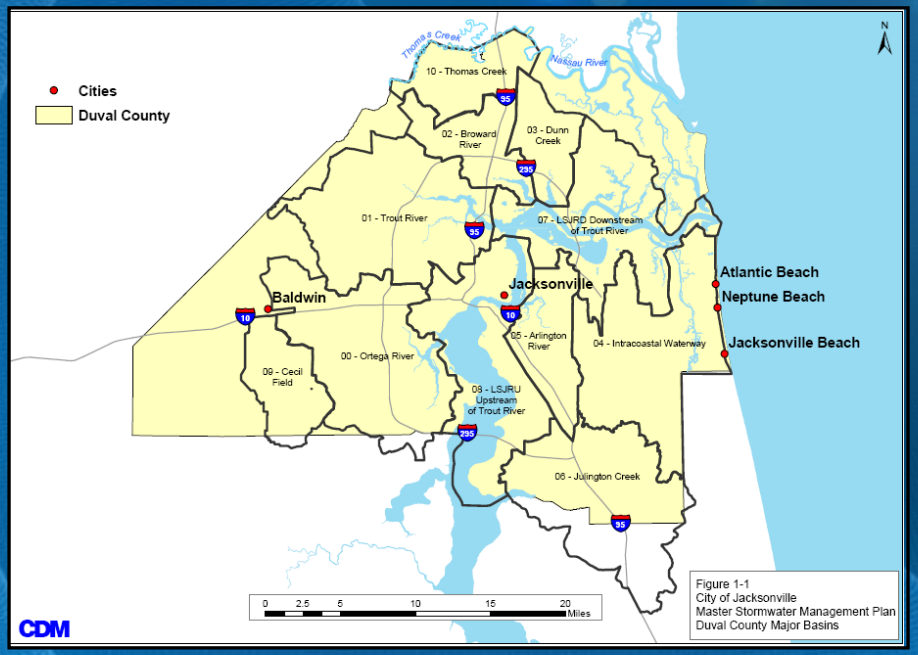
LOW IMPACT DEVELOPMENT COUPLED WITH FLOOD MITIGATION



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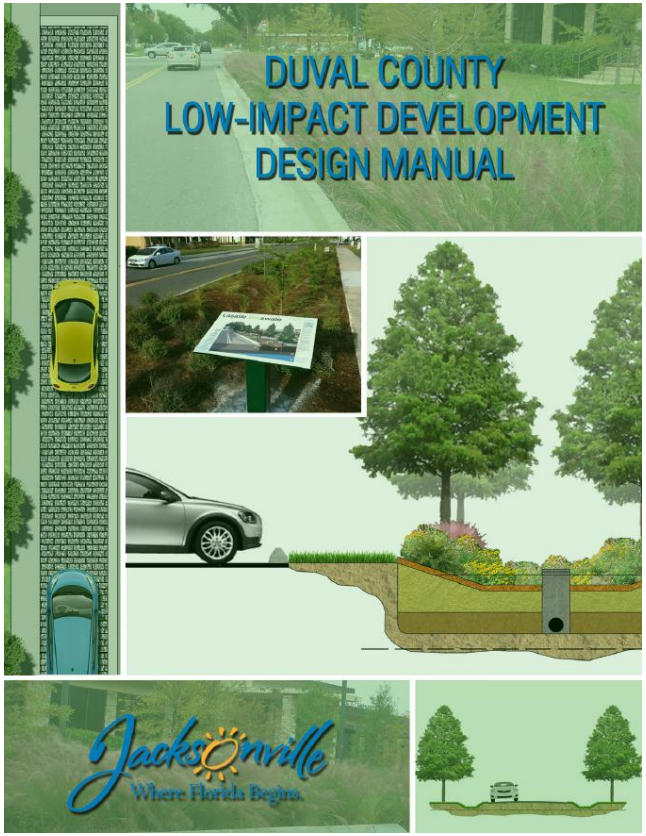
Seth Nehrke, P.E., D.WRE

2013 Jacksonville Environmental Symposium

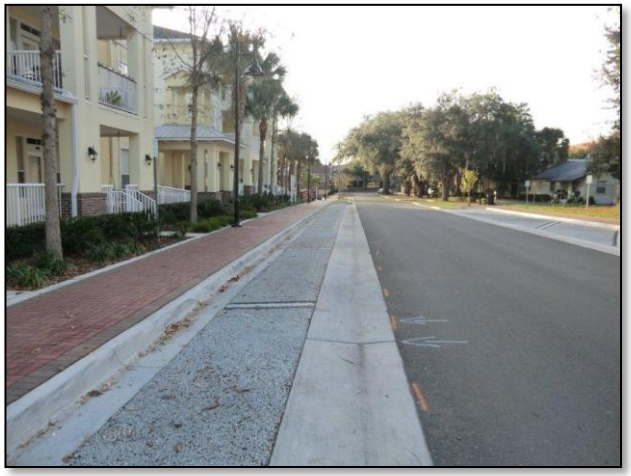
Examples of Low Impact Development (LID) Considerations in Jacksonville

- Master Stormwater Management Plan (MSMP) 1992
  - Floodplain and floodway protection
  - Volume-time detention
  - Stormwater project components
- City of Jacksonville LID Manual
- Wurn and Fletcher Morgan Parks study
- Valens Drive study



City of Jacksonville Preliminary LID Manual Focuses on Right-of-Way LID Applications

- Conveyance and landscape swales
- Bioretention
- Pervious pavement



Benefits of LID Practices

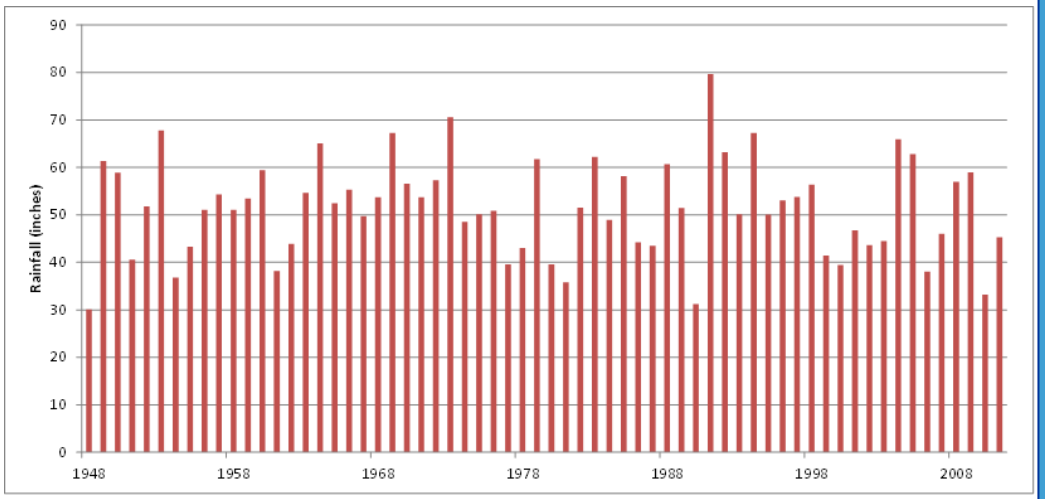
- Water quality
  - Pollutant loads are reduced in proportion to runoff volume reduction
  - Reduced size requirement for ponds with LID in tributary area
  - Improved water quality and lower temperature discharges
- Water quantity
  - Increased groundwater infiltration, recharge, and baseflow
  - May result in reduced pipe sizes and storage volume requirement for pond with LID in tributary area
  - Reduced discharge volumes
  - Reductions in potable water supply use by landscape irrigation

Evaluation of Runoff Control Practices

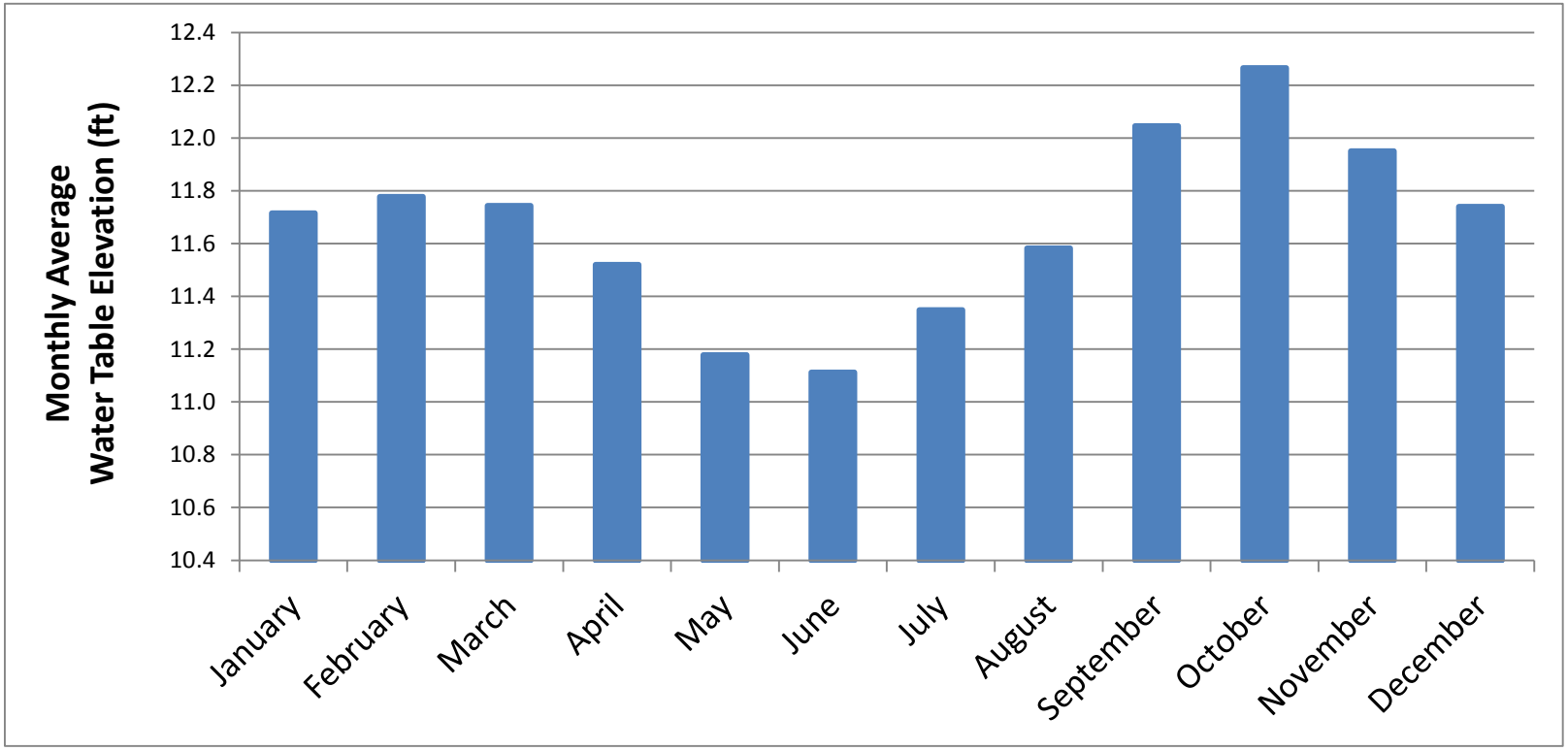
- Goal: reasonable water budget and seasonal water table representation
- Long-term H&H and water quality simulations using SWMM5
  - Pre-development (runoff, groundwater) for undeveloped (pervious) land
  - Post-development: impervious land (e.g., roadway, parking lot) routed to LID feature
  - Determine average annual % runoff capture

SWMM5 – Undeveloped Area

- Long-term simulations using SWMM5
  - Surface runoff hydrologic parameters based on MSMP modeling
  - Added groundwater parameter values for calculation of baseflow
  - Target: Rainfall converted to roughly 30% streamflow, 70% ET



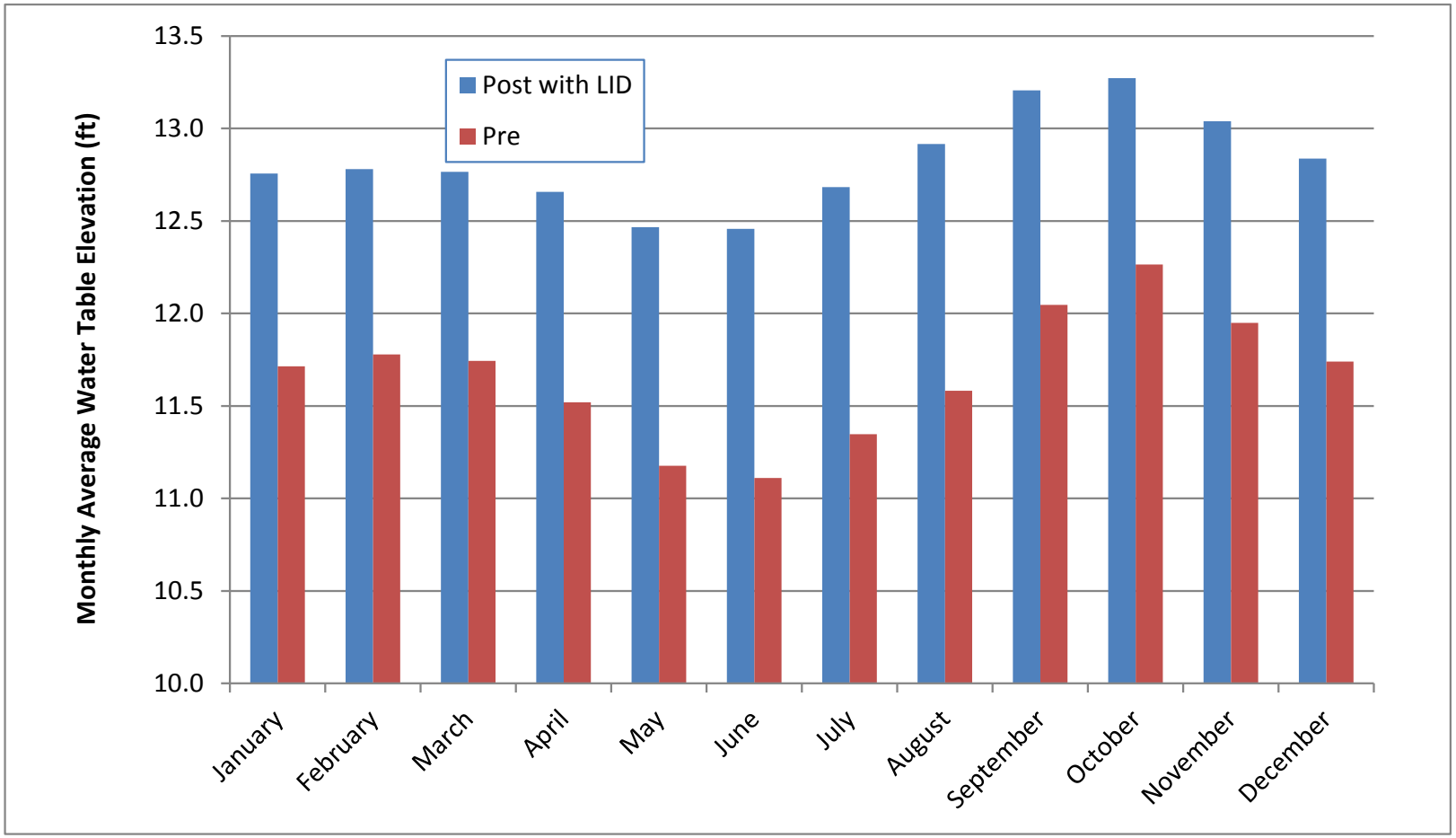
SWMM5 – Undeveloped Area: Simulated Seasonal Water Table



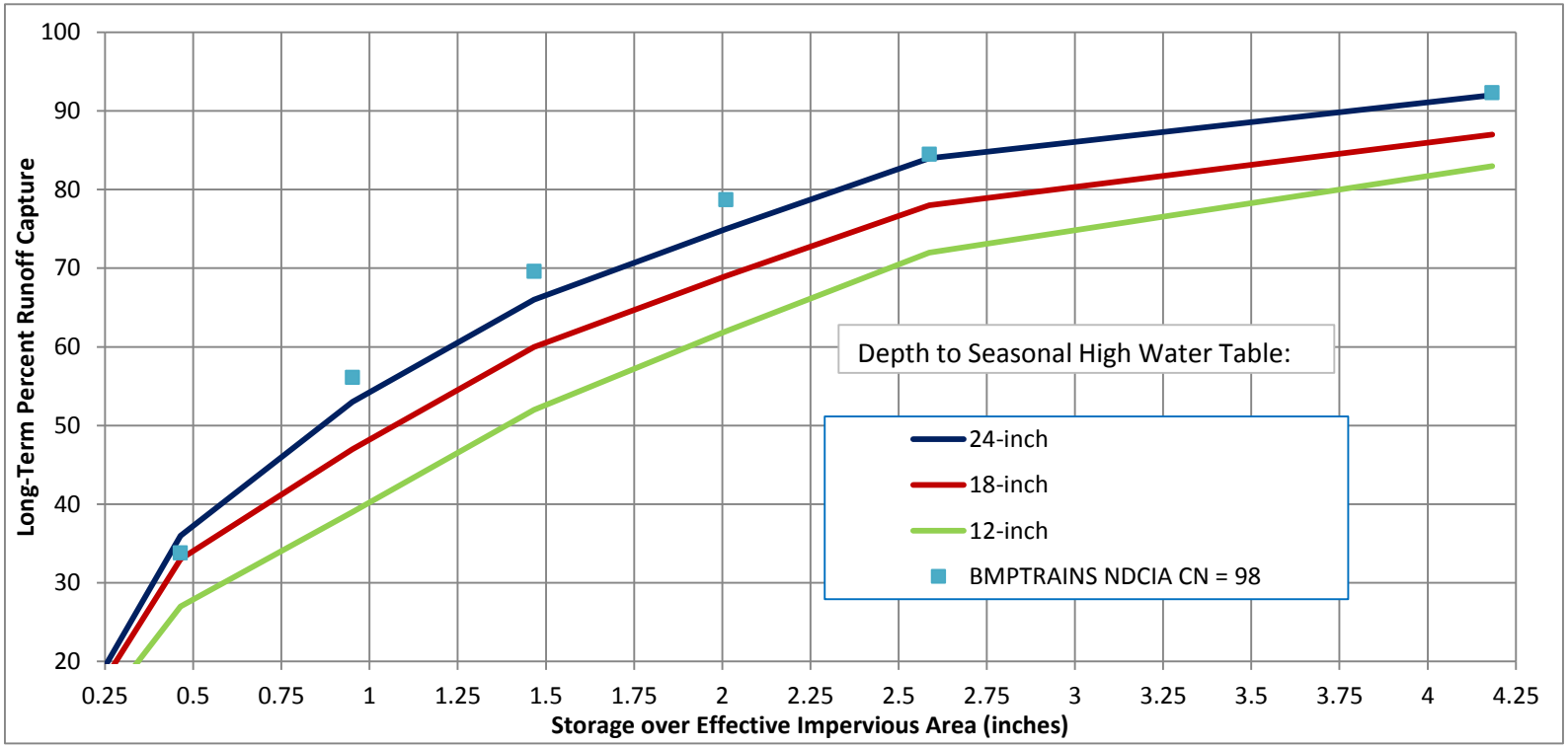
SWMM5 – Developed Area

- Long-term simulation with impervious area runoff routed to LID feature
  - Various ratios of impervious tributary area to LID surface area
  - Typical design characteristics for LID feature (e.g., bioretention ponding depth and planting media depth)
- Goal: determine runoff capture efficiency based on LID storage/treatment volume

SWMM5 – Model Shows Higher Local Water Table After Development with LID

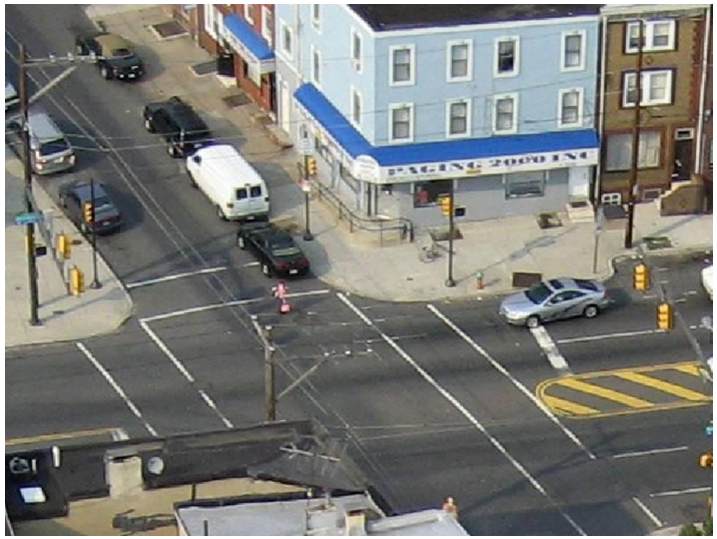


Results Based on Storage Volume and Depth to Seasonal High Water Table



Other Potential LID Practices

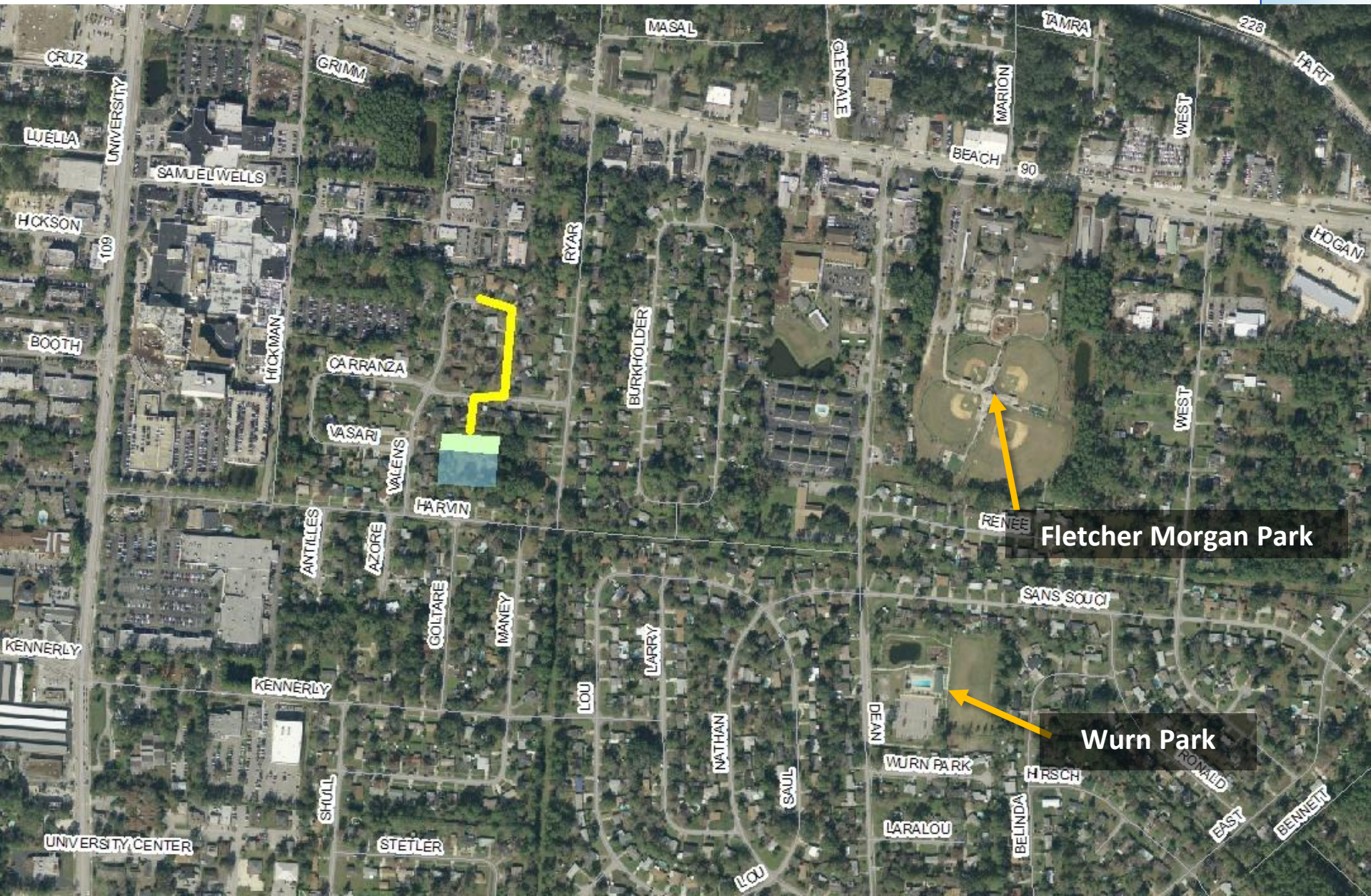
- Reduced roadway widths
- Filter strips
- Curb extensions
- Landscaping planter boxes



Example Studies in Jacksonville

- Wurn and Fletcher Morgan Parks
  - Opportunity for stormwater irrigation from existing ponds
  - In tributary area to impaired waters (Pottsburg Creek, Lower St. Johns River)
- Valens Drive
  - Known area of nuisance flooding
  - In tributary area to impaired waters (Pottsburg Creek, Lower St. Johns River)
- Evaluation Aspects
  - Benefits (e.g., increased infiltration and recharge, volume and load reduction, peak stages reduced, potable water use reduction)
  - Costs

Recreational LID Demonstration Projects



LID Retrofit Opportunities: Public Facilities

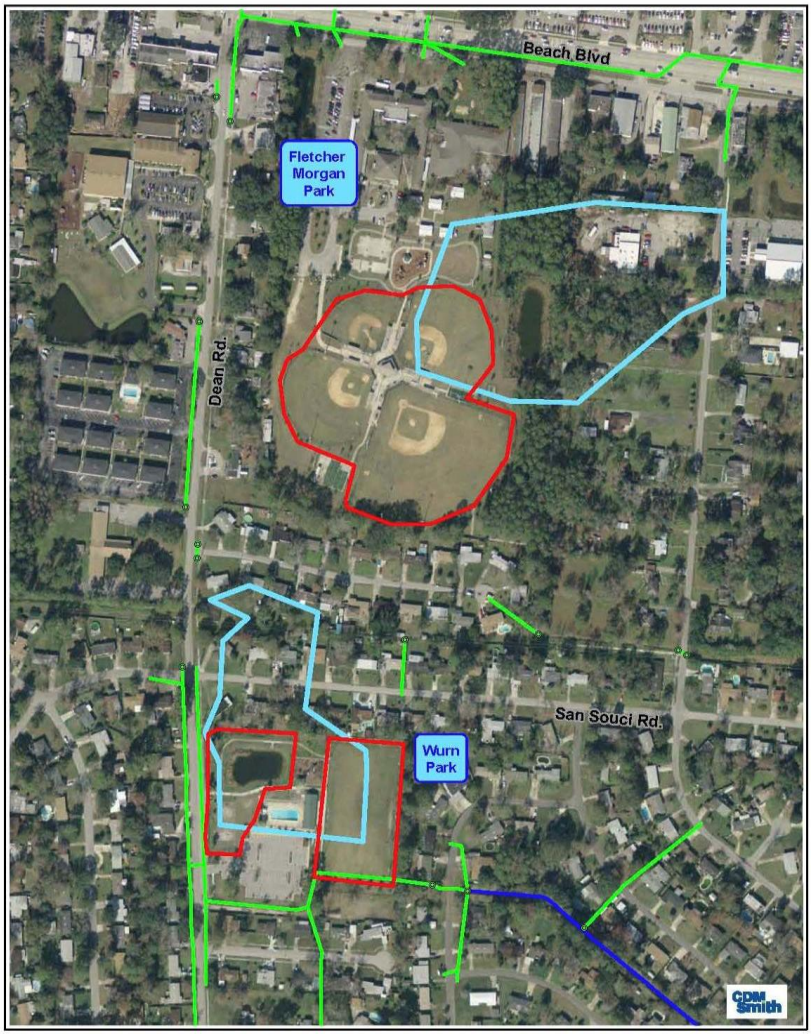
LID Retrofit Opportunities: Public Facilities

Stormwater Irrigation Evaluation

- Define irrigation and tributary areas
- Determine irrigation demand
- Quantify savings

Stormwater Irrigation Evaluation

Define Irrigation & Tributary Areas



Irrigation Areas
Tributary Area for Harvesting
Piped Conveyance
End Walls

N

0 125 250 500 Feet

Figure 1-1
City of Jacksonville
Wurn and Fletcher Morgan Park
Stormwater Harvesting Pilot Study
Location Map

Analyze Supply and Demand

Location: Fletcher Morgan
Season: Summer
Watering Days: 4 days/wk (typical)

Zone No.	GPM	Zone Flow (gal/day)*	Zone Flow (gal/wk)*
1	78.1	4,700	18,800
2	75.7	4,600	18,200
3	76.9	4,700	18,500
4	61	3,700	14,700
5	72.6	4,400	17,500
6	72.4		
7	61		
8	61		
9	73.2		
10	76.3		
11	67.1		
12	54.9		
13	54.9		
14	0		
15	0		
16	30.4		
17	63		
18	63		
19	60		
Total	**1,102**		

Location: Wurn Park
Season: Summer
Watering Days: 5 da
Std. Head Flow 14.2 ga

Zone No.	Heads/ Zone
1	6
2	9
3	7
4	7
5	7
6	7
Total	**43**

* Typical daily irrigation values provided by the City. Minutes of irr

Fletcher Morgan Park Irrigation

Watershed	8.63	Acres	Pond Depth	8 feet
Impervious:	1.75	Acres	Pond Area	0.36 Acres
Percent Impervious	20.3	%	Bott. Area	0.09 Acres
Runoff Coeff Perv.	0.12	-	Pond Volume	1.8 ac-ft
Runoff Coeff Imp.	0.85	-	Pond Volume	78,408 ft^3
Re-Use Volume in pond	15,700	ft3		
Irrigation Area	7.2	acres	Re-use Depth	1 ft
Reuse efficiency	84	%	Re-use Volume	15,700 ft^3

Yearly Rainfall	52	in/yr NE FL	
Weekly Rainfall Runoff (equivalent)	0.32	in/wk Watershed	
C	0.27		
Effective Impervious Area (EIA)	2.31	Acres	
Reuse Volume [V] (In. over EIA)	1.87	in	
Reuse Rate [R] (In./day over EIA)	0.21	in/day	(from REV Chart; Figure 31-1 SJRWMD Applicant's Handbook)
Reuse Rate [R] over irrigated area	1,008	ft^3/day	
	0.27	in/wk	
Required	5,062	ft^3/day	
Percentage of Demand Met	**19.9**	%	20%

Wurn Park Irrigation

Watershed	4.5	Acres	Pond Depth	7 feet
Impervious:	1.35	Acres	Pond Area	0.34 Acres
Percent Impervious	30.0	%	Bott. Area	0.07 Acres
Runoff Coeff Perv.	0.12	-	Pond Volume	1.435 Ac-ft
Runoff Coeff Imp.	0.85	-	Pond Volume	62,509 ft^3
Re-Use Volume in pond	14,810	ft^3		
Irrigation Area	3.3	Acres	Re-use Depth	1 ft
Reuse efficiency	85	%	Re-use Volume	14,810 ft^3

Yearly Rainfall	52	in/yr NE FL	
Weekly Rainfall Runoff (equivalent)	0.46	in/wk Watershed	
C	0.34		
Effective Impervious Area (EIA)	1.53	Acres	
Reuse Volume [V] (In. over EIA)	2.67	in	
Reuse Rate [R] (In./day over EIA)	0.18	in/day	(from REV Chart; Figure 31-1 SJRWMD Applicant's Handbook)
Reuse Rate [R] over irrigated area	672	ft^3/day	
	0.39	in/wk	
Required	1,765	ft^3/day	
Percentage of Demand Met	**38.1**	%	38%

CDM Smith

Stormwater Irrigation ROI

Item	Units	Unit Cost	Quantity	Total Cost
Captial Costs				
1. Horizontal Well				
1a. Mobilization and Site Prep. (5% of construction cost, 1b - 4)	EA	$ 4,347	2	$ 8,693
1b. Dewatering	EA	$ 9,000	2	$ 18,000
1c. Excavation	CY	$ 7	1,040	$ 7,280
1d. 6" Perforated PVC Pipe	LF	$ 10	300	$ 3,000
1e. Gravel	TN	$ 80	80	$ 6,400
1f. Geotextile	SY	$ 3	272	$ 816
1f. Sod	SY	$ 4	800	$ 3,200
2. Pond Reshaping[1]	CY	$ 7	3,748	$ 26,236
3. Covered Pump Station	EA	$ 8,000	2	$ 16,000
4. Irrigation Automated Control System	EA	$ 3,000	2	$ 6,000
Subtotal 1 - Capital Costs				$ 95,625
Contingency (30%)				$ 28,688
Subtotal 2 - (Capital Costs + 30% Contingency)				$ 124,313
Design Services				
Feasibility Study				$ 9,630
Data Development				$ 29,394
Design and Permitting				$ 64,504
Construction Services				$ 10,699
Subtotal 3 - Development Cost (Subtotal 2 + Design Services)				$ 238,540
Annual Operations & Maintenance Cost				
5. Horizontal Well	LS	$ 1,500	2	$ 3,000
6. Pump Station	LS	$ 2,500	2	$ 5,000
Annual Potable Water Savings				
7. Annual Water Savings (deducted)[2]	kgal	$ (4.33)	1,936	$ (8,385)
Annual Water Qualilty Value Savings				
8. Annual Total Nitrogen Worth (deducted)[3]	MT	$ (1,000,000)	0.026	$ (26,000)
Subtotal 4 - Total Annual Savings (5, 6, 7 & 8 in 2013 dollars)				$ (26,385)
Years to Recover Investment (subtotal 3 / subtotal 4, in 2013 dollars)				**9.0**

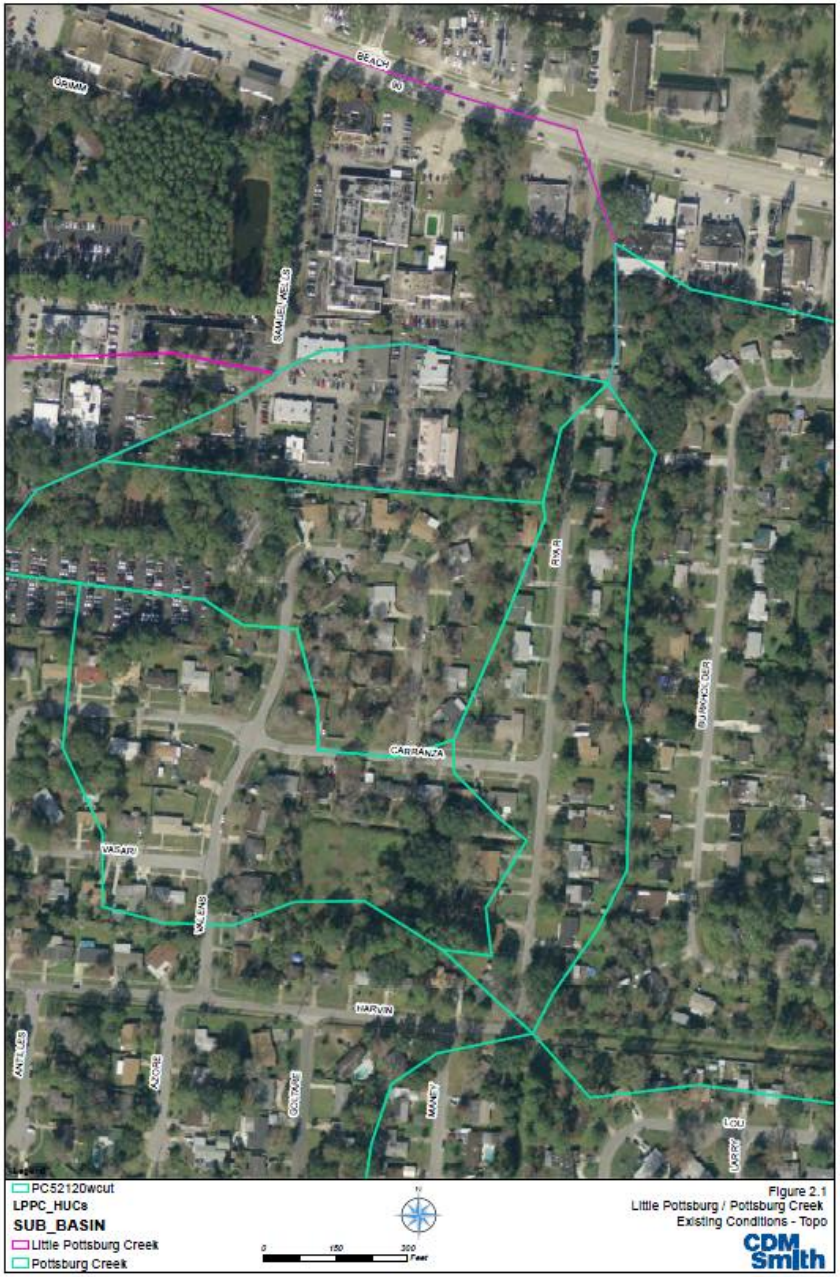
1. Assume 4 feet of excavation required for each pond (i.e., wet excavation).
2. JEA rates are $3.86/kgal for commercial irrigation + $0.37/kgal environmental fee = $4.33/kgal; quantity based on weekly irrigation schedules provided by COJ Parks and Recreation Department for an assumed 5 month irrigation season, and calculated irrigation demand met though harvesting of 35% for Fletcher Park and 57% for Wurn Park.
3. Based on conceptual worth of total nitrogen (TN) for water quality trading planning ($1M/metric ton TN)

9 years

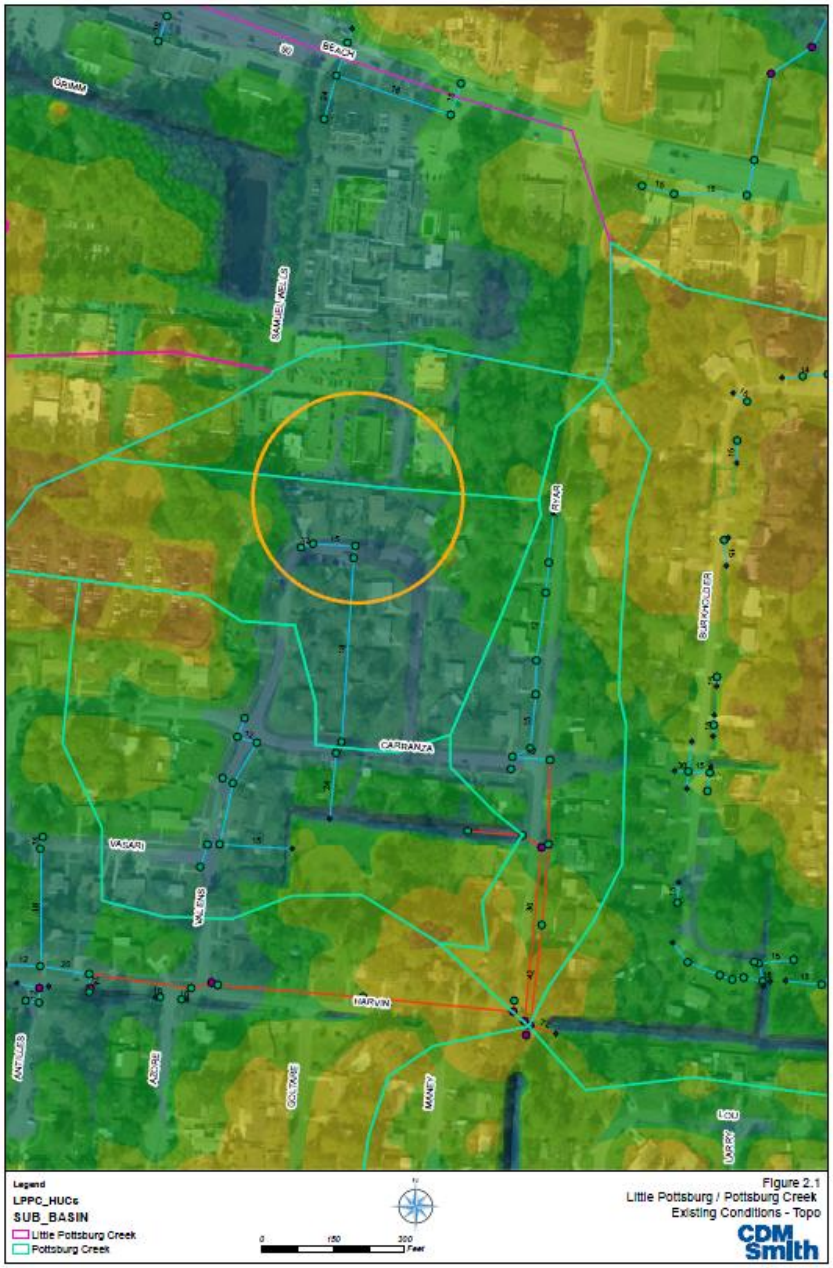
CDM Smith

Recreational LID Demonstration Projects

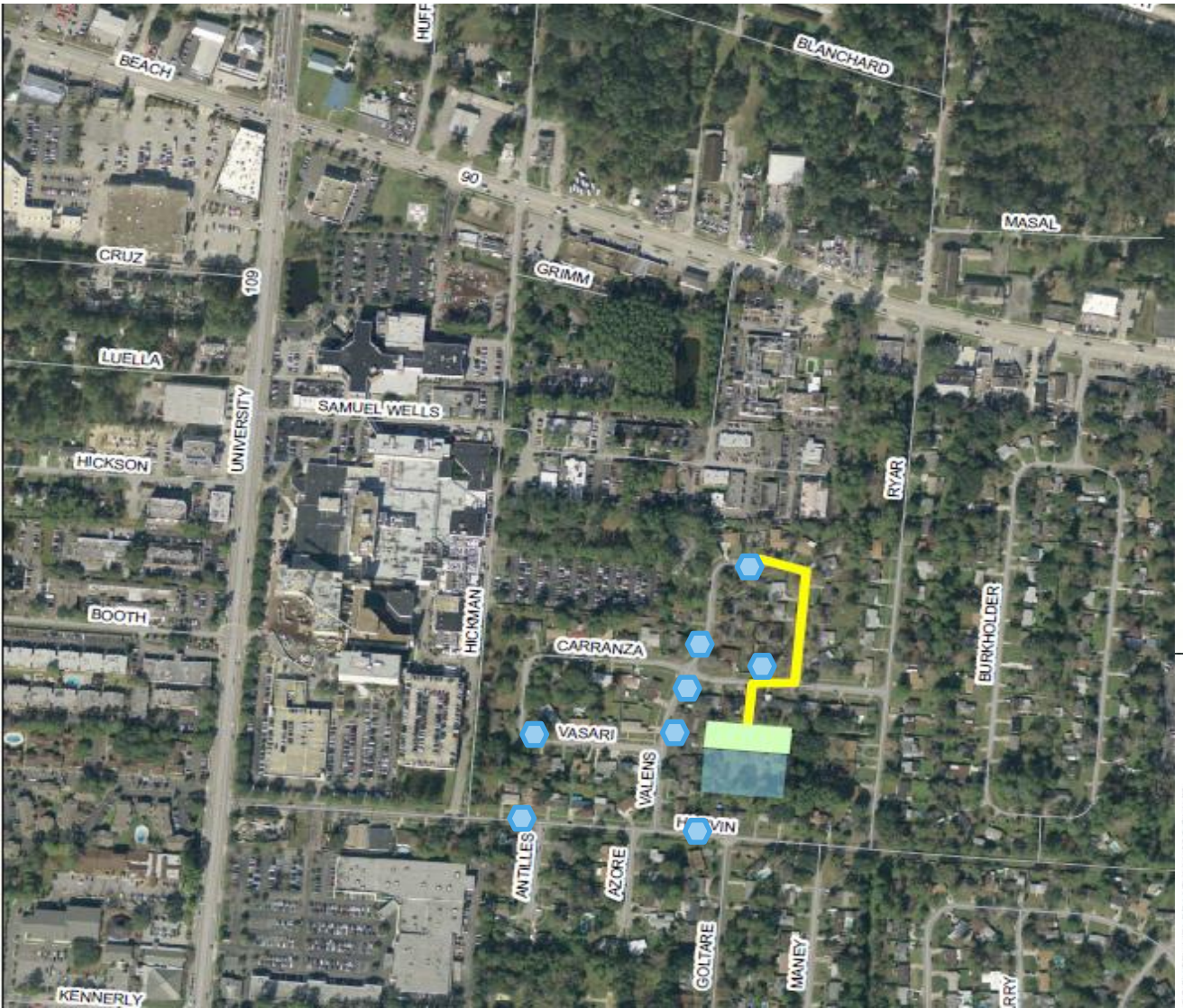
Project Area



Project Topography



LID Retrofit Opportunities: Flood Control



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

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Educational Components

Stormwater BMP educational signage installed throughout the park

Educational Components (cont.)

Baffle box with viewing cover allows visitors to see the mechanics behind an otherwise invisible technology

Educational Components (cont.)

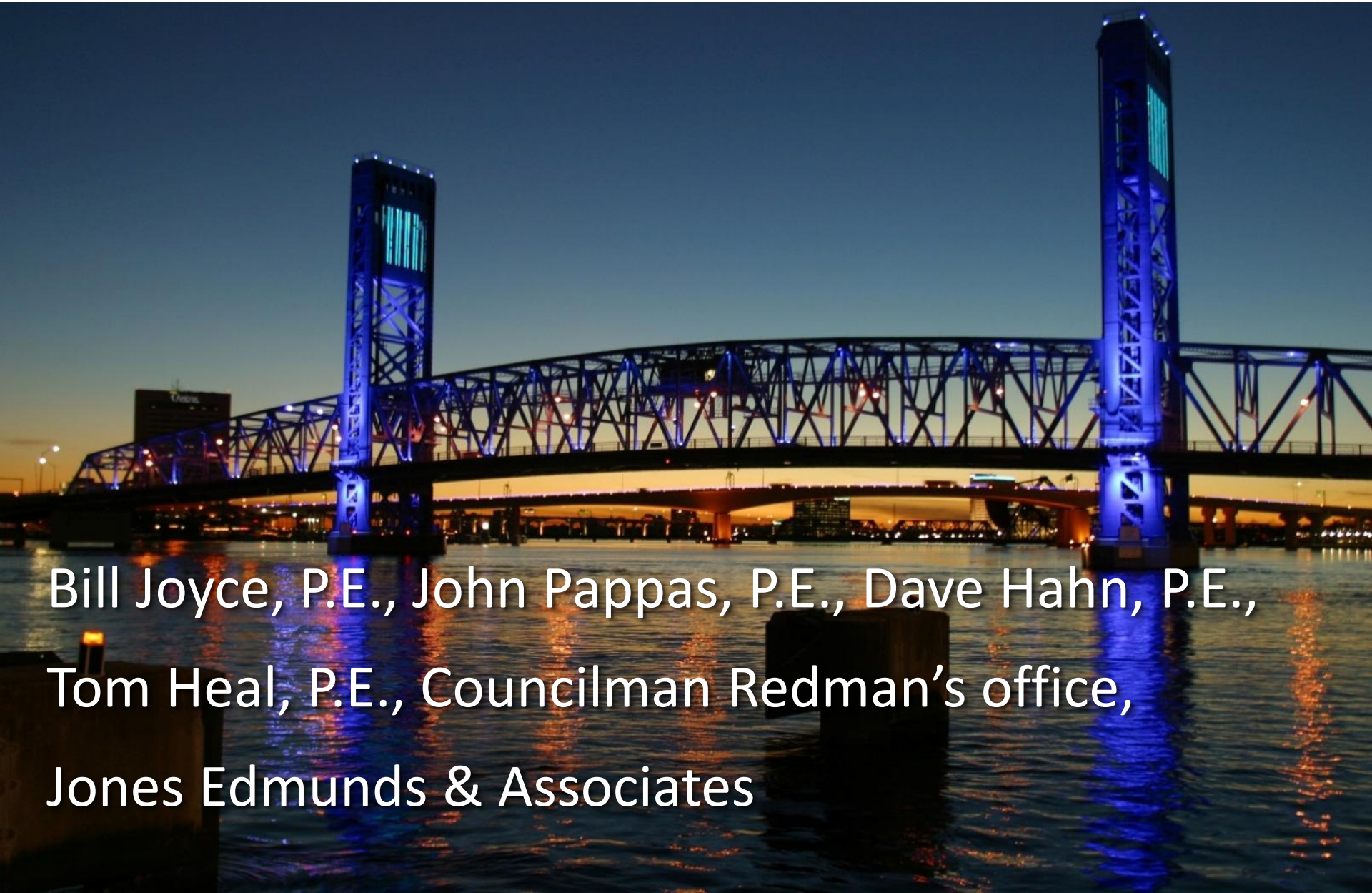
- Host field trips and events
- NPDES MS4 permit education credits

City of Jacksonville – LID Next Steps

- Identify additional locations to employ stormwater irrigation
- Move forward with design and implementation of Valens Drive Low Impact Development Demonstration Project
- Implement LID Manual into design requirements

SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Special Thanks to

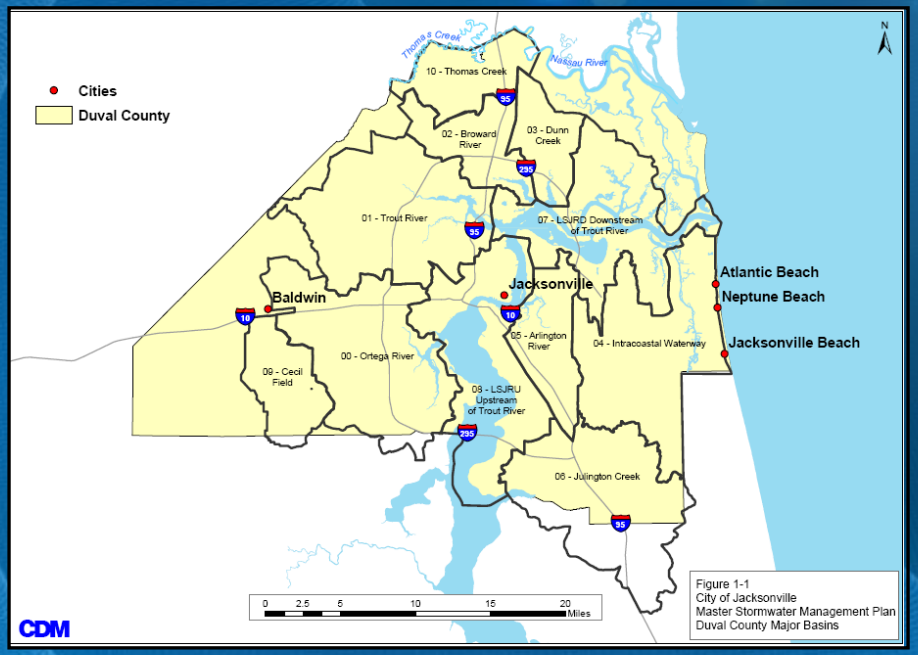


Bill Joyce, P.E., John Pappas, P.E., Dave Hahn, P.E.,

Tom Heal, P.E., Councilman Redman's office,

Jones Edmunds & Associates

LOW IMPACT DEVELOPMENT COUPLED WITH FLOOD MITIGATION



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