignment of design criteria for public and “privately” funded storm drain. For example: stormwater prefers geotextile erosion control however the drainage manual requires rock rip rap. Our allowable manhole spacing and reinforced concrete box dimensions exceed what operation and maintenance staff can service.

Future Considerations

- The SWMP Planning Section is responsible for prioritization maintenance activities and service levels for service provides. Evaluate opportunities to establish defined levels of service for maintenance activities.
- Identify potential opportunities for efficiencies based on Accela work order system to help refine frequency of maintenance tasks and help prioritize locations.
- Investigate how to compare maintenance benefits with the remaining program elements to assist in the Resource Programming Task.

City Resources

This initiative is not expected to require additional City resources but it is possible that resources may be shifted to different activities.

Complimentary Initiatives

- B. Storm Drain Rehabilitation Program – Stormwater maintenance staff may be utilized to assist in the storm drain assessments.
- K. Public Channel Maintenance – The results of the channel inventory and assessment could impact the planned channel maintenance backlog.
- M. Natural Area Preservation, Conservation, and Restoration – This initiative could assist in a reduction of maintenance activities for certain areas.

Action Plan

- Process Lead: Chris
- Technical Lead: Cannon
- Staff Involvement: Field Ops, Floodplain Admin, ENV, Parks, Streets?, Water?, Kiran



- Stakeholder Involvement: N/A
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional References

- 2016 Stormwater Field Ops Work Program
- FY 2016 Cost of Service Master Plan
- TPWA 2017 APWA Conference – Storm Water Infrastructure Asset Management Plan
- Prioritization Tools – Maintenance Project Prioritization (Refer to SWMP Prioritization Tools Appendix)

E. Flood Preparedness (Warn, Respond, Recover)

Strategic Direction

A standard operating procedure (SOP) for flood preparation, response, and recovery will be prepared to inform responsibilities and roles of stormwater staff before, during, and after a storm event. An evaluation will be conducted to determine the feasibility of expanding the real-time flood warning program strategically to include more enhanced and predictive flood warning components.

Purpose

The Flood Preparedness (Warn, Respond, Recover) initiative will consist of identifying, consolidating, and organizing these elements in order to manage residual risks, warn, and inform people. These flood preparedness elements are intended to be consistent with the SWMP Master Plan and Floodplain Management Plan. These ongoing and future activities and elements will create an effective flood warning/responding/recovering system for the city. These components include:

- The City (Ranjan) Flood Warning Master Plan. Consider opportunities to strategically utilize CASA
- The results of the ongoing / current Texas Water Development Board grant effort that includes a flood response plan,
- The City (Cannon) SOP that he is working on? ok
- Identifying the noted gaps in the flood preparedness elements, between the SWMP Master Plan objectives and what city efforts have accomplished to date.
- Consider a comprehensive Standard Operating Procedure for the SWMP and staff for flood preparedness, warning, and response.

Background

The current City flood warning system is often not able to provide many residents with advanced warning due to the short, flashy storm events typical of many watersheds in the City. In addition, the current SWMP warning program has technical challenges such as a lack of reliable data to warn residents about emergent flood risks. Varied levels of data precision are used to warn of flood risk throughout the City. Flood and some erosion hazard risk maps are available, but communication of these risks is challenging.

Current Practices at City of Fort Worth

Stream Crossing Inventory

The City utilizes a Stream Crossing Inventory tool to help identify flood warning priorities. More information is available on this tool in SWMP Prioritization Tools Appendix.

Flood Warning System / Flashers

The current flood warning system in Fort Worth, known as the High Water Warning System (HWWS), relies on water level measurements made at 52 low-water crossings throughout the city. Roadside flashers are installed at those 52 locations, to immediately warn drivers of a flood hazard. At the same time, text and email alerts to first responders are issued when the water level sensors of each flasher system are triggered from rising water.

Weather data (mainly rainfall) is collected at 39 low-water crossings and seven other weather stations. The gaged data is communicated through two dedicated radio frequencies in real-time, to a receiver station at the Burnett Plaza building.



The Flood Warning System (FWS) will use the existing HWWS communication backbone as much as possible, while making improvements to weather data collection, and will disseminate the real-time data to the public and other stakeholders.

A grant through the Texas Water Development Board (TWDB) is providing development support for this system. The grant project has the following overall goals:

- Improve system reliability
- Expand the gaging network with additional rain gaging sites
- Upgrade data collection and data dissemination (communication tool) software
- Develop a Flood Response Plan

Peer Community Review

16. Flood Warning	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your community have a flood warning program?								
Yes								
No								
If so, what are the primary objectives of the flood warning program? (Check all that apply)								
Protect low water crossings								
Warn for frequently flooded underpasses								
Install flood warning when a capital project solution is too expensive								
Install flood warning in response to a loss of life or high water rescue								
N/A								
What are your future goals for flood warning?								
Expand the program								
Shrink the program								
Stay the same								
N/A								
Are there new technologies that you expect to implement in your flood warning program in the next 5 years?								
Yes								
No								
I don't know								



17. Flood Preparedness and Response	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Is your stormwater department involved in the flood response immediately following a storm event?								
Yes	Yellow	Green	Green	Green	White	Green	Green	Green
No	White	White	White	White	Red	White	White	White
Does your stormwater department have a written procedure for response to flooding events?								
Yes	Yellow	White	White	Green	Green	Green	Green	White
No	White	Red	Red	White	White	White	White	Red
<i>Clarification: FTW Operations and Maintenance has a specific response plan.</i>								
Is your department responsible for delivering data to emergency responders or citizens during a storm event that impact flooding response decisions?								
Yes	Yellow	White	Green	Green	Green	Green	Green	Green
No	White	Red	White	White	White	White	White	White
I don't know	White	White	White	White	White	White	White	White
<i>Clarification: FTW stormwater staff are responsible for delivering data when the Emergency Operations Center is activated in large storm events. Flood gage data is provided to emergency responders for all storm events.</i>								
18. Public Data	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
What information does your community make accessible to the public? (Check all that apply)								
Maintenance work orders	White	White	Red	Red	White	White	White	White
Local floodplains and erosion hazards	Yellow	White	Green	Green	Green	Green	White	Green
GIS data	Yellow	Green						
Pipe conditions assessment	White	White	Red	Red	White	White	White	White
Downstream drainage constraints	White	White	Red	Red	White	Red	Red	White
Watershed studies	White	White	Red	Red	Red	Red	Red	Red
Hydrologic and hydraulic models	White	White	Red	Red	Red	Red	Red	Red
None of the above	White	White	White	White	White	White	White	White
<i>FTW GIS data is available on the website. Local floodplains and erosion hazards are available through "One Address" query online. Additional information such as watershed studies and H&H models are available upon request. Some communities may have responded to include data that is only available upon request.</i>								
20. Climate Change	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Have changes been made to your program in recent years to address climate change?								
Yes	White	White	Red	White	Red	White	White	White



No I don't know								

Arlington

- City currently has 5 stream gauges. Looking to revamp and increase to 16 gauges.
- City would like to establish standard operating procedure for major storm events.
- Floodplains provided on City website.
- New website called “Open Arlington” intended to serve as central clearinghouse for accessing, visualizing, and interacting with public open data sets.
- No proposed changes relating to climate change

Austin

- Common Operating Picture for management of conditions during flood events, improved real-time flood inundation mapping.
- Program changes have primarily been on the operation side to reduce carbon footprint. We will likely consider the potential impacts of climate change in the ongoing development of our asset management plan and in some cases may consider more extreme design events for critical facilities.

Dallas

- Stormwater department is involved in the flood responses immediately depending on impacts following a storm event.
- Flood Control Division has a written procedure for responses to flooding events.
- Department is responsible for delivering data to emergency responders or citizens during significant events, if the city suspects one is imminent.

Oklahoma City

- Headed in same direction as Fort Worth, but just now trying to get started.
- Do the best they can during flood response. No formal response plan.
- Sent out staff in roughly 5 sqmi. increments last flood event – assess damage, talk to residents, and retrieve high water marks.
- Watch list from complaint database to monitor storm infrastructure prior to or during rain events.
- Open records request for any public information if not provided on website.
- News crews will call to get information regarding storm events.
- After the 2013 flood, professor at OU analyzed rainfall and provided new data. City is planning to incorporate new rainfall data from the NOAA rainfall site. City does not anticipate 100yr event will increase by much.

Raleigh

- Looking to build strong GIS to help support flood warning.
- USGS has an alert system that will alert you on stream gage that will send out alerts.
- City has network of 12-14 stream gages across City.
- Looking at Austin Flood Warning system

- Imaps site is web based GIS that shows floodplains, infrastructure, watersheds, etc. Alluvial flood layer needs to be checked to see local floodplains.
- In the middle of an open data initiative. Participated last year working with an entity to review open data. Already begun through the Raleigh Open Data Portal to provide more data to public. Historically may not have been provided unless requested. For instance, impervious area billing information is something that is now provided. Over 100,000 records are in database for customer to pursue if they would like.

Charlotte

- Flood warning program operated by Mecklenburg County.
- Primary objectives include notification of frequently flooded homes, businesses, streets, traffic and pedestrian safety, etc.
- City only gathers information after a flood event.
- As per Essential Service Function ESF-3 we collaborate with the Charlotte-Mecklenburg Emergency Management Office to provide data.
- Flood Information and Notification Systems (FINS) provides precipitation, flood stage, and flood depth to the public.
- Looked into making changes to our program to address climate change, but there's nothing thus far.

Stakeholder Feedback

Stakeholder comments:

1. Agree with Warn & Inform program elements and like the title of the category.

Future Considerations

The following future considerations have been identified as part of the Stormwater Management Program Master Plan Update:

Preparedness (General)

- Determine whether structural mitigation plans (such as improved bridges) should be made to reduce specific flooding risks or provide an adequate flood warning system to reduce those risks. This will include a conscious decision-making process that will include subjective factors (potential loss of life, rescues) as well as quantifiable factors (costs, dependability).
- Address the challenges of improving the reliability of data collection and dissemination to accurately inform stakeholders of emergent flood risks. This will require a significant upgrade to the existing system and will have to be done systematically and on a prioritized basis.
- Improve the necessary coordination before, during, and after an event with other City departments such as TPW Streets, Emergency Management, and outside entities such as the Tarrant Regional Water District, Corps of Engineers, USGS (gages), and National Weather Service.
- Consider CRS initiatives to incorporate into the flood warning/response plan.
- Determine the city policy for flood warning priorities and locations (e.g. only at low water crossings). Include decisions on whether to manage flood prone areas that are expensive to “mitigate” or to use a warning system as a replacement for flood reduction projects.
- Develop a severe weather warning SOP to be executed through the City website and social media blasts as well as via other communications (radio, TV).

- Develop low-water crossing outreach materials for HOAs and apartments to identify hazards to educate current and future residents
- Evaluate sandbag program and consider expansion of the program. Provide public outreach on when sandbags are available and how they can be obtained.
- Prepare a SOP for flood response and better define road closure process.
- Consider staging of equipment or develop a process for sending equipment home with staff if storms are forecasted outside work hours.
- Establish process for coordination with emergency management and other entities before, during and after flood event.
- Investigate grant funding for emergency services.
- Document and refine, if necessary, the process to gather documented incidents during floods.
- Communicate, in advance of flooding, areas of potential danger such as low water crossing information with HOAs, NAS, etc. to educate existing and new residents about flood risk.
- Decide on maintenance of flood warning hardware, either through City staff or a consultant. If City staff, consider needs for training.
- Expand subscription based program for text and email severe weather warnings and encourage participation to all residents through workshops and the Runoff Rundown Newsletter.
- As part of upgrading the flood warning system, provide intensity of rainfall triggers for field operations.
- Evaluate CASA radar opportunities for greater effectiveness and efficiency.
- Investigate sand bag program standard operating procedure.

Warning

- Initiate severe weather warning through City website and social media blasts and in coordination with partners such as the National Weather Service.
- Support flood response SOP with public communication plan with identified communication strategy before and during the flood event
- Field Operations will utilize flood warning data for road closures and other actions.
- Provide alert notification to ISD's and similar organization and update communication with them as needed per flood response plan and changing situations.
- Expand Social Media program, as needed and practical, during flood events.
- Develop online mapping of current road closures, detours, etc. during flood events, possibly through Waze, to display on City website.

Response

- Implement appropriate sections of flood response plan being developed by planning as part of Flood Warning Plan.
- Something to consider is being prepared to take photos during events in areas where we are looking at doing a potential future project to better document/support the need for a mitigation project

Recovery

- Assess flood damages: identify flooded properties and provide substantial damage estimations (possibly based on FEMA criteria/significant damage thresholds)
- Evaluate (post flood) road closures and citizen response to warnings.

- Identify flooding impacts to CIPs that are under construction.
- Review and document performance of completed CIPs in areas of interest.
- Maintain "Ditch List" and continue to actively review hotspot maintenance needs.
- Identify maintenance needs and flood damage— particularly those needs that could be reimbursed with federal funding.
- Document coordination with EMO and Floodplain Management.
- Develop post-flood summary memorandum:
 - Include info about flood response when someone placed a call for help.
 - Evaluate whether Fire and Emergency Management provide periodic updates to council and if so, how.
 - Include data on road closures.
- Assist with mapping and summary of flood event data. Review media reports and online info to accurately map flood incidents.
- Assist with distribution of post-flood summary memorandum.
- Develop plan for how to update council after an event.

City Resources

This initiative is not expected to require additional City resources.

Complimentary Initiatives

- J. Program Wide Communication Plan
 - Public data
 - How much City engineering data, studies, maps, gage information, and planning data would public like to see and how would they like to access it?. This could overlap with development services as well.
 - What data do you make accessible to the public? Data such as maintenance work orders, local floodplains and erosion hazards, GIS data, pipe conditions assessment, downstream drainage constraints, etc.

Action Plan

- Process Lead: Ranjan
- Technical Lead: Cannon
- Staff Involvement: Field Ops, Floodplain Admin, EMO, Traffic, Field Eng./Tim, Deon, Linda S., GIS staff
- Stakeholder Involvement: TWDB, NWS, ISDs, CASA, Corps, COG, Neighboring Jurisdictions, MedStar/Other non-city emergency responders
- Resource: Coordinate with Bob Horton
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional References

- Prioritization Tools – Stream Crossing Inventory (Refer to SWMP Prioritization Tools Appendix)
 - Roadway Flood Hazard Assessments by Steve Eubanks – This initiative led to the Stream Crossing Inventory Prioritization Tool.
- Maintenance Ditch List – This is a list kept by maintenance to identify critical locations for inspection and maintenance prior to and following a significant storm event.



- The National Hydrologic Warning Council – A Brief Look at Social Media in Emergency Management – December 2016

F. Level of Development Review Policy

Strategic Direction

Investigate policy revisions that could increase the level of protection from adverse impacts of flooding as a result of development in flood-prone areas, incentivize development to help reduce flood risk, and properly account for the cumulative impacts of development.

Purpose

Investigate and refine policies that prevent the adverse impacts of flooding as a result of development. Specific policies were identified for consideration during the SWMP Master Plan update and those are described in more in Future Considerations. Policy update considerations will need to consider the following challenges identified in the SMWP Master Plan:

- Determining the Overall Appropriate Level of Care - The City has provided design standards but is not ultimately responsible for the design and construction of private development. How much oversight can/should realistically be applied with regard to standards, review process, and enforcement to ensure new/re-development doesn't create or aggravate drainage issues? The answer to this question is not an objective matter and is resource constrained.
- Balancing Flexibility, Responsiveness, and Predictability - The efficiency of private development is enhanced by City permitting that is highly flexible, quick to respond to customer challenges and queries, and is highly predictable. These things all work against each other and, given resource constraints, it is an ongoing challenge to balance these factors. Additionally, certain Federal regulations adopted by the City offer fewer opportunities for flexibility and are dependent upon experienced applicants and knowledgeable permit review staff members.

Background

Fort Worth and most other major cities promote orderly growth and development, safe construction, and neighborhood vitality through development oversight.

Current Practices at City of Fort Worth

The City of Fort Worth applies the requirement of “No adverse Flooding Impacts” for development and redevelopment.

- Same criteria for greenfield and infill sites with one exception for small infill lots
- Review sites greater than 1 acre
- Goal is to minimize risk of adverse drainage impacts onsite or offsite
 - Significant level of detail but still just an “audit”
- Water quality requirements only during construction
- Development Incentives
 - The Berry / University Development Plan is the only location with incentives in place for developers to over-mitigate in the form based code.
- Development is allowed to increase stormwater discharges and runoff volumes from a site if the additional discharges do not cause flooding downstream.

Development Oversight – Considerations by the City

- Ensure compliance with drainage standards
 - Goal is to minimize the possibility of adverse impacts onsite/offsite



- Timely review process
- Flexibility
 - Regulate to the “spirit” of the standards not just “the letter”
 - Works against timeliness
- Predictability
 - Trying to be “Predictably flexible”
- Manage Stormwater resources
 - No specific fee for reviews

Peer Community Review

Development Oversight	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Is downstream conveyance capacity considered in a "first-come, first-served" basis?								
Yes								
No								
I don't know								
Does your community utilize City funded watershed studies to inform future development requirements for mitigation/detention?								
Yes								
No								
I don't know								
Does your community require that infrastructure be designed for ultimate watershed development condition?								
Yes								
No								
I don't know								
If not, is there an expectation that future development will be mitigated on-site or through regional detention?								
Yes								
No								
N/A								
What is the threshold of lot size for development review?								
Less than 0.5 ac								
Between 0.5-1.0 ac								
1.0 ac or greater								
I don't know								



Are small lot and large lot developments reviewed differently?								
Yes								
No								
I don't know								
In your opinion, what level of development review does your community provide?								
Significant - equal level of significant review for all applicants								
Moderate - review effort is focused on critical applications in areas of known flooding								
Minimal - the primary responsibility is with the applicant								
N/A								
Does your community require fees for stormwater development reviews?								
Yes								
No								
I don't know								
11. Water Quality	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your community have water quality requirements for private development?								
Yes								
No								
I don't know								
<i>FTW has water quality requirements as part of the current MS4 program and SWMP requirements.</i>								
Does your community have water quality requirements for publicly funded projects?								
Yes								
No								
I don't know								
<i>FTW will consider water quality improvements as part of publicly funded projects.</i>								



14. Impacts of Development and Infill								
	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
If yes to either of the previous two questions, which of the following were contributing factors leading to these requirements? (Check all that apply)								
Protection of a community resource such as a lake or waterway								
MS4 permitting requirements								
Anticipation of future federal requirements								
Desire for greater quality of life								
Recreation								
Aesthetics								
N/A								
Which pollutants are you actively trying to reduce? (Check all that apply)								
Bacteria								
Hydrocarbons								
Nitrates								
Heavy metals								
Sediments								
Other								
N/A								
Does your community's stormwater program manage your MS4 permit?								
Yes, the permit is managed by the stormwater department								
No, the permit is managed by a separate department								
Does your community have specific strategies and policies to address the flooding impacts of infill and redevelopment?								



Yes								
No								
I don't know								
<i>Clarification: FTW requires no adverse impacts for all development but does not have specific strategies to address infill and redevelopment.</i>								
Does your stormwater department have the opportunity to review the flooding impacts of redevelopment when there is not platting or replatting associated with the project?								
Yes								
No								
I don't know								
What requirements are used to regulate cumulative impacts of development? (Check all that apply)								
Fully developed future conditions watershed analysis								
No increase in discharges								
Control impervious area increases								
Require applicants to reduce design discharges								
Watershed planning has identified specific mitigation requirements								
Other								
N/A								
Does your community have different criteria for greenfield and infill development?								
Yes								
No								
I don't know								
Are there specific areas of the City where increased discharges are specifically prohibited? (E.g. older areas of the community with known flooding or erosion issues)								
Yes								
No								
I don't know								



Are there policies and processes in place for your program to regulate impervious percentages of a single family residential lot redevelopment?								
Yes								
No								
I don't know								

Arlington

- No specific threshold of lot size for development review. Required if permit or platting is required.
- City has a flood study review fee, but no general stormwater review fee.
- City staff of 4 people within the community development and planning department responsible for full construction plan review.
- Post-construction BMPs policy currently requires certain amount of points based on size of development.
- No inspection during or after construction.
- City reviews redevelopment at site plan level through building permit process.
- Need floodplain easement on re-plats. Basically treated as new plat.

Austin

- Drainage, water quality, and floodplain review are all part of the overall development review fee.
- Contributing factors for amenities such as the Barton Creek swimming pool rather than activities in creeks.
- Primarily Polycyclic Aromatic Hydrocarbons, bacteria like EC, heavy metals such as PB and ZN, sediments like TSS, and others such as COD, TP, and TN are pollutants the city is actively trying to reduce.
- Policies to address the flooding impacts of infill and redevelopment are still under development.
- Greenfield and infill development criteria is under development.
- City regulates to no adverse impact, so any increases in flow must be contained within drainage system and drainage easement; detention required to detain to match pre-development conditions; both effectively limit increases in discharge.
- Impervious cover limited by zoning maximums; Size limitations (setbacks and building envelopes) for redeveloped homes.

Dallas

- City has water quality requirements for private development and publicly funded projects per MS4/construction General Permit.
- City is also actively trying to reduce legacy pollutants/floatables.
- MS4 permit is management by the stormwater division of TWM.
- Development services has the opportunity to review the flooding impacts of redevelopment when there is not platting or replatting associated with the project.
- In certain conditions, detention is required to regulate cumulative impacts of development.
- Regulation of impervious percentages of a single family residential lot redevelopment is done through economic incentives (fee is related to impervious cover)

Oklahoma City

- Approximately 3-4 staff assigned to plan review, but they would like to add more. 5 people can review plans from stormwater but 1 main person from stormwater staff reviews.
- Review times are generally communicated at pre-development meeting. Typically, 4 weeks from the time they submit plans to the time they get reviews back.
- Typically more than 1 review cycle. Usually 2 reviews but can be more.
- Detention would require different level of review for small and large developments. No difference for anything else.
- Same level of review for all development.
- City reviews calculations in plans.
- New criteria manual coming out soon. Tying ordinance to criteria manual.
- No specific requirements for private development on water quality.
- No site specific TSS removal, but headed that way. Detention used for water quality.
- TMDL is driving a greater focus on water quality and the City is considering detention ponds to help address TSS concerns in lakes.
- No different than any other development. Same standard as anyone else.
- Have to meet historic runoff rate (pre-development not just existing conditions).
- If they are not platting, stormwater permits will still trigger review. Building permit tied to stormwater permit.

Raleigh

- Most recent text change to ordinance that allows City to look at single family parcels. Reviewing every project of any significance for stormwater impacts. Historically had a threshold for disturbance of area. With new ordinance, requiring property owners to control volume of stormwater runoff. Website development/inspections has highlights.
- City currently performs all reviews in house. Team of reviewers, about 7 full time in next fiscal year. Turn-around time for plan reviews is very strict and published on the website for different submittal types. Have a team dedicated to expedited review times for an additional review fee.
- Each proposed development must evaluate their impacts downstream. But they evaluate existing conditions of watershed, not fully built out conditions.
- Reviewing any projects greater than 12,000 square feet. Based on disturbed area, not impervious. Changing ordinance so that it control contiguous and non-contiguous.
- Drainage fees are required and fee schedule is online.

Charlotte

- Not considered a first come, first served basis in most cases. In specific instances, like small lots on redevelopment, yes.
- Our Post Construction Stormwater Ordinance requires detention on-site (based on specific criteria) and/or mitigation.
- Redevelopment is defined as any increase in impervious percentage. In certain areas, there are specific exemptions as part of the site betterments guidance for redevelopment incentives.
- Threshold of lot size for development review is 1.0 acres or greater for residential. 20,000sf of impervious is the commercial trigger, not lot size. Creating more than 24% built upon area will trigger stormwater review.



- The staff process is the same on small lot and large lot development reviews; the requirements can vary. For example, small commercial sites can pay a Fee-in-lieu for water quality requirements.
- Department has the opportunity to review the flooding impacts of redevelopment for downstream analysis. But, not for single family, low density developments.
- Situation is dependent on specific areas of the city where increased discharges are specifically prohibited. Peak is regulated, volume is not. Downstream analysis, site specific. Increases are not specifically prohibited in specific geographic areas.
- Although there is not a hard cap for the program to regulate impervious percentages of a single family residential lot redevelopment, the stormwater department will review any project that exceeds 24% built upon area.

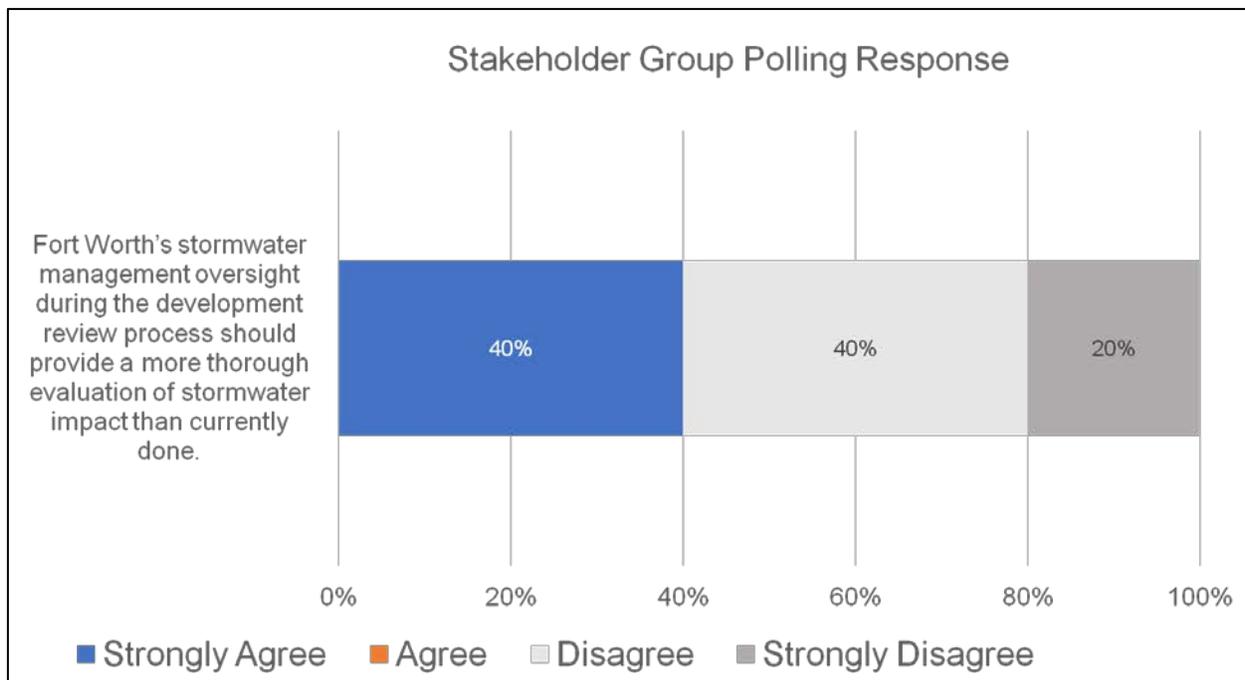
Peer Community Review - Cumulative Impacts

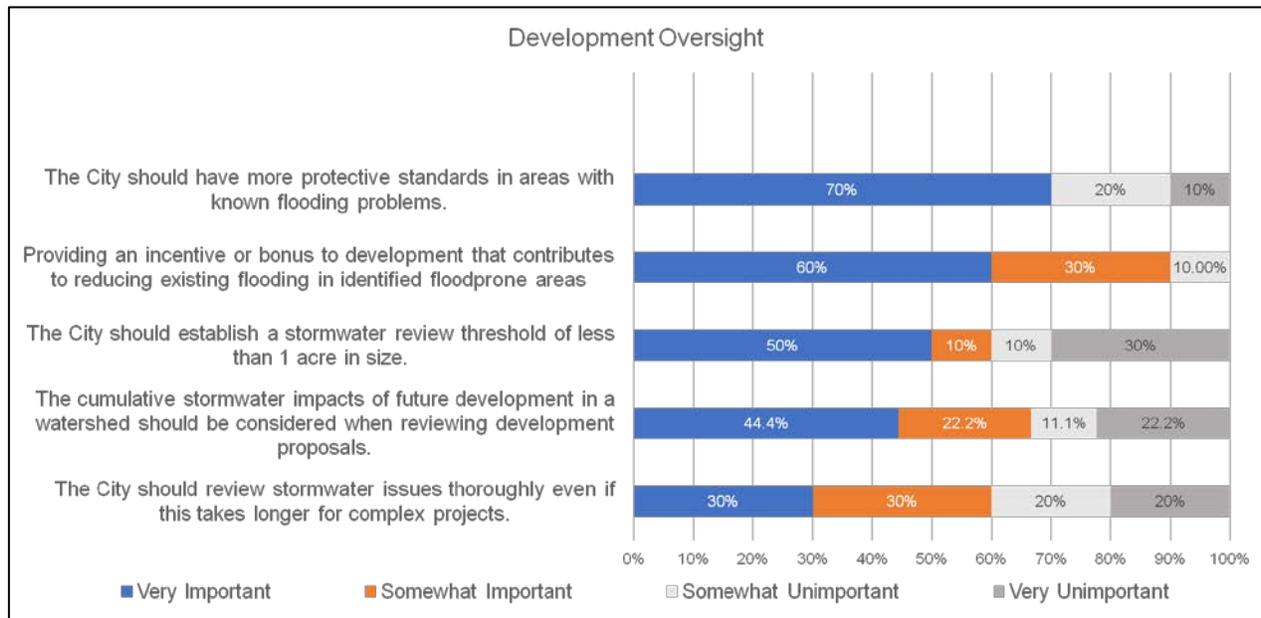
Refer to the Cumulative Impacts Peer Review in the Additional References section for additional peer review information specific to this topic.

Stakeholder Feedback

The following polling responses were provided by stakeholders through the Master Plan Update process. Public polling responses are also available and were generally similar in nature with the stakeholder responses.

Stakeholder Polling Responses





Stakeholder comments:

1. The infill areas are the more troublesome situations. Lee – This gets into expensive public policy. If our goal is to densify, the expense of stormwater improvements may have to be shared by the public as they cannot be fully carried by development. Chris – There are desirable redevelopment areas that will be too expensive to redevelop because it is not feasible. Bailey Industrial Park sump is an example. Gary – The catch is that there are detention ponds and other options that can be used besides just building bigger pipes. Need to find other ways to handle it by slowing it down.
2. The less than one acre review threshold sounds good but cumulatively, the redevelopment areas are having a big impact.
3. These known flooding areas or local floodplains might need to have more thorough review.
4. Like reviewing the areas more where there are floodprone areas.
5. Is resource management really possible to keep our development review costs the same as we are expected to develop more over time? We are constantly trying to keep up with increased development trend.
6. We need to do more areas like Berry University Form Based code that reward developers (build higher) to over detain.
7. Could you regulate differently in areas that are more flood prone?
8. Thinking about the existing flooding in Arlington Heights, we should consider opportunities to help make things better when new development occurs.
9. Is there a mechanism through the development permit or some other opportunity to require a fee from development to help assist in the stormwater improvements in these inner City areas with known flooding issues? Perhaps consider a TIF? There is however, an understood “loophole” that if they show no impact then there may not be a responsibility to pay for these fees.
10. Interested in understanding who is causing the flooding issues and being able to develop a

cost/cause/pay. And currently the system is more of a subsidization of development, in my opinion. And it appears that the current system is fine except for the new development that negatively impacts an existing system. Are there areas where specific inflows are causing issues downstream?

11. Detention in a parking lot is something that is designed all the time in Alliance. Is there an opportunity to partner with development and have the stormwater utility pay for something to help make stormwater issue even better?
12. The council wants tax revenue with new buildings and new employees and sometimes these require rebates. Additional fees may be opposed to the council goals.
13. The current standards do not consider volume of runoff. We do focus on the peak runoff rate. In that sense, we are not restricting or preventing all of the impacts. It would be helpful to see the list of BMP that we currently use and which BMPs other communities use that we do not.
14. From development perspective, inside the City make sure we are taking care of these problems. The last phase of development gets to be extremely expensive. The iSWM development works really well with large areas outside of the loop. Recognize it is almost punitive on redevelopment or smaller developments.
15. Need flexibility for urban vs greenfield.
16. Cumulative impact – infill development – extremely important.
17. Permeability percentage – worth considering.
18. Can cumulative impacts be addressed while not reviewing anything smaller than an acre?
19. Is development paying for their fair share of the cumulative impact for the areas in the City of Fort Worth that are having these problems? Or is that spread out across the City?
20. The City needs to identify potential development centers. Any incentives should be vetted with public before they are provided. The preferred incentives need to be acceptable to the public. In the Berry/University Development Plan, I disagree with allowing parking reduction and building height increase as an incentive for providing stormwater improvements.
21. It is my opinion that changing the development review threshold to look at lots less than 1 acre would not be very effective. If you start reviewing lots that are too small it could negatively impact ability to redevelop.
22. Need to understand what is established as existing condition. An intermediate condition when a lot is redeveloping should not be held as the existing conditions.
23. For TCU area, the stealth dorms cumulatively have a stormwater impact. I think it is important that the City is aware of what is going on.
24. The 1 acre review threshold is defined by platted lot. Three consecutive lots that are redeveloped at the same time would not be looked at unless each lot is greater than 1 acre.
25. Concerned with 2nd bullet and the consideration of reducing the 1 acre review threshold in areas of known flood risk. City should not do anything that will slow down development.
26. Would like to see stated that we want vetted policy with resident feedback.
27. Agree with the future actions regarding Cumulative Impacts.
28. Do it faster in order to keep development moving along.
29. What do you mean by development services?
30. There are a lot of places that already have streets and sewers. We are losing greenspace and farm

land as the city is becoming more developed. There are lots of rundown and vacant buildings that could be renewed or redeveloped. We can't go back. The redevelopment of older areas could be an opportunity and could have an impact on property values.

31. Incentivized development – what does that mean?
32. Are there grants for incentivized developments and local areas?
33. What's the right balance to decide whether a development needs a stormwater permit?
34. Lake Worth example demonstrates there are some areas where more stringent [water quality] requirements make sense. Would like process to identify targeted areas. Especially in areas where stormwater is resulting in flow leaving a polluted site.
35. Drinkable, swimmable, etc. – there are different levels that need to be defined. Multiple aspects of water quality that need to be considered.
36. Very low priority for environmental improvement. Turning dirt as part of development is a small issue compared to historical and industrial impacts. There are more stringent standards now. Most of the problem is caused by a few.
37. Long term O&M issue is important. TCEQ & USACE are already requiring some water quality improvements. The City removed the inlet protection around downtown that was constructed as part of the pilot evaluation. Why? Cost/Benefit?
38. In Austin, every development has 2 ponds essentially. Not good for Fort Worth. BMPs (silt fences, etc.) should be considered only if they are actually effective. Practical solutions are good for Fort Worth.
39. It sounds like we are not wanting to change the development code, but we know many of the causes of flooding is development.
40. The 1 acre development review threshold is primarily an infill development issue. Greenfield development is already being regulated heavily.
41. We all agree that enforcement of stormwater regulations and prevention of unpermitted changes (such as filling in a designed drainage swale) is an issue that needs to be addressed.
42. Caution when considering urban (small) vs. subdivisions (large) developments.
43. Review stormwater as a holistic approach for real solutions.
44. When it comes down to < 1 acre development the regulation can be “much less.” Booklet to developer with building permit data.

Public Comments

45. Funding for some of this needs to be included in the upcoming 2018 bond package. We should require developments less than an acre to have a stormwater management plan that doesn't make these problems worse. Our City council needs to start taking these concerns seriously.
46. Is there any type of stormwater management that looks into the whole development even though each lot is under an acre?
47. When living in Florida, there were impermeability limitations placed on every property which forced owners to make decisions on what types of impervious area could be constructed on their property.
48. New development is not necessarily what is causing the issue, it is more about the older developments.

49. The City Planning Department and Stormwater do not always count impervious areas in the same way.
50. Curious what impacts were caused by paving over an empty lot near Walgreens. How much did this cost the City?

Future Considerations

The following future considerations for Development Review have been identified as part of the Stormwater Management Program Master Plan Update:

- **Work with the public and development community to evaluate if more protective standards should be used in areas with known flooding problems**
- **Consider reducing the 1 acre review threshold in areas of known flood risk**
- **Work with the Planning Department and stakeholders to identify potential development incentives**
- **Evaluate options to help minimize cumulative impacts of development**

The written and/or refined policies will need to be thoroughly vetted to determine the preferred direction for the City. They should support the established goals/objectives of the City Comprehensive Plan and be consistent with the City adopted Floodplain Management Plan and the overall Stormwater Master Plan.

Policy Development Considerations

Known Flooding Areas

This policy development should be considered in conjunction with the local floodplain development policy.

Local floodplains and areas of known flood hazard have been identified throughout the City and are known to many residents and City staff. These areas are already subject to flooding and it should be considered whether additional regulatory measures should occur in the review of development and redevelopment. If so, how would the areas or local flooding be identified – watershed, mapshed, local floodplain buffer, etc.? The City currently requires a downstream study to show that no adverse flooding impacts will result from increased runoff due to proposed development or redevelopment activities. In these areas where flooding already occurs, the City may identify these areas as known flooding zones and consider one of the following options:

- Option 1 – No change in regulation of known flooding areas
 - No change in regulatory requirements would allow the continued development and redevelopment within a watershed of known flooding issues. Under the current regulatory policies which allow increased stormwater discharges, the cumulative impacts of multiple developments could result in adverse flooding impacts.
 - Consider identification of areas throughout the City with known flooding hazards to inform future development and redevelopment of the risk to the new/redevelopment and to existing property owners.
 - Continue the current policy to allow development to increase stormwater discharges if shown to not have an adverse flooding impact downstream.

- Option 2 – No increased stormwater peak discharges
 - This policy change in areas of known flooding would require development changes to mitigate any increased discharges. In this case, development changes would need to consider mitigation measures such as detention.
 - Consider review of all development, even those smaller than the current 1 acre threshold.
- Option 3 – No increase in stormwater runoff volume
 - This policy change in areas of known flooding would require applicants to mitigate any increased discharges and increase in runoff volume. In this case, the development changes would need to consider measure such as retention and limit the addition of impervious area. Retention can be challenging in the typical soils that exist in the City of Fort Worth.
 - Consider review of all development, even those smaller than the current 1 acre threshold.

Stormwater Review Property Size Threshold

- Option 1 – No change in the stormwater review property size threshold
 - The City currently requires the submittal of an iSWM plan and a downstream assessment of flood impacts for any development submittals on a plat that is larger than 1 acre.
 - No change would result in the continued requirement that parcels less than 1 acre are allowed to development and redevelop while meeting the requirements of the City of Fort Worth, but without a review by the City.
- Option 2 – Review development impacts for properties that are 0.5 acres or greater
 - The City, in the past, reviewed development and redevelopment of properties that were 0.5 acres or larger. This review required significantly more resources on behalf of the City and it was determined that the sites between 0.5 and 1.0 acres were unlikely to result in impacts based on the City current no adverse flooding impacts standards.
 - If the City were to implement more stringent standards such as water quality requirements, no increase in discharges, or other requirements similar to peer communities, it's more likely that smaller properties that develop without mitigation could have an impact that exceeds City regulatory requirements.- so how is this tied to 0.5 acres or greater- is this saying that if we review from 0.5 instead of 1.0 then it will be easier to regulate water quality requirements, etc?
- Option 3 – Review development impacts for all properties, regardless of parcel size.
 - Under the current regulations that allow development to increase stormwater discharges and volumes, this option is less practicable because it is unlikely that properties smaller than 0.5 acres will not be able to meet the current regulations.
 - If additional regulations or requirements are implemented then this may be something to consider for areas with known flooding.

Cumulative Stormwater Impacts

The current City regulations allow for increased stormwater discharges and runoff volumes if shown to not have adverse flooding impacts downstream. It is understood that cumulatively, many of these increases in discharges and runoff volume may ultimately lead to additional flooding issues downstream. Many communities have attempted to address the cumulative impacts of development through one of the following methods:

- Require no increase in stormwater discharges. Detention or mitigation is often required.
- Require retention of stormwater discharges that prevent any increase in stormwater runoff volumes. This is more challenges in the Fort Worth region due to the limited soil infiltration.

- Require a fee-in-lieu of to facilitate construction of regional projects to help mitigate the cumulative impacts. The City of San Antonio uses this type of approach.
- Require a uniform release rate, established based on watershed specific analysis, to determine the amount of stormwater discharge from each site that could occur without significant impacts. The City of Chicago uses this approach.

Refer to the Additional References section for peer community review information on Cumulative Impacts.

Development Incentives and Partnerships

The Berry / University Development Plan is the only location with incentives in place for developers to over-mitigate in the form based code. Partnership opportunities and mutually beneficial projects are something that the City has considered in the past and intends to pursue in the future. Development incentives are challenging in the absence of a form based code because the City requirements are currently at the minimum level to prevent liability. The “No Adverse Impacts” requirement cannot be relaxed or negotiated as part of a development partnership. Therefore, the development incentives would need to consider form based code or other means to provide a greater yield or benefit to the development in response to over mitigating the stormwater impacts.

The City does currently provide for stormwater utility fee reductions up to 50% for stormwater detention and treatment, but this has only be utilized on a limited scale by development so far.

Stormwater Criteria Manual Updates

The Fort Worth Stormwater Criteria Manual was updated in 2006, 2012, and most recently in 2015. Implementation of the considerations of this key initiative may require a future update in order to implement the changes. It should also be considered to establish a frequency for future updates in order to have a routine review and update in order to maintain consistency with current practices and updates that have occurred to procedures, checklists, etc.

Enforcement

Enforcement of the stormwater criteria and policies needs to be considered as part of this initiatives. Currently, the City does not provide post-construction inspection to determine whether construction is consistent with approved stormwater submittals or to identify unpermitted construction. The City has inspectors that are currently focused on other enforcement activities and it may be possible to utilize these resources to also provide enforcement for stormwater. That would need to be investigated further.

City Resources

Several of the considerations of this initiative could result in additional resource requirements. It has not yet been determined the level of additional resources or where those resources would come from.

Complimentary Initiatives

- A. Local Floodplain Policy
- C. Private Property Channel Erosion Policy

Action Plan

- Process Lead: Jennifer
- Technical Lead: Stephen Nichols
- Staff Involvement: Floodplain Admin, Linda S., PLN, Legal, Code Compliance
- Stakeholder Involvement: DAC, SW Stakeholder Group Small Group, PLN Commission



- Resource: Coordinate with Bob Horton
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...
- Consultant Support for *ID/Defining floodprone areas (key white paper focus- how do we define a floodprone area?)*, areas draining into these, benchmarking on other cities that use volume based approach to supplement what has already been done, etc.

Additional References

- ASFPM – No Adverse Impacts How-to Guide for Regulations and Development Standards – 2017
- Fort Worth – iSWM and Cumulative Impacts – 2017 by Chris Johnson and Stephen Nichols.
- Fort Worth – Peer Community Review on Cumulative Impacts.
- Evaluating Release Rates for Specific Watersheds in Cook County – March 2017 and the City of Chicago Outlet Capacity Maps

G. Resource Programming Normalization Framework

Strategic Direction

Apply asset management principles and develop a framework to integrate and process prioritization data in conjunction with other strategic factors in order to optimize programming decisions.

Purpose

Given the service level gaps that exist in every element of the SWMP, significant effort and emphasis has gone, and must continue to go, to optimizing the use of resources to accomplish the mission and vision of the program as efficiently and effectively as possible. A significant facet of the prioritization challenge is comparing the relative priorities of the needs of the major elements of the SWMP, and systematically determining overall SWMP priorities. For example: deciding if resources would be more effectively used on flood warning versus increased maintenance of facilities.

Background

Current Practices at City of Fort Worth

During the last ten years, the SWMP has developed several very useful tools to compile and present prioritization data to help inform the objective criteria for program elements. These tools have allowed for additional efficiency within the SWMP as they allow multiple factors such as costs, risks, and asset management principles to be considered simultaneously. However, there are still significant gaps and no overall prioritization of the program as a whole. Subjective criteria such as public opinion, economic development impacts, aesthetics, and neighborhood impact require considerable judgment and interpretation and can often be difficult to apply consistently.

Peer Community Review

4. Project Prioritization	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your community have a project prioritization framework for selecting capital projects?								
Yes								
No								
If so, are qualitative or quantitative factors the primary basis for project prioritization?								
Qualitative								
Quantitative								
Qualitative and quantitative factors are both considered								
Does your community track flood reduction project successes in a quantitative manner?								
Yes								
No								
I don't know								
If so, what information is tracked? (Check all that apply)								



Structures removed from floodplain								
Erosion protection								
Customer satisfaction levels								
Average daily traffic trips affected (or other traffic measures)								
Return on investment								
Effect on property values								
Criticality (evaluating likelihood of failure and probability of failure)								
Flood warning abilities								
Level of service improvement								
Emergency accessibility								
Other								
N/A								
5. Level of Service	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your community construct projects that provide less than 100-year level of protection?								
Yes								
No								
If so, what types of constraints could result in construction of a project with less than 100-year capacity? (Check all that apply)								
Budgetary constraints								
Construction feasibility								
Project would be too disruptive								
Property acquisition limitations								
Other								
N/A								
Does your community have a written process to determine level of service?								
Yes								
No								
I don't know								
<i>FTW level of service is based on drainage criteria manual. A minimum level of service for capital projects with constraints (such as those listed above) has not been established.</i>								
6. Financial Planning	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
What is your approximate 2017 annual capital improvement project budget?								
	\$11.2 M	\$15.7 4M	\$27.7 M	\$30M	\$70M	\$10.7 M	\$50M	\$44.5 M



<i>FTW budget does not include debt service. It's possible that some of the respondents included debt service in this total.</i>								
What is your approximate 2017 stormwater debt service obligations?								
	\$9.4 M	\$9.25 M	\$3.62 M					\$12.5 M
What was your total capital budget for the last 10 years?								
	\$150 M	\$63.6 5M	\$210. 9M	\$630 M	\$835 M	\$57M		\$408 M
What is your expected total capital budget for the next 10 years?								
	\$100 M	\$150 M	\$285 M		\$1B	\$95M		\$960 M
<i>FTW estimated budget does not include a fee increase or bond funds. Some respondents may have included estimated bond funds.</i>								
What percentage of your stormwater capital budget is typically dedicated to flood reduction projects that are less than \$1 million?								
Less than 25%								
25-50%								
50-75%								
Greater than 75%								
I don't know								
What percentage of your stormwater capital budget is typically dedicated to flood reduction projects that are between \$1 million and \$5 million?								
Less than 25%								
25-50%								
50-75%								
Greater than 75%								
I don't know								
What percentage of your stormwater capital budget is typically dedicated to flood reduction projects that are between \$5 million and \$10 million?								
Less than 25%								
25-50%								
50-75%								
Greater than 75%								
I don't know								



What percentage of your stormwater capital budget is typically dedicated to flood reduction projects that are greater than \$10 million?								
Less than 25%	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
25-50%								
50-75%								
Greater than 75%								
I don't know								
What types of funding does your stormwater program receive? (check all that apply)								
Stormwater user fees (stormwater utility program)	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Permitting fees								
Special tax districts								
Grants	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
General fund								
Does your community have a debt cap for the stormwater utility?								
Yes	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
No								
I don't know								
Approximately what percentage of your annual stormwater utility budget is dedicated to debt service?								
Less than 10%								
Between 10 and 20%								
Between 20 and 30%	FTW							
Greater than 30%								
I don't know								
6. Financial Planning (cont.)								
	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your stormwater department set aside budget each year to pursue private or public partnership opportunities?								
Yes								
No	FTW							
I don't know								
What is the largest project that your stormwater utility will typically fund with pay-go capital?								
Less than \$1 million								
\$1-5 million	FTW	ARL						
\$5-10 million								
\$10-20 million								
Greater than \$20 million								



Arlington

- Framework for prioritization – Neighborhood projects complaint driven; other projects identified through watershed studies.
- Criteria includes structural flooding, flooding frequency, how long has the flooding occurred, and opportunity (other infrastructure also being built at the same location).
- No written policy for LOS less than 100-year.
- City has roughly \$300M in flood mitigation projects in backlog
- Approximate \$15M 2017 annual CIP budget.
- Approximate \$2M towards debt service (will increase next year).
- \$15-\$16M for 2017 SWU revenue (current rate \$5.65 with \$0.50 increase per year until \$7.50)
- \$9.2M in bonds for 2017.
- Total capital budget last 6 years approximately \$63,650,000 (includes \$25M bond). City recommended no more than \$4M per year if extrapolated to determine last 10 years (extrapolated 10 year total capital budget approximately \$80M).
- Stormwater department sets aside approximately \$150k per year for either private or public partnerships (almost entirely public partnerships).

Austin

- City's approximate 2017 annual capital improvement project budget is \$32.5 million for all CIP funding sources (\$27.7 million drainage utility fee funding source)
- City's approximate 2017 stormwater debt service obligations is \$3,625,548.
- Total capital budget for the last 10 years was \$210,967,000.
- Expected total capital budget for the next 10 years is \$285 million.
- Less than 25% for 2017, but 0% based on FY18 appropriation data will be dedicated to flood reduction projects that are less than \$1 million.
- Less than 25% for 2017, but 5% based on FY18 appropriation data will be dedicated to flood reduction projects that are between \$1 million and \$5 million.
- Less than 25% for 2017, but 14% based on FY18 appropriation data will be dedicated to flood reduction projects that are between \$5 million and \$10 million.
- Less than 25% for 2017, but 23% based on FY18 appropriation data will be dedicated to flood reduction projects that are greater than \$10 million.
- Austin does not have a debt cap for the stormwater utility. The debt cap is for the City based on Property and Sales Tax.
- Less than 10% of the city's annual stormwater utility budget is dedicated to debt service. Total budget is \$94.6 million, debt service is \$3.6 million, 3.8% of budget.

Dallas

- Initially quantitative and then qualitative factors are the primary basis for project prioritization.
- Drop in water surface elevation/in river are also tracked in a quantitative manner.
- Approximately \$30M in annual CIP budget.
- There is no amount in debt service obligations.
- Total capital budget for the last 10 years is approximately \$630M (2006 and 2012 Bonds)
- Total CIP budget for the next 10 years is about \$450M if things go accordingly.
- Stormwater capital budget varies widely. However, it's normally between 25-50% for projects that are less than \$1M.



- Floodplain management projects have always been bond program funded.
- Bond funded projects with private investment are typically prioritized, amount varies.
- City may be transitioning to stormwater revenue bonds. This type of financing is typically more expensive.
- City used to form special drainage districts to be able to fund the construction of flood reduction projects in specific areas. But, the city stopped doing these in the late 1970's.
- 2006 flooding supported project implementation per needs inventory priorities (more than 10 years ago).

Oklahoma City

- Came up with prioritization for drainage bond projects. Structural flooding, street flooding, yard flooding, known flooding complaints/areas, benefits of project. Number 1 weight is structural flooding.
- Citizens were given opportunity to provide input. Online surveys, take home surveys.
- No database to track flood reduction progress.
- Huge flood in early '90s. Major creeks were improved back in the '90s.
- Biggest hotspots that remain for flooding are in the downtown area.
- Most flooding from local drainage system. Unimproved creeks in sprawling areas are becoming more of a flooding problem, but for the most part new development stays away from flood prone areas.
- Some roadway crossings are infeasible to construct to 100-year LOS, especially older structures that are being replaced.
- Some storm drain rehab projects are on the list of bond projects.
- No level of service criteria for storm drain rehab. Mostly just trying to fix the issue as quick as possible. Primarily reactive.
- Protect for 100-year event but infrastructure not necessarily designed for it. Most level of service challenges are with roadway cross structure capacity.
- Stormwater bond project competing against other bond projects. Roughly \$225M out of \$1B for stormwater.
- Stormwater projects not funded by stormwater fees. General revenue bonds fund stormwater capital projects.
- Roughly \$120M for downtown stormwater project needs. City attempts to split up into \$5-\$10M projects.
- \$17M per year in stormwater revenue. SWU \$5.75 per household on average. Based on meter size.
- Usually around \$100-\$150k from stormwater utility revenues used for small capital projects. These projects are the extent of pay go flood reduction projects which are mostly rehab or larger maintenance needs.
- Issue permits for stormwater discharge for industrial and new construction. Roughly 1000 permits going on at a time. \$65 each permit. Looking to increase permit fee.
- \$17M in stormwater fee revenue.
- Maintenance crew to maintain dams. Funded by drainage utility.
- City does not charge fee for drainage reviews.
- Very rare for private development to pitch in to fund projects. Not many public private partnerships



- Storm drain improvements in conjunction with roadway improvements included in current bond package.
- Last storm water utility fee increase was in 2010. Graduated plan that ended in 2014. Started in 1995 to fund NPDS. Started at \$3.70 per household?
- SWU increases driven by need.
- Entire City not under mandatory detention.
- Fee-in-lieu only done in special cases. Site has to be under 0.5 acre for fee-in-lieu and show no downstream impacts.
- Have to meet historic runoff rate (pre-development not just existing conditions). Multi-frequency.
- Areas of known flooding identified in GIS based on complaint database. No defined polygon/area. Engineers notified of detention/site runoff requirements at pre-development meeting.
- Stormwater staff, maintenance crews and MS4 permit funded through SWU fee. Some bond money used for rehab projects.
- Private consultants will do design work on CIP projects. Preliminary sizing and estimates for CIP projects have been completed by staff in house.

Raleigh

- Plan for 10-year level of service for storm drain. 25-year thoroughfares. 100-year for FEMA floodplains.
- For a capital project, try to achieve the highest level of service as possible within the budget.
- Plan for 10-year storm drains at a minimum. Might try for higher if we can get it. Can often get to 25-year level of protection. Some flexibility with freeboard requirements. For retrofit projects can often look at a smaller level of service and relax freeboard requirements. Try to achieve maximum extent practicable. Must convey lower level of service to citizens at public meetings and understand that it can be better than it was before.
- Have not issued stormwater revenue bonds. \$2M loan from state loan for debt.
- Net income must two times the debt service. Net income = revenue – expenses. Pay go capital to date.
- Clean Water Management Grant Funds and some other state funds. As they continue to build the program, revenue bonds may become part of the strategy as they complete more of the watershed studies.
- Not likely to fund a project greater than \$10M in current pay-go. Try to create phases. If not, then they would need to hold for revenue bond. Focus on revenue bonds first.
- Subject to tropical storms, but no recent storms that have changed the focus of the program. Hurricane Matthew brought 14-16 inches of rain in southeast part of state and washed out many structures and will need public funds to rebuild. Floyd in 1999 and others have brought major impacts. As part of master planning efforts they will research the complaint calls and try to identify the localized flooding issues. Going back to evaluate national agencies for rainfall to ensure the data is still accurate.
- Open to public private opportunities. If there is something that can be constructed that expands a project from public to private interests, they will consider that. For instance, green infrastructure paid for by developer but placed in a public right of way. Cannot pursue private opportunities alone. But can contribute public funds to private property improvements when there is a public benefit.



Charlotte

- Severity and call in date are used in project prioritization.
- Erosion is not ranked unless it is threatening public infrastructure.
- Prioritization are similar across different projects/programs but they are not measured against each other.
- Currently in a data collection process of asset management and hopeful that will create a more holistic approach.
- About 350 purchased in County. About 15-20 purchased in City. Inspection team sends out customer satisfaction for during construction satisfaction.
- Strive to meet roadway standards and meet 100-year level of service for structures. Want to improve situation
- Most stormwater projects are within existing developed areas and due to constraints we can't always provide 100-year protection.
- When inheriting Land Development subdivision infrastructure, houses are built after pipe is in the ground. When stormwater becomes involved, these buildings/houses are a constraint to work between and create hardships with equipment, shoring of the houses, etc.
- Land Development Standards and Storm Water Design Standards as well as Subdivision Ordinance to set level of service.
- \$67M total SWU revenue
- \$12.5M to debt
- \$11M to cover maintenance. Some fund balance, etc.
- \$44.5M to capital.
- \$960M from paygo and debt issuance expected in next 10 years.
- Had some general obligation bonds when stormwater utility first starter but not recently.
- Debt cap for the stormwater utility based on net operating revenues.
- Funding level to pursue either private or public partnership opportunities has dwindled recently. At one time is was close to \$500k
- The City has increased SWU fees approximately 22 times in 25 years; county increases every few years.
- The plan review fees are paid by developers for their plan. The Land Development Services reviews everything for stormwater, roads, utilities, subdivisions, zoning compliance, etc. It is a one stop shop. They are fully funded by plan review and inspection fees.

Stakeholder Feedback

Stakeholder comments:

1. Will the Trinity River Vision Project help with the stormwater issues?
2. How much acreage is included in remaining capital project areas?
3. Need to identify opportunity. Come up with metrics. For example, measure/quantify the problem like reducing flooded area by a certain percentage with galvanized resources. Get some of the mushy/mushy out of the way. Address the opportunities ahead of us.
4. I am not comfortable with question. I would spend capital budget on reducing debt service so that we could issue more debt and fix some problems.
5. Don't want to pass up opportunity to fix an issue now when it is less expensive than it will be in

the future.

6. In tonight's meeting, we only talked about residential and businesses paying fees. Is there ever an opportunity to utilize grant funds? Need to show how it's easier to develop new areas than older areas. Maybe city can bring federal funds to rehab.
7. Is there ever an opportunity for general fund budget to be spent on stormwater efforts?
8. We are proposing to move budget from build floodplain and storm drain rehabilitation to maintenance. Then storm drain rehabilitation budget category will be included with the maintenance category. Mitigate flooding and erosion will continue to be its own category.
9. The funding gap on the mitigation and hazards – we have \$300–400 million backlog with a \$10 million annual budget - is this making a dent or are we losing ground/gaining ground?
10. What do we mean by \$400 million dollars of critical CIP needs? It sounds kind of scary. Are all of these needs critical?
11. If you have about \$10 million per year in capital funds and about \$300 million in CIP needs, are we going to completely address all the critical needs in 30 years?
12. How likely are stormwater projects to be included in the general obligation bond program? We need at least one project in the bond program.
13. We need to be responsive to what people know is a priority but also be responsible in addressing some of the problems that people are unaware of.
14. It is unfortunate that some stormwater problems will not be fixed until someone drowns and there is a news story.
15. What's the cost on the North Service Center and where did that money come from?
16. The single biggest issue is lack of required funds to make a truly impactful statement on the problems stormwater faces. The staff has done a great job on many levels in addressing and resolving as much as possible with the limited funds they have.
17. Does the city have a grant program to apply, manage, and track grants?

Public Comments:

18. We would like to see more focus on public safety. Not just property but loss of life and potential threats to people.
19. If we want to have a nice City and a livable community, we all have to pay into that.
20. Do you anticipate that there would be any stormwater capital project funding in upcoming bonds?
21. It sounds to me like you have a lot of really good ideas and strategies, but the big challenge is finding financing. That is the biggest. I think it might be good to use some resources that you do have to investigate alternative financing. Also, as we've learned from the Houston tragedy, development has a huge impact on drainage problems. Until the city accepts that and understands that, the challenge will be balancing a rush to expand the tax base. If you start hindering development, you'll run into some political problems to get them to accept that development is creating a lot of these problems. We certainly learned it firsthand. It's incremental development that's occurred over a long period of time.

Future Considerations

The following future actions for Resource Programming Normalization Tools include:

- Expand as needed the prioritization tools developed by the SWMP on a more global program basis to compare more objectively between program elements.
- Prepare additional benchmarking of how other comparable communities prioritize the major elements of their Stormwater programs, not just within the elements themselves. The City of Austin Watershed Protection Master Plan has made some effort to compare flood mitigation, water quality improvements, and channel stabilization.
- What is the proper balance between large and small projects?
- What is the appropriate level of budget that should be set-aside for reactive needs (e.g. system emergencies, voluntary buyouts, partnership opportunities, etc.)?
- How can overall community priorities be understood and tracked over time to determine how the SWMP can best help accomplish them?
- When will a lower level of service be considered?

City Resources

This initiative is expected to require some additional planning resources to establish the process but the resource requirements should be reduced once a system is developed.

Complimentary Initiatives

- Most of the key initiatives could be considered complimentary or at least will be considered as part of this initiative.

Action Plan

- Process Lead: Chris
- Technical Lead: Kiran
- Staff Involvement: Program Dev. Section, CIP rep, Flood Warning rep, Maintenance Rep/Field Ops
- Stakeholder Involvement: Top Mgmt./Greg, ITC
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional References

- City of Austin - Watershed Protection Master Plan
- Black and Veatch - 2016 Stormwater Utility Survey
- Baker – 2012 Feasible Options Report
- Fort Worth – 2016 Stormwater Utility Fund Financial Review / Policy Formulation
- AMEC Foster Wheeler – Top 10 Ways to Upgrade Your Stormwater Program

H. Property Buyouts

Strategic Direction

Define a consistent City policy regarding participation in the buyout of properties at risk of flooding or erosion.

Purpose

Identify when the City would participate in property buyouts and develop a procedure to prioritize and budget for these buyouts.

Background

In many instances, the cost of acquisition and demolition or relocation of existing structures in flood and/or erosion prone areas is less than the cost of structural erosion or flood control measures to mitigate the erosion and/or flooding of those properties. However, complications often arise when “Buyouts” are proposed to solve an existing problem. Some of the complications include: political/legal issues, loss of tax revenue, demolition or relocation of structure and maintenance of now vacant property, “checkerboarding of neighborhoods”, preservation of the neighborhood integrity/culture, and the owner’s personal and emotional attachment to their home or business and its location. Voluntary buyouts serve as a method of last resort for responsible communities to support their residents, when other structural or maintenance solutions are infeasible, ineffective, or have a disproportionately high cost relative to the benefits they would achieve.

Some of the potential benefits of a voluntary buyout program include:

- Relocates families, businesses out of harm’s way.
- Eliminates future flood damages and health and safety risks for owners and rescuers.
- Reduces repetitive subsidized flood insurance payments and federal disaster assistance.
- Restores floodplain to its natural and beneficial function for stormwater storage.
- Creates open space with the potential for community amenities (i.e. parks, gardens, playing fields, etc.).
- Creates opportunities for flood mitigation measures to benefit the remaining properties.

Current Practices at City of Fort Worth

Currently the City is pursuing voluntary buyouts in several ways. It is a featured component of the adopted June 2016 Floodplain Management Plan, as shown in the excerpt below:

2.3 Encourage Relocation, Acquisition & Building Elevation Projects

2.3.a Develop a voluntary property acquisition plan and program

2.3.b Pursue grants to complete property acquisition projects

2.3.c Develop public education on funding for property retrofitting & building elevation

2.3.d Assist property owners with grant applications for improvements

2.3.e Develop a program to assist property owners with elevation & relocation projects for residential structures

In the Floodplain Management Plan, it is noted that the City historically has not been involved in relocation and acquisition projects. However, this activity can be cost effective and is one of the few activities that guarantees flood and erosion hazard risk reduction for the specifically acquired structure. The acquired



properties may be repurposed to open space for different City uses, such as parks, recreation areas, and stormwater detention.

In addition, the City is currently pursuing voluntary property acquisition and demolition of several historically flood prone properties in the Arlington Heights area through FEMA grant funding. The City hopes to acquire enough contiguous parcels to construct stormwater detention to mitigate flooding for the remaining neighborhood.

Peer Community Review

Buyout Program	Fort Worth	Arlington	Austin	Dallas	Oklahoma City, OK	Raleigh, NC	San Antonio	Charlotte, NC
Does your community have a voluntary buyout program?								
Yes								
No								
<i>FTW has participated in voluntary buyouts on a case-by-case basis for NFIP participants. There is not a voluntary buyout program with defined policy and criteria.</i>								
If so, is there a written policy or process for prioritizing buyouts?								
Yes								
No								
N/A								
<i>FTW policy is consistent with the FEMA or grant funding requirements.</i>								
How are acquired properties utilized? (Check all that apply)								
Parks								
Open Space								
Detention Ponds								
Other								
N/A								
Has there been neighborhood opposition to buyouts?								
Yes								
No								
N/A								
How are the buyouts budgeted?								
Budgeted amount consistent each year								
Budgeted amount varies each year								



Buyouts are typically in response to a major event								
N/A								
<i>FTW budgets \$100K annually for local grant share of voluntary buyouts.</i>								

Have you successfully utilized grants to fund property buyouts?								
Yes								
No								
N/A								
Who maintains the purchased property?								
Stormwater Dept.								
Parks Dept.								
HOA								
Other								
N/A								
Have you condemned property for stormwater purposes?								
Yes								
No								
I don't know								

Arlington

- No formal policy for buyouts.
- Currently event based – initiated after significant flood events.
- Focus is on SL & SRL properties – 25% substantial damage threshold.
- Buyout program is voluntary.
- Approximately \$150k per year allocated to property buyouts – rolls forward in capital budget if not used.
- Applied for HMGP grant in 2015. City received money in fall of 2016 and plans to purchase 6 homes through the grant program.
- Most buyouts solely through City funds (All City funds for Rush Creek).
- Have applied for RL grants through TWDB in the past.
- Condemned 1 property in the past for stormwater purposes as last resort (easement acquisition).
- City has more storm drain related flooding than riverine flooding. Much progress in the past 10-15 years for riverine flooding due to buyout program.

Austin

- City of Austin's buyouts are project based and are selected only when they're the most feasible flood mitigation solution; the City of Austin does not have a City-wide voluntary program.
- Acquired properties are utilized by parks, open space, detention ponds, and community gardens.

Dallas

- Buyouts are for repetitive loss, via needs inventory and bond program.
- There is a criteria for all needs in regards to a process for prioritizing buyouts.
- Buyouts are typically budgeted in response to a major event such as capital bond program.
- City has condemned property for stormwater purposes as required for capital construction projects.

Oklahoma City

- Purchased properties after some of the major flood events in the 1990s.
- Larger voluntary buyout program has not been initiated under the current City management. Will buy properties when needed.
- No success with grants to buyout properties in the floodway. Many Severe Repetitive Loss properties. Tried for 3 years, no success. 5-6' of water in one property.
- Have not tried to pursue grants for structures in local floodplains.
- Bought out approximately 17 structures for City bond project; not really for flood relief. Neighborhood agreed to buyout.
- Buyouts only for special projects and case-by-case basis.

Raleigh

- 2004-2005 the Stormwater Utility was established.
- Pulling everything together now with technical, financial, etc.
- Initially focused on high level FEMA floodplains and level of service for riverine areas. In second phase, intend to take it down to a more granular level, looking at 50 acres.
- Several ongoing projects of buyout, specifically in gateways to downtown. Not typically pursued as stand-alone City project. More through HMGP FEMA Grant. 100% funded from outside grants currently. However, City will set aside money for matching grant funds. Not saying that these buyouts would not occur in the future. At least one project identified that buyout was the best alternative.
- Success rate on grants has been pretty strong. Can be difficult to get all checks and balances to get application. But when it makes sense and meets criteria, it has been successful. Website includes sample projects.
- Flood Mitigation is \$200K for matching funds. Grant funds received recently have been around \$1M.
- Will not condemn for buyout alone. Will look at condemnation for easements. Rarely condemn structure completely. For example, property is not a rep loss but has flooding in crawl space and best option will be acquisition. Generally for properties established many years ago. Minimum 2 feet above 100-year WSEL is current standards.

San Antonio

- Generally no, but there are project specific buyouts.

- Example – Flood control receiving channel – Project management team approached those folks to see who would be on board for voluntary buyouts.
- Case-by-case basis – for projects.
- FEMA grant money in response to 1998 flood. One time thing.
- Have condemned for easements.
- No active plan to develop voluntary buyout program. It has been a part of the conversation.

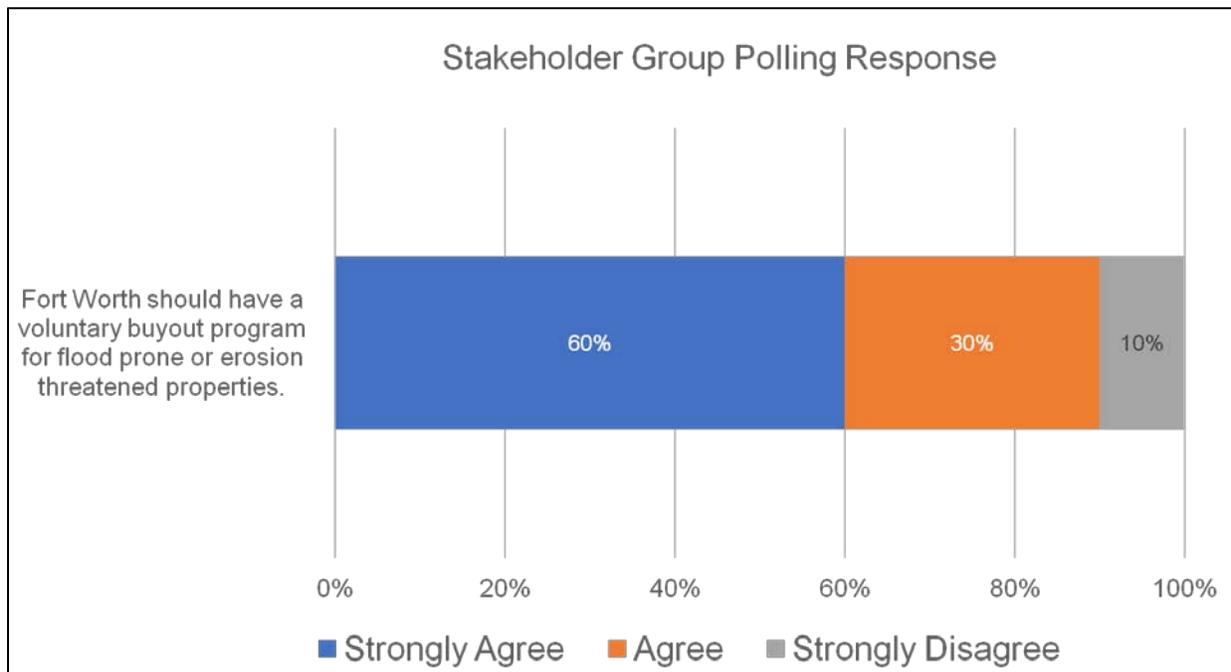
Charlotte

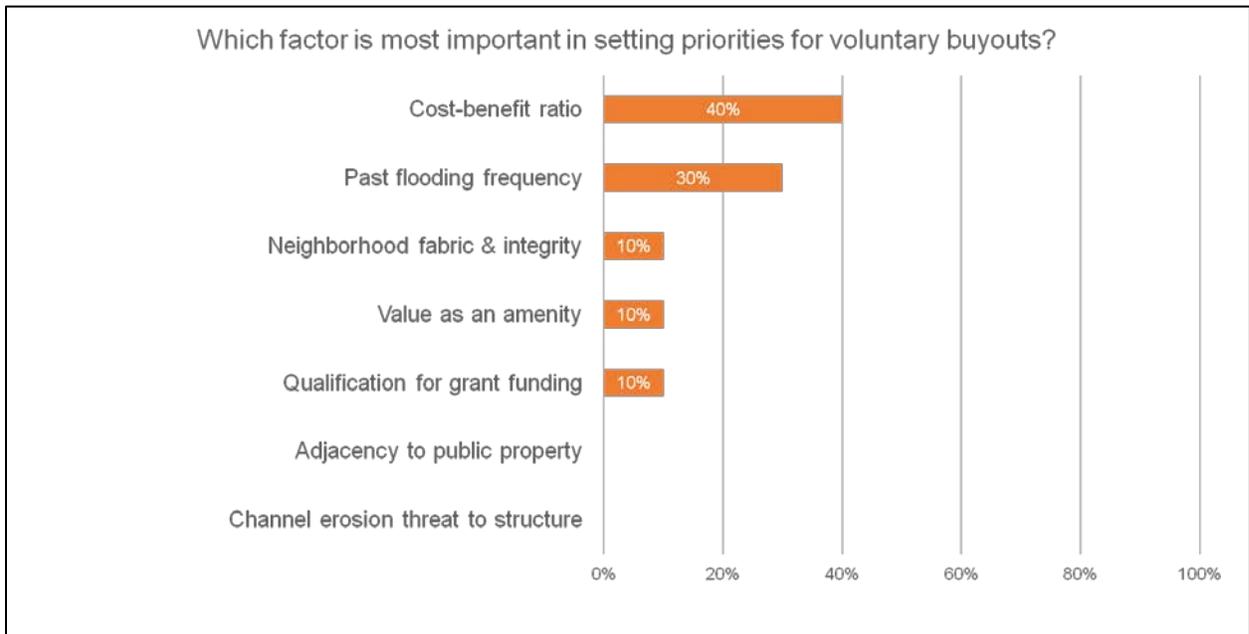
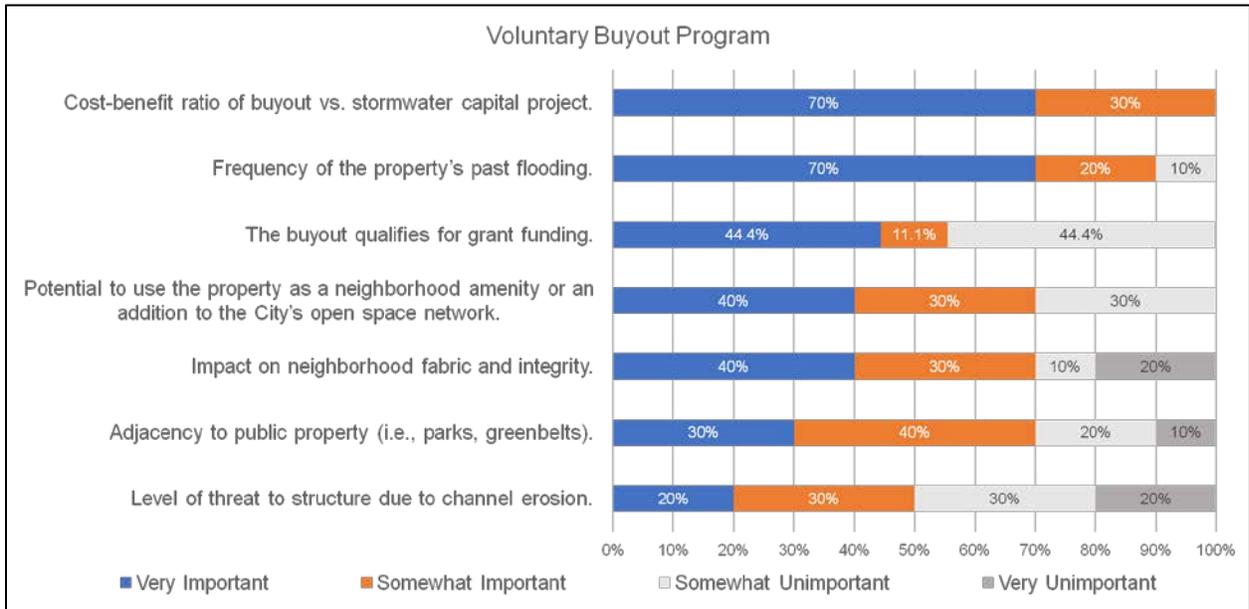
- Risk Assessment / Risk Reduction Plan for FEMA floodplain
- Local Floodplains and Capital Needs are measured against benefits and costs of project. Capital will approach it more from the standpoint of a benefit to cost if the home owner is willing to sell their property.
- Some adjacent property owners have expressed concern, but these are minor. Have occasionally deeded property to adjacent owners for ownership and maintenance.
- County will purchase several homes next to each other that could result in a park.
- Sometimes property will be rebuilt to current standards.
- Commercial and Residential properties have been condemned for projects. Relocation costs, etc.

Stakeholder Feedback

The following polling responses were provided by stakeholders through the Master Plan Update process. Public polling responses are also available and were generally similar in nature with the stakeholder responses.

Stakeholder Polling Responses





Stakeholder Comments:

1. To what extent would prioritized list of potential buyouts be kept confidential?
2. Be careful not to over commit the City to be required to purchase any property.
3. Written policy and procedures would help remove some of the subjectivity.
4. Have you considered a vetting with neighborhood associations? Having their support on the overall process would be very helpful for what to do after that property is bought out.
5. Can you use capital funding for buyout?
6. Is the purpose of the buyout to protect individuals or to set up a park/area to resolve the flooding problem? There could be issues with a holdouts in neighborhoods that have flooded repeatedly but don't want their neighborhoods messed with.
7. Master Plan should address voluntary buyout in a policy. May not address the issues from a macro standpoint, this may be more situational. Master Plan should include a buyout policy as a tool in the tool box that we could use as appropriate. The stormwater problems are way beyond this but we need to have this element in the plan for it to be stronger.
8. Interested in community involvement aspect of voluntary buyout program development.
9. If we complete a buyout, what is the chance we could do mitigation to benefit the rest of the neighborhood? That should be an important factor.
10. Two years ago, the City showed rendering of buyouts with amenities and ponds. Very impressive and recommend that you show these pictures in the future.
11. There are two perceptions: 1) We are buying the property because the owner is in trouble. 2) We are buying the property because there is an opportunity to construct improvements for the public benefit. Stakeholder in favor of the second and opposed to the first.
12. Availability of grant funding was relatively unimportant in the polling but it is something that we need to keep looking at it.
13. Voluntary buyout could take 10 years to become a priority if historical flooding is a priority. History can be difficult to define.
14. Note that everything with the voluntary buyout program is assumed to apply to businesses too.
15. We foresee a situation where City would need a lot that homeowners won't sell. Voluntary buyout does not prevent City from using other powers/authority.
16. Best thing is internal and external communication and coordination. It is great that City is coming up with a game plan. In the Zoo Creek watershed near Berry Street there are empty lots (with The T) that we have an opportunity to plan before we pave.
17. How does buying out a house eliminate flood or erosion risks to structures?
18. Where are the grant opportunities coming from?
19. The grants themselves, are they for FEMA floodplain area or are they local?
20. The \$65-100 million is the cost of capital projects, but how many houses they would have to buyout so they wouldn't have to spend \$100 million?
21. Do we really want to establish hardened, fast policies and take the decision away from people? The geography of the City has so many different areas to look at, I think it's almost impossible to set hard standards that the people have to follow. I think you have to give people the discretion that are in charge of these things to make some decisions.



22. Do we limit voluntary buyouts to residential properties? That will be decided as part of the policy development but the residential voluntary buyouts are more controversial and that is why it was a focus of the stakeholder meetings.
23. Voluntary buyout program – what role of neighborhood associations and preservation of look and feel of neighborhood?

Public Comments

24. \$8-10 million isn't nearly enough to fix all of Fort Worth stormwater problems, even with the voluntary buyout program these problems keep getting worse and more expensive to fix.
25. Based on voluntary buyouts, what is next step if no grant funds are awarded? Personally I am already mired in federal red tape and now local red tape that prevents me from moving forward.
26. If buyouts do not occur for low lying we are left with very few option. Neighbors are angry if we elevate a flood prone property. Can the property owner get tax abatements if we do not receive service from the City? Would City support us against neighbor's opposition in raising house?
27. We still have questions regarding the overall timing of voluntary buyouts and the funding sources that the City is pursuing. We were initially informed that buyouts would begin this Spring. Now there are significant delays. I agree with one of the comments that the City needs to prioritize this project in terms of funding and timing of buyouts, which in all likelihood means the issuance of a municipal bond(s) to pay for the project. Is or has the City considered this avenue of funding? If not, we strongly believe it should.
28. Fair value for all property assessed through the buyout process.

Future Considerations

The following future considerations for voluntary property buyouts have been identified as part of the Stormwater Management Program Master Plan Update:

- **Written policy, vetted by public and City staff**
 - **Initial focus on benefit-to-cost & historical flooding**
- **Include voluntary buyouts as an element in our flood mitigation budget**
- **Maintain prioritized list of potential buyouts**

The written policies will need to be thoroughly vetted to determine the preferred direction for the City. The policy should support the established goals/objectives of the City Comprehensive Plan and be consistent with the City adopted Floodplain Management Plan and the overall Stormwater Management Program Master Plan.

Policy Development

The City and stakeholders have a stated goal to develop a policy for buyouts. The following items should be considered as part of the voluntary property buyout policy development process.

Goals / Objectives

- Develop a voluntary acquisition/buyout policy crafted to support other flood and erosion hazard mitigation activities.
- Consider whether the program should be limited to voluntary purchases. A comment from the stakeholders on the written report suggested that the program should not be limited to voluntary purchases. Often, specific property locations are critical to provide significant stormwater benefits. How should the City handle these situations?
- Prepare a buyout policy that is consistent with goals/objectives of the City Comprehensive Plan and compatible with the overall Stormwater Management Program Master Plan.
- Include buyout policy strategy that directly addresses the significant challenges for the City to purchase properties and relocate residents to areas where minimal disruption to their lifestyle, family goals, and financial resources are adequately achieved.
- Address and make recommendations in the buyout policy regarding budgetary issues/constraints, including: levels of funding to provide necessary resources for acquisition, demolition and future maintenance of acquired properties.
- In the policy, address the legal, financial, regulatory, and technical/practical issues of a voluntary buyout flood and erosion mitigation program, many of which are addressed below.
- Consider goals for reducing the number of habitable structures at high risk of flooding by frequency, through acquisition. For example, reduce the number of structures in the 5-yr floodplain by half within 3 years and eliminate within 5 years. Note that this should be only undertaken based on the optimal overall mitigation solution and not limited just to buyouts.

Voluntary Buyout Program Potential Components

- The City should only use buyouts when absolutely necessary. The buyout process is a very emotional event for both the property owner and the neighborhood, and can generally affect persons already struggling with the economic impact of flooding and/or erosion issues.
- Consider and address, with policy statements, the significant challenges for the City to purchase properties and relocate residents to areas where minimal disruption to their lifestyle, family goals, and financial resources are adequately achieved. This may be included in a section regarding prioritization or criteria for acquisitions of flood prone properties.
- Establish the buyout policy as a voluntary program, with mandatory buyouts undertaken only when eminent domain is a condition of funding, or in extreme cases. Determine what constitutes an extreme case.
- Establish an evaluation/review component of the policy to regularly evaluate the efficiencies of the buyout program experiences by residents, including staff and contractor performance. Include post-buyout project evaluations to ensure that important lessons can be captured and integrated into future processes.
- Include in the policy a program for voluntary buyouts by resident initiative and request (i.e. resident approaches the City).
- Develop the policy to ensure that property owners fully understand the acquisition program and the consequences of not participating in a voluntary buyout program.
- Consider strategies in policy such as lumping together multiple Repetitive Loss (RL) and Severely Repetitive Loss (SRL) properties across the City that aren't part of a larger mitigation project and pursue grant funds for buyouts for them.
- The policy should include recommendations regarding budgetary issues such as sufficient levels of funding to provide necessary resources for maintenance of acquired properties.
- Possibly include a policy strategy to reserve funds for buyout of high risk properties affected by extraordinary flood or erosion events.
- Within the policy, develop an alternative purchase strategy/program for eventually buying high flood risk properties, even if the current owner does not yet want to sell. This would be especially important with clustered properties to implement comprehensive flood mitigation in a given neighborhood.
- Develop a consistent policy to be used across all buyout programs (both voluntary/optional for property owner and possible eminent domain acquisitions), so that all buyout program participants have access to equitable benefits.
- In the policy include a discussion and recommendation of evaluating the potential need for buyouts as a flood or erosion mitigation alternative, before annexing any property.
- In the policy, consider and address the potential harm to the viability of neighborhoods through reduced property values with a buyout program.
- In the policy, address the issues of buying out most of an area. For instance, would it makes sense to focus on the whole area to avoid leaving isolated houses? This can eliminate the need to maintain infrastructure and the possibility of future flood rescue and flood risk.
- Develop the policy to include a system for tracking homeowners in areas with historically flooded homes who may be willing to move and sell their house to the City in the future.
- Consider a policy that would reduce the level of damage where homes could be repaired to less than the FEMA standard of 50% of property value, to encourage participation of more high-damage properties into the buyout program. (Example: Arlington uses 25%). This can be a very difficult policy to implement and recommend contacting Arlington or others to get their feedback before moving in this direction.

- Using the experiences from area communities that have finished acquisition and demolition projects, recommend written guideline and policy for procedures in procurement and implementation of the projects. There are many technical issues that will need to be developed from the guidelines, related to contractors, real estate, utilities, disposal, hazardous wastes, site security, public relations, and related matters. (Note: City of Arlington has excellent list of lessons learned from contracting for demolition)

Property Use

- Consider the constraints that stem from the regulatory requirements associated with state and federal funding and grant sources. (i.e. FEMA and U.S. Army Corps of Engineers buyout program). Property remaining as open space in perpetuity is often a grant requirement.
- Ensure that all property purchased for flood mitigation buyouts is not be put to any use that is contrary to flood mitigation.
- Consider whether acquired property can be returned to adjacent property owners, after a deed restriction prevents future development, with a condition of perpetual property owner maintenance.
- Policy should specify options for any acquired properties that may be repurposed to open space for different City uses, such as parks, recreation areas, and mitigation projects such as stormwater detention.

Prioritization

- Include a contingency plan or program for emergency purchase of structures that have been catastrophically damaged by a flood or erosion event.
- Make sure that the “acquisition/buyout” option is included and evaluated in the prioritization process for overall/City-wide flood hazard mitigation.
- Create a database for all property that has been purchased for flood or erosion mitigation, including all pertinent information (address, date of purchase, total cost, flood history, etc.) related to the project. Note: There are legal restrictions (privacy) that would need to be considered on some data.
- Create a system for tracking homeowners in areas with historically flooded or erosion threatened homes who may be willing to move and sell their house to the city in the future.
- Create a database and location mapping to identify any voluntary buyouts by resident initiative and request (i.e. resident approaches the city).
- Create a database of structures in high risk, frequently flooding or eroding areas, which are possible candidates for buyouts, so that a voluntary buyout process may be initiated following a flood event or disaster declaration. Note: this strategy could be included in the evaluation of alternatives in city flood mitigation studies/reports and used as input to the database.
- In the policy, include a method for prioritizing flood prone properties which are at high risk of flooding that includes specific thresholds of risk such as a 5- or 10-year flood. Policy should address a range of thresholds that might be encountered within the City.
- The buyout policy should consider as many relevant risk parameters to be incorporated into the overall flood mitigation prioritization process, such as watershed size, history of high damage events, FEMA or non-FEMA floodplains, and other factors.

Grant and Partnership Opportunities

This would include the continuation of many of the past or ongoing City of Fort Worth pursuits of state and federal funding for flood mitigation. In the June 2016 Floodplain Management Plan, one of the

mitigation actions is *Pursue grants to complete property acquisition projects*. The following grants should be considered for application to the City of Fort Worth voluntary buyout policy and intended use.

- FEMA
 - The Federal Emergency Management Agency (FEMA), through the Texas Governor’s Division of Emergency Management (TxDEM) and the Texas Water Development Board (TWDB), can provide substantial federal funding for the purchase of flood-prone homes through FEMA's Flood Mitigation Assistance program (FMA), the Hazard Mitigation Grant Program (HMGP), and the Pre-Disaster Mitigation program (PDM). By pursuing FEMA grants, the city leverages local funding with federal funding to acquire and demolish homes that are at high risk of flooding in the future. Federal funding for home buyout has historically required local matching funds of at least 25%, although some grant programs (severe repetitive loss) may pay up to 100% of eligible costs.
- USACE
 - The USACE can provide studies and implementation projects that include planning, analysis, and development of non-structural alternatives (such as flood prone property acquisition) under Section 205 of the 1948 Flood Control Act, as amended.
 - This Corps’ acquisition alternative (also known as the “buy-out”) involves the acquisition, demolition, removal of structures from the floodplain, and the relocation of residents to flood free housing. The practicality of floodplain acquisition depends on several factors. They include the frequency and severity of flooding, the willingness of residents to move out of the floodplain, the availability of flood-free housing, the value of the property, and the need for areas of a more compatible floodplain use such as parks or nature areas. Permanent acquisition can be a very effective means of reducing flood damages, as well as public damages and costs.
- HUD
 - The Department of Housing and Urban Development (HUD) administers the federal Community Development Block Grant (CDBG) program that can assist with housing, economic development, and measures to reduce damage in future storms. In Texas, the General Land Office (GLO) administers this part of the CDBG program. When the President declares a major disaster, Congress may appropriate funds to the Department of Housing and Urban Development when there are significant unmet needs for long-term recovery.
 - HUD provides flexible grants to help cities, counties, and states recover from presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. In response to presidentially declared disasters, Congress may appropriate additional funding for the Community Development Block Grant program as Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. Since CDBG Disaster Recovery (CDBG-DR) assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources.

Communication Plan

- Develop communication plan and tools to support the Property Buyout Policy. Include information on benefits to residents and City staff, as well as possible positive and negative impacts on neighborhoods.
- Include information on retrofitting and flood proofing (non-residential structures only) of existing flood prone structures and options such as elevating of buildings where feasible.

Maintenance Plan

- Develop a strategy/plan for including any purchased floodplain properties in the annual or long-term City stormwater maintenance program.
- Identify any unique maintenance issues related to landscaping, vegetation, trees, non-mow areas, and environmentally sensitive areas.
- Coordinate with Parks Department to seek synergies of maintenance needs to accomplish more frequent mowing requirements for residential areas and parks.

Policy Development Considerations

- Option 1 - No action / Status Quo
 - Continue with current “unwritten” voluntary buyout practice of addressing specific flooding problems on an “as-need” basis in critical areas, where structural solutions are infeasible, such as Arlington Heights.
- Option 2 – Develop a Voluntary Buyout Policy Based on Risk Assessment
 - Set up a classification system to identify and group known flood and erosion prone properties, based on level of risk (frequency, depths, danger to lives, damages). Extremely high risk properties such as Severe Repetitive Flood Insurance Loss (SRL) could be one category. Repetitive Flood Insurance Loss (RL) could be another.
 - Develop a long term plan/program for eliminating these properties through acquisition and removal of the high risk structures, including a financial plan for annual expenditures.
 - Communicate the plan to affected property owners.
 - Provide property owners with options such as relocations, timing, etc.
- Option 3 – Develop a Voluntary Buyout Policy as part of a disaster response.
 - Identify high priority properties at risk of flooding and erosion that meet the criteria for potential acquisition.
 - Fund annually a voluntary buyout budget that accumulates each year and is available for acquisition of properties.
 - Following a disaster such as a flooding event, be prepared to submit damaged properties for grant funding and leverage available budget to meet matching grant fund requirements.
 - This policy would need to be considered in conjunction with the local floodplain policy development. For instance, if the City decides to pursue a local floodplain policy that would require flooded properties that exceed a specified damage threshold to rebuild to new standards, then a voluntary buyout policy would likely be in high demand following a major flooding event.

City Resources

This initiative is expected to require some additional resources on a recurring annual basis. It has not yet been determined the level of additional resources or where those resources would come from.

Complimentary Initiatives

- A. Local Floodplain Policy – Local floodplains could be identified for prioritized buyouts.
- C. Private Property Channel Erosion Policy – Buyouts may be considered as part of a future channel erosion policy.

Action Plan

- Process Lead: Jennifer



- Technical Lead: Clair
- Staff Involvement: Program Dev. Section, Field Ops, Parks, PLN, Legal, Linda S., Floodplain Administration
- Stakeholder Involvement: PLN Commission, SW Stakeholder Group Small Group, S&V
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional Resources

- 2016 Stormwater Rethink Aimed at Flooding in Atlanta Neighborhoods
- 2017 Road to Recovery Remains Long for Cities Hardest Hit by Hurricane Matthew
- 2017 Environmental Law Institute – An Action Guide for Local Governments on How to Maximize Community Benefits, Habitat, Connectivity, and Resilience

I. Opportunistic Construction of Small CIPs

Strategic Direction

Emphasize smaller project execution with operating budget and seek partnerships for larger projects

Consider the use of City staff and equipment to complete the construction of small capital projects. The goal of this initiative would be to find cost benefits utilizing City resources instead of outside contracts.

Purpose

The purpose of this initiative is to develop a proactive and efficient small Stormwater CIP program that will:

- Address the mitigation needs for “hotspots” that have been identified as small local flood reduction projects.
- Provide coordination with Infrastructure maintenance on construction of small capital projects where they have the capacity and equipment to construct. Criteria needs to be established for how “large” of a project they can practically and efficiently construct.
- Determine which small CIPs ought to be given highest priority.

Background

Current Practices at City of Fort Worth

A majority of the SWMP flood mitigation CIPs are in the small CIP category, defined as small, localized, one million dollar or less projects that are often in “hotspot” flooding areas. Since 2008, the city has issued \$150 million in revenue bonds and constructed over 130 flood mitigation projects. Of these, 75 were major projects and 55 were minor projects.

Evergreen contracts are utilized for contractors to construct some small CIPs currently, but the mobilization costs are often too high to be efficient at some of the smaller projects. Large projects currently go through CIP Delivery.

Peer Community Review

N/A

Stakeholder Feedback

N/A

Future Considerations

The following future actions for this initiative are:

- Include the small CIP prioritization within the context of the overall CIP program
 - Flood risks and funding allocation should be weighed against large CIPs
- Construct minor capital projects as needed through stormwater maintenance.
- Work with Field Ops to develop this capability through stormwater maintenance and determine what services should be included and excluded – for example, manholes, inlets, etc?
- Determine whether stormwater maintenance can participate in small storm drain rehabilitation projects as well as other small capital projects.
- Communicate project benefits



- Update completed project GIS
- Provide capitalization of assets and project costs.

City Resources

This would be a shift in resources from other activities and would not directly impact the overall resources to maintenance.

Complimentary Initiatives

- B. Storm Drain Rehabilitation – This could be considered as part of the small CIPs
- D. Prioritization of Critical Maintenance Tasks – Could be impacts to the maintenance activities
- K. Public Channel Maintenance – Could impact the backlog of public channel small CIPs.

Action Plan

- Process Lead: Kiran
- Technical Lead: Cannon
- Staff Involvement: Field Ops, CIP rep.
- Stakeholder Involvement: N/A
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional Resources

- N/A



J. Program Wide Communication Plan

Strategic Direction

Communicate effectively to public and City staff so they can make informed and educated decisions.

Purpose

This initiative will seek to find more effective ways for stakeholders to access stormwater data, particularly data that depicts chronic flooding and potential erosion risk. Website refinements and updates will be considered as part of this initiative as well as availability of digital data.

The success of future SWMP Master Plan initiatives will be contingent on the outreach, engagement, and education of stakeholders. An overall outreach strategy and framework will be evaluated in coordination with the overall City outreach and engagement process.

Background

Current Practices at City of Fort Worth

The City is very active in a number of different public communications including:

- Newsletters
 - *Runoff Rundown* Newsletter (annual city-wide mailout focused on flood risk awareness and insurance availability)
 - Direct Mail Newsletters (project specific as needed)
- Online
 - City Stormwater Website
 - Project/Planning specific webpages
 - Online Questionnaires
 - Neighborhood Email Blasts
- Public Meetings
- Social Media Campaigns (NextDoor, Twitter, etc.)

Peer Community Review

19. Communication	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
How does your community communicate flood related information to the public? (Check all that apply)								
Social media								
Text message								
National Weather Service feed								
Television								
Website								
Reverse 911								
Other								
N/A								



What data does your community communicate with the public? (Check all that apply)								
Precipitation								
Flood stage								
Flood depth								
Forecasting								
Road closures								
Highwater rescues								
Stranded vehicles								
Other								
N/A								
Does your community recommend actions to public along with the information that is communicated?								
Yes								
No								
N/A								

Arlington

- No reverse 911 targeted for specific areas.

Dallas

- City has National Weather Service feed on Flood Control website. City also has outreach program.
- When available for river, flood depth is communicated with the public.
- City recommends the actions of ""Don't drive onto flooded roadways"" to the public along with information.

Oklahoma City

- Action center for public to call in. Receive calls every day. Can be anything, not just drainage related. Try to respond within a week.
- High water rescues and stranded vehicles tracked in GIS.

Charlotte

- Flood Information and Notification Systems (FINS) provides precipitation, flood stage, and flood depth to the public. Includes Charmeckalerts.org
- City uses media messages, ""Turn Around, Don't Drown""

Stakeholder Feedback

Stakeholder comments:

1. Are the flooding issues primarily in developed areas?
2. Are you sharing the engineering assessments and prioritizations with other departments and decision makers like parks, planning, etc.?



3. Can you give an idea of what is involved in an engineering study and what are some actions that have been initiated as a result of these studies?
4. What do you call your planning department?
5. Vision seems to lack aspirational goals and vision. Need something to get behind like water is a valuable resource and something that we can rally behind.
6. Need to integrate our streams and organizations with current funding to push this vision.
7. Would like to hear more about quality of life and overall goals. It is understood there is better quality of life when you don't have erosion.
8. These seem more like goals than vision. Vision needs to be higher level.
9. What is stormwater telling mayor, council, etc.? We need more green space returning water to the ground.
10. Collaborative needs to be expanded to include internal and external collaboration.
11. Collaboration and partnerships are the same. Could be collapsed.
12. Be clear about the negative impacts of poor drainage.
13. We assume city management and council are on top of everything. Where is leadership on this? How aware is city leadership of stormwater? Do you have their respect? Do they understand how serious the stormwater issues are?
14. This and previous slide are not visions, these are strategic goals. No idea how you can achieve your goal with this level of detail. Need to clean up verb tenses.
15. Lake Worth watershed mostly uncontrolled because it is outside of the Fort Worth City limits. Need NCTCOG or someone to help program to coordinate adjacent communities.
16. Pollution control has issues in existing neighborhoods because of used car oil, etc. Agrilife Texas Watershed Stewards has an educational program to help inform existing residents about stormwater pollution. We need more education.
17. I believe after 5 years of being on Stormwater Citizen Committee and the FEMA Stormwater Committee that the City needs to raise financial support and awareness of these issues.
18. Meeting was very well planned and well conducted. Stakeholder's input is obviously valued. Good job!
19. We never talked about the role of educating the community on why there are problems. There is always an opportunity to do better.
20. I have a question about the real problem. Who is managing the Trinity River and the levees? Is that USACE responsible?
21. I'm satisfied with the process city staff conducted. I thought stakeholder's participation level was great. I'm confident the final product (master plan) will be a very comprehensive and very well thought out document. Staff has done a great job!
22. Work with Planning Department for benefit to community as an amenity.
23. No hard and fast policy /must have flexibility always.

Public Comments:

24. I live in Riverbend Estates and long after moving in I learned HOA is responsible for the drainage and flood control for the neighborhood and roughly 2000 acres upstream from us pursuant to a

1989 Drainage Facilities Maintenance Agreement between the developer and the city. If there were to be a flooding event I am concerned about the HOA's financial ability to run the pumps to maintain the drainage. What can the HOA do to get financial assistance with this? Is there a way to apply for funds to be allocated to us to assist with the drainage maintenance?

25. Interested in attending future meetings and learning about our engagement process.

26. Thank you for putting together this meeting and allowing public input.

Future Considerations

- SWMP Business Plan
 - The proposed SWMP Business Plan would provide an opportunity to communicate with the public. It would afford the SWMP the opportunity to be open and transparent in all aspects of the planning and development of ongoing and future services and programs.
 - Could be combined with existing SWMP communication efforts to educate residents and the general public on how the city Stormwater program provides day-to-day and long term services.
- Roles and responsibilities – Determine who is responsible for reviewing and implementing the overall communications plan.
 - City's communication office
 - SW Communication (Linda)
 - IT
 - TPW (Jeff)
- Consistent Messaging
 - Be aware of all the program elements and how they fit together.
 - Coordinated communications with other City initiatives
 - Proactively plan for public communication support for the Business Plan and policy implementation schedules.
 - Include MS4 Coordination
 - Implement Floodplain Management Plan education and outreach initiatives
- Communicate Flood Risk to Public
 - How do you do this with decision makers? What are tools and ways to make this info available to people? How do we manage the scary message?
 - How frequently do you engage the City council? Have you found effective ways to communicate stormwater needs even when there is not recent flooding?
- Website Updates
 - The website needs to be updated to include current information. The information also needs to be organized around a more intuitive structure that makes it easier to locate information.
- Public data
 - How much City engineering data, studies, maps, gage information, and planning data would public like to see and how would they like to access it? This could overlap with development services as well.
 - What data do you make accessible to the public? Data such as maintenance work orders, local floodplains and erosion hazards, GIS data, pipe conditions assessment, downstream drainage constraints, etc.



- People need to be able to follow-up on work orders. Resident response transparency. Show people how their issues/complaints/needs are being addressed.
- Other Topics for Communication Plan
 - Support the SWMP Master Plan Implementation Strategy for the future SWMP Stakeholder Group and Working Subgroups. This will replace the current CAC.
 - Identify areas for targeted outreach to increase flood insurance participation, such as non-FEMA floodplain residents
 - Focus targeted public information campaign to address man made inlet blockages
 - Increase flood insurance participation based on coordination with Floodplain Management
 - Educate importance of reporting flooding and maintenance concerns
- Notes from 11/2015 CAC meeting participants on how to possibly get public input on the SWMP. This information was considered as part of the SWMP and may be helpful as future public communications initiatives are planned.
 - Match up F & D graded mapsheds with HOAs/neighborhoods – attend one of their regularly scheduled meetings and ask for input
 - Schedule meeting with larger league of neighborhoods
 - Talk with larger groups that communicate with neighborhoods such as North Fort Worth Alliance and ask them to spread information about the MP
 - Be clear the MP is citywide and not for a specific area
 - Be conservative on timeframe, don't provide an aggressive schedule that can't be met
 - Brief each CM what we are doing and ask them to share information with their constituents
 - Split the city into 4 sections (north east, north west, south east, south west) and hold a meeting in these areas to reduce number of meetings
 - Ask neighborhoods in floodprone areas for SW representative (often may have one on their committee) and schedule a meeting specifically with these representatives
 - Group floodprone areas together and hold a meeting for these areas only
 - Ask people for input on selling more bonds (SW vs. general revenue bonds), increasing SW fee, etc.
 - Use short 10 second video clips to spread the word

City Resources

This initiative is expected to require some additional resources to establish the plan but the resource requirements should be reduced after it is developed.

Complimentary Initiatives

- Most of the key initiatives could be considered complimentary as the communications plan will establish processes for internal and external coordination/outreach.

Action Plan

- Process Lead: Jennifer
- Technical Lead: Linda S.
- Staff Involvement: All 4 program element reps. (CIP, Flood Warning, SDS, Floodplain Admin/CRS, Field Ops), City Communications Office, TPW Communications/Jeff, IT, EMO
- Stakeholder Involvement: N/A
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...



Additional Resources

- 2016 Fort Worth City News – Digital Enhancements promote transparency, accountability
- 2015 Fort Worth Community Survey – Draft Report
- 2017 Fort Worth Community Survey – Findings Report
- City of Fort Worth – Capital Projects Communication Plan
- APWA Reporter – 2016 Utilizing utility master planning for public engagement and developing public support



K. Public Channel Maintenance

Strategic Direction

Complete an inventory and criticality assessment of public channel infrastructure rehabilitation needs. Based on the results, evaluate needed adjustments to the program to rehabilitate critical channel infrastructure needs.

Purpose

The purpose of this task is to become more strategic and proactive regarding the public channel maintenance.

Background

Current Practices at City of Fort Worth

The City currently utilizes a Stormwater Channel Rating Form to help rank and prioritize channel maintenance needs across the City. A comprehensive channel inventory and assessment task is underway to help identify and quantify the maintenance needs across the City related to channels.

Accela work order system is used to track work orders, cost of service, etc. The City’s stormwater maintenance section has utilized Accela and other tools to track performance goals and metrics for nearly all of the maintenance tasks.

Peer Community Review

7. Channel Maintenance	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
How does the stormwater department and parks department share maintenance responsibilities for green infrastructure?								
On a case-by-case basis								
Parks department maintains								
Stormwater department maintains								
The community does not actively maintain any green infrastructure								
Other								
Does your community have a regular schedule of maintenance for engineered channels?								
Yes								
No								
I don't know								

Arlington

- Maintenance responsibility for green infrastructure: In a park – parks responsibility; Not in a park – stormwater responsibility.
- Engineered channel maintenance: concrete lined inspected annually; grass lined mowed 3-4 times per year.

Austin

- If the green infrastructure is within a park, the Parks Department would be responsible. Most of the City's GI facilities to date have not been in parks.
- Maintenance trend is toward natural channel with no or limited mowing. Mowing is only maintained on certain channels.

Dallas

- Streets department maintains some responsibilities for green infrastructure.

Oklahoma City

- Street department has drainage section that does repair and maintenance.
- Some pervious pavement and rain gardens have been constructed. Not much LID.
- Mowing contracts for engineered or natural channels. Clear natural channels of blockages.
- Regular maintenance for engineered channels. No scheduled maintenance but they are regularly maintained.
- City has GIS file that shows inventory of engineered channels.

Raleigh

- City will maintain channels within the ROW or within any areas where they have permanent drainage easements. Not necessarily regular maintenance. Have more recently taken on a more major responsibility for maintenance and are still working on better defined maintenance schedule.
- Maintenance is focused on channels around ROW. Have a list of locations where they check. Not many engineered channels in town. There is some maintenance for pruning shrubbery around streams, but that is not maintenance that City will be involved with. City is focused on functional maintenance of the channel for the overall system, like major blockages, etc.

Charlotte

- Parks not involved in maintenance responsibilities. Combination of private and public maintenance, depending on project ownership.

Stakeholder Feedback

Stakeholder comments:

1. What do you mean by maintained channels?
2. What types of channels are maintained?
3. Where are we in terms of indexing and inventorying the public channels? Is there a chance that channels become a higher priority? What if we find the issues are much bigger?

Future Considerations

The following future actions for this initiative are:

- Complete the channel inventory and assessment of stormwater infrastructure
- Apply channel assessment scoring criteria to include criticality (business risk) information for prioritizing maintenance actions and planning activities
- Develop and maintain criticality ranking of channel inventory



- Establish channel infrastructure maintenance needs and prioritize projects for field operations based on channel inventory and assessment.
- Consolidate mowing program of SWMP maintained properties to all be managed together – will require coordination with Parks Department
- Query Accela work orders that involve sediment removal or erosion complaints and send to planning for consideration with erosion and capital project prioritization
- Consider Open space/MBF design standards for no maintenance requirements
- Develop signage and communication tools to support natural areas that have reduced maintenance frequency
- Add open channel inspections to regular maintenance program
- Review issues and establish criteria for armored channel retrofit and repair scenarios
- Evaluate process to streamline the easement research and identification process to help inform field operations of options and responsibilities
- Update easement feature class in City GIS data
- Provide support to update feature data as needed to maintain channel inventory
- Bar ditches
 - Maintenance staff are not necessarily equipped for bar ditch maintenance. A high number of customer calls relate to these bar ditches. The City spends a lot of time and money on other items that do not have as many calls and maybe there should be a greater emphasis on the level of resources and focus on bar ditches.

City Resources

The impact to City resources will be better known following the completion of the channel inventory and assessment along with the prioritization of maintenance tasks.

Complimentary Initiatives

- D. Prioritization of Critical Maintenance Tasks
- M. Natural Area Preservations, Conservation, and Restoration

Action Plan

- Process Lead: Chris
- Technical Lead: Cannon
- Staff Involvement: Field Ops, Parks, Field Engineering/ROW easement research
- Stakeholder Involvement: N/A
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional Resources

- N/A

L. Mitigation Banking

Strategic Direction

The SWMP could create an environmental mitigation bank to mitigate the environmental impacts of stormwater projects based on regulatory requirements. Stormwater mitigation projects could bank credits and make them available for other City projects at a reduced cost compared to the private mitigation banks.

Purpose

The purpose of this initiative is to evaluate the feasibility and need for an environmental mitigation bank. This bank would need to be maintained by the City into perpetuity so the sites would need to be strategically selected and ideally provide additional public benefits such as the Nature Gardens or other public spaces.

Background

In a Memorandum of Agreement (MOA) signed February 6, 1990 between the USACE and the EPA, mitigation was defined as a sequential process of avoiding, minimizing, and compensating for adverse impacts to the aquatic ecosystem. Compensatory mitigation is required for unavoidable adverse impacts to the aquatic ecosystem that cannot reasonably be avoided or further minimized in order to replace those aquatic ecosystem functions that would be lost or impaired as a result of a USACE-authorized activity.

A mitigation plan is required for a general permit, individual permit, mitigation bank, or in-lieu fee program. Final mitigation plans must include the 12 components listed in Part II below. The USACE may require additional information as necessary to determine the appropriateness, feasibility, and practicability of the mitigation project.

The purpose of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts to waters of the U.S. authorized by USACE permits. The USACE will determine what compensatory mitigation is required based on the practicability of replacing the aquatic functions lost as a result of the permitted activity. Permit applicants are responsible for proposing an appropriate compensatory mitigation option commensurate with the amount and type unavoidable impacts. Compensatory mitigation may be performed using methods of restoration, enhancement, establishment, and in certain cases preservation in order to successfully improve aquatic resource functions.

Current Practices at City of Fort Worth

This initiative is a relatively new concept that is patterned after the U. S. Army Corps of Engineers (USACE) Section 404 Mitigation Bank alternatives program. The USACE allows entities that disturb “Waters of the U.S.”, i.e. primarily wetlands and adjoining habitat, to purchase “mitigation credits” to offset the impact of the proposed action (usually filling, channelization, clearing, construction). The eligible mitigation banks are established by deed restricting certain areas of high quality environmental habitat or by physically creating environmentally acceptable habitat and wetland features in a restricted area.

Some drivers for this initiative are:

- City Management has expressed concern with spending dollars on mitigation. Fort Worth has spent approximately \$1.5M over last 5 years on mitigation.
- Cost of bank credits are not constant or predictable. For example, one project had a preliminary quote of \$40k, but final cost six months later was \$55k.
- Cost of bank credits may exceed total project cost and can cause a project to be infeasible.



Peer Community Review

3. Regional Flood Mitigation	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Which of the following regional mitigation measures are currently being implemented or planned for implementation in your city? (Check all that apply)								
Regional detention	Yellow		Green		Green		Green	Green
Major stream channelization	Yellow			Green			Green	
Major storm drain trunk line improvements	Yellow		Green	Green	Green	Green	Green	Green
Major storm drain tunnels			Red	Red			Red	Red
Wetland restoration	Yellow			Green		Green		Green
Stream erosion mitigation	Yellow	Green						
Channel daylighting	Yellow					Green	Green	Green
Other								
Has your City banked wetland mitigation credits to meet USACE Section 404 requirements?								
Yes, credits have been banked and utilized				Red			Red	Red
Yes, credits have been banked but not been used								
No	Yellow	Green			Green			
I don't know			Red			Red		
<i>FTW has purchased mitigation bank credits but the City has not banked credits on one project to be utilized on another project.</i>								
Is your community actively planning regional detention in advance of private development?								
Yes	Yellow		Green					
No		Red		Red	Red	Red	Red	Red
Is your community active in constructing regional detention in advance of private development?								
Yes			Red					
No	Yellow	Green		Green	Green	Green	Green	Green
<i>FTW is primarily focused on planning detention for flood reduction of existing development. However, the City has supported regional planning efforts for detention in developing watersheds.</i>								
If your community is active in planning or constructing regional detention, how are your costs reimbursed?								



Fee-in-lieu of detention								
Special drainage district								
Development of impact fees								
TIF or PID Funds								
Other								
N/A								

Arlington

- Currently implementing a pilot program for stream erosion mitigation with emphasis on reach based solutions.
- Reach based erosion mitigation projects for the pilot program were determined/ranked based on overlaying the erosion CIPs from watershed studies with the City’s complaint database.
- Total of 4 projects identified at approximately \$1M-\$3M each project.
- The goal is for the pilot program to not interfere with flood mitigation projects.

Austin

- Our accumulated Regional Stormwater Management Program fees have been used to perform planning studies and to design and construct regional detention facilities in several of our watersheds. We also encourage private development consider regional rather than site specific solutions when the development is large enough or groups of developers are willing to cooperate.

Dallas

- Major stream channelization, major storm drain trunk line improvements, major storm drain tunnels, wetland restoration/creation, and stream erosion mitigation are being implemented in the City.

Oklahoma City

- Most regional detention was constructed back in the ‘90s.
- Currently expanding one of the existing ponds.
- Bond issue coming up in September. Many projects proposed to replace major storm drains in downtown. Some of the bond projects put in are for detention. Roughly \$2M for each detention project.

San Antonio

- Some of the mandatory detention centers have very sensitive downstream natural features, or other areas that are high risk and subject to flooding. Not allowed to do fee-in-lieu of in mandatory areas, must detain (except for really small sites).

Charlotte

- Daylighting has been fairly limited in City. County has uncapped some larger systems. Will look at opportunities but those are relatively infrequent.
- Have used tunnels under state road, but these are limited to small runs.

- They have a mitigation bank and will sell those credits to other departments. The City manages the bank internally.
- Developers will drive the regional detention planning and construction to achieve fee credits. City is not planning or constructing detention. Maybe one example of planning for detention to help facilitate redevelopment of an area but not yet built.
- File for water quality improvements. Fees must be used in the same watershed for BMPs or SCMs. City likes regional 10, 50, or 100 acres of drainage. Wetponds, wetlands, open air sand filters, and some proprietary devices.

Stakeholder Feedback

Stakeholder comments:

N/A

Future Considerations

The following future actions or considerations for this initiative are:

- Understanding of the Issue – Risk Analysis
 - How significant would the impact be on City budget implications, etc.
 - Business case for/against mitigation banking
 - Look at 2018 bond program- would any of the projects identified need mitigation credits? How would this impact the budget?
 - Determine what triggers mitigation credit requirements and what is the average cost.
 - Coordinate with other city department CIPs to determine if they want to consider the topic of mitigation banking to better manage resources
- Is a mitigation bank worth it for a public entity? Since this is a relatively new concept, has it proven to be a viable and economical alternative for environmental mitigation?
- Develop internal communications plan to support decision on mitigation
- How do you create an urban-setting mitigation bank that satisfies the stringent criteria and regulations of the USACE?
- Evaluate and develop strategy for implementation of CIP mitigation credit system. Evaluate if City is interested in mitigation banking, PRM, selling credits, etc. Identify benefits/cost of PRM, mitigation bank credit purchasing, credit selling, etc.
 - Purchase agreements and legal documents would need to be considered if the bank is going to sell credits outside of the City.
- Consider CIP prioritization adjustments for City funded projects to establish mitigation credits
- Prepare for future mitigation project design and implementation
- Evaluate the maintenance and preservation needs for a mitigation banking program
- Consider for FEMA CRS points natural beneficial function of floodplains, wetlands, and water in conjunction with natural area preservation, conservation, and restoration
- Make a go/no-go decision and proceed with implementation
- Working with other departments to understand who should lead this effort? May not be a stormwater driver.
- Mitigation projects would have to be maintained by City for the foreseeable future, so it would need to have a public benefit for education and entertainment like the Nature Preserve. Have to find the right project.



City Resources

The impact to City resources is not known at this time. There is a potential to reduce the overall City resources required for mitigation banking through this initiative.

Complimentary Initiatives

- C. Private Property Channel Erosion Policy – Stream stabilization projects could contribute towards banking or require mitigation credits.
- M. Natural Area Preservations, Conservation, and Restoration – Could contribute towards a mitigation bank, depending on the location.

Action Plan

- Process Lead: Ranjan
- Technical Lead:
- Staff Involvement: Parks, Streets, Water, CIP rep, Floodplain Administration, ENV, PLN, Field Ops
- Stakeholder Involvement: N/A
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional References

- USACE - Mitigation Banking Resources
- USACE – July 2017 Meeting Notes
- Consider the following points of contact for information regarding their efforts on Mitigation Banking
 - Harris County Flood Control District – Halff is aware of some efforts on HCFCD in this regard
 - Oklahoma Department of Transportation – Halff was aware of an SOQ by ODOT in August 2017 to setup a Mitigation Bank.
 - Dallas, San Antonio, and Charlotte responded to the peer review that that they have banked credits. Charlotte had some specific input on this initiative.

M. Natural Area Preservation, Conservation, and Restoration

Strategic Direction

The benefits resulting from this initiative could include a reduction of flood and erosion risks as well as lower costs for future capital projects by allowing the drainage ways to function more naturally. The use of native vegetation also allows for reduced maintenance of engineered channels. Channel maintenance needs are growing at a rate of 1.5 miles per year and this program could help reduce this need. Outreach and education are important to inform stakeholders of the ecological benefits of the program and the reason for/benefit of less frequent mowing in targeted areas.

Purpose

Evaluate the feasibility of an expanded program for Natural Area Preservation, Conservation, and Restoration

Background

Current Practices at City of Fort Worth

The City had a successful, award winning project that was an example of natural area preservation, utilizing native grasses and low maintenance. The project was named the *Valley Ranch Chanel Restoration Project – Implementing the Native Prairie Grass Program* and was awarded the TPWA 2014 Project of the Year. The project property was not under the long-term control of the City and the project went away but it is considered a success that could potentially be replicated in other parts of the City.

The SWMP has trained personnel that can help in the selection of appropriate plantings and maintenance techniques.

Peer Community Review

2. Multi-objective Flood Reduction Solutions	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA
Does your City acquire property for the purpose of natural area and floodplain preservation? For instance, would the City purchase a floodplain easement from a property owner that is not actively developing or platting?								
Yes								
No								
I don't know								
If so, how is property typically acquired?								
Consultant or private entity								
City staff								



Trust for Public Land or other non-profit									
Other									
N/A									
Does your community ever purchase flood-prone tax foreclosed property without a specifically planned project?									
Yes									
No									
I don't know									
<i>FTW has evaluated the purchase of property for floodplain acquisition and protection.</i>									
How are the maintenance responsibilities shared for multi-objective projects such as regional detention in a park?									
Parks Dept.									
Stormwater Dept.									
It depends									
I don't know									
Does your community have a written plan for natural areas and open space planning?									
Yes									
No									
<i>FTW plan includes the Comprehensive Plan and the 2015 Parks, Recreation, and Open Space Plan.</i>									
12. Floodplain Preservation	FTW	ARL	AUS	DAL	OKC	RAL	SAN	CHA	
Does your community have natural area preservation or buffer zones in floodplain areas?									
Yes									
No									
I don't know									

Arlington

- Multi-objective projects are considered part of the linear parks program and maintained through the parks department.
- Erosion Clear Zone & Creek Buffer Zone.

Austin

- City of Austin rarely purchases flood-prone tax foreclosed property with a specifically planned project.
- Stormwater components are typically maintained by Stormwater Department.

Dallas

- City would purchase a floodplain easement for Great Trinity Forest.
- City has a written plan for natural areas and open space planning for Great Trinity Forest.
- Major stream channelization, major storm drain trunk line improvements, major storm drain tunnels, wetland restoration/creation, and stream erosion mitigation are being implemented in the City.

Oklahoma City

- If parks agrees it is a park, even if regional detention, parks department agreeable to maintain.
- Several regional ponds in City.
- Buffer zone put into new comprehensive plan.

Raleigh

- From time to time the opportunity will arise for City to purchase tax foreclosed properties and that will be pursued. At times, a resident will ask City if they are interested in purchasing property.
- Growing responsibility in stormwater maintenance. A detention pond on park would currently be maintained by parks. In coming year, the stormwater department will take more responsibilities for maintenance, inspections, and routine maintenance. Major repairs will be shared with “owning department”. Ask each department to reimburse stormwater for maintenance. Value to overall City is a single group managing all stormwater controls. The initial intent with centralized SCM maintenance budget to determine how much the cost will be. In the future, the costs will be allocated to each owning department.
- SCMs may be placed on a park property when needs and goals of parks and partnering city departments are in alignment to best meet overall city needs. An example would include facilitating a street improvement project. Treating the water and providing some communication and educational opportunities would be multiple benefits.
- Always looking for an opportunity to daylight. Looking for it as possible options. Focused more on storm drains that are located under greenfields. Neighborhood improvement project example where one house was acquired and the culvert was daylighted (about 1,000 linear feet).
- Lake Preservation / Lake Management is administered as part of stormwater. Often small ponds that were developed with neighborhood or farm pond. There is a program for retrofitting these structures when there is an opportunity for stormwater quantity or quality improvements. These projects are on website and include dam retrofits. High Hazard Dam for instance will be scored 10 on safety. Might even include some wetland retrofits. Multi-objective projects. Not focused on projects that are just regional detention. 20 watershed plans and often an upstream regional detention pond is found to be the most beneficial. But it would have to weigh in against all the factors for prioritization. Mostly doesn't make sense for storage facilities greater than 300 acres. Too large of a detention facility. Have examples of retrofitting pond upstream that provides more attenuation that helps reduce size of storm drain upstream. New regional detention would be difficult to almost impossible due to permitting.

Charlotte

- City does not acquire floodplain easements. FEMA regulated floodplains are privately owned, but no easements on these properties unless part of greenway master plan.
- County will remove blockages, but residents have maintenance responsibilities as well.
- County will pursue stream restoration but they do not do capital projects to reduce flooding.

Stakeholder Feedback

Stakeholder comments:

N/A

Future Considerations

The future actions, questions and considerations for this initiative are:

- Maintenance
 - Need appropriate easements and maintenance plan.
 - Who is responsible for maintenance in natural areas?
 - What level of maintenance should be used?
 - Should vegetation be wild, maintained, or a combination?
- Who has control of how the land is used?
- What about requiring erosion and meander setbacks or buffer zones?
- Is this a concept that could be included within ROW or easements?
- Should the SWMP and Parks Departments share maintenance responsibilities for green infrastructure and multi-use detention facilities?
- Suggest areas for reduced maintenance frequency and natural grass planting program
- Place "no mow" signs in appropriate locations and establish native grass and other "Green Zones"
- Coordinate open space opportunities with flood control needs for new developments, repetitive loss areas, and tax foreclosed properties
- Potentially provide economic incentives for developers to preserve natural areas
- Consider dedicating more area to natural preservation by acquiring open space within the floodplain (rather than easement dedication)
- Coordinate with Waters of the US mitigation credit program
- Identify and prioritize reach based stream stabilization solutions to reduce continued maintenance needs
- Educate and help support the identification of native grasses and plantings. These are site specific initiatives that need support.
- Utilize geomorphological assessment for highly erosive area identification
- Consider Riparian corridor restoration opportunities in conjunction with mitigation banking credits
- Consider creating a stream restoration master plan that could compliment this initiative
- Prepare educational materials, signage, guidebooks, etc. for natural areas
- Launch a reverse litter program educational outreach in conjunction
- Coordinate educational outreach on illegal dumping in conjunction
- Vector control would need to be a consideration
- Would the Trust for Public Land be helpful in acquiring the property and planning greenprint?

City Resources

The impact to City resources is not known at this time. Ideally, this initiative would reduce the resources required for maintenance, flood mitigation, and erosion mitigation over time.

Complimentary Initiatives

- C. Private Property Channel Erosion – Stream stabilization projects could contribute towards restoration.



- D. Prioritization of Critical Maintenance Tasks – Reduced maintenance of natural areas could be utilized for other areas of need.
- F. Level of Development Review Policy – Incentives and requirements related to open space may be considered as part of this initiative.
- J. Program Wide Communication Plan – The Natural Area Preservation, Conservation, and Restoration initiative will depend on the effective communication of the program goals and objectives to be successful.
- L. Mitigation Banking – Could contribute towards more natural areas with limited maintenance.

Action Plan

- Process Lead: Jennifer
- Technical Lead: Chris
- Staff Involvement: Field Engineering, Floodplain Admin, Field Ops, Parks, Planning (trails, bluezones, greenprinting), Environmental
- Stakeholder Involvement: S&V, TRWD
- Next Steps: Use MP report and white paper to develop schedule, process, milestones...

Additional References

- Lake Worth Greenprint – 2014 Project Summary
- City of Fort Worth – 2016 Floodplain Management Plan
- Bluezones