

**D1 - Urban Channel Improvements
& Flood Storage Detention Techniques**

Rodrigo Vizcaino, PE, CFM Liane Holl, PE, CFM David Phan, PE, CFM

TFMA Annual Meeting - March 2025

INTRODUCTION



- Needs and Understanding
- Neighborhood Flooding
- Channel Improvements
- Detention
- Easement / Right-of-Way Acquisition



BACKGROUND

Neighborhood Flooding

- June 2019
- Belaire Avenue & Westside Drive
- Cedar Springs Branch Watershed

BACKGROUND

Neighborhood Flooding

- Google Streetview, December 2023
- Belaire Avenue & Westside Drive
- Cedar Springs Branch Watershed



BACKGROUND

Roadway Flooding

- August 2022
- IH - 30 (WB) & Cesar Chavez Boulevard Underpass



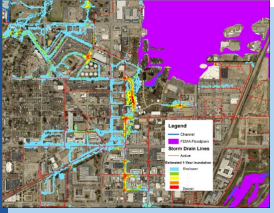
FLOOD CONTROL NEED



- 1 Climate change & increase in rainfall intensity
- 2 Increased impervious area from development
- 3 Lack of inlets or storm drainage systems
- 4 Undersized and/or aging storm drainage pipes
- 5 Land locked, undersized neighborhood channels



NEIGHBORHOOD FLOODING




Background

- Lack of storm drainage
- Aging storm drainage
- Flooding hot spots with no catch basins
- Flood control study (1D & 2D analysis)

Solutions

- Upstream detention
- Storm drainage improvements (bypass line / upsizing)
- Pipe Rehabilitation (open cut or trenchless)
 - CIPP
 - Slip lining
 - SAPL
 - Pipe Bursting
 - Spot repairs



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CHANNEL IMPROVEMENTS



- Heavily urbanized watersheds
- Undersized channel overflows
- Aging channel / structural failures
- Flood prone homes & roadways
- Aging storm drain lines
- Lack of flood study

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CHANNEL IMPROVEMENTS

Pensive Channel Flooding

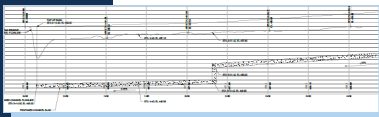


- Background**
- 292-acre watershed fully-developed
 - 15+ flood prone homes from Pensive channel overflow
 - Aging 8' diameter elliptical brick lined storm line
- Alternative Analysis**
- Channel improvements
 - Upstream detention
 - Bypass of flows
 - Downstream improvements
 - Pipe rehabilitation

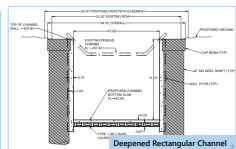
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CHANNEL IMPROVEMENTS

Pensive Channel Flooding



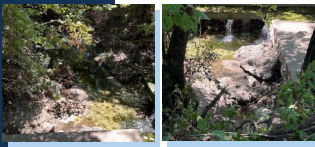
- Solution**
- Channel improvements
 - Ex. 5' deep trapezoidal channel excavated to 14' deep rectangular (drill shaft walls)
 - Walnut Hill storm drainage trenchless spot repairs
 - SAPL geo-polymer lining



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CHANNEL IMPROVEMENTS

Vinemont Channel to Dixon Branch



Key Issues

- Excess runoff conveyed by undersized channel
 - Channel land-locked
 - Overgrowth vegetation = high tailwater
 - Scour and concrete lining failures at outfall

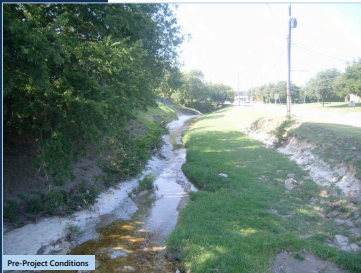
Innovative Solutions

- Opportunities for outfall channel clearing / widening
 - lower tailwater (hydraulic grade line)
- Evaluation for runoff reduction (bio-swales, upstream detention, permeable pavement at big lots)
- Convert to deeper rectangular channel (as in Pensive)

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CHANNEL IMPROVEMENTS

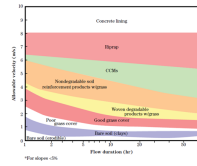
Cottonwood Creek Streambank Stabilization Improvements



Problem

- Bank erosion encroaching onto residential property
- Flooding of adjacent street
- Creek confined

Figure 8-25 Effect of flow direction on allowable velocities for various channel shapes



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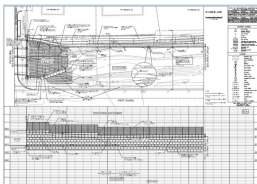
CHANNEL IMPROVEMENTS

Cottonwood Creek Streambank Stabilization Improvements



Solution

- Modular block retaining wall
- Articulated Concrete Blocks (ACBs)
- Earthen sloped-back right bank



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CHANNEL IMPROVEMENTS



- USACE Section 404 Permit – riparian zones
- Severe erosion could result in degradation / loss of adjacent riparian vegetation
- Water Quality
- Increase in turbidity
- Sustainable Practices
- Native and bio-degradable materials
- Aquatic Habitats & Protected Species
- State / Federally listed species

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DETENTION IMPROVEMENTS



- Background
- Possible solution to undersized constricted trapezoidal channels
 - Hydrograph attenuation to decrease flow conveyance to channels and storm drain systems
 - Regional detention - control riverine flooding
 - In-line vs. off-line (lateral storage ponds)

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REGIONAL DETENTION VS LOCALIZED



Bente Branch Regional Detention Facility – Cedar Hill, TX

Constraints

- Available land at key location for detention
- Too far upstream; may not help downstream flooding

Alternative

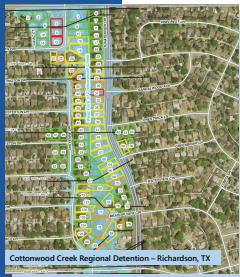
- Enclose
- Multi-functional ponds used as recreation
- Have retention component

Conclusions

- Local Site Detention → Flow reductions at point of discharge only
- Regional Detention → Flow reductions far downstream

DETENTION REGIONAL

Cottonwood Creek Regional Detention, Richardson



Cottonwood Creek Regional Detention – Richardson, TX

Issue

- Frequent neighborhood flooding downstream of UTD
- Severe channel erosion

Constraints

- UTD expanding site development
- Securing land for detention
- Creek limits

DETENTION REGIONAL

Cottonwood Creek Regional Detention, Richardson



Cottonwood Creek Regional Detention – Richardson, TX

Modeling

- Schematic → Traditional steady state
- Design → Dynamic modeling
- 50% storm event diversion

Alternative Solutions

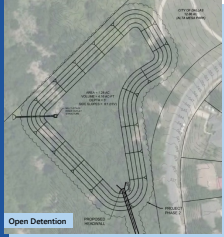
- Offline 30 acre-ft detention
- Online 50 acre-ft detention



DETENTION

LOCAL

Detention Pond at Nandina Neighborhood, Dallas



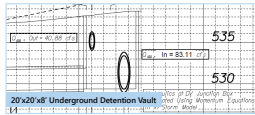
Problem

- Flow diversion required to maintain 1% storm event LOS at neighborhood
- Diversion generated impacts to receiving watershed

Analysis

Additional detention evaluation:

1. Open channel detention at Alta Mesa Park (City owned)
2. Underground detention vault (limited storage volume)
 - Dynamic modeling 1D/2D flow simulation



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DETENTION

Inline Detention

- New concrete retaining wall at channel cross-section → damming effect
- Benefits
 - No ROW needed
 - Minimal regrading vs new pond
 - Minimal environmental impact
 - Natural incised channel and upstream floodplain storage available
- Overflow weir design with low flow orifice
- Need flood storage volume upstream



EASEMENT / ROW ACQUISITION

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EASEMENT / ROW ACQUISITION



Timely & Complex

- Many channel areas are privately owned
- Identify ownership and acquisition need early
- Begin conversations/negotiations early
 - Understanding of flood impact
- If done too late, project could be stalled or cancelled



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CONCLUSION

1. Flood Control Need
2. Neighborhood Flooding
3. Channel Rehabilitation & Capacity Upgrades
4. Flood Storage Detention
 - Local vs Regional Detention
 - Inline vs Lateral
5. Easements / Right-of-Way



LJA  **dallas water utilities**
city of dallas

Thank You!

Rodrigo Vizcaino PE, CFM Project Director LIA, North Texas Public Infrastructure RVizcaino@lja.com	Liane Holl PE, CFM Project Engineer LIA, North Texas Public Infrastructure LHoll@lja.com	David Phan PE, CFM Engineering Program Administrator City of Dallas, Floodplain Management David.Phan@dallas.gov
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