Land Development, Water and Energy: Quantifying Impacts

Pierce Jones, Director
Program for Resource Efficient Communities

UF UNIVERSITY of FLORIDA
IFAS Extension

Program for Resource Efficient Communities

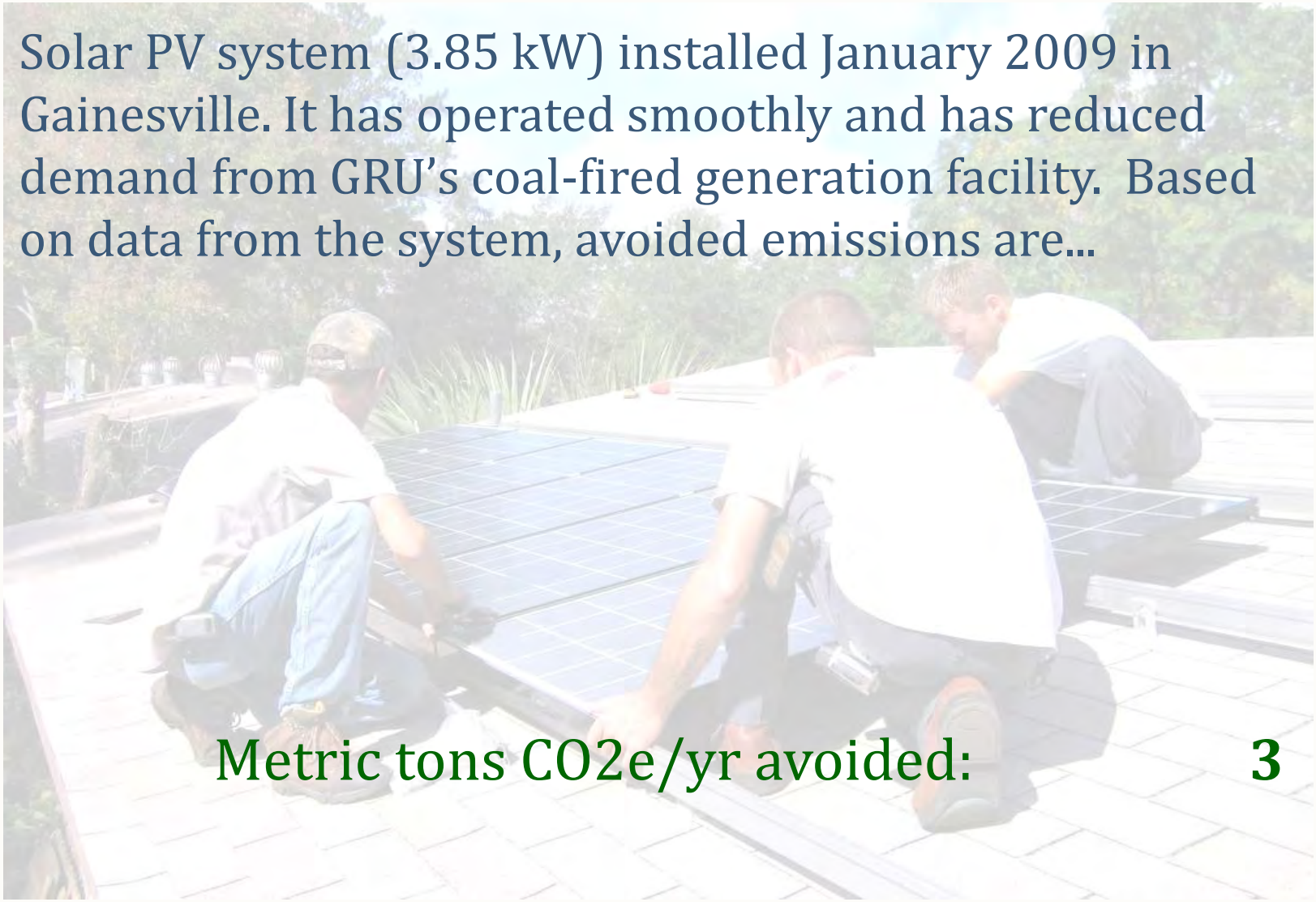
We promote application of design, construction and management practices that measurably minimize environmental degradation and make more efficient use of energy, water and other natural resources in master planned communities.

Quantifying Impacts:
Solar PV Context

Solar PV

Solar PV

Solar PV system (3.85 kW) installed January 2009 in Gainesville. It has operated smoothly and has reduced demand from GRU's coal-fired generation facility. Based on data from the system, avoided emissions are...

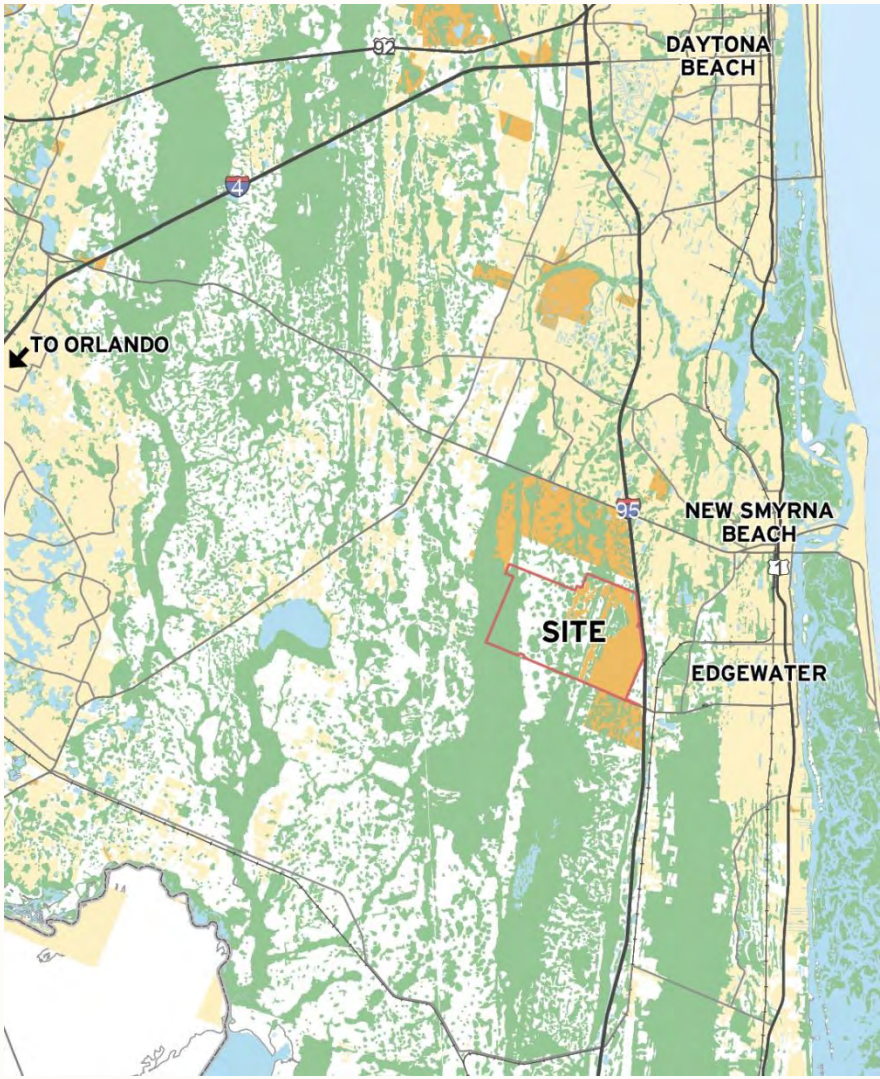


Metric tons CO_2e/yr avoided: **3**

Restoration's Two Designs: Quantifying Impacts

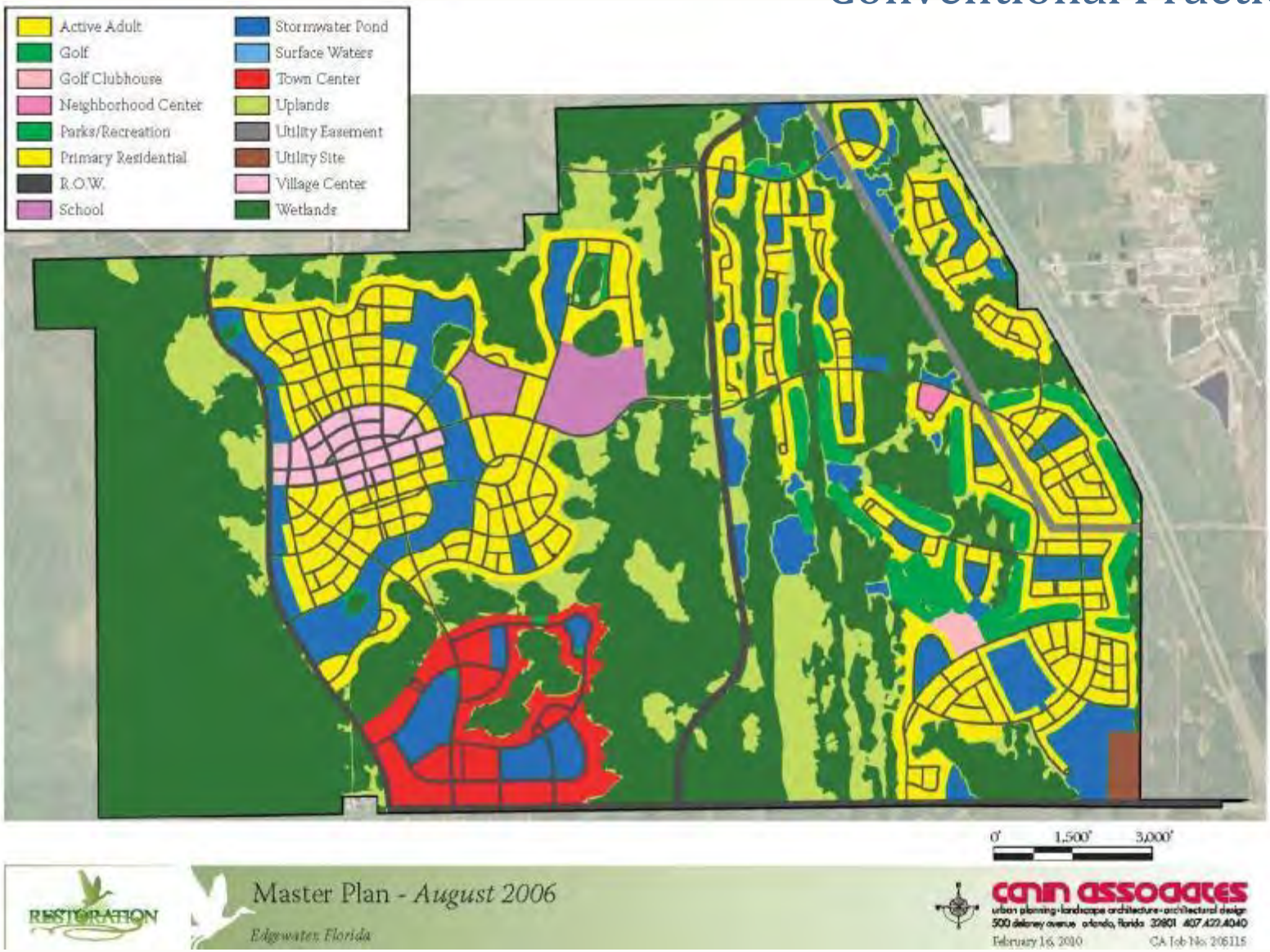
Restoration Case Study

- This 5,187-acre master plan evolved significantly over its 4-year permitting process.
- Designs were for 8,500 dwelling units.
- It was fully entitled earlier this summer based on the 2009 design.
- Restoration is entitled to create a mixed-use, transit oriented community with 3.5 million ft^2 of commercial space.



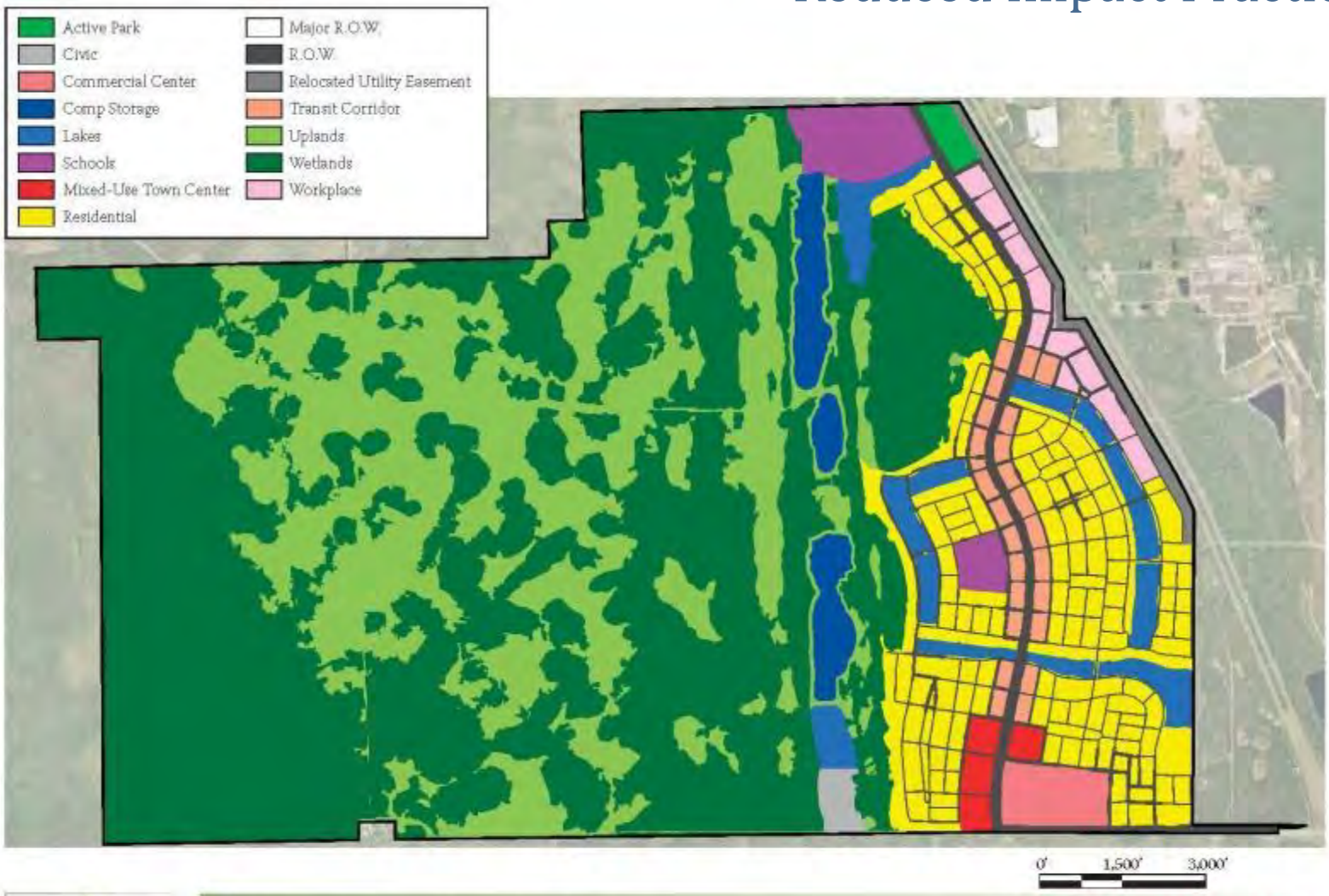
Restoration 2006

Conventional Practice



Restoration 2009

Reduced Impact Practice



RESTORATION

Master Plan - *December 2009*

Edgewater Florida

cmm associates

urban planning · landscape architecture · architectural design

500 delaney avenue orlando, florida 32801 407.422.4040

February 16, 2010

CA Job No. 205113

Quantifying Performance:
Roads

Restoration's Road Infrastructure 2006 Design

Life Cycle Analysis (50 year life)

Location and Type	Description	RoW (Ft)	Miles	Lane Miles	$/Linear Ft	Cost	Annual $MtCO_2e$
Onsite: A	6-lane divided	150	5.45	32.7	$2,000	$57,552,000	2,289
Onsite: B	4-lane divided	124	2.17	8.68	$1,500	$17,186,400	608
Onsite: D	2-way street with bike lanes and on-street parking	70	9.36	18.72	$1,000	$49,420,800	1,310
Onsite: E	2-way street with parking on 1 side	52	50.27	100.54	$800	$212,340,480	7,038
Offsite: A	6-lane divided	150	2.58	15.48	$2,000	$27,244,800	1,084
Offsite: B	4-lane divided	124	2.51	10.04	$1,500	$19,879,200	703

Restoration's Road Infrastructure 2009 Design

Life Cycle Analysis (50 year life)

Location and Type	Description	RoW (Ft)	Miles	Lane Miles	$ / Linear Ft	Cost	Annual $MtCO_2e$
Onsite: A	6-lane divided	150	0.67	4.02	$2,000	$7,075,200	281
Onsite: C	6-lane boulevard with streetcar frontage lanes and parking	190	2.68	16.08	$4,000	$56,601,600	1,126
Onsite: D	2-way street with bike lanes and on-street parking	70	6.03	12.06	$1,000	$31,838,400	844
Onsite: E	2-way street with parking on 1 side	52	26.75	53.5	$800	$112,992,000	3,745
Offsite: A	6-lane divided	150	2.81	16.86	$2,000	$29,673,600	1,180

Restoration's Road Infrastructure

Life Cycle Analysis (50 year life)

Inputs	2006 Plan	2009 Plan
• Miles:	72	39
• Lane miles:	186	103
• Impervious area, ft^2	17,000,000	10,000,000
• Landscaped area, ft^2	6,000,000	3,000,000
• Cost	$383,623,680	$238,180,800
GHG Emissions		
• Mtons CO2e/yr:	13,031	7,176

Metric tons CO2e/yr avoided: **5,855**

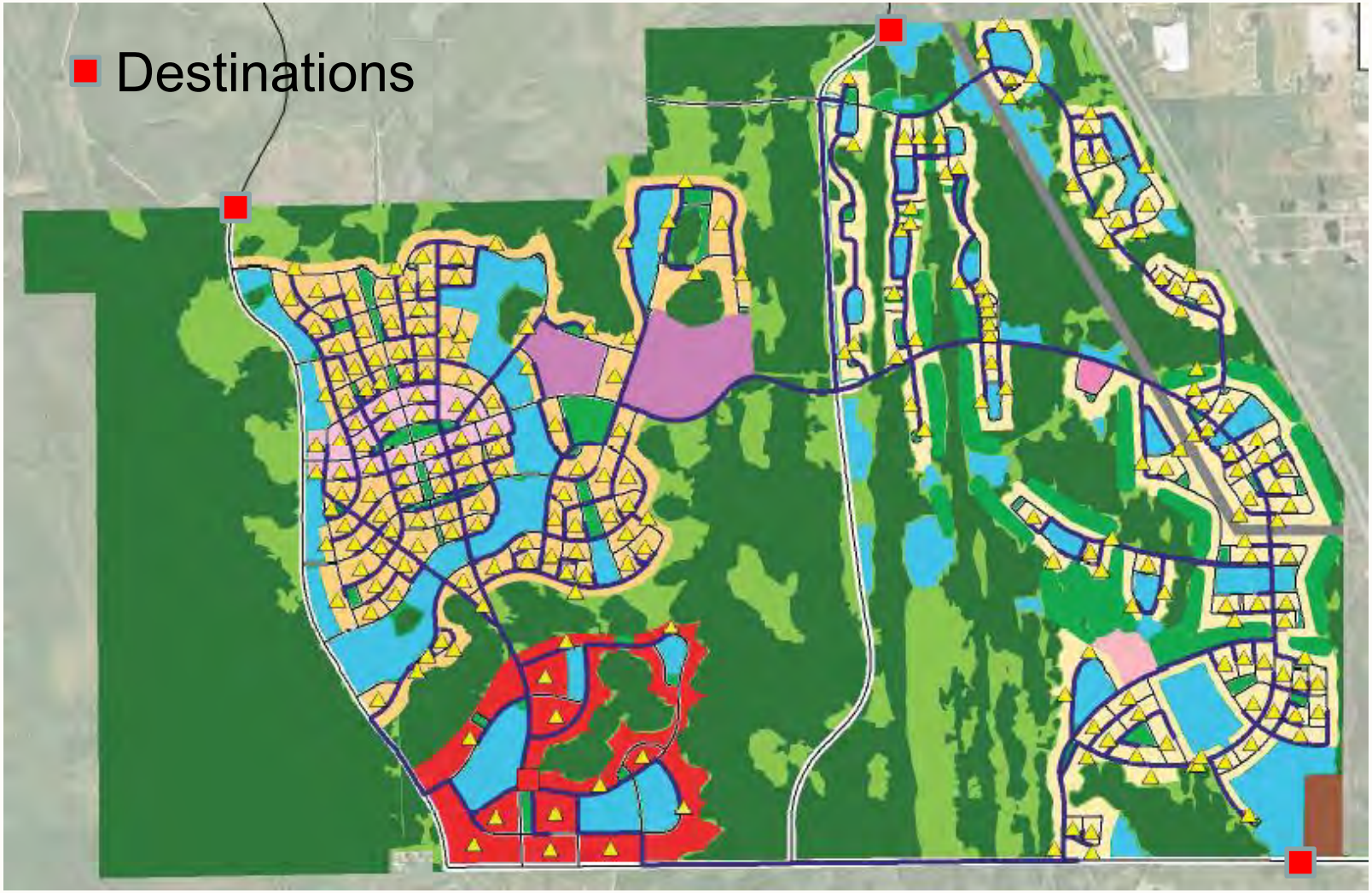
Initial costs avoided: **$145,442,880**

2,000 solar rooftops - ~$20,000,000

Quantifying Performance: Transportation

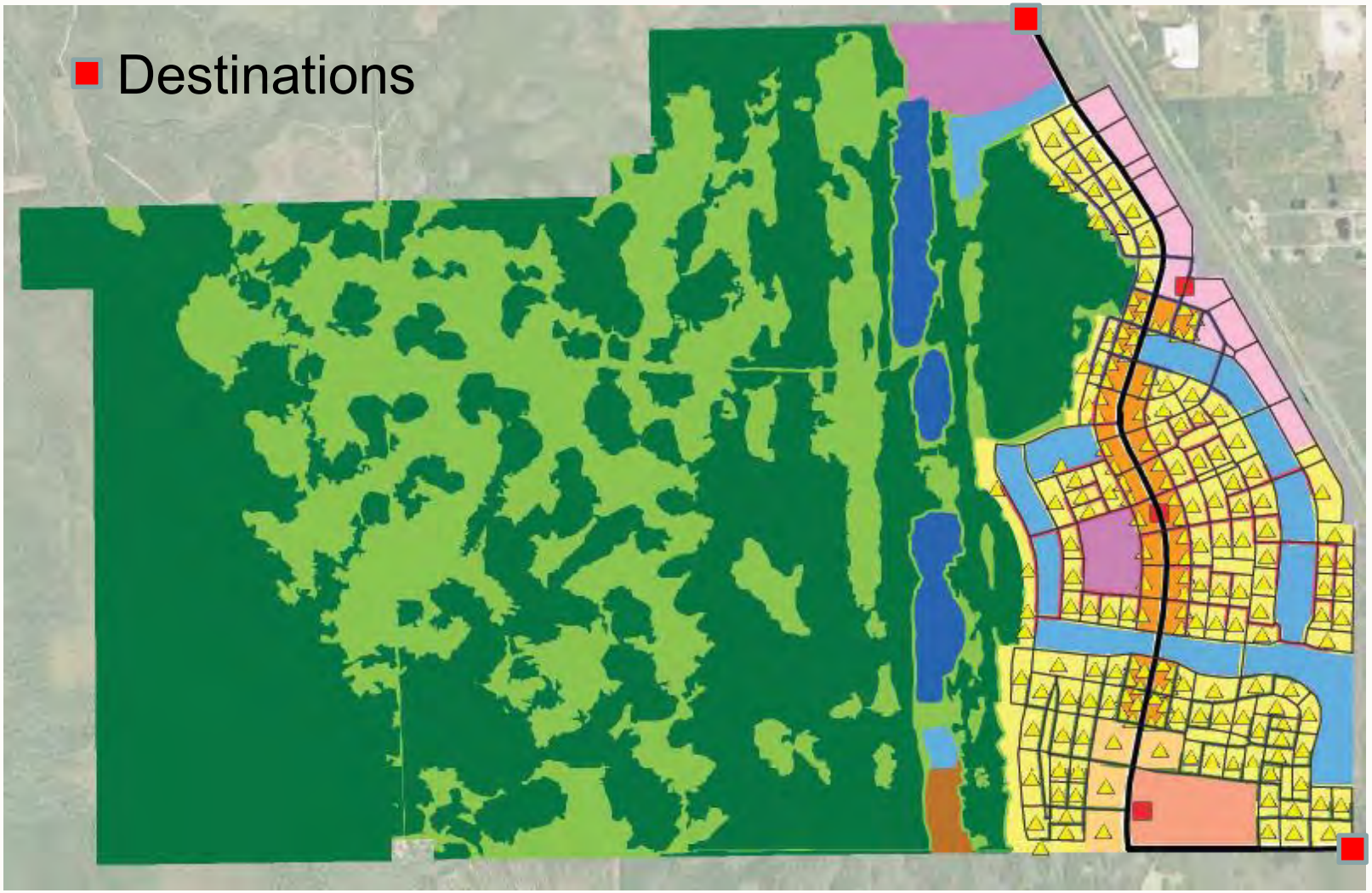
Transportation – Restoration 2006 Design

VMT Analysis



Transportation – Restoration 2009 Design

VMT Analysis



Transportation – Restoration's Two Designs

VMT Analysis

Inputs	2006 Plan	2009 Plan
• Trips:	68,000	68,000
• Internal trip length, miles	1.75	0.38
• Onsite trip capture	20%	50%
• Total daily travel, miles	594,000	349,000
• Gasoline, gallons/day	29,254	17,216
GHG Emissions		
• Mtons CO2e/yr	98,900	58,200

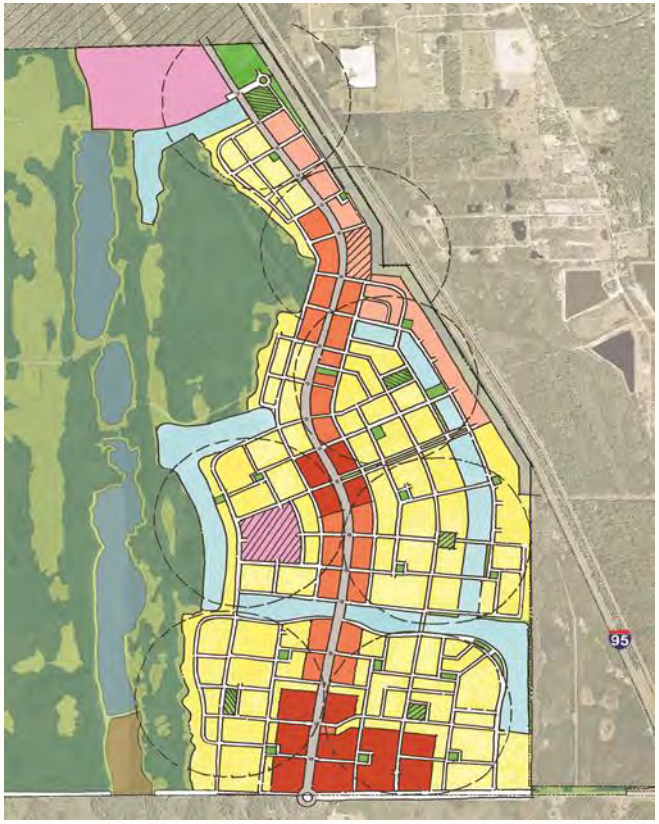
Metric tons CO2e/yr avoided: **40,700**

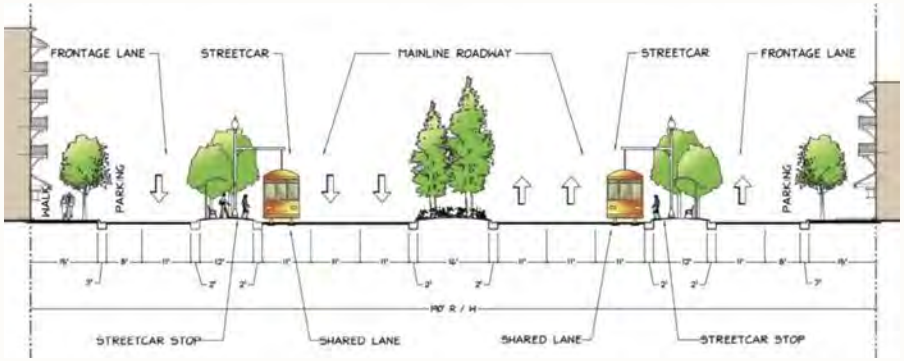
Fuel costs/yr avoided: **$13,000,000**

13,000 solar rooftops - ~$130,000,000

Restoration 2009

Transit Ready Corridor





Quantifying Impacts: Landscaping

Landscaping Impacts

Conventional Practice

Landscaping Impacts

Greenhouse Gas Accounting (Groundwater)

Mowing:

15 lbs $CO_2e/1000ft^2/yr$

Fertilizer:

29 lbs $CO_2e/1000ft^2/yr$

Pesticides:

1 lbs $CO_2e/1000ft^2/yr$

Irrigation:

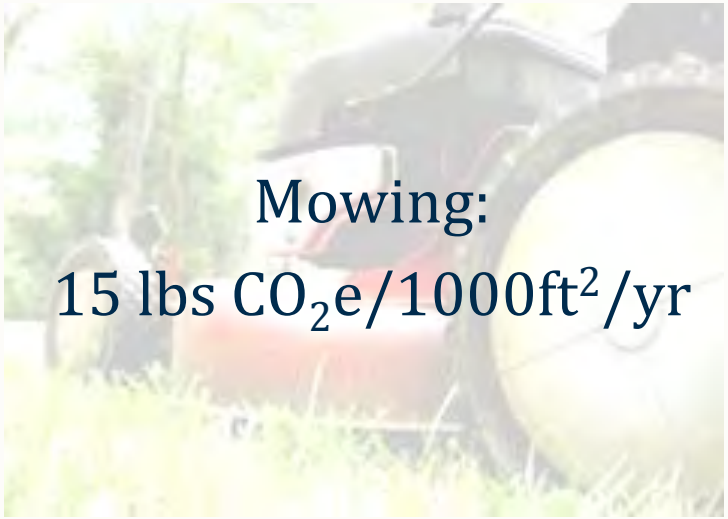
34 lbs $CO_2e/1000ft^2/yr$

(Groundwater)

.2 MT CO2 or 6% of a solar rooftop

Landscaping Impacts

Greenhouse Gas Accounting (Desal)

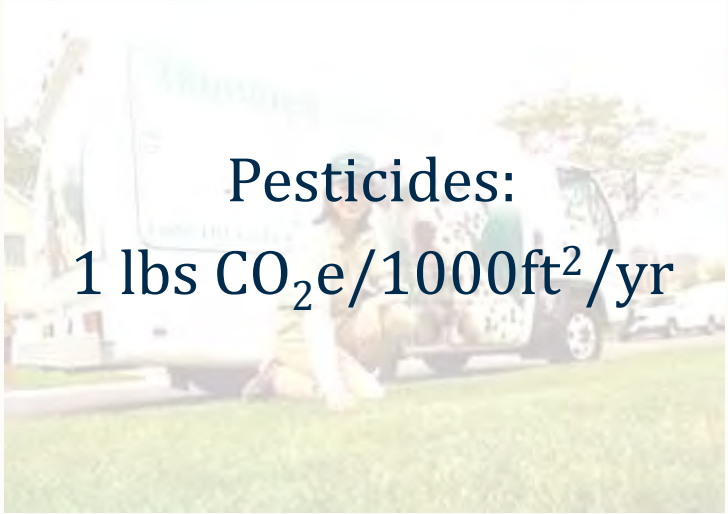


Mowing:

15 lbs $CO_2e/1000ft^2/yr$

Fertilizer:

29 lbs $CO_2e/1000ft^2/yr$



Pesticides:

1 lbs $CO_2e/1000ft^2/yr$

Irrigation:

579 lbs $CO_2e/1000ft^2/yr$

(Desal)

1.5 MT CO2 or 50% of a solar rooftop

Quantifying Performance: Landscaping

Restoration 2009

Reduced Impact Design

- The largest lots are 60’ wide
- Compact homes (45’x 70’ lot) 375 ft^2 landscaped area
- Less than 25% of residences with lots designed for any turf

Landscaping Impacts – Restoration 2009

Low Impact Practices

City of Edgewater
Development Order Requirements Include:

- "….no use of potable water in common areas….."
- "….requirements for minimal to no added inputs of water and synthetic fertilizers and pesticides….."

Landscaping Impacts – Restoration Designs

Resources Accounting

Inputs	2006 Plan	2009 Plan
• Landscaped Area - acres	988	428
• Pesticides - lbs	2,240	345
• Fertilizer - lbs N	135,000	18,400
• Mowing - gal gas	33,000	4,460
• Irrigation - mgal	988	63
GHG Emissions		
• Mtons CO2e/yr:	11,685	798

Metric tons CO2e/yr avoided: **10,900**

3,600 solar rooftops ~$72,000,000

Restoration's Two Designs:
Better Development Practices?

Florida Land Development

Moving Forward

Better Practices:

- Greater density and retention of natural areas
- Energy-efficient, vertical development
- Mixed-use, transit-oriented community design
- Reduced investment in new infrastructure

Benefits:

- Greatly reduced initial costs (~$200,000,000)
- Reduced homeowner costs (~$400/month)
- Reduced community financial risk

Florida Land Development

Recent Events

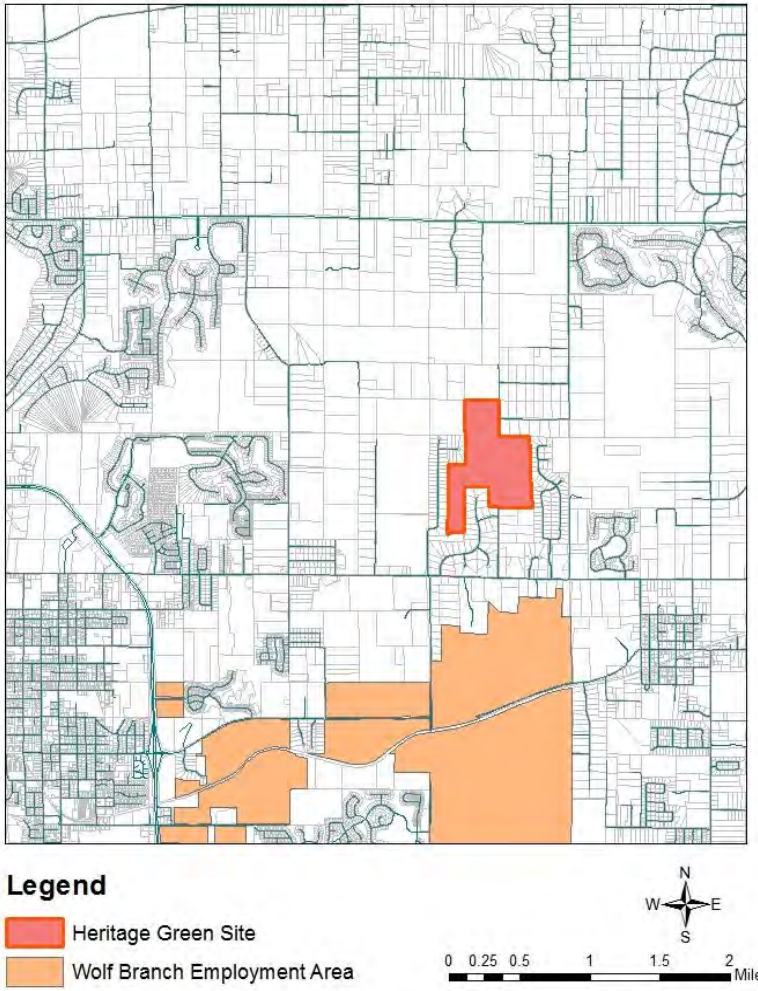
Heritage Green:
Three Development Scenarios

Heritage Green

Single Family Residential

Site Characteristics:

- 210 acre in pasture on well drained sandy soil.
- Lake County, Florida
- Zoned 'Rural Transition'
- Surrounded by 1 to 5 acre lot residential subdivisions.
- Planned large 'employment center' nearby.



Heritage Green

Rural Transition Residential Development Options

Lake County's Comp Plan offers three densities:

- One unit/five acres; no open space.
- One unit/three acres; 35% open space.
- One unit/acre; 50% open space.

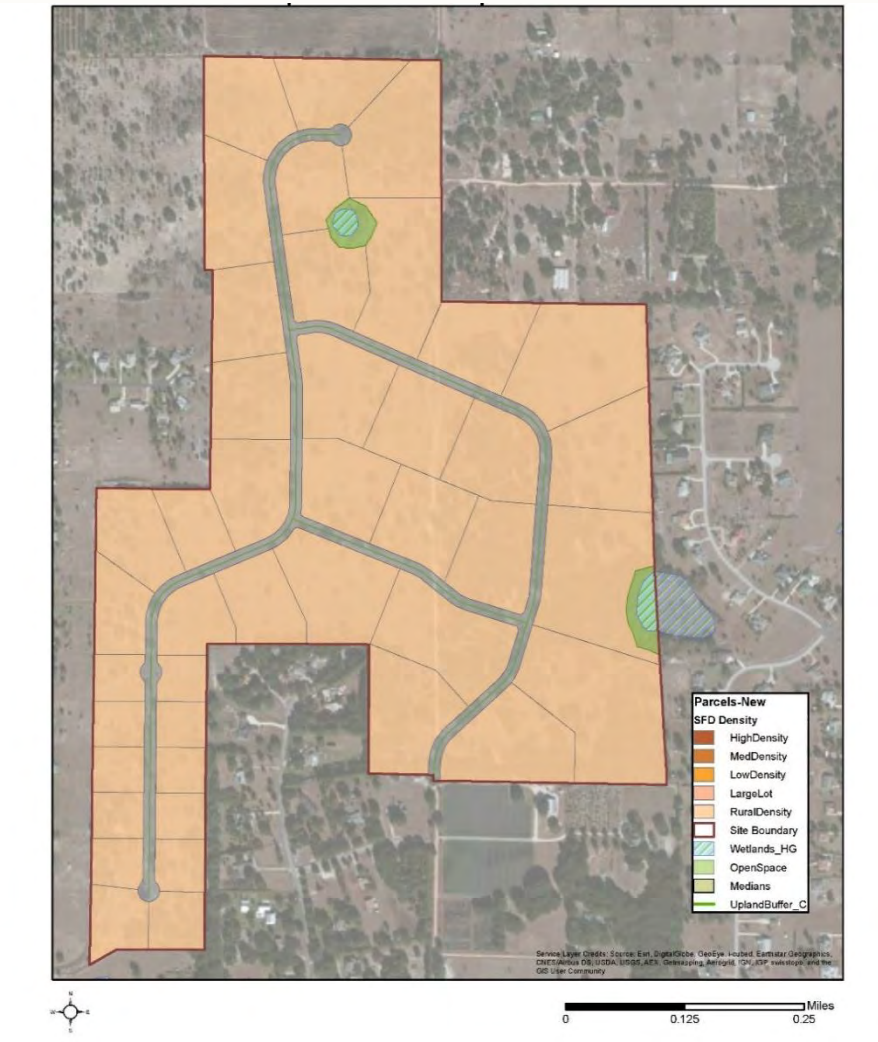
Heritage Green's developer proposed another option:

- Two units/acre with 50% open space and hook up to central water and wastewater treatment.

Heritage Green 1/5 Scenario

Features:

- 42 homes
- No designated open space
- Well & septic system
- Stormwater practices:
  - Vegetated swales
  - No curb & gutter
  - Conventional basins
- No amenities



Heritage Green 1/1 Scenario

Features:

- 207 homes
- 50% open space
- Well & septic system
- Stormwater practices:
  - Vegetated swales
  - No curb & gutter
  - Conventional basins
- No amenities:

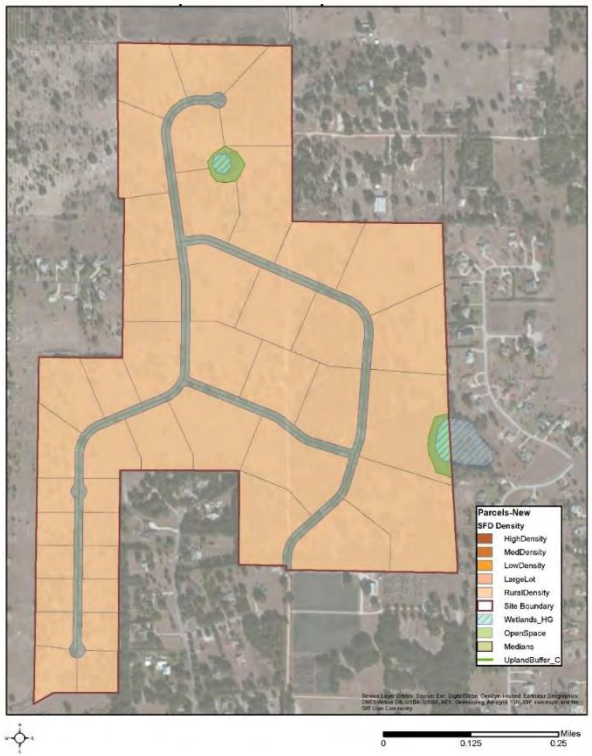
Heritage Green 2/1 Scenario

Features:

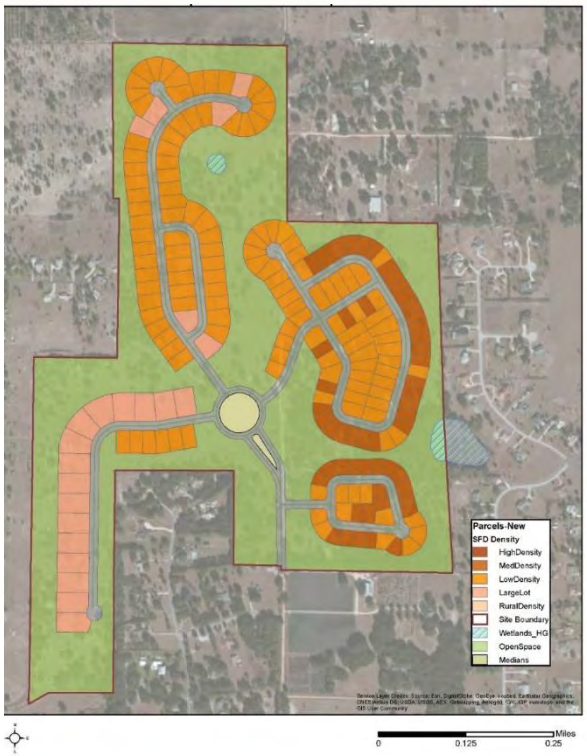
- 418 homes
- 53% open space
- Central water & wastewater
- Amenities:
  - Walking track (4.5 mile)
  - Community garden
  - Community pool

Heritage Green

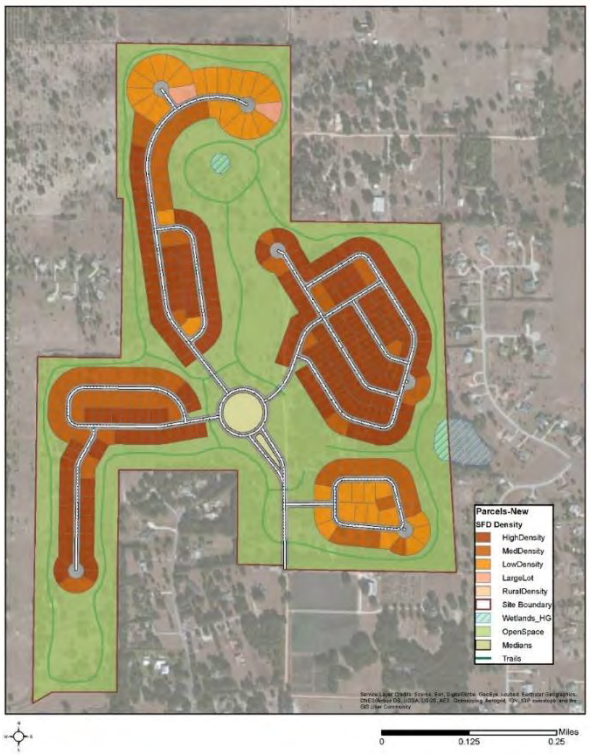
Three Scenarios:



Scenario 1/5
42 DU



Scenario 1/1
207 DU

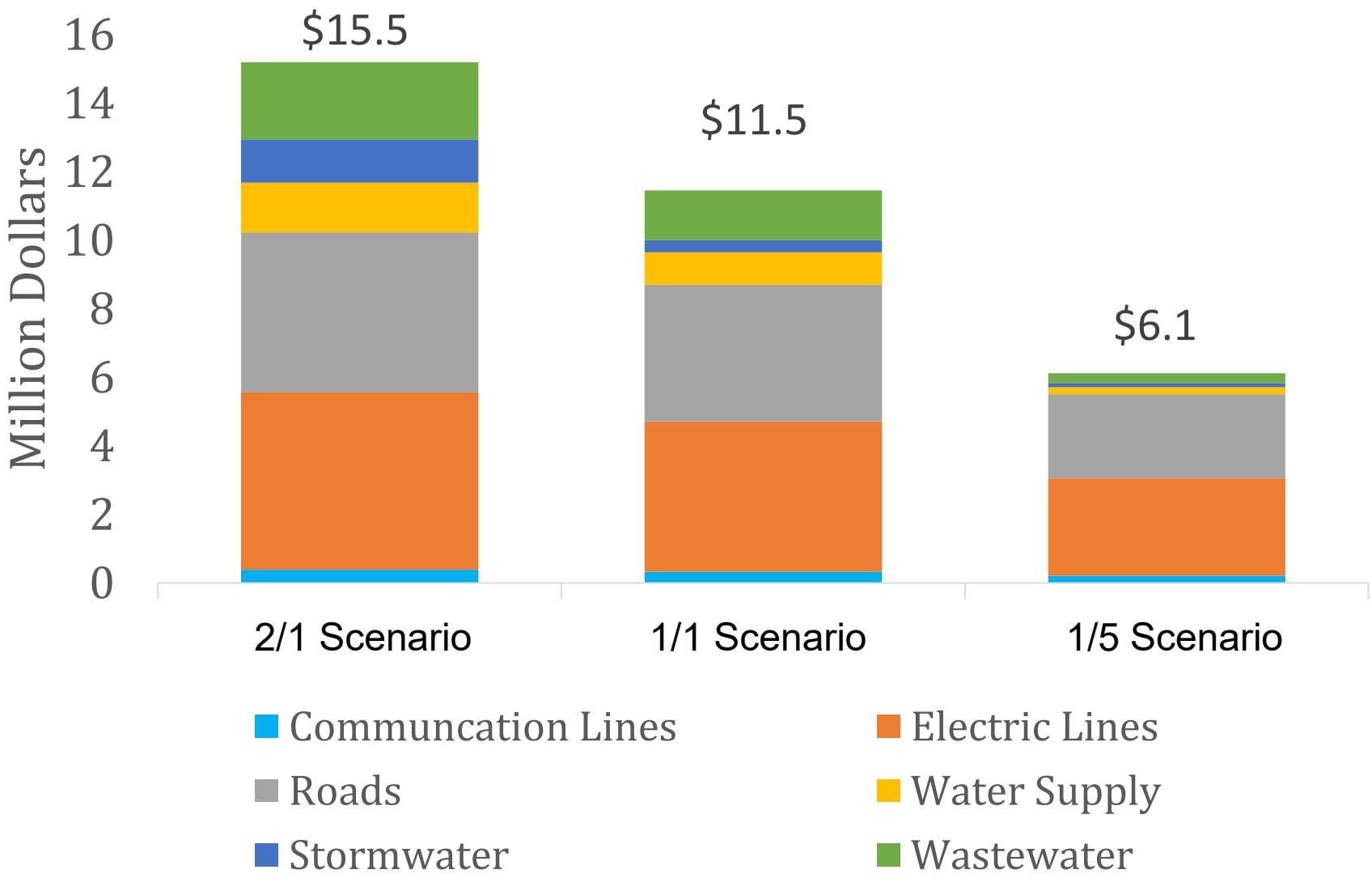


Scenario 2/1
418 DU

Quantifying Performance: Heritage Green Metrics

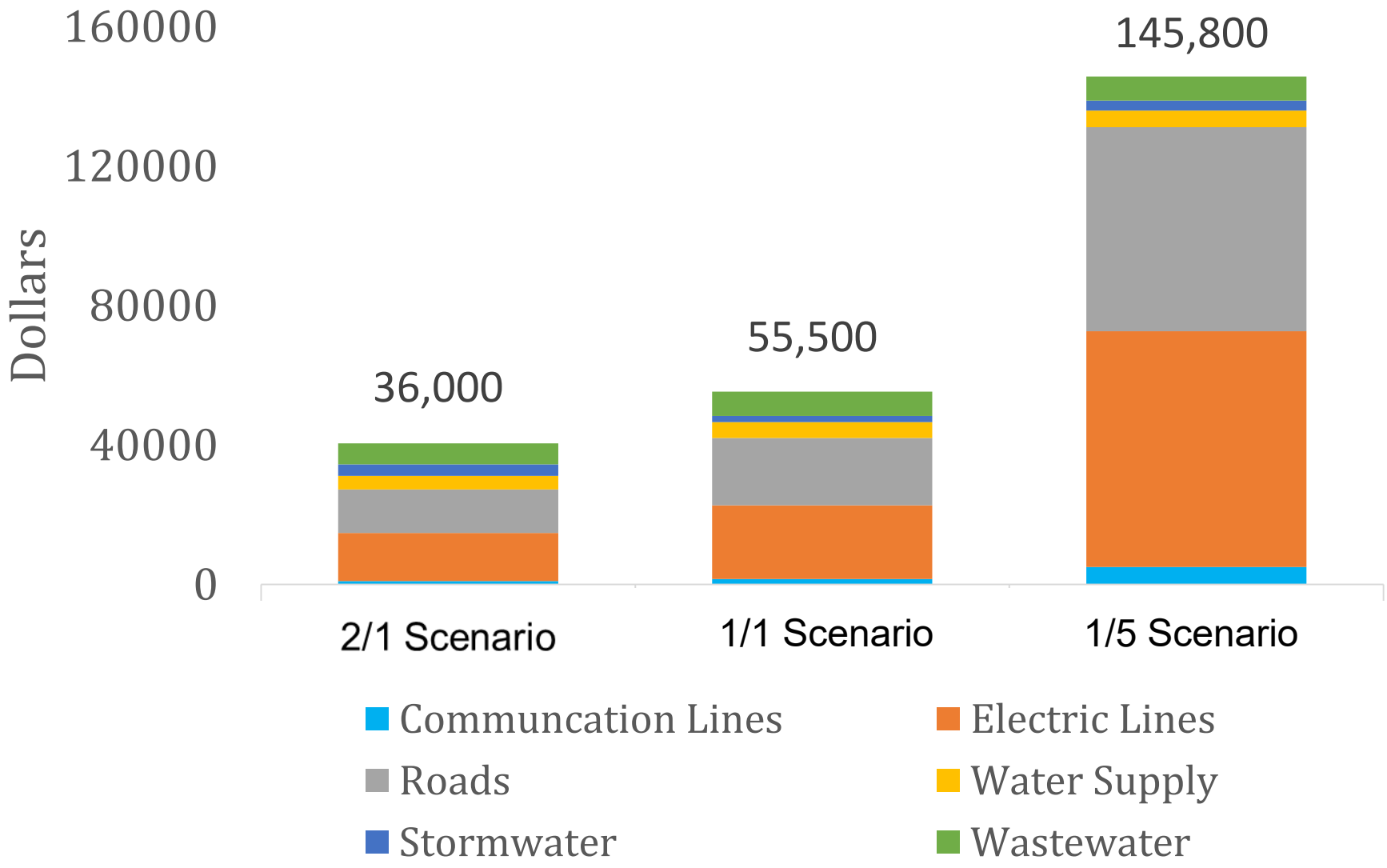
Heritage Green - Metrics

Infrastructure Costs



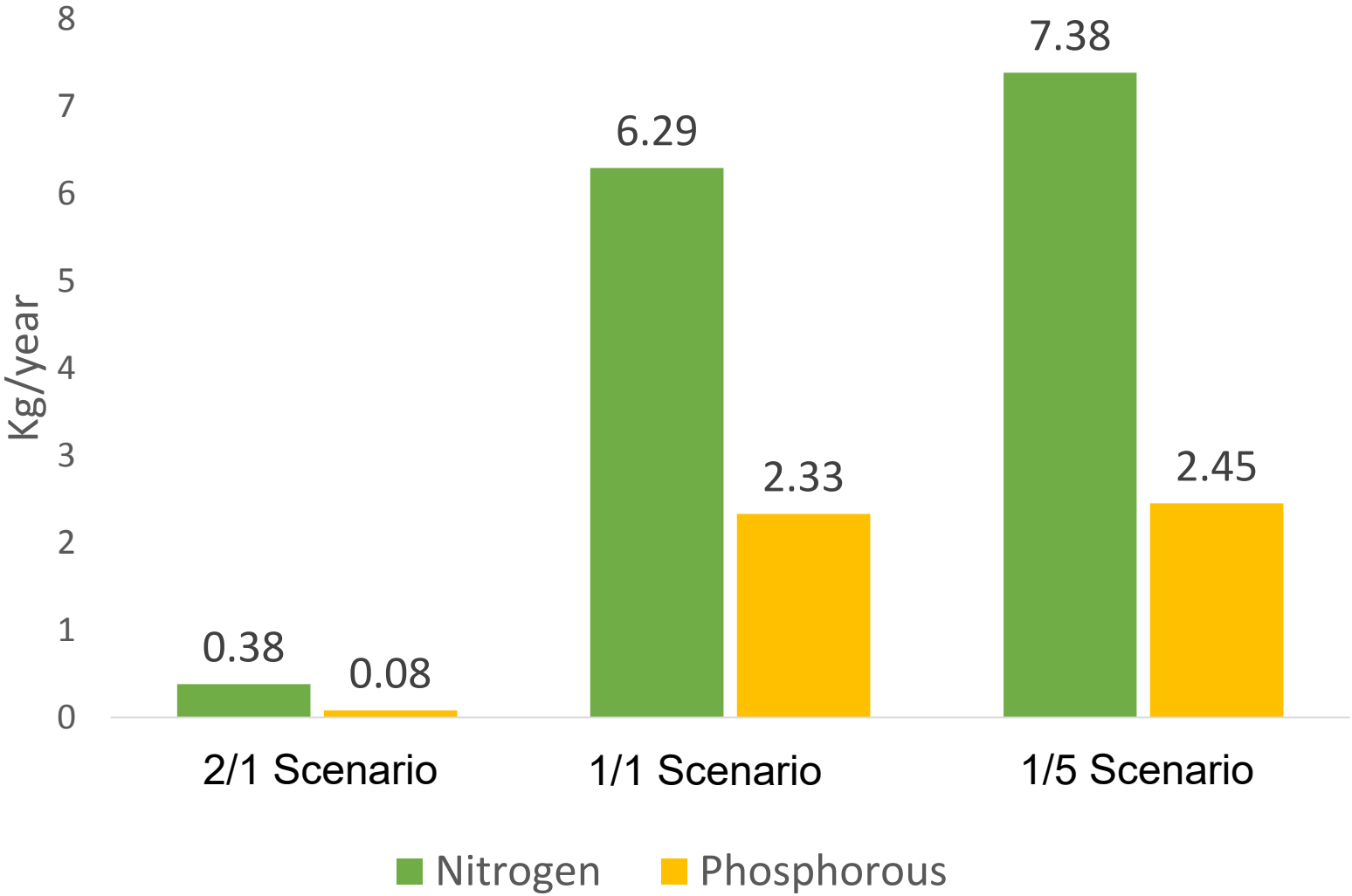
Heritage Green - Metrics

Infrastructure Costs/Household



Heritage Green - Metrics

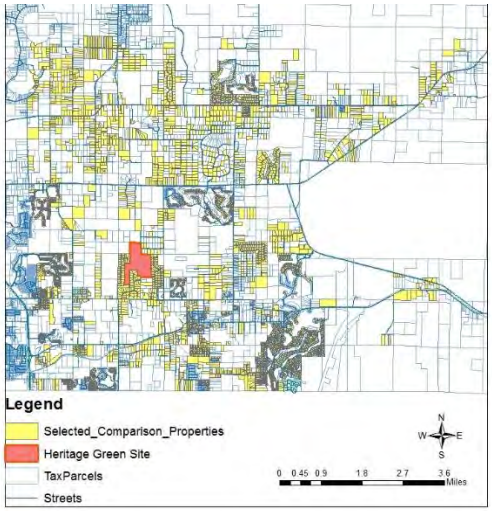
Annual Household Nutrient Load



Heritage Green - Multipliers

Property Tax Revenues

- Evaluated homes in lot size categories similar to the three Heritage Green scenarios.
- Found 4,356 homes built after 1990 with appraised values > $100,000.
- Calculated average assessed property values for the three groups.
- Estimated tax revenues for each scenario.



Heritage Green - Metrics

Property Tax Comparison

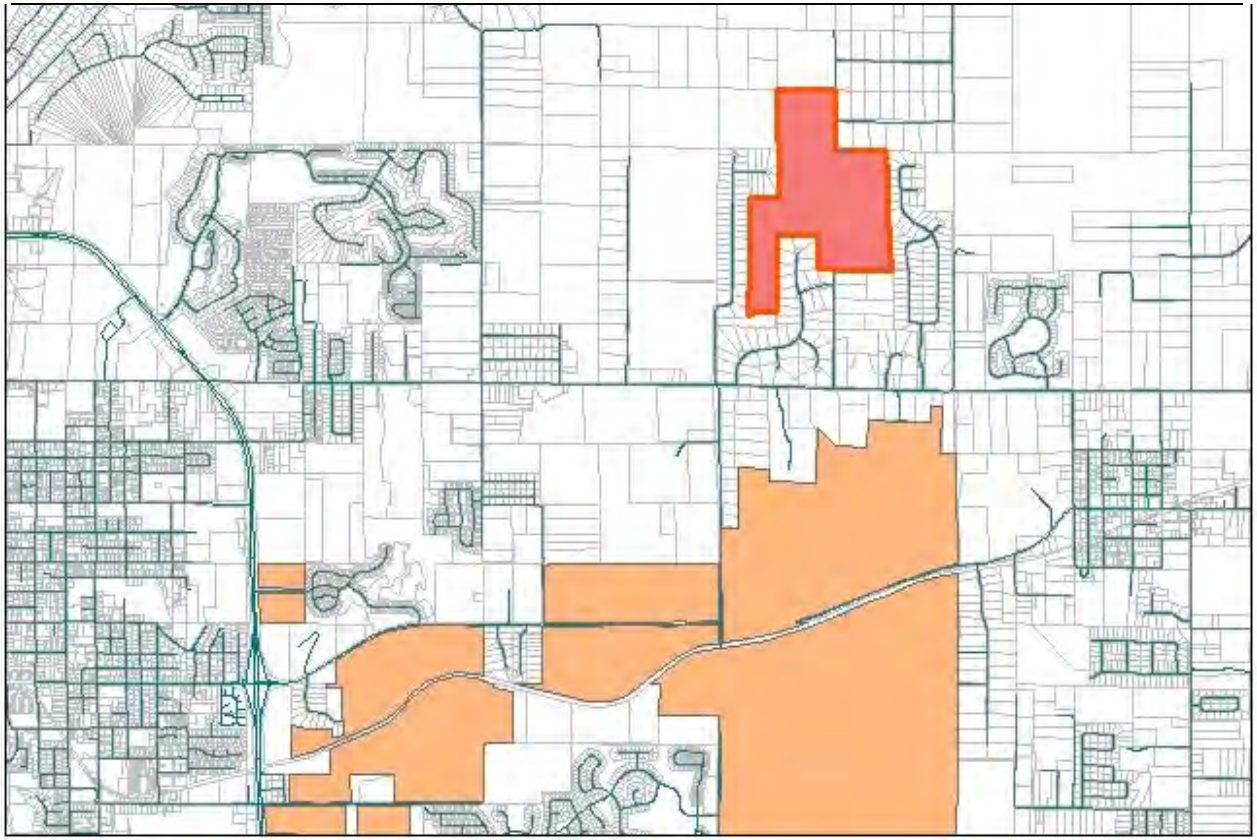
	Comparison Properties			Equivalent Tax Revenue		
Housing Density	No. of Homes	Mean Assessed Value	Tax Revenue per Home	Scenario 2/1	Scenario 1/1	Scenario 1/5
SFHigh	1,205	$141,140	$1,373	$57,666	-	-
SFMed	1,006	$191,680	$1,865	$643,425	$149,204	-
SFLow	1,142	$216,630	$2,108	$35,348	$267,692	-
SFVery Low	1,003	$227,640	$2,215	-	-	$93,027
HG Total				**$766,439**	**$416,896**	**$93,027**
% Loss vs. Scenario A				-	**(46%)**	**(88%)**

Heritage Green Designs:
Better Practices…

Heritage Green - Metrics

	Scenario 2/1	Scenario 1/1	Scenario 1/5
Urban Land Use per HH *(acres)*	0.27	0.50	4.85
Designated Open Space *(acres)*	109.9	103.6	0
Road Length per HH *(feet)*	50	78	237
Infrastructure Costs per HH *($)*	41,000	56,000	146,000
Water Demand per HH *(gallons/year)*	198,000	370,000	860,000
Impervious Area per HH *(square feet)*	3,600	6,600	10,200
Total Volume Stormwater *(acre-feet)*	59	62	41
Nitrogen Load *(kg/year)*	0.4	6.3	7.4
Phosphorous Load *(kg/year)*	0.1	2.3	2.4
% Tax Revenue Loss vs. Scenario 2/1		(46%)	(88%)

Heritage Green/Wolf Branch Employment Area



Legend

Heritage Green Site

Wolf Branch Employment Area

N
W E
S

0 0.25 0.5 1 1.5 2 Miles

Land Development Trends:
Walmart?

Demographic Shifts Contribute To The Changing Face Of Retail

by Yuki Noguchi

February 17, 2014 4:00 PM

Another such example is the new Wal-Mart near the Capitol in Washington, D.C. Above the store, there are 200 residential units. "On both sides of those demographic barbells, these are groups who want to be close to restaurants, they want to be close to places to exercise, and they don't want to be tied to the yard and mowing grass and all of those things," McAvey says.

Lifestyle Centers

Biltmore Park (Asheville, NC)

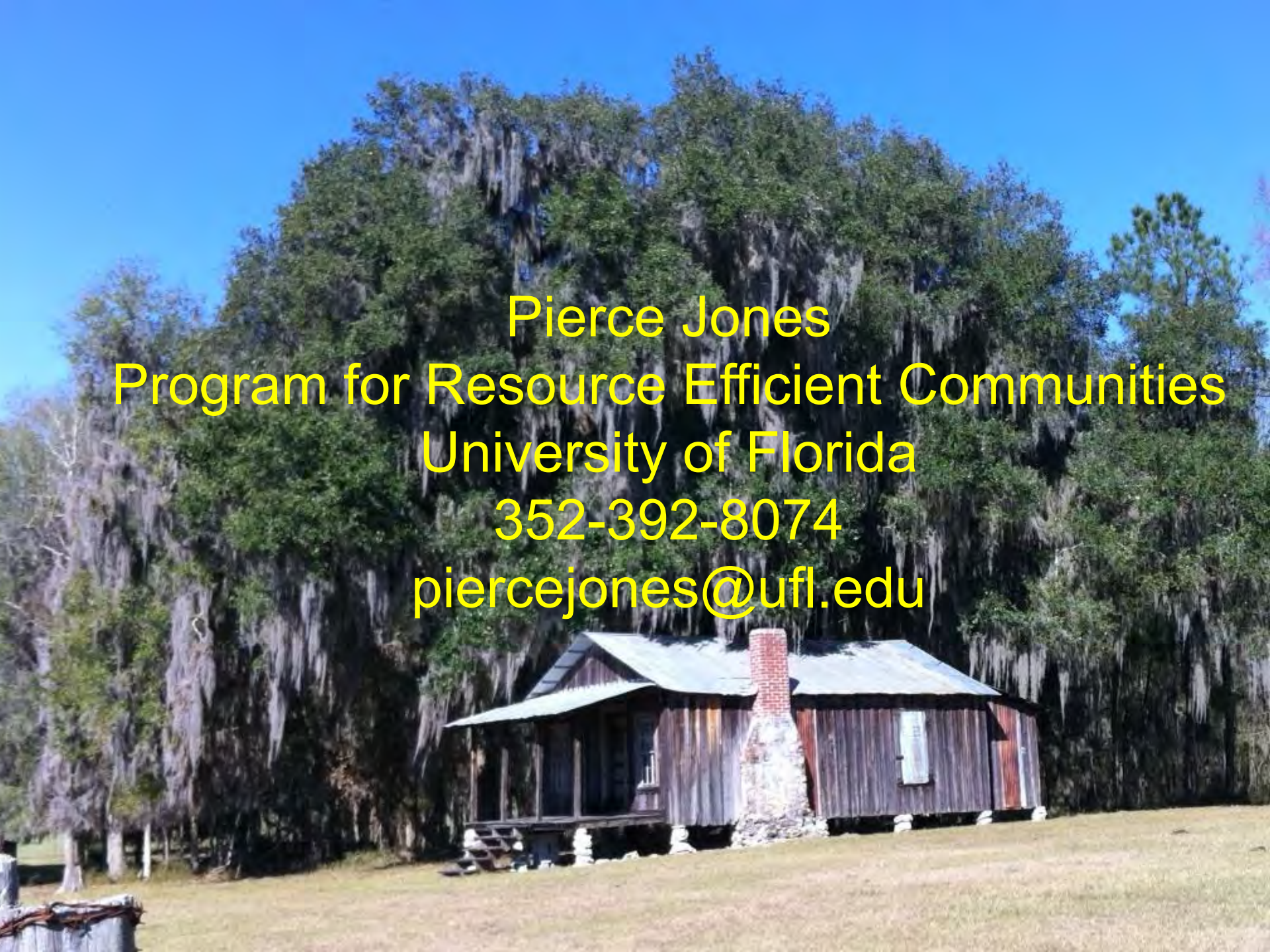
Bradford (Cary, NC)

Lifestyle Centers: Publix

Orlando, FL

Lifestyle Centers: Publix

Birmingham, AL



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Florida Land Development

Building Permits: Single-Family Detached

- 2003 155,000
- 2004 185,000
- 2005 208,000
- 2006 146,000
- 2007 70,000
- 2008 39,000
- 2009 27,000
- …… ……
- 2014 57,000

Water Consumption Patterns:
“Running Annual Water Budgets”

CITY OF CLERMONT

ORDINANCE NO. 2010-11-C

DIVISION 1. ADMINISTRATION

Definitions:

(26) "Running Annual Water Budget" shall mean a water budget based on twelve (12) consecutive months of irrigation water consumption.

DIVISION 2. IRRIGATION

(6) All properties that receive water for landscape irrigation must have a separate landscape irrigation meter. The City shall establish a Running Annual Water Budget (RAWB) for each landscape irrigation customer based on property size, pervious area, and an annual landscape irrigation application rate of 35 inches.

September 28, 2010

St. Johns River
Water Management District

October 11, 2011

SUBJECT: City of Clermont
Consumptive Use Permit Number 2478

PERMIT CONDITIONS:

34. The permittee shall continue to implement… Running Annual Water Budgets (RAWBs)… require that customers… who receive water for landscape irrigation have a separate landscape irrigation meter and comply with the approved RAWB for their property. Properties that exceed the RAWB may be fined by the City. A report detailing the activities in this program must be included in the Water Conservation Plan summary.

ENVISION ALACHUA

A community discussion on the future of East County

CONVENED BY PLUM CREEK

SIGN UP for EMAIL UPDATES

INTERACTIVE PROPERTY MAP

Community Workshops

East County Educators Committee

Envision Alachua Process

Envision Alachua Task Force

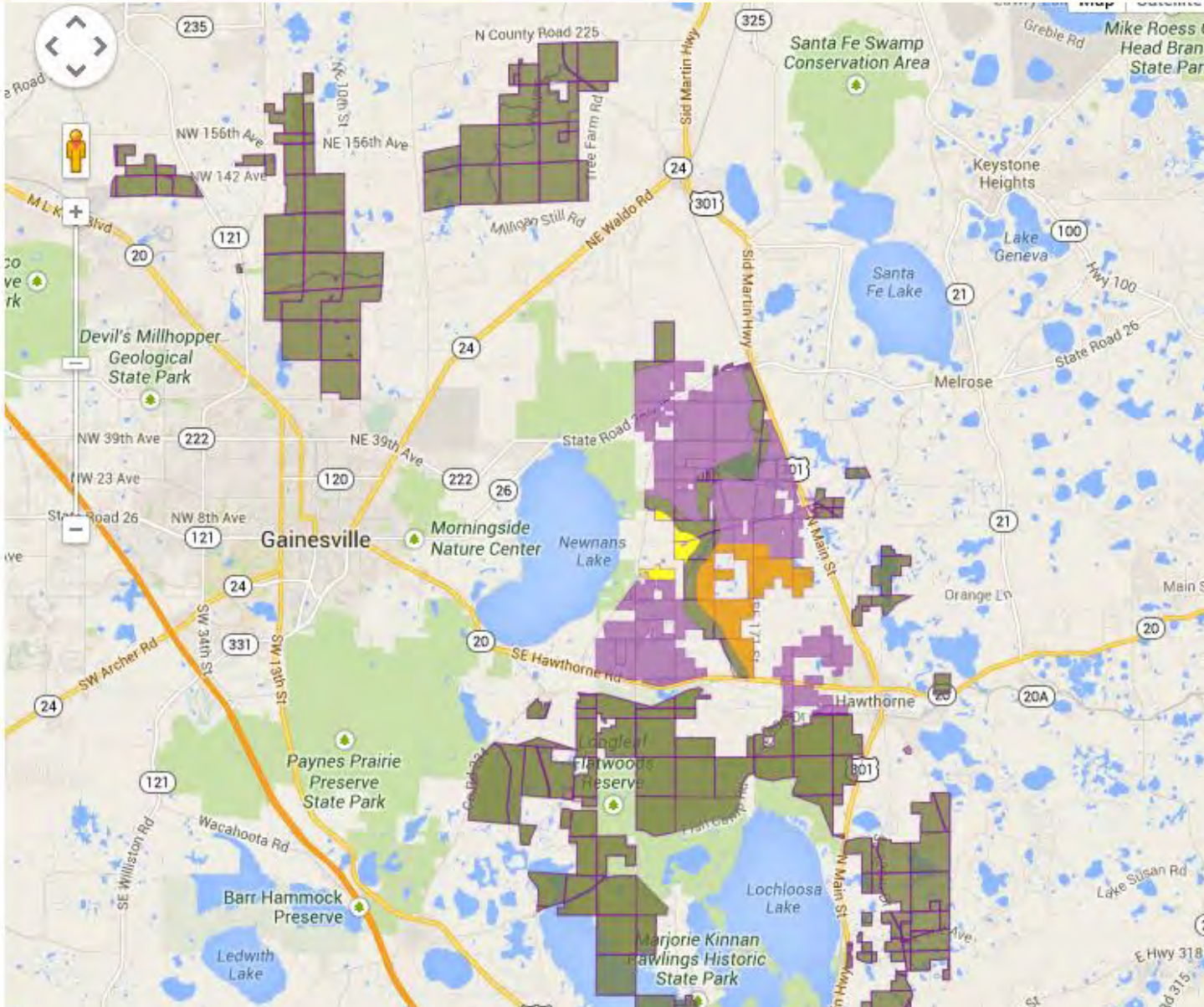
Envision Alachua Technical Advisory Group

Models of Innovation Series

Why Here? Why Now?

Request a Presentation

AWARDS AND RECOGNITION



Plum Creek Sector Plan

Objective 10.4.3 – Water Resource Protection

- **<u>Policy 10.4.3.1 Water Supply Strategy</u>**
- Residential lots… shall not be irrigated with potable water except for a limited period during the initial establishment of landscaping;
- The priority for the use of reclaimed water shall be given to environmental restoration projects, industrial users and agricultural users. Single family lots shall not receive reclaimed water;
- There shall be no individual wells for individual residences or businesses. All wells… shall be monitored as part of the utility system;