



Low Impact Development

Lessons over the Years

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Don't mess with Texas.

STATE DEPARTMENT OF HIGHWAYS





Don't mess with Texas®

Low Impact Development



- Exceeds Local Water Quality Requirements
- Eases Burden on Support Entities
- Prevents Downstream Erosion
- Mitigates Flash Flooding
- Aesthetically Appealing
- Mimics Nature
- Absorbs Greenhouse Gases
- Solves Tough Engineering Challenges



But Do
Developers
Care?



WHY: VISION





Single Family Residential



CAMELLIA RESIDENTIAL DEVELOPMENT



Side By Side Comparison

Conventional Costs

- Based on ~~80 Acres and 224 lots~~ ^{Conventional}
- Cost per Developable Acre - ~~\$97,132~~ ^{LID}
- Cost per Lot - ~~\$34,690~~ ^{323 lots}

99 MORE

LID Construction Costs

- Based on ~~80 Acres and 224 lots~~ ^{LOTS!}
- Cost per Developable Acre - \$85,417
- Cost per Lot - \$21,156

44% increase

But...does this
correlate to 44%
higher costs?

Side By Side Comparison

ITEM	CONVENTIONAL	LID
Clearing, Grubbing and Site Preparation	\$400,000	\$400,000
Water Distribution System	\$672,071	\$509,196
Wastewater Collection System	\$697,032	\$839,784
Storm Water Collection System	\$449,106	\$1,598,016
Detention Basin	\$296,235	\$0
Amenity Basin	\$2,875,275	\$0
Irrigation System	\$0	\$248,093
Landscaping for LID Features	\$0	\$31,437
Paving and Grading	\$2,295,889	\$3,044,378
SWPPP	\$84,959	\$162,468
	\$7,770,567	\$6,833,372



Commercial & Retail

Easton Commons

WHY Low Impact Development in Commercial?

- Economics

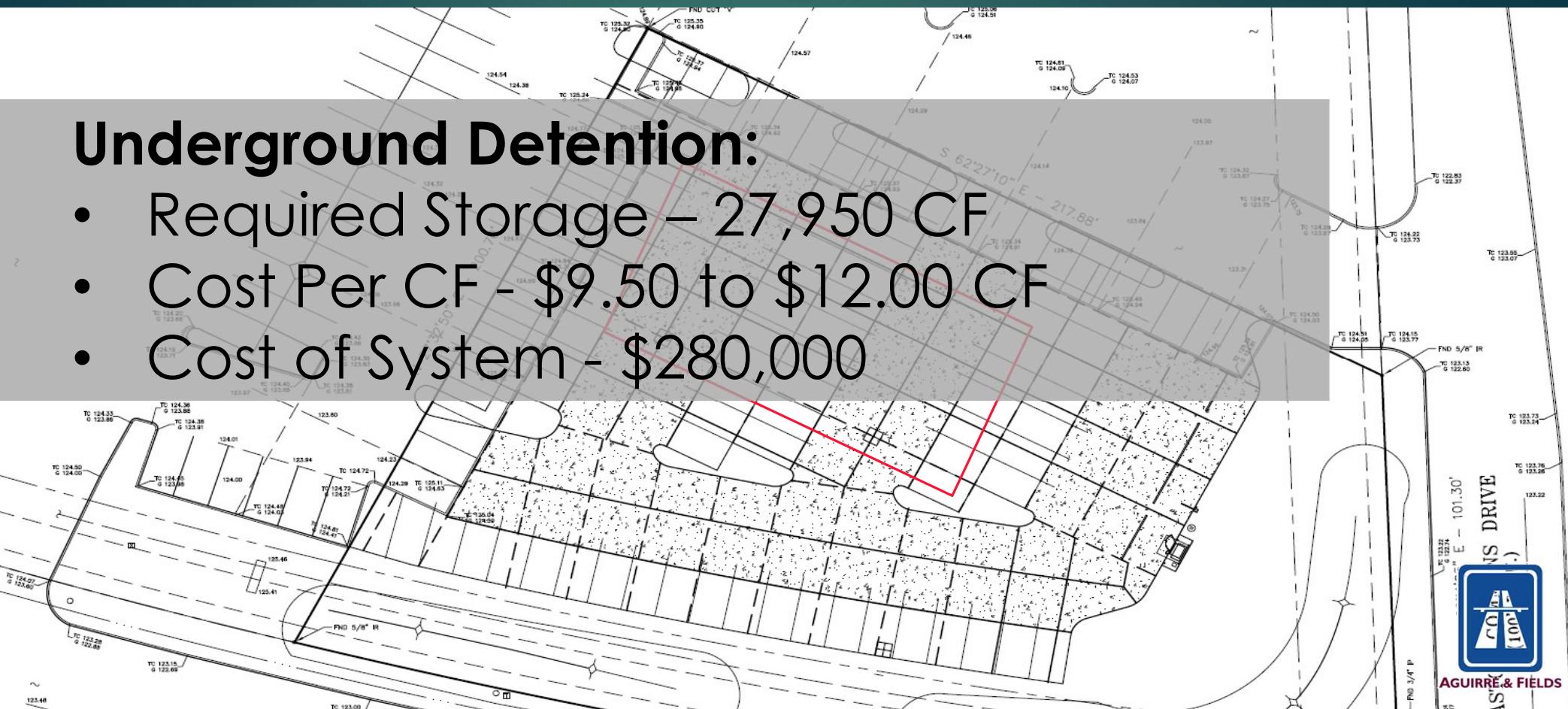


AGUIRRE & FIELDS

Easton Commons – Economics

Underground Detention:

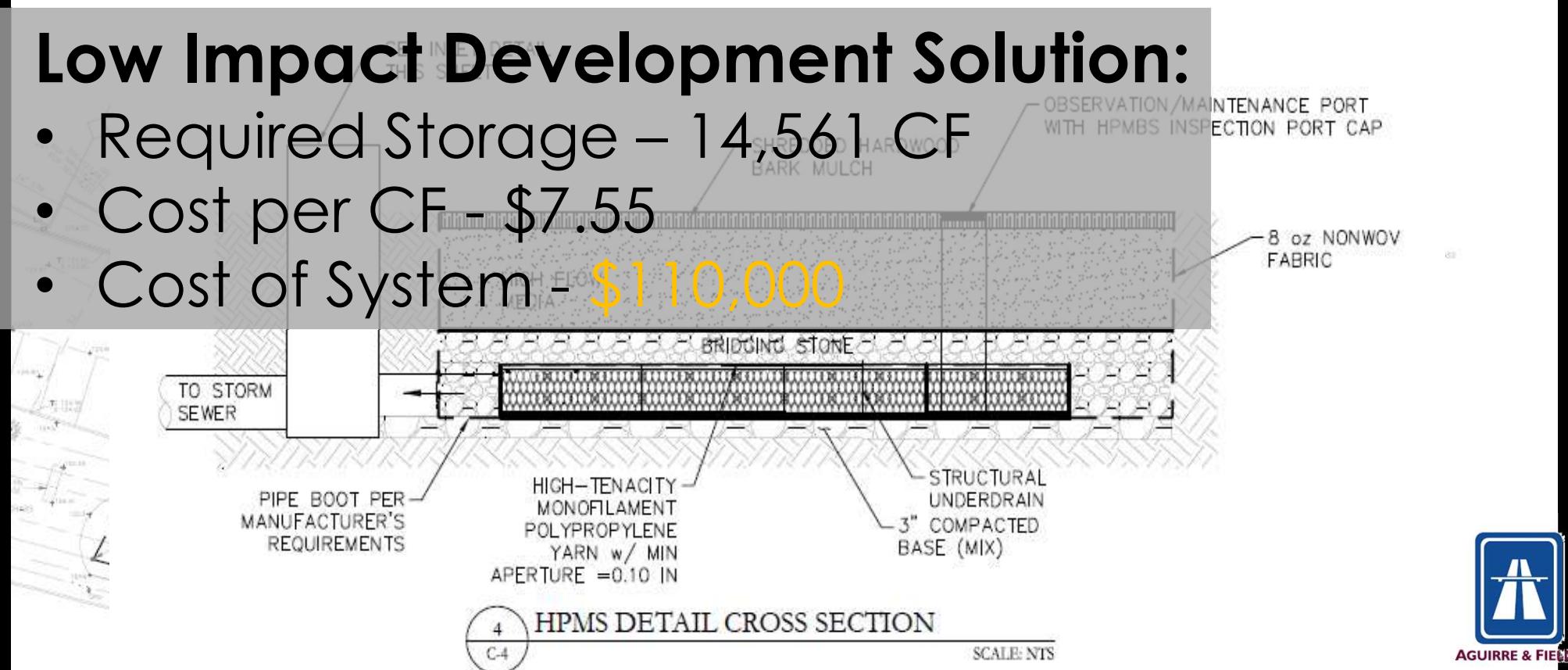
- Required Storage – 27,950 CF
- Cost Per CF - \$9.50 to \$12.00 CF
- Cost of System - \$280,000



Easton Commons – Economics

Low Impact Development Solution:

- Required Storage – 14,561 CF
- Cost per CF - \$7.55
- Cost of System - \$110,000



Easton Commons – Economics





A One and
Done
Commercial
Example?



LID Map

490 views

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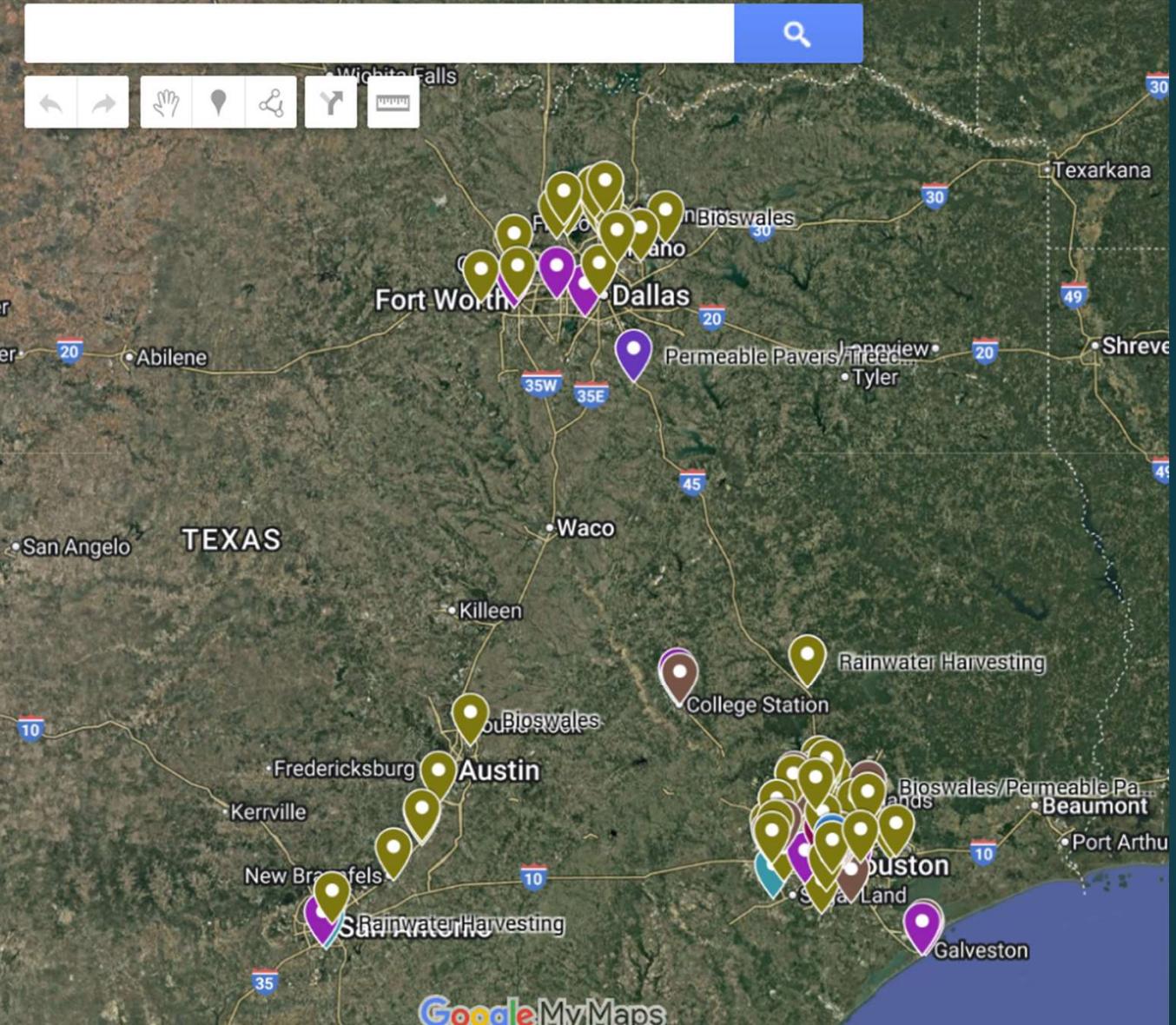
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Greenrise LID Projects

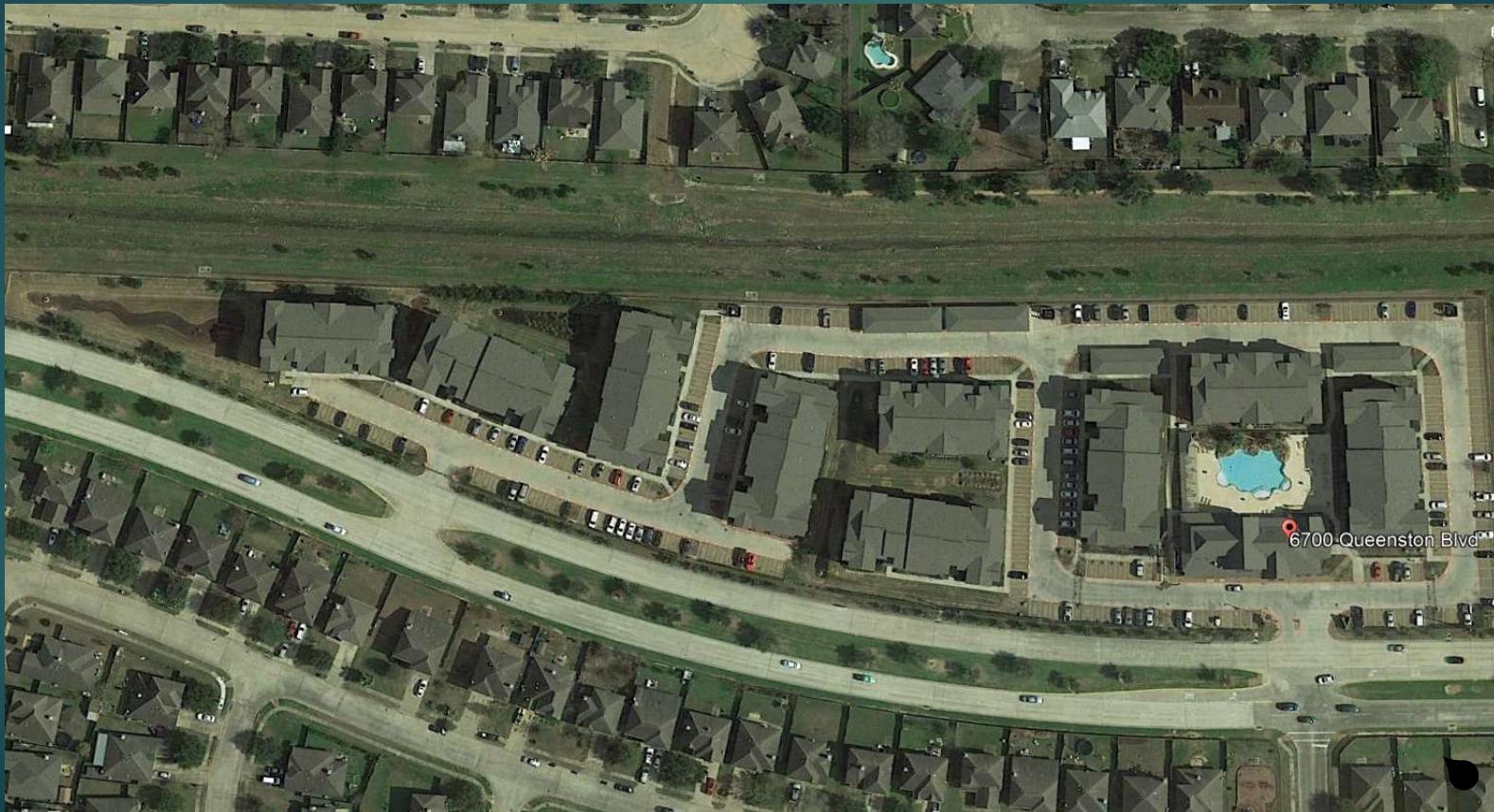
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-  Bioswales (83)
-  Permeable Pavers (44)
-  Bioswales/Permeable Pavers (14)
-  Rainwater Harvesting (10)
-  Treecells (3)
-  Bioswales/Rainwater Harvesting (2)
-  Bioswales/Treecells (1)
-  Permeable Pavers/Treecells (1)



Queenston Manor Apartments – Academy Development Corp.



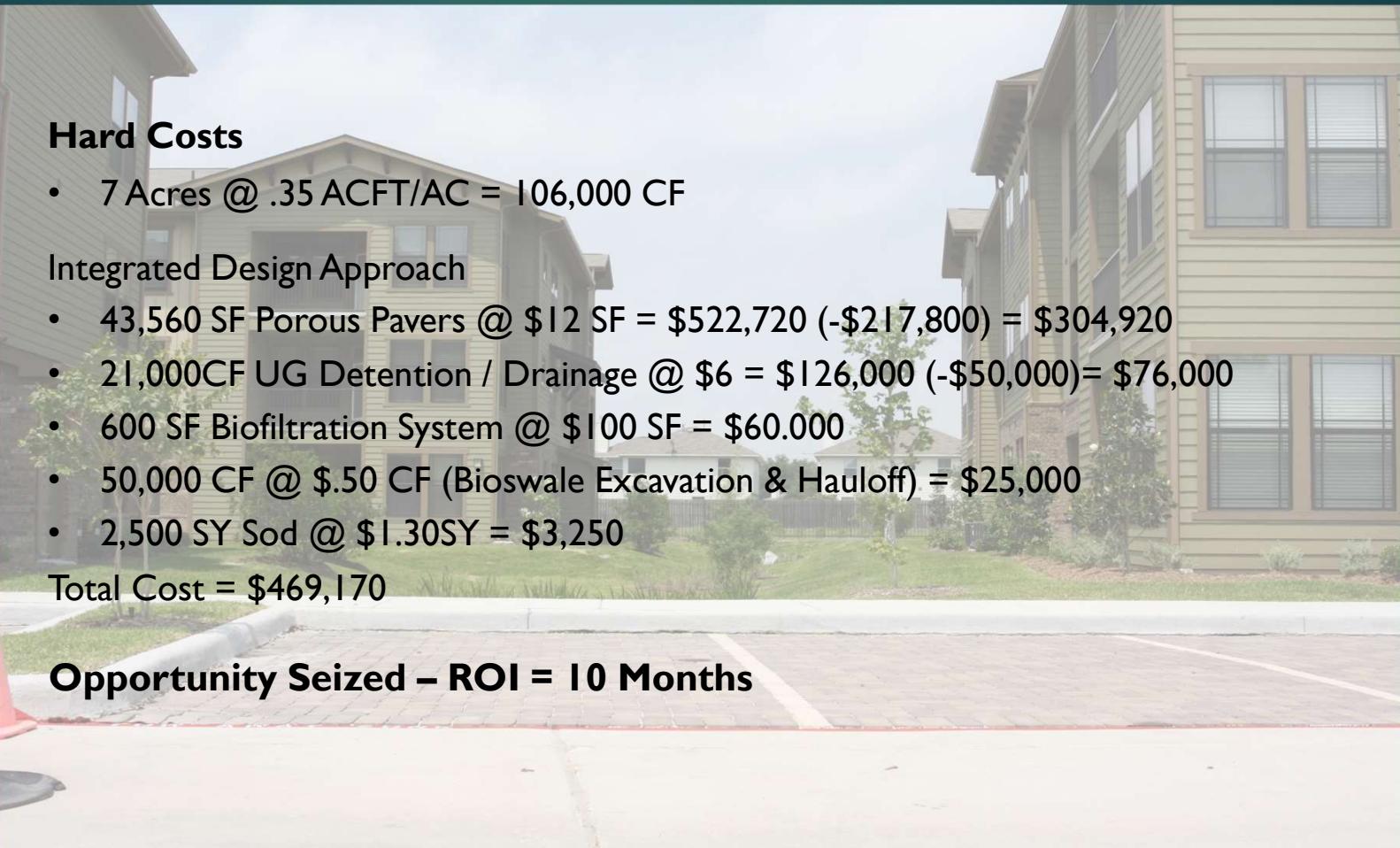
Queenston Manor Apartments - Economics



Queenston Manor Apartments - Economics



Queenston Manor Apartments - Economics



Hard Costs

- 7 Acres @ .35 ACFT/AC = 106,000 CF

Integrated Design Approach

- 43,560 SF Porous Pavers @ \$12 SF = \$522,720 (-\$217,800) = \$304,920
- 21,000CF UG Detention / Drainage @ \$6 = \$126,000 (-\$50,000) = \$76,000
- 600 SF Biofiltration System @ \$100 SF = \$60,000
- 50,000 CF @ \$.50 CF (Bioswale Excavation & Hauloff) = \$25,000
- 2,500 SY Sod @ \$1.30SY = \$3,250

Total Cost = \$469,170

Opportunity Seized – ROI = 10 Months

Queenston Manor Apartments - Economics





Capital Improvement Projects

Birnamwood Drive

Harris County



WHY Low Impact Development?

- Reduced Construction Costs
- Reduced Maintenance Costs
- Safety
- Practice What We Preach
- Proof of Concept

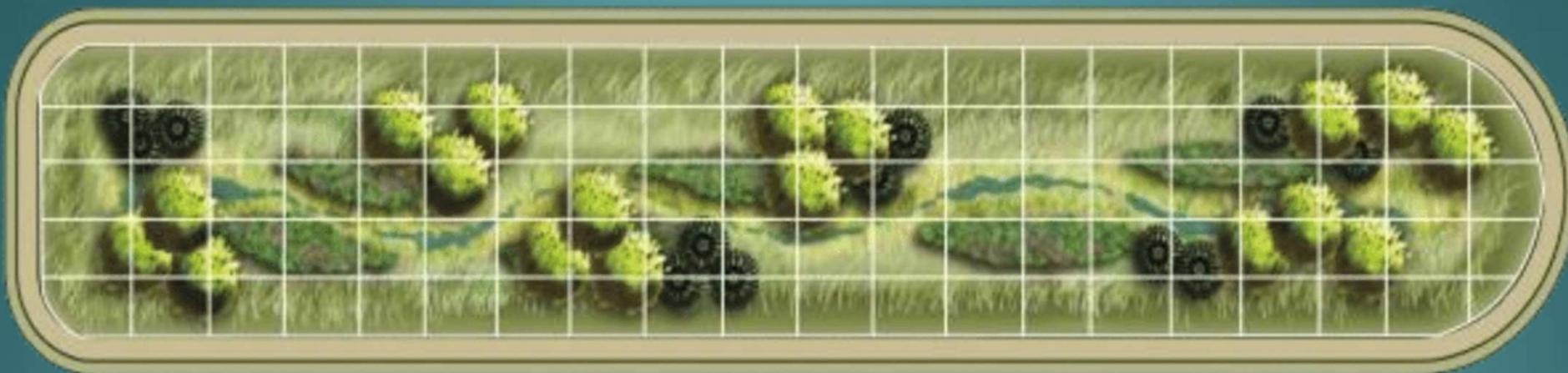


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klotz associates

1-Mile Long 4 lane Concrete Boulevard with Median

	Traditional (estimated)	LID (actual)
Site Prep & Earthwork	\$391,634.00	\$449,060.00
Drainage	\$400,000.00	\$288,432.00
SWPPP	\$69,600.00	\$87,000.00
Landscape Planting	\$30,000.00	\$66,140.00
Landscape warranty/Maint	\$0.00	\$34,630.00
Bridge	\$208,517.00	\$208,517.00
Subgrade & Paving	\$1,139,791.00	\$1,139,791.00
Traffic	\$9,000.00	\$9,000.00
Signing & Striping	\$25,461.00	\$25,461.00
Traffic Signal	\$128,010.00	\$128,010.00
Utilities	\$16,140.00	\$16,140.00
Extra Work Items	\$15,650.00	\$36,650.00
Biofiltration System	\$0.00	\$132,931.00
SWQ System	\$30,000.00	\$0.00
Detention Basin	\$350,000.00	\$0.00
Total	\$2,813,803.00	\$2,621,762.00
estimated cost benefit:	\$192,041.00	7% Cost Reduction Per Mile

Traditional Bioretention



Soil Type	Low Flow Rate Soils	Medium Flow Rate Soils	High Flow Rate Soils
Infiltration Rate	5 in/hr	30 in/hr	100 in/hr
Flow Rate in CFS/SF	.000115 CFS/SF	.00069 CFS/SF	.0023 CFS/SF
Area of Bioretention Required for 3 CFS	26,086 SF of Bioretention	4,347 SF of Bioretention	1,304 SF of Bioretention
Cost Per SF	\$15 SF	\$45 SF	\$150 SF
Cost of Solution	\$391,290.00	\$195,615.00	\$195,600.00
Cost of Maintenance Assuming \$1 SF / 2X YR	\$52,172.00	\$8,694.00	\$2,608
10-Yr Life Cycle	\$913,010.00	\$282,555.00	\$221,680.00

Bagby Street

City of Houston

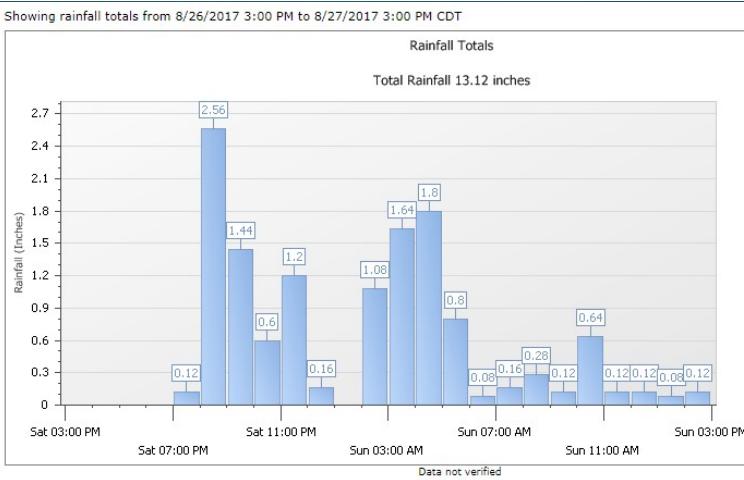
WHY Low Impact Development?

- Green Roads Certification
- Increased Storm Sewer Capacity
- Decreased Size of Storm Sewer Conveyance Pipe
- Proof of Concept

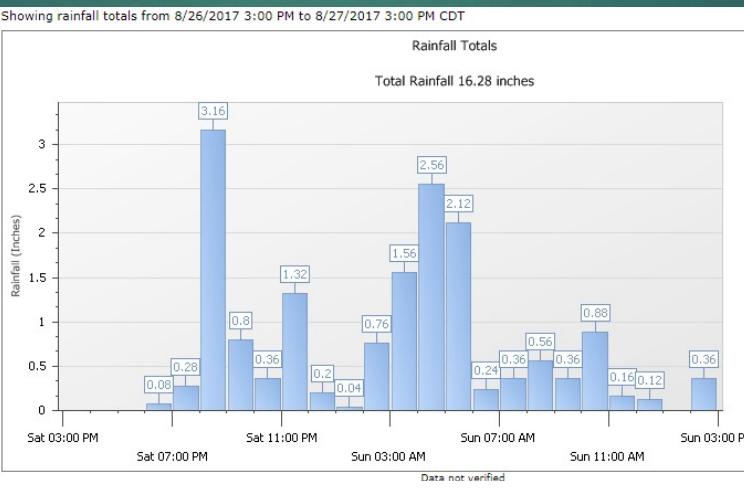
WALTER P MOORE



WALTER P MOORE



> 100 yr over previous 24 hours



Bagby Street

City of Houston



“During Memorial Day, Tax Day and Hurricane Harvey Floods, Bagby Street **Out Performed** Every Street in the Midtown District”

- Marlon Marshal
Director, Engineering & Construction
Midtown Redevelopment Authority

WALTER P MOORE



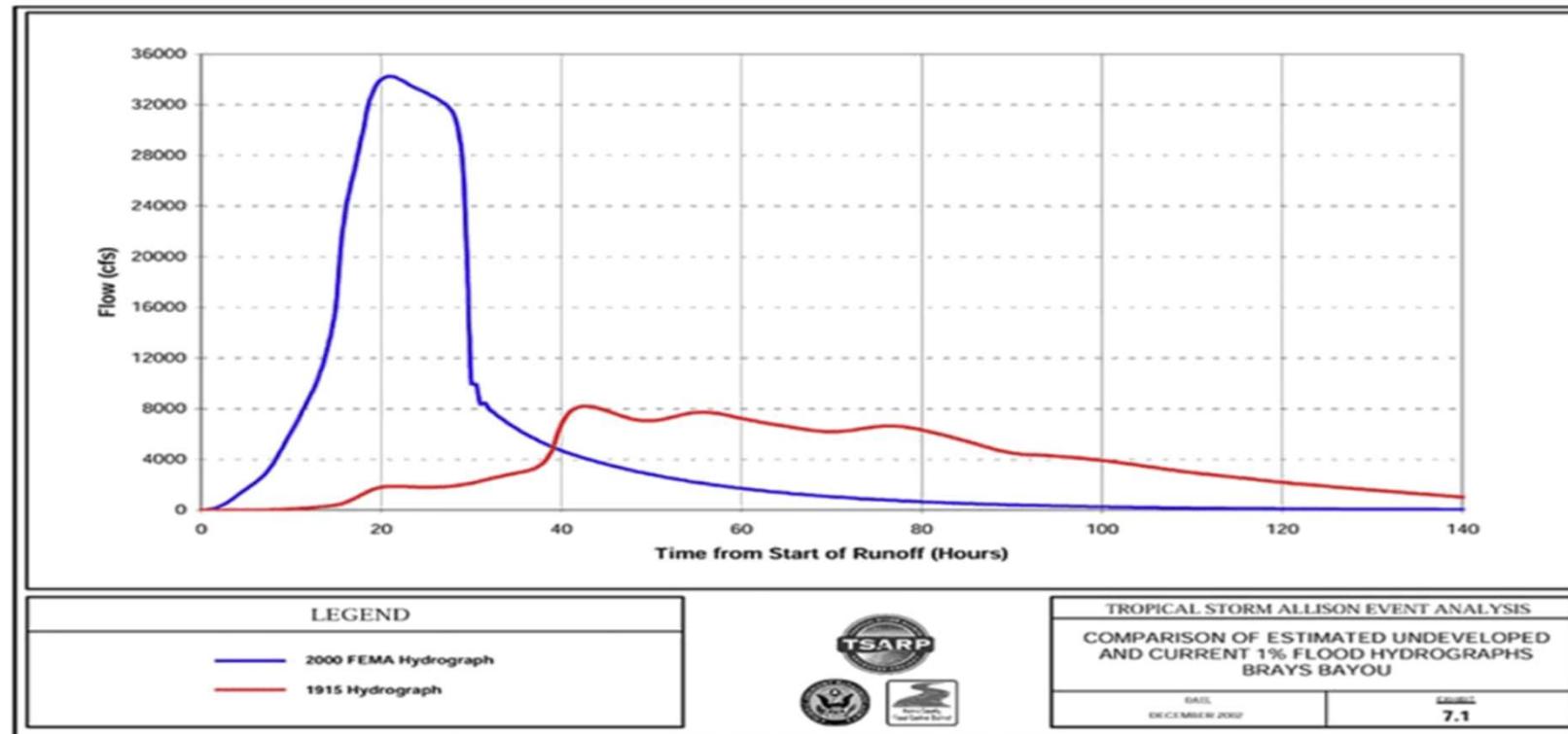
SAN MARCOS RIVER

An aerial photograph of a modern urban area. In the foreground, there are several multi-lane roads with white dashed lines and some greenery. In the middle ground, there are various buildings, including a prominent one with a red roof and a large hillside in the background. The sky is blue with scattered white clouds.

WHY FOCAL POINT FOR WATER QUALITY

HOW: BELIEFS





White Oak and Brays Hydrographs: 1915 & 2000

Blue line shows 2000 concentrated urban runoff; red line shows 1915 pre-urbanized runoff

Resilient Design





Resilient Design - Tax Day > 16"



Resilient Design- Harvey > 29"



Thank you!

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