

# FLOOD RISK MANAGEMENT OBJECTIVES AND PRIORITIES FOR THE CITY OF BELLAIRE

**ROSS GORDON, PE, CFM**

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# INTRO TO FLOOD RISK MANAGEMENT

- Cannot 'control' flooding (there are no guarantees)
- We aim to manage risk in order to achieve an acceptable 'risk profile' for Bellaire
- What is the appropriate 'risk profile'? (this informs our design criteria)
  - Acceptable frequency of minor / nuisance flooding?
  - Acceptable frequency of major / structural flooding?
  - Susceptibility to different types of flooding (e.g. fluvial, pluvial) and tailwater conditions?
- What can we afford? Do the benefits outweigh the costs?
- Holistic flood risk management (recognizing multiple causes of flooding)
  - Local Drainage (streets, storm sewer collectors)
  - Semi-Regional Drainage (major storm sewers, drainage ditches)
  - Regional Drainage (Brays Bayou)
  - Development standards (if it floods, but no one is damaged, do we care?)

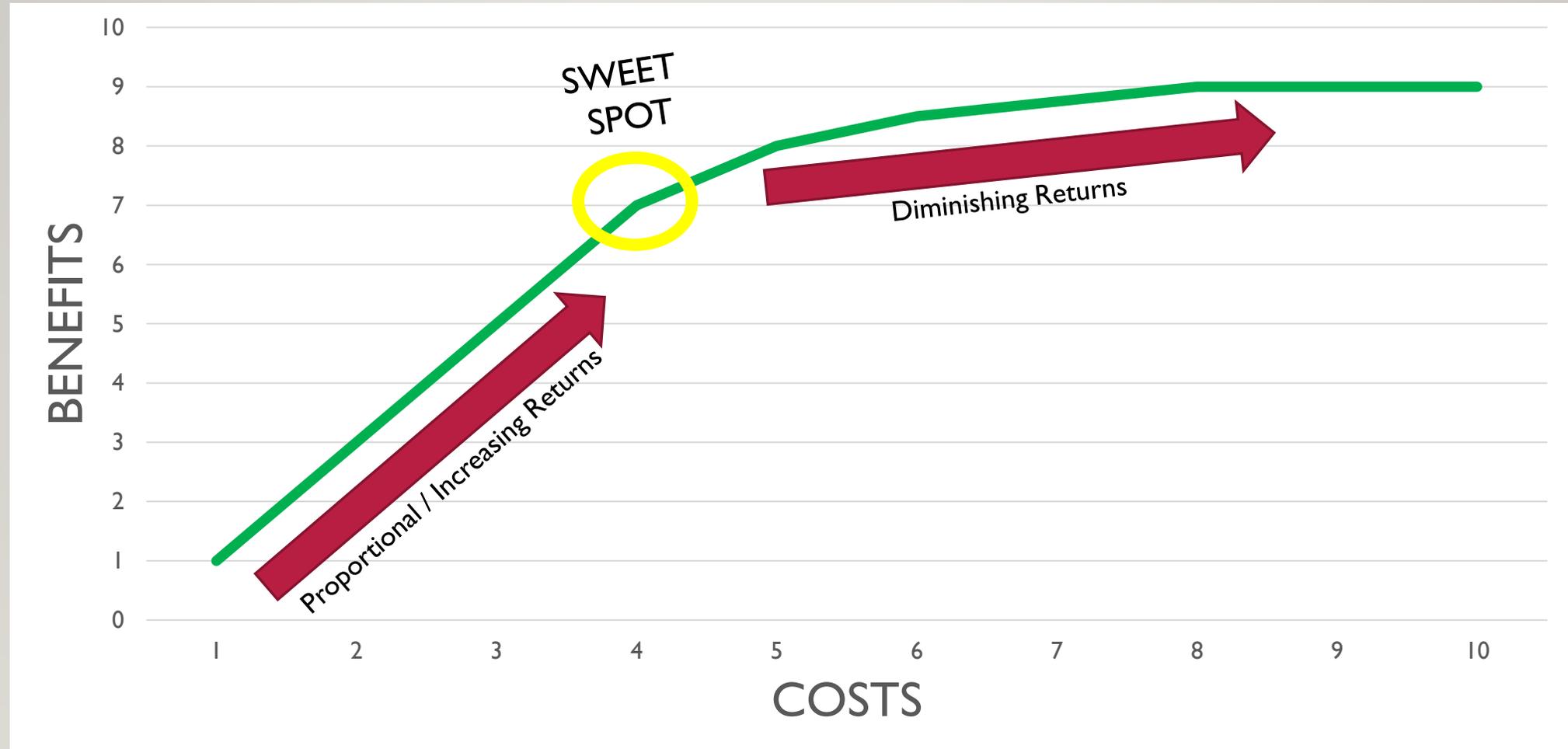


# WHAT ARE THE BENEFITS?

- Prevented loss of life
- Prevented flood damages
- Prevented secondary impacts of flooding
  - Time off work
  - Temporary housing costs
  - Mental health / peace of mind
  - Economic output of businesses / tax revenue
  - Etc.
- Increased property values
- Improved access for emergency services
- Increased mobility during rain events
- Increased appeal of our community
- Reduced insurance premiums (potentially)

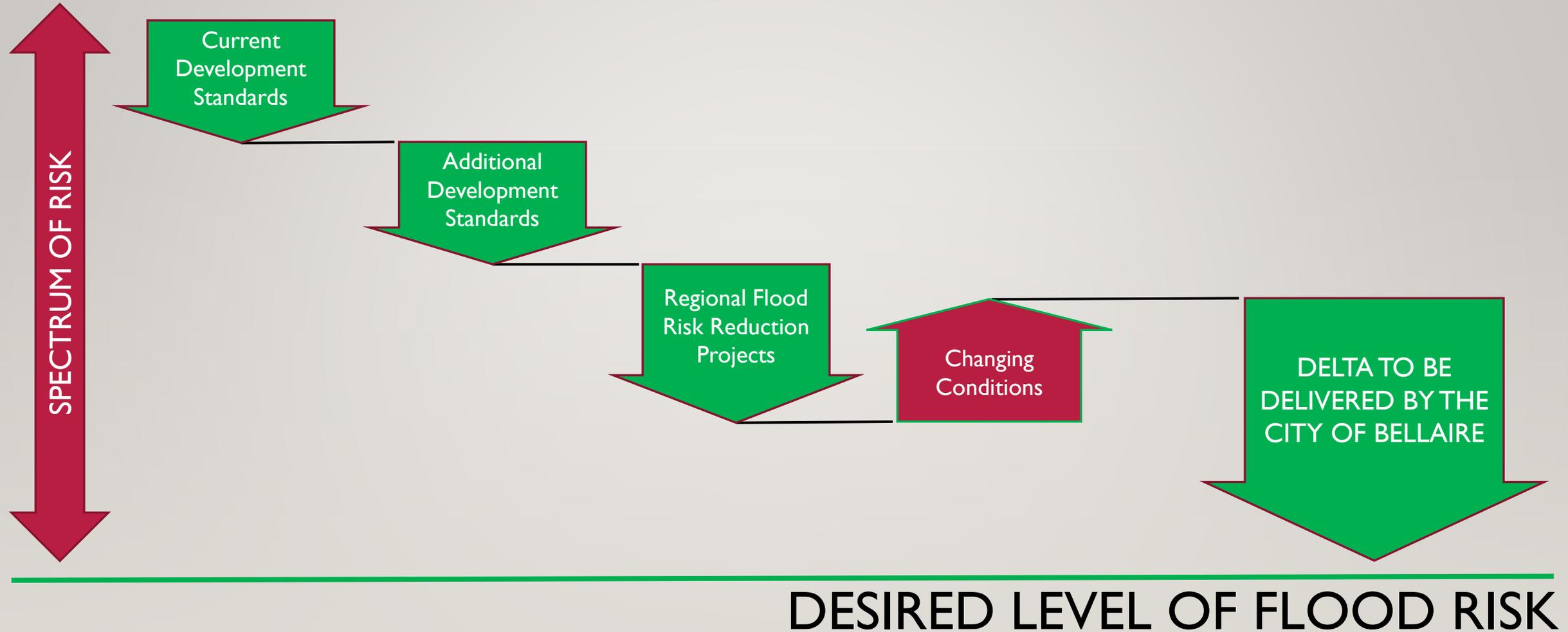


# OPTIMIZING OUR INVESTMENT

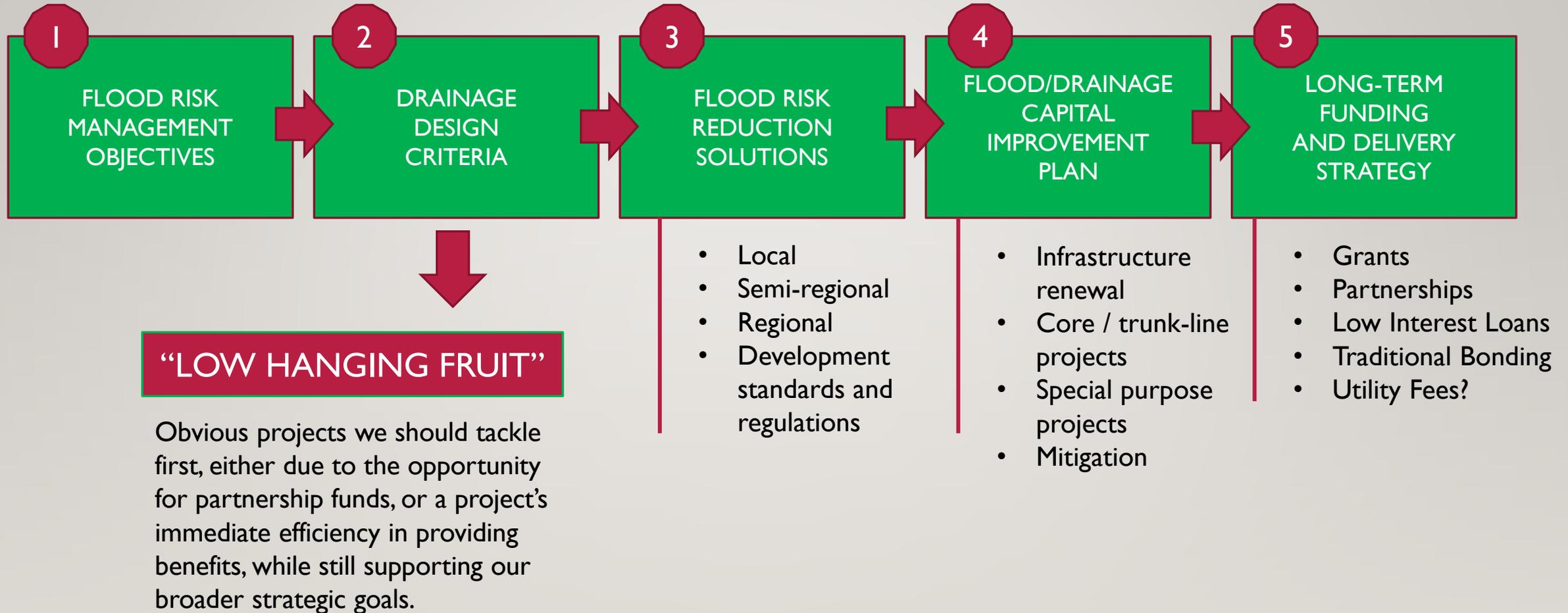


# CURRENT LEVEL OF FLOOD RISK

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# NEXT STEPS / IMPLEMENTATION PLAN



# DISCUSSION ITEMS FOR TODAY

- High-level flood risk management objectives
- Approach to development / floodplain regulations
- Objectives / drainage criteria for local drainage
- Objectives / drainage criteria for semi-regional drainage
- Approach to regional drainage (advocacy / partnerships)
- Approach to implementation / funding
- Next Steps

# HIGH-LEVEL FLOOD RISK MANAGEMENT OBJECTIVES

# CONSENSUS OBJECTIVES (STRAW MAN)

- We recognize that there are multiple causes of flooding, and through multi-faceted efforts we aim to holistically reduce the frequency and severity of flood events which impact our community.
- By reducing our flood risk, we provide greater physical and economic security for our residents, we increase the monetary value of our properties, and we enhance the appeal of our community.
- Critically, through our development policies and infrastructure improvements, we aim to:
  - Prevent, to the greatest degree reasonable, structural flooding in MAJOR storm events (e.g. the 100-yr flood)
  - Limit, to the greatest degree reasonable, excessive street flooding in MINOR storm events (e.g. the 10-yr flood)
- We recognize that in a flat, low-lying, city like Bellaire, which is subject to highly intense rain events, that we must learn to live with flood risk. We aim to safely manage floodwaters such that significant impacts to our residents occur less frequently and at smaller scales.
- We recognize our fiduciary duty to our taxpayers and aim to make sound financial decisions related to investment in our infrastructure. We shall consider both the benefits and costs of all infrastructure investment and aim to optimize infrastructure solutions to maximize the return on the investment.



# DEVELOPMENT / FLOODPLAIN REGULATIONS



# DEVELOPMENT/FLOODPLAIN REGULATIONS

- Recognize that in the long-term, the most reliable and cost-effective means of preventing structural flooding is to elevate homes/structures above the floodplain.
- Near term tasks:
  - Estimate the rate at which re-development is occurring, plotting out the anticipated number of at grade, partially elevated, and fully elevated homes in Bellaire over the coming 50-year period. This should also look at areas where home elevation has been, or may be, more or less prevalent, and how that may impact flood planning considerations.
  - Review the current Flood Damage Prevention Ordinance and assess if current home elevation requirements are sufficient. This must consider anticipated changes over a long-term planning horizon (e.g. 50 or 100 years). The City of Bellaire could adopt more aggressive requirements (e.g. 2 ft above the 100-yr or 1 ft above the 500-yr, whichever is higher)
  - Review the current Flood Damage Prevention Ordinance to assess if current floodplain fill mitigation requirements are sufficient. This may require coordination with other areas of Chapter 9 which relate to residential drainage.
  - Fully codify new City of Houston drainage requirements for commercial development, which are being enforced currently. Determine if any additional requirements are appropriate for either new development or re-development.
  - Consider and evaluate changes to our building codes which could reasonably mitigate the impact of residential construction on drainage/flooding. Specifically, if any provisions are necessary or appropriate to mitigate for the drainage impacts of impervious cover on residential property. This could also include requirements for or incentives to utilize pervious surfaces instead of impervious surfaces, or other site design requirements (e.g. downspout disconnects).



# OBJECTIVES / DRAINAGE CRITERIA



# LOCAL DRAINAGE

- Recognize that all infrastructure must be re-constructed on a rolling basis (approximately every 50 years), and that it becomes prudent and cost-effective to provide for appropriate drainage when this “infrastructure renewal” occurs.
- Effectively speaking, to keep our infrastructure in reliable working order, on average we must re-construct ~2% of our City’s infrastructure each year (or ~20% of our infrastructure every decade) to keep pace.
- We need a long-term street/drainage capital improvement plan detailing when the remainder of our “older” streets will be reconstructed (e.g. 2020s, 2030s, 2040s,), and how that reconstruction should interface with other drainage improvements. We should also coordinate these improvements closely with adjacent City of Houston drainage improvements.
- Important design considerations include:
  - Provide for an appropriately sized storm sewer (e.g. 2-yr, 5-yr, 10-yr, etc. capacity)
  - Provide for cascading overland flow, in accordance with a city-wide overland flow master plan (dictating how we want floodwaters to cascade/flow through Bellaire and to Brays Bayou) – ensuring we are not just “moving the flood” within Bellaire
  - Do we want to provide for additional subsurface detention within our public ROW?
- Design Criteria:
  - Maintain flood elevation below gutter/curb elevation in the XX-yr event (aka the storm sewer capacity)
  - Maintain flood elevation below the ROW elevation in the XX-yr event (aka the cascading overland flow capacity)
  - Maintain flood elevation X-ft below the finished floor elevation in the XX-yr event (aka the extreme event capacity)
  - \*\*\*must adopt assumptions on available downstream capacity / tailwater elevation (may be multiple scenarios to consider)



# SEMI-REGIONAL DRAINAGE

- Recognize that the performance of our local drainage systems will be dependent on the ability of our semi-regional drainage system (major storm sewers, drainage ditches/channels) to accept and convey floodwaters to Brays Bayou.
- Recognize that increases in discharge to Brays Bayou (translating to increased water surface elevations on the Bayou) from these semi-regional drainage systems must be mitigated. This will most likely be achieved through the addition of storm water detention in or near Bellaire or on the mid-stream section of Brays Bayou. This mitigation would need to be in place before the conveyance improvements are constructed/completed.
- Recognize that many of the components which make up our semi-regional drainage system are controlled in whole or in part by others (e.g. TxDOT, City of Houston, HCFCD). As such, improvements must be collaboratively developed/implemented.
- Recognize that the performance of our semi-regional drainage system will be highly dependent on water levels in Brays Bayou. We most likely will need to consider multiple performance criteria (e.g., performance with a lower/reasonable water surface elevation on Brays Bayou and performance with a higher/more extreme water surface elevation).
- Recognize that improvements to these systems will be very costly, and likely should be considered separately from more regular “infrastructure renewal” activities. These projects will require coordination with partner entities and corresponding mitigation, both of which take extensive time to develop.



# SEMI-REGIONAL DRAINAGE

- Important design considerations include:
  - Plan for accompanying local drainage improvements which will increase the efficiency of water getting to the semi-regional drainage system
  - Provide for an appropriately sized storm sewer or channel section (e.g. 10-yr, 25-yr, 50-yr, or 100-yr capacity)
  - Provide for cascading overland flow, in accordance with a city-wide overland flow master plan (dictating how we want floodwaters to cascade/flow through Bellaire) – ensuring we are not just “moving the flood” within Bellaire
  - Provide for necessary mitigation (detention), to prevent impacts to Brays Bayou water surface elevations
  - Must decide if acquiring additional ROW is feasible and/or acceptable
  - Should consider at least two different sets of design criteria to promote cost-effective design:
    - Typical Storm: Top-of-pipe tailwater elevation in Brays Bayou (for example)
    - Extreme Storm: Bank-full elevation in Brays Bayou (for example)
- Design Criteria:
  - Maintain flood elevation below gutter/curb elevation in the XX-yr event (aka the storm sewer capacity)
    - May have 25-yr for the Typical Storm and 10-yr for the Extreme Storm, for example
  - Maintain flood elevation below the ROW elevation in the XX-yr event (aka the cascading overland flow capacity)
    - May have 50-yr for the Typical Storm and 25-yr for the Extreme Storm, for example
  - Maintain flood elevation X-ft below the finished floor elevation in the XX-yr event (aka the extreme event capacity)
    - May have 100-yr for the Typical Storm and 50-yr for the Extreme Storm, for example
  - \*\*\*must decide how to consider/phase-in re-development activity in defining elevation targets

# ADVOCACY / PARTNERSHIPS FOR REGIONAL DRAINAGE



# REGIONAL DRAINAGE

- Recognize that Bellaire has little ability on its own to reduce water surface elevations on Brays Bayou
- Recognize that, through Project Brays, HCFCD has significantly improved the performance of Brays Bayou. However, residual risk exists and further improvements will still be necessary to achieve our desired risk profile.
- The City of Bellaire should support HCFCD (and others) in their regional flood risk management efforts related to Brays Bayou. This could include further channel improvements, additional detention, or other less traditional means such as deep stormwater tunnels. In addition, this includes partnerships to develop required impact mitigation.
- Recognize that extreme event sheet flow from areas outside Bellaire contributes to flooding within Bellaire.
- The City of Bellaire should work closely with the City of Houston (and TxDOT) to advocate for and assist in the formulation projects which can better collect runoff in areas outside of Bellaire and safely convey that runoff to Brays Bayou (preventing it from entering the City of Bellaire)
- Recognize that no matter where you live, or what infrastructure improvements we are able to make, there is always a risk your house could flood (e.g. an Act of God). Accordingly, flood insurance remains the most effective last line of defense, helping to limit the cost of flooding and to increase the speed of recovery after a flood event.
- The City of Bellaire should actively promote and encourage ALL homeowners, regardless of their location in Bellaire, to purchase and maintain flood insurance.



# IMPLEMENTATION / FUNDING



# IMPLEMENTATION / FUNDING PLAN

- **No / Low Cost:** development / floodplain regulation, flood insurance advocacy, and regional advocacy / coordination
- **Traditional Bond Funding:** “infrastructure renewal” related to local streets and drainage
  - Spreads the cost of the investment over the future users of the infrastructure (25-year bond)
  - Not typically eligible for grants or partnerships – generally the full and complete responsibility of a municipality
  - **The question:** when do we re-initiate these efforts and at what pace? Need a street/drainage capital improvement plan.
- **Special Projects:** semi-regional drainage improvement projects, and corresponding mitigation
  - Possibility for partnership projects, leveraging HCFCD, TxDOT, City of Houston support and funding
  - Possibility for grants or other special financing considerations (State / Federal)
  - Need for local funding, which most typically would be provided through traditional bond funding
  - **The question:** how can we implement these “game-changing” projects at the lowest cost to Bellaire taxpayers? Need a fully fleshed out “drainage master plan”, geared towards understanding how we can most advantageously package the program, or components of the program, into high performing projects/groupings which could secure outside partnership / funding. This also includes the functional sequencing of conveyance improvement projects and mitigation facilities over the planning horizon (e.g. 10 to 30 years) in order to achieve our flood risk management objectives.
  - **Our goal:** give the City of Bellaire every chance possible to secure game-changing outside funding/partnerships, which would allow us to more quickly achieve our objectives (e.g. 10 years), while laying the ground-work to achieve our objectives in an incremental but cost-effective manner over a longer planning horizon (e.g. 30years).



# EXAMPLES OF PARTNERSHIP / FUNDING

- **Partnerships:**

- HCFCD for Cypress Ditch
- TxDOT for IH-610
- City of Houston for neighborhood drainage / sheet flow
- HCFCD / City of Houston for regional mitigation facilities

- **Grants**

- FEMA Hazard Mitigation Grant Program (HMGP)
- FEMA Building Resilient Infrastructure and Communities (BRIC) grant program
- GLO/HUD Community Development Block Grant Disaster Recovery (CDBG-DR) – Infrastructure
- \*\*\*TWDB Flood Infrastructure Fund (FIF) / Regional Flood Plan / State Flood Plan

**NEXT STEPS**



# THE TASK FOR CITY COUNCIL / CITY STAFF

- Establish consensus objectives for flood risk management
- Determine our acceptable 'risk profile', considering cost (this may be iterative)
- Determine appropriate 'design criteria' for drainage projects
- Develop solutions to achieve acceptable 'risk profile' over a reasonable time frame
  - This is a long-term program of improvements (likely 10 to 30 years)
- Optimize phasing and delivery of solutions
  - Deliver benefits in a timely manner (an in the areas of greatest need first)
  - Delivery projects in the most cost-effective manner
  - Secure outside funding support (regional/state/federal)
- Have to think 'long-term' – our infrastructure is a 50-year investment
- Must act quickly on currently available partnership projects (with cost-share potential)



# ALIGNING THE CITY FOR ACTION

- City Council to develop flood risk management objectives (April / May)
- City staff to finalize and close out Master Drainage Concept Plan (April / May)
- City staff to select new engineering consultant / flood technical advisor (April / May)
- Next, Staff / Flood Technical Advisor should:
  - Solicit community input on goals and objectives / path forward
  - Develop and refine drainage design criteria
  - Advance “low hanging fruit” projects
  - Secure partnerships / funding to deliver the “low hanging fruit” projects
  - Create long-term capital improvement plan to achieve broader drainage objectives
  - Pursue outside funding / partnerships to cover as much of the costs as is possible
  - Advance engineering / development of the initial phases of the capital improvement plan
  - Align funding for the timely delivery of the initial and subsequent phases of the plan



# FURTHER DISCUSSION

