# A Case Study of Restoration: Quantifying Design Impacts

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UF UNIVERSITY of FLORIDA
IFAS Extension

## *Program for Resource Efficient Communities*

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

# *Florida Land Development:*

Context

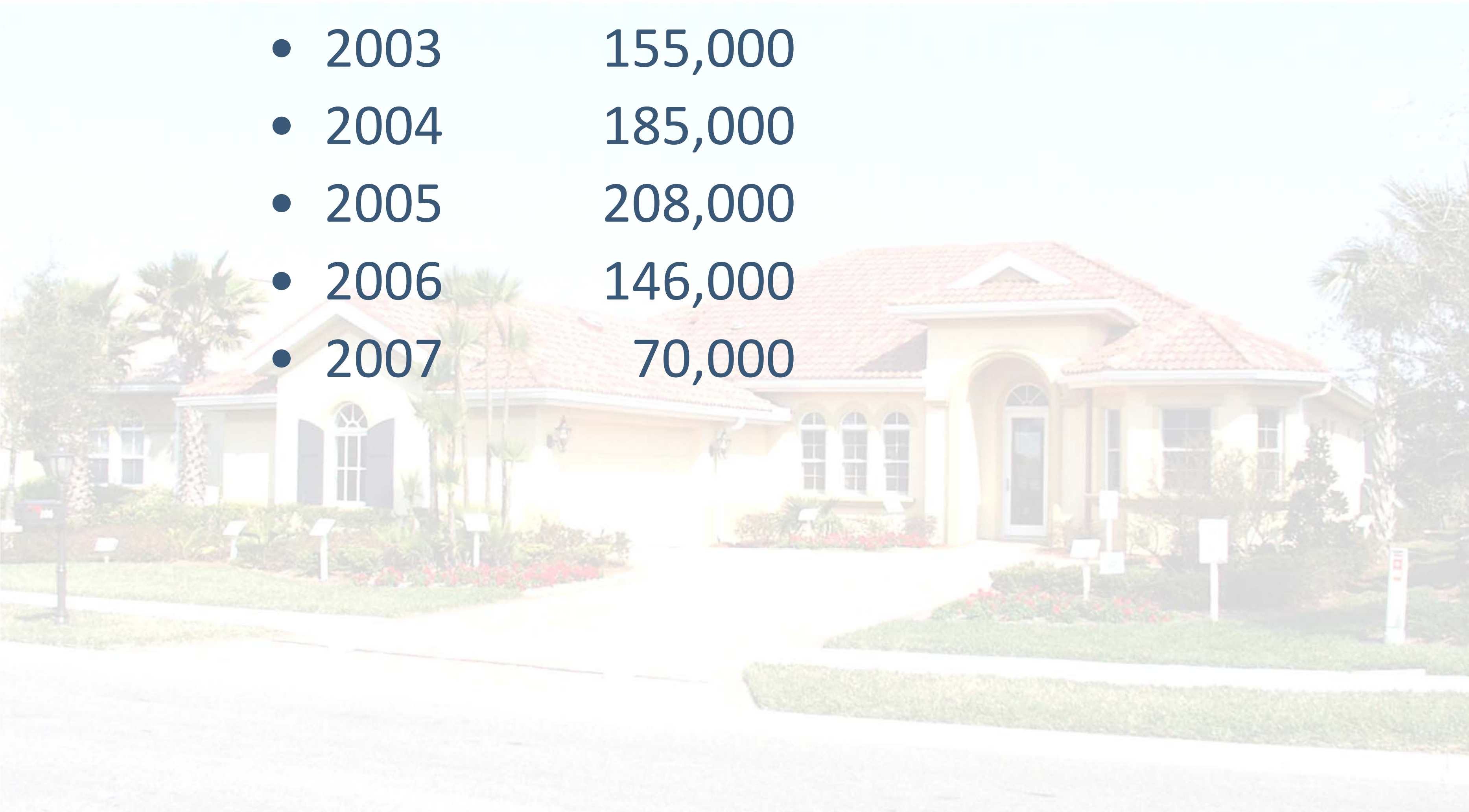
## *Florida Land Development*

### Population

- 1980 10,000,000
- 2005 17,000,000
- 2030 28,000,000

# *Florida Land Development*

## Building Permits: Single-Family Detached



- 2003 155,000
- 2004 185,000
- 2005 208,000
- 2006 146,000
- 2007 70,000

# Florida Land Development

*Florida Land Development:*

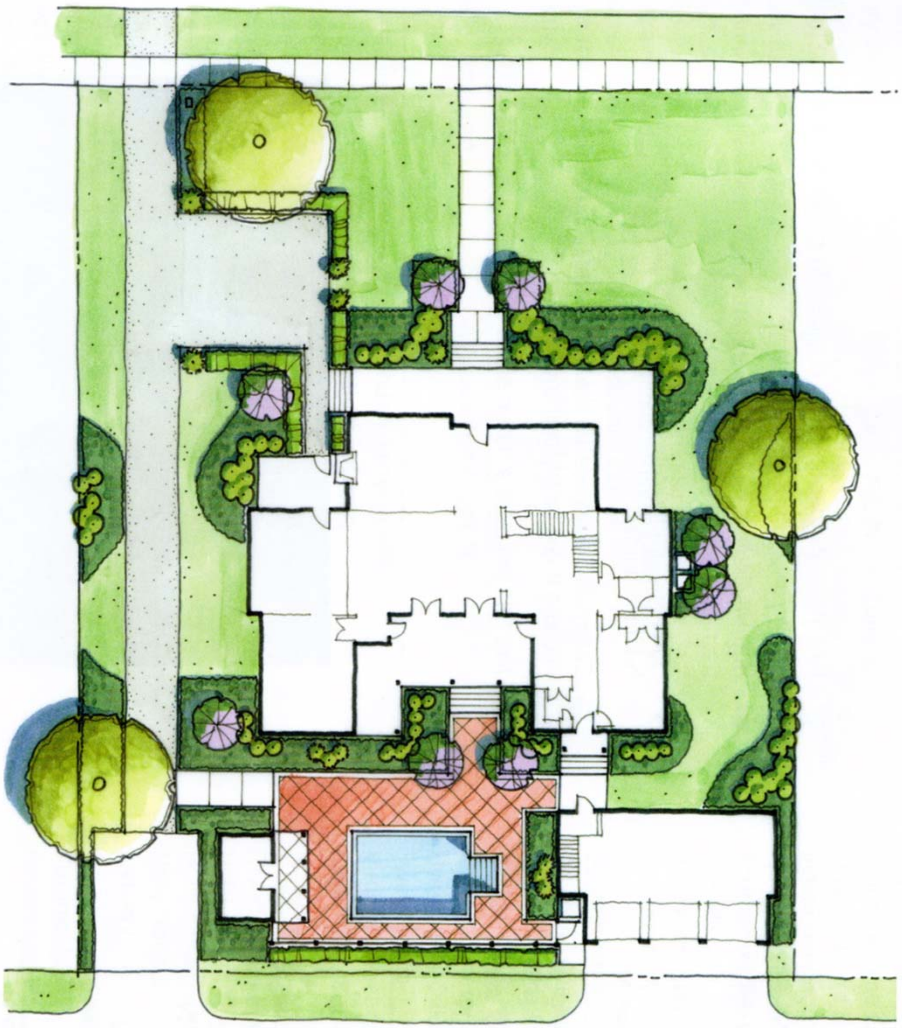
Current Conventional Practice

# *Florida Land Development*

## Oakland Park


# *Florida Land Development*

## Oakland Avenue Lot



| | |
|---|---|
| **FRONT YARD** | |
| Trees | minimum of 2 canopy trees and 2 accent trees |
| Shrubs | 20% minimum |
| Groundcover | 15% minimum |
| Turf | 60% maximum |
| **SIDE YARD** | |
| Trees | minimum of 1 canopy tree and 2 accent trees |
| Shrubs | 30% minimum |
| Groundcover | 0% minimum |
| Turf | 70% maximum |
| **ALLEY YARD** | |
| Shrubs | 30% minimum |
| Groundcover | 0% minimum |
| Turf | 70% maximum |

# *Florida Land Development*

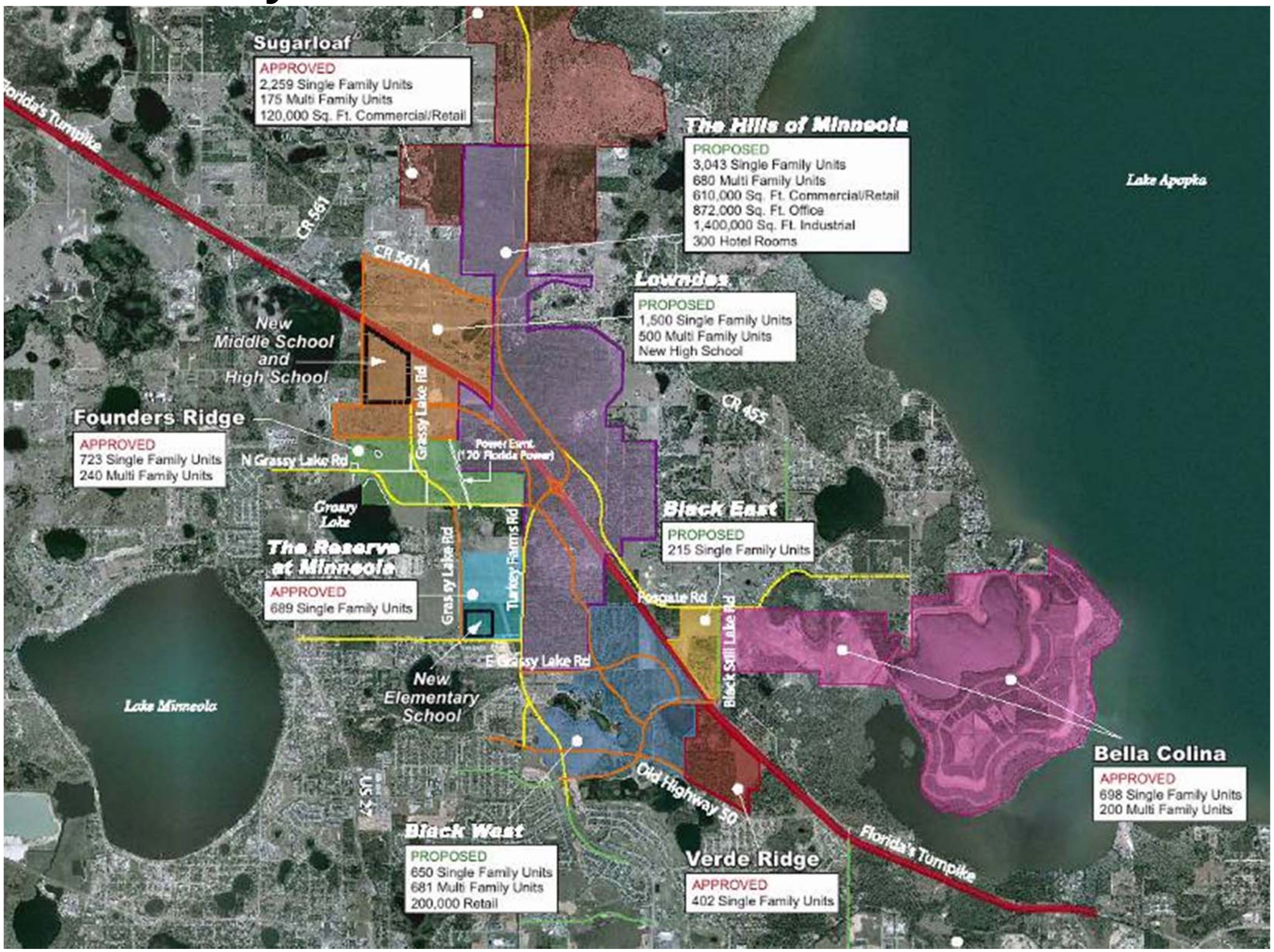
## Conventional Practice




# *Florida Land Development*
## Conventional Practice

# *Florida Land Development*

## Lake County



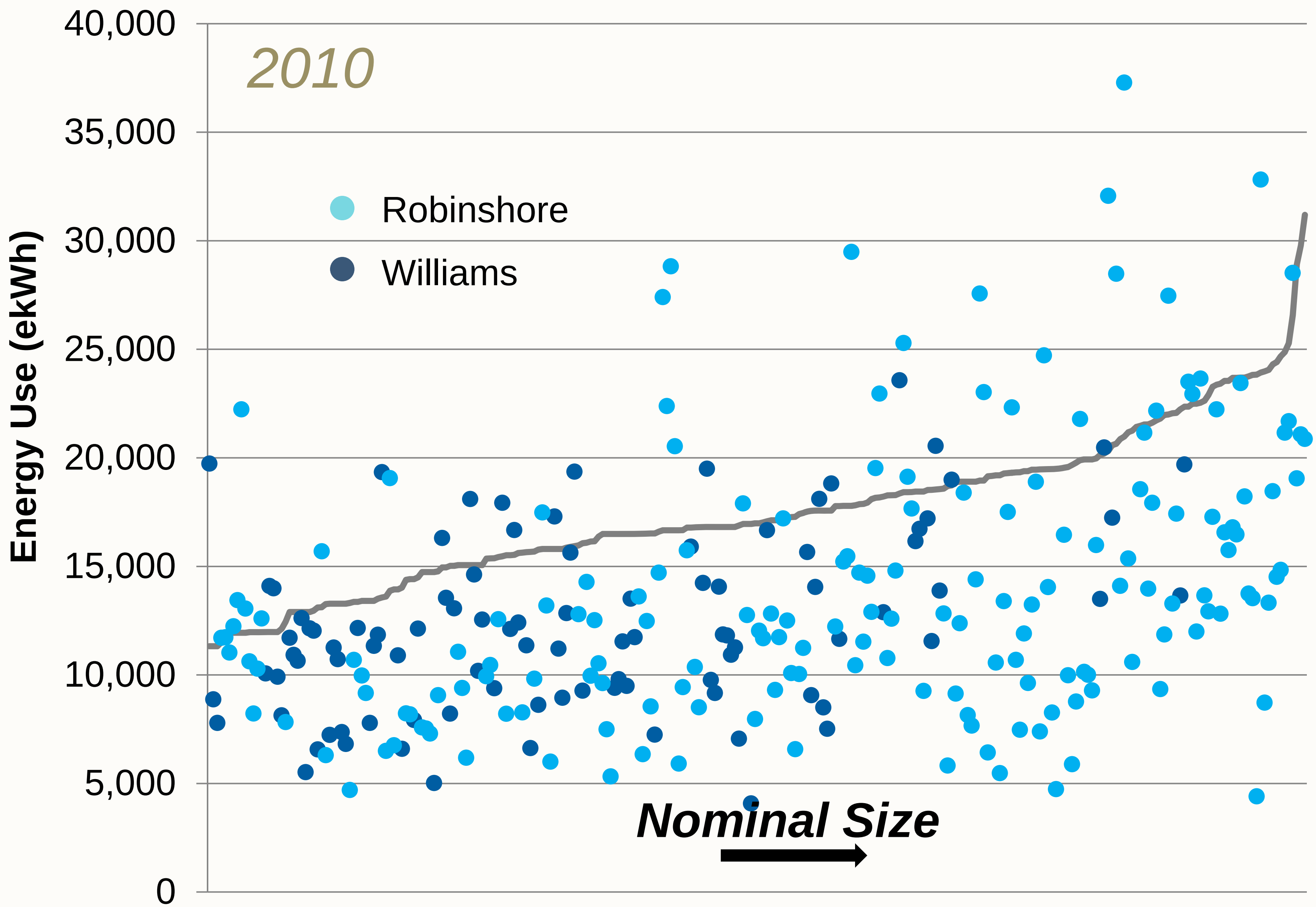
# *Development Impacts:*

Energy

# *Energy Supply*

## Longleaf - Alachua County

# Energy Supply



## *FPL and Progress Energy Again Asking To Pass Along Ghost-Nuke Plant Costs*

FlaglerLive | August 6, 2011

Florida Power & Light and Progress Energy Florida are seeking to pass along about $335 million in nuclear costs to customers next year. While a large chunk of the money would go toward upgrading already-existing nuclear plants, customers also would cover expenses for new plants that are not slated to start operating for at least another decade.

If the commission approves Progress' revised request for the Levy and Crystal River projects, residential customers in 2012 would pay about $4.66 a month for 1,000 kilowatt hours to cover the costs. The hearing comes at a time of heightened scrutiny of nuclear power, largely because of the recent earthquake triggered disaster at Japan's Fukushima plant.

*Development Impacts:*

Water Supply

SOUTH FLORIDA
THE BUSINESS JOURNAL
March 24-30, 2006 • $2.50 southflorida.bizjournals.com Broward Edition

# Water woes hit development

**EDITOR'S NOTE:** *This is the first in a series examining how the region's drinking water is running low.*

BY SUSAN STABLEY

South Florida has run out of natural sources of drinking water and will likely experience halted development due to the problem.

Major real estate projects in the tri-county area must be curbed until alternative sources of water can be developed, according to the state. Already, it has told Miami-Dade County to reject 17 large-scale projects because of drinking water scarcity.

And the creation of alternative water sources will not happen soon. The work will cost of hundreds of millions of dollars and can take decades to complete, according to estimates from regional and local water officials.

"For us to go back into a built environment is a very expensive proposition," said Doug Yoder, assistant director of Miami-Dade County's water and sewer department.

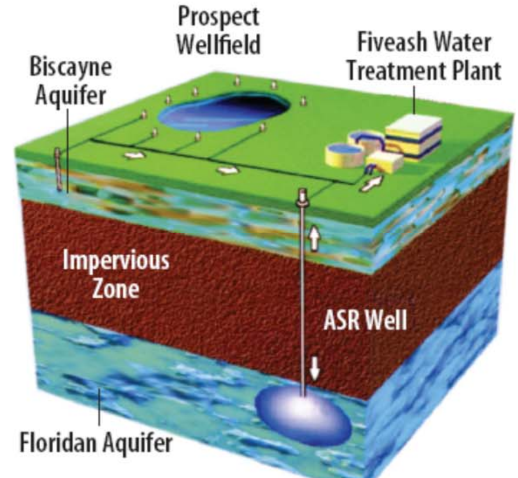
Last week, Gov. Jeb Bush vowed to make South Florida confront its water issues before the state will approve any more large projects.

"It makes no sense to develop west and west and west without the adequate development of infrastructure and water supply," Bush said at the Urban Land Institute's Symposium on Regional Cooperation on March 17.

See **WATER,** Page 62

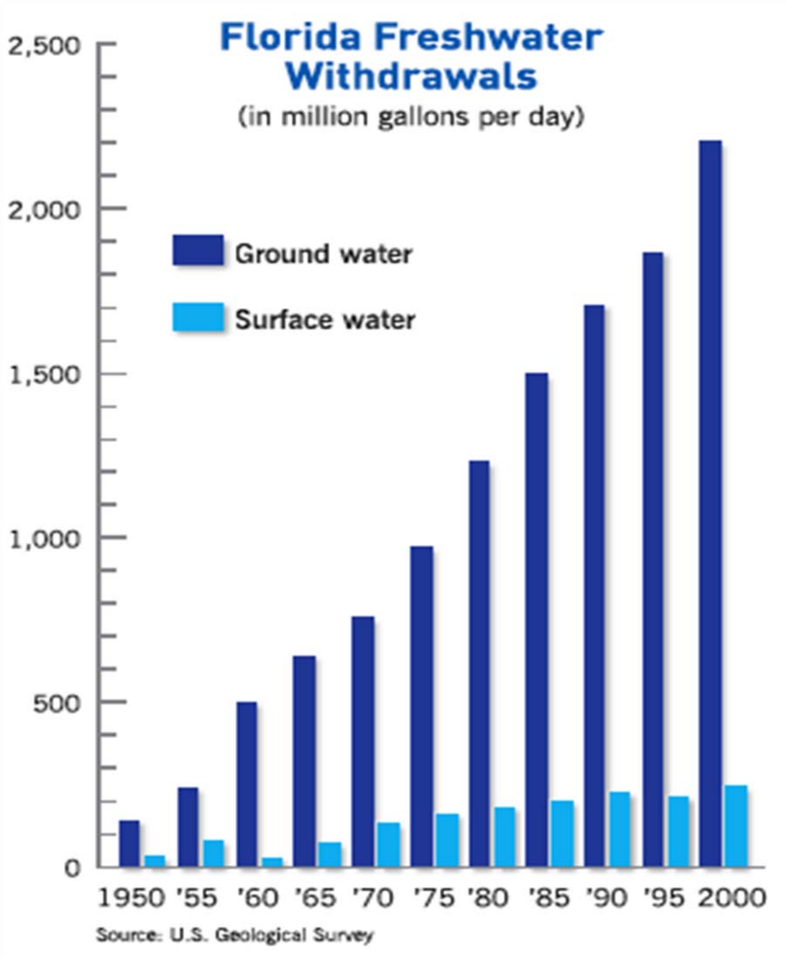
## POTENTIAL SOLUTION

Fort Lauderdale is pumping water into the saltier Floridan Aquifer, where it forms a freshwater bubble that can be tapped in times of drought.




Source: City of Fort Lauderdale Public Services Department

# Water Supply




Tampa Bay Water Desalinization Facility

# *Florida Land Development*

## Conventional Practice


St. Petersburg Times

# Man jailed for brown lawn gets help from neighbors

By Erin Sullivan, Times Staff Writer
In print: Monday, October 13, 2008

BAYONET POINT — "He's in prison for God knows how long because we can't afford to sod the lawn," said his sobbing daughter, Jennifer Lehr.

Prudente has owned a home in the deed restricted community since 1998. The covenants require homeowners to keep their lawns covered with grass.


*Free from jail, Joseph Prudente, 66, inspects his new lawn with pride Sunday. Prudente, who says he barely has enough to pay the mortgage, was jailed for having a brown lawn.*

St. Petersburg Times

# Swiftmud says old sod can't be replaced

Marlene Sokol, Times Staff Writer
In Print: Saturday, November 22, 2008

Homeowner, get used to that sickly looking lawn. Local water managers are saying not to resod until summer. That means no sheets of green turf off a flatbed.

*Baldomero Moreno, left, and Erasto Osoric, who work for Curasod, lay sod Friday at a new home in Wesley Chapel.*

"Anything that causes you to need more water is unacceptable," said Robyn Felix, Southwest Florida Water Management District spokeswoman .

The agency's order, issued more than three weeks ago, has created confusion for local government, an enforcement issue for homeowner associations, and panic among small businesses that install turf.

St. Petersburg Times

# Tampa Bay Water makes last withdrawal from tapped out reservoir

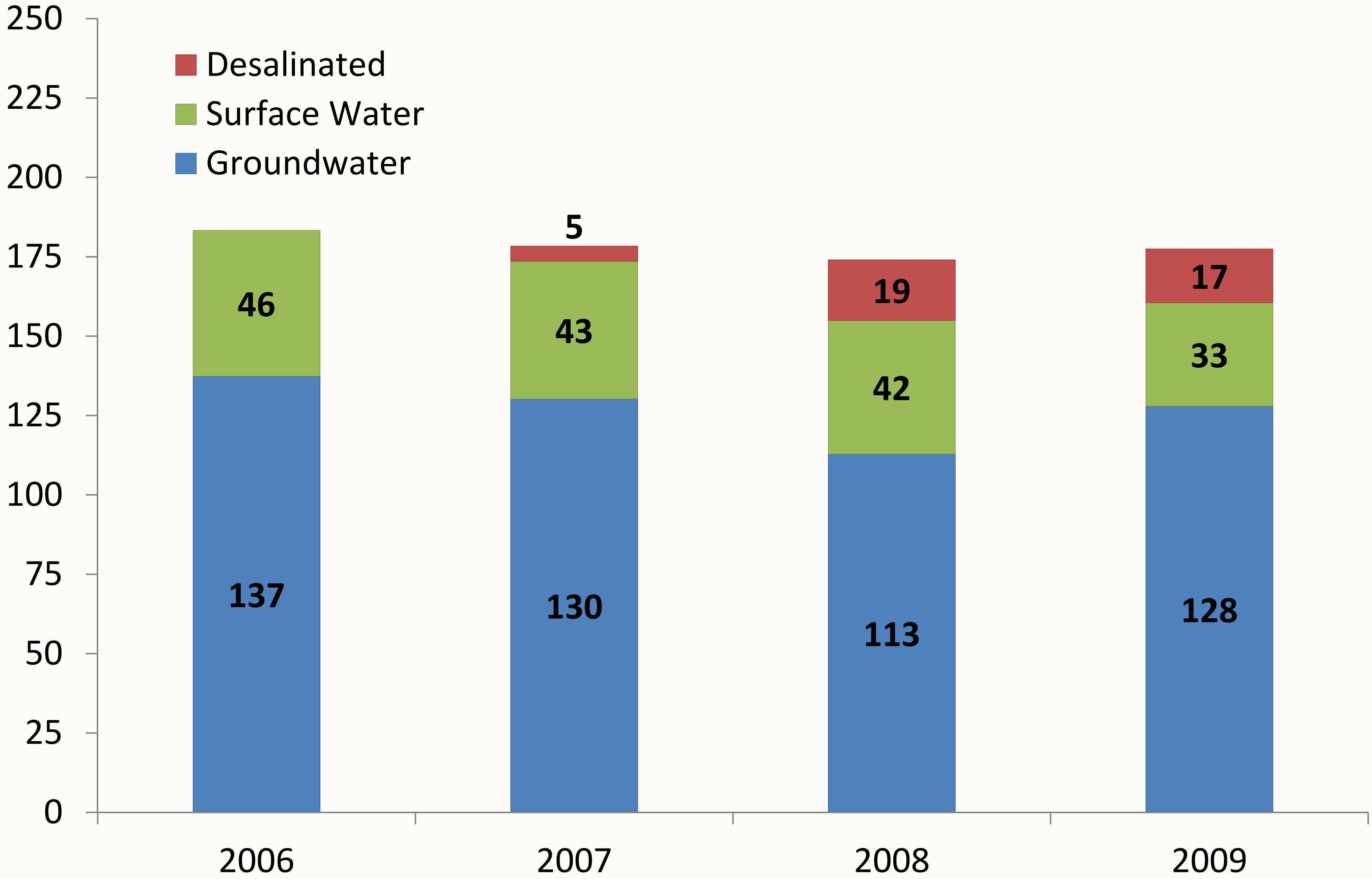
*By Craig Pittman, Times Staff Writer*
*In Print: Saturday, March 14, 2009*

Get used to having a brown lawn for a while. As of this week, Tampa Bay Water has virtually drained its 15 billion-gallon reservoir.

From now until the summer rainy season, it must rely on its two remaining sources of water: its sometimes troubled desalination plant and the dwindling supply in the underground aquifer. "It's going to be a long couple of months waiting for the rainy season," Tampa Bay Water spokeswoman Michelle Robinson said Friday.

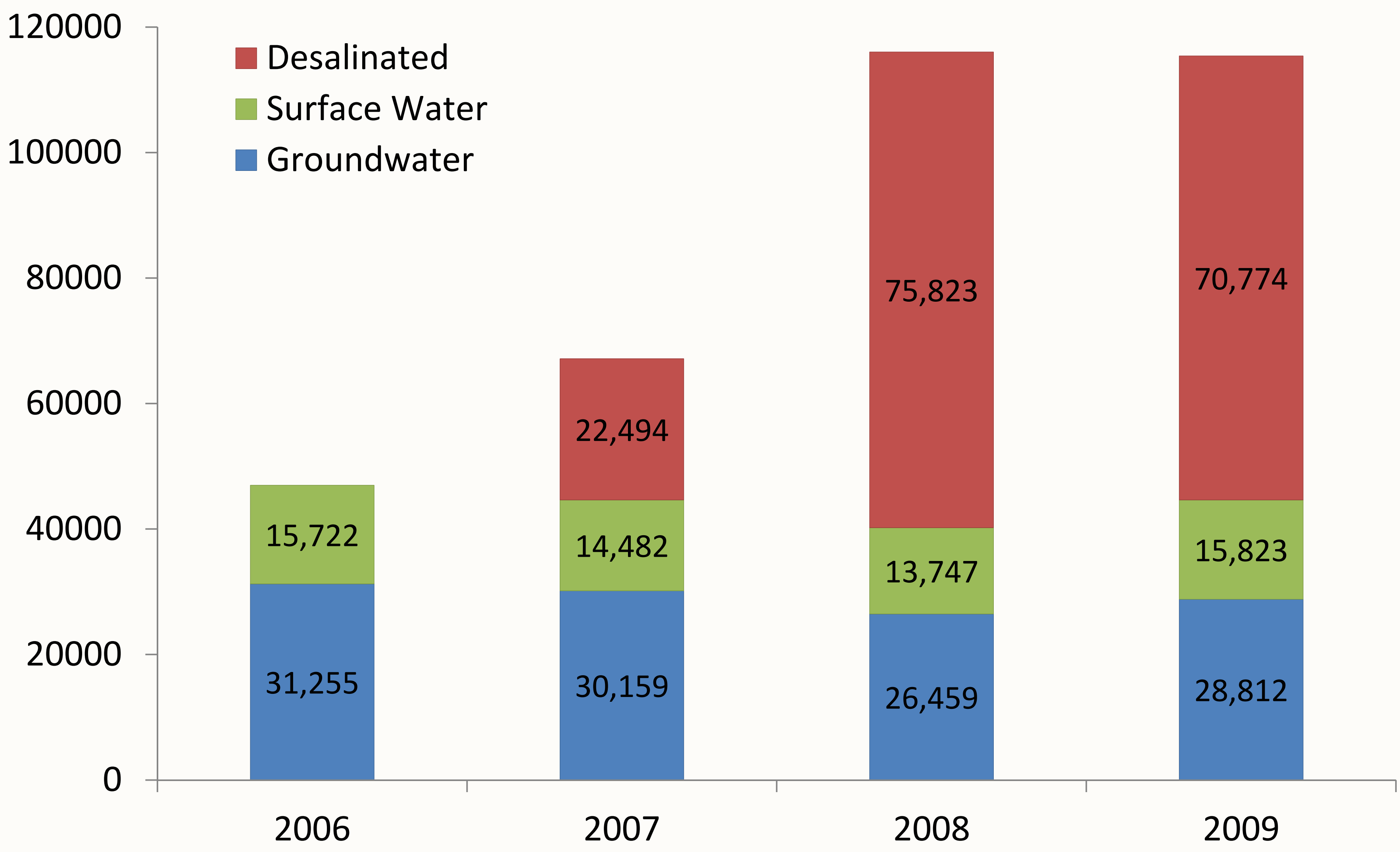
*Water Supply*

# TBW Annual Production by Supply Type (MGD)



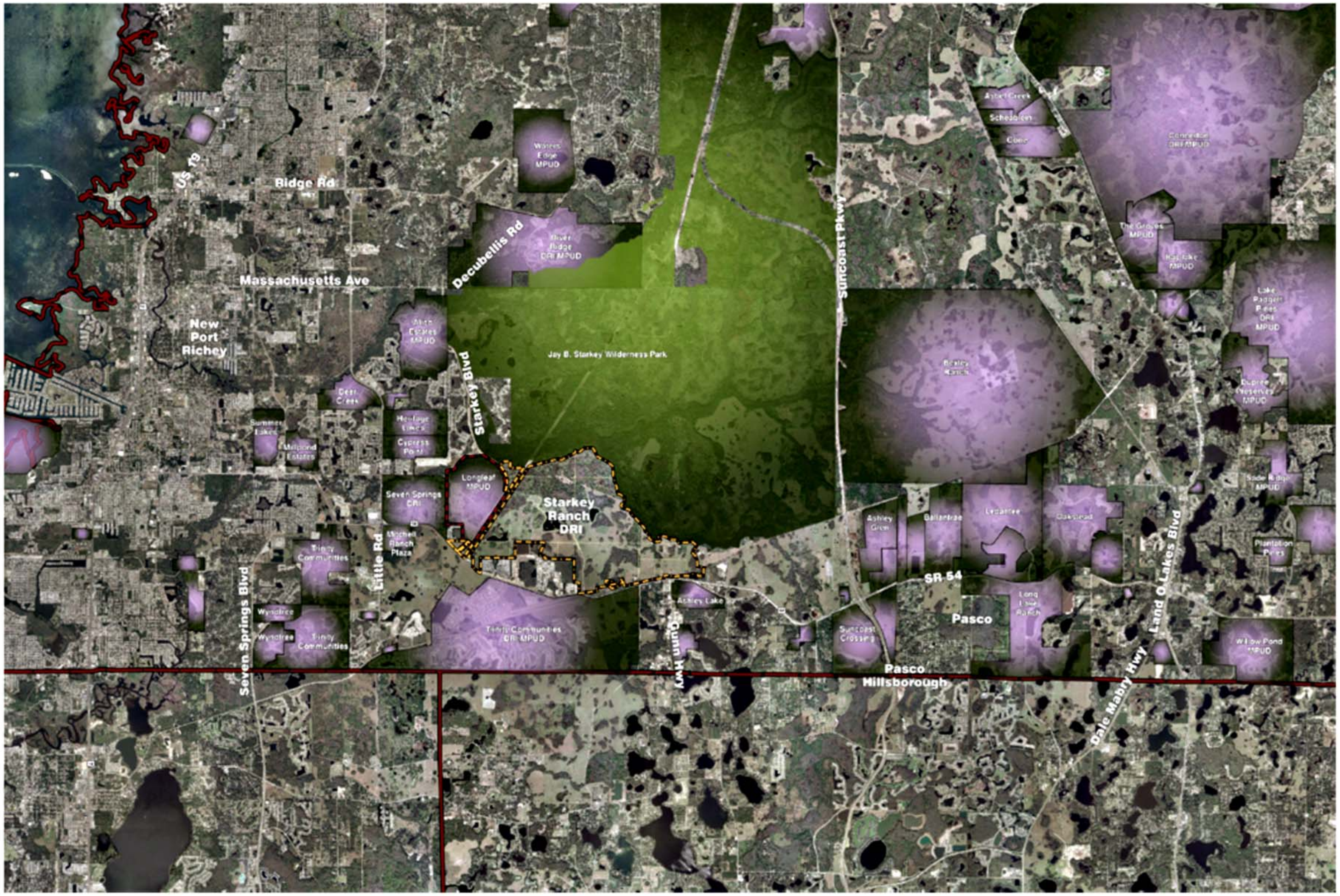
*Water Supply*

# TBW Carbon Footprint by Supply Type (mtons $CO_2e$)



# *Water Supply*

## Pasco County



# *Development Impacts:*

Water Quality

POLICYFORUM

# Controlling Eutrophication: Nitrogen and Phosphorus

Daniel J. Conley, Hans W. Paerl, Robert W. Howarth, Donald F. Boesch, Sybil P. Seitzinger, Karl E. Havens, Christiane Lancelot, Gene E. Likens

The need to reduce anthropogenic nutrient inputs to aquatic ecosystems in order to protect drinking water supplies and to reduce eutrophication, including the proliferation of harmful algal blooms and “dead zones” in coastal marine eco-systems has been widely recognized. …a cascading set of consequences has been set in motion, arising from massive increases in fixed N additions to the biosphere, largely through the production of fertilizers and increases in fossil fuel emissions. P levels have also significantly increased because of fertilizer use, as well as from wastewater.

20 FEBRUARY2009 VOL 323 **SCIENCE** www.sciencemag.org
*Published by AAAS*

# *Water Quality*

## St Johns River

Microcystis Bloom - St. Johns River mid-channel south of the Buckman Bridge - 08.19.05 - 2:04pm



Microcystis Bloom - East bank of the St. Johns River - Mandarin - 08.19.05 - 2:42pm

*Water Quality*

## 2005 Fertilizer Consumption (Tons/yr):

| | |
|---|---|
| • Clay | 1,190 |
| • Nassau | 1,540 |
| • Duval | 3,970 |
| • St Johns | 22,780 |

## *Water Quality*

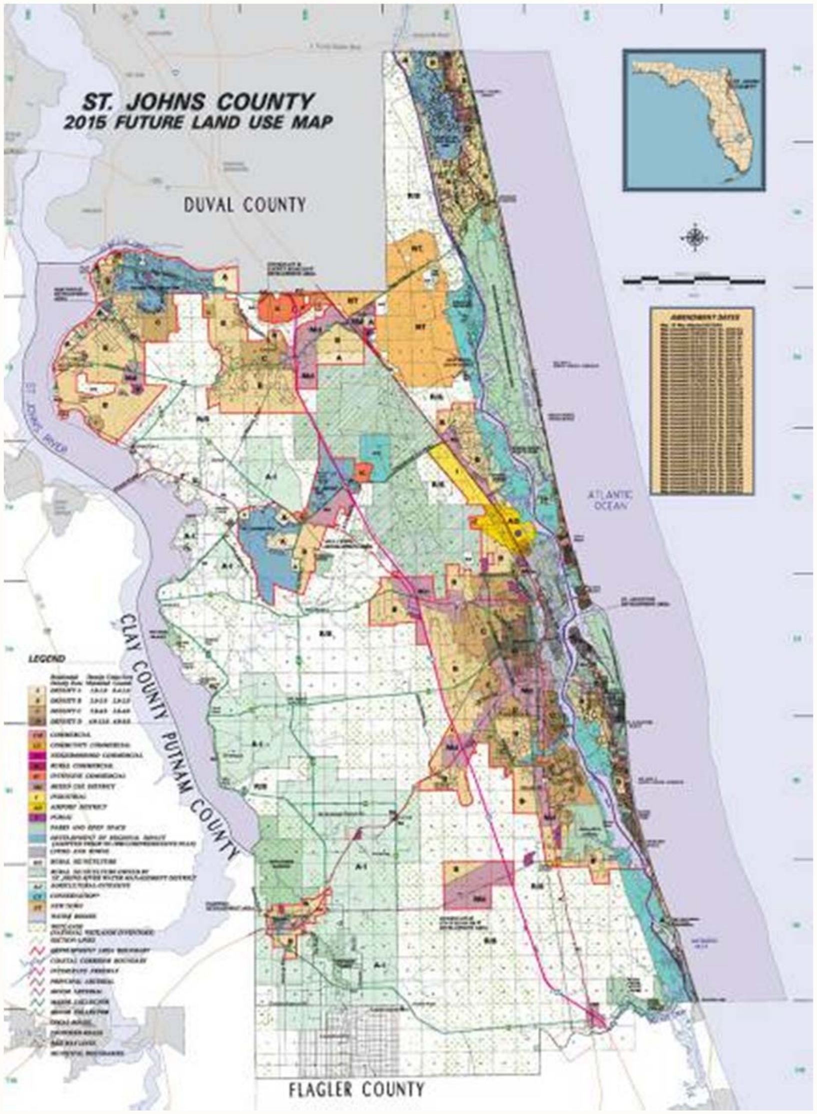
# 2005 Fertilizer Consumption (Tons/yr):

| | | |
|---|---|---|
| • Clay | 1,190 | 5,230 |
| • Nassau | 1,540 | 2,040 |
| • Duval | 3,970 | 23,500 |
| • St Johns | 22,780 | 3,480 |

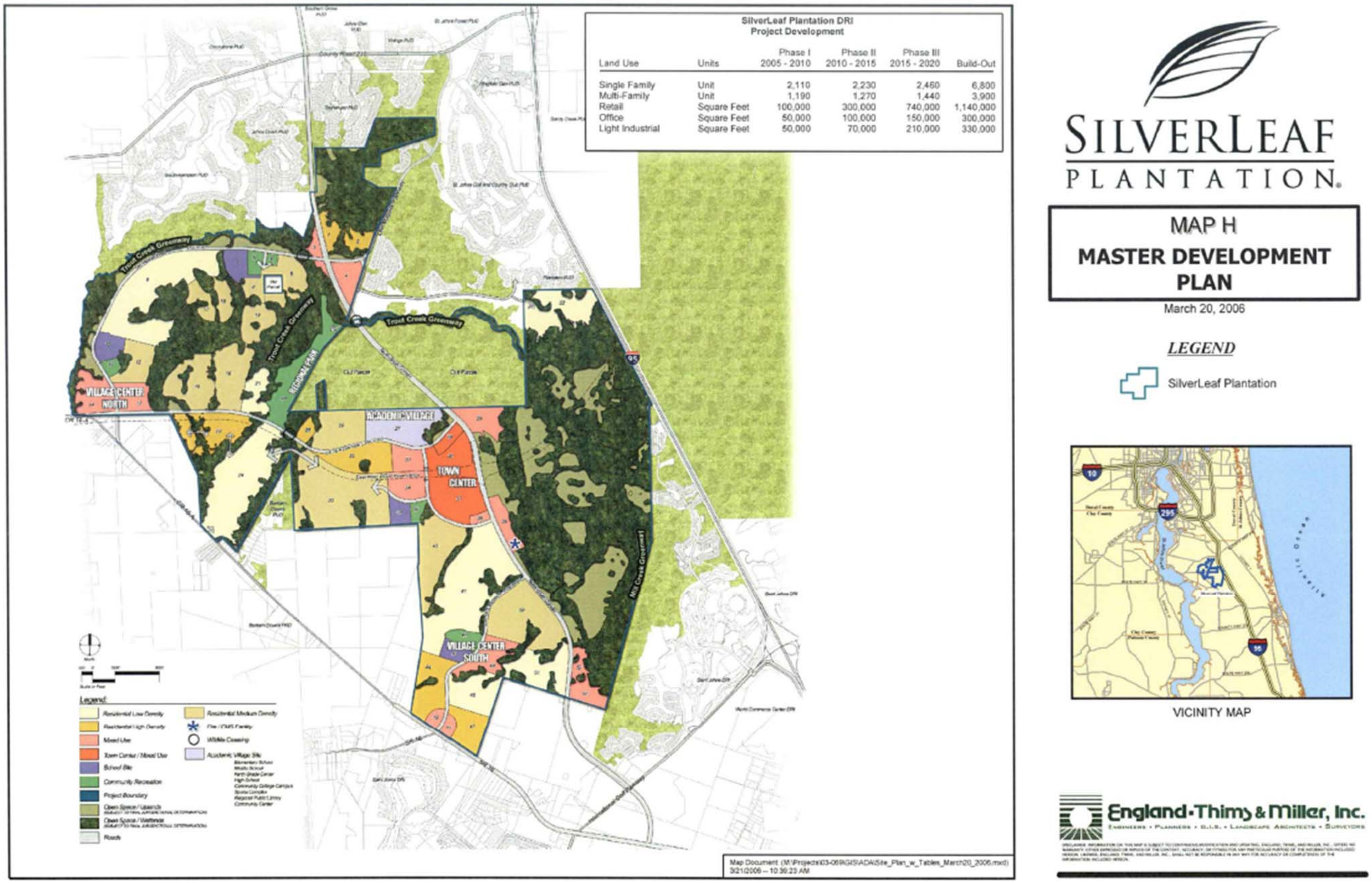
# *Florida Land Development*

## Conventional Practice


# Water Quality

# Water Quality




SilverLeaf Plantation DRI Project Development

| Land Use | Units | Phase I 2005 - 2010 | Phase II 2010 - 2015 | Phase III 2015 - 2020 | Build-Out |
|---|---|---|---|---|---|
| Single Family | Unit | 2,110 | 2,230 | 2,460 | 6,800 |
| Multi-Family | Unit | 1,190 | 1,270 | 1,440 | 3,900 |
| Retail | Square Feet | 100,000 | 300,000 | 740,000 | 1,140,000 |
| Office | Square Feet | 50,000 | 100,000 | 150,000 | 300,000 |
| Light Industrial | Square Feet | 50,000 | 70,000 | 210,000 | 330,000 |

# *Water Quality*

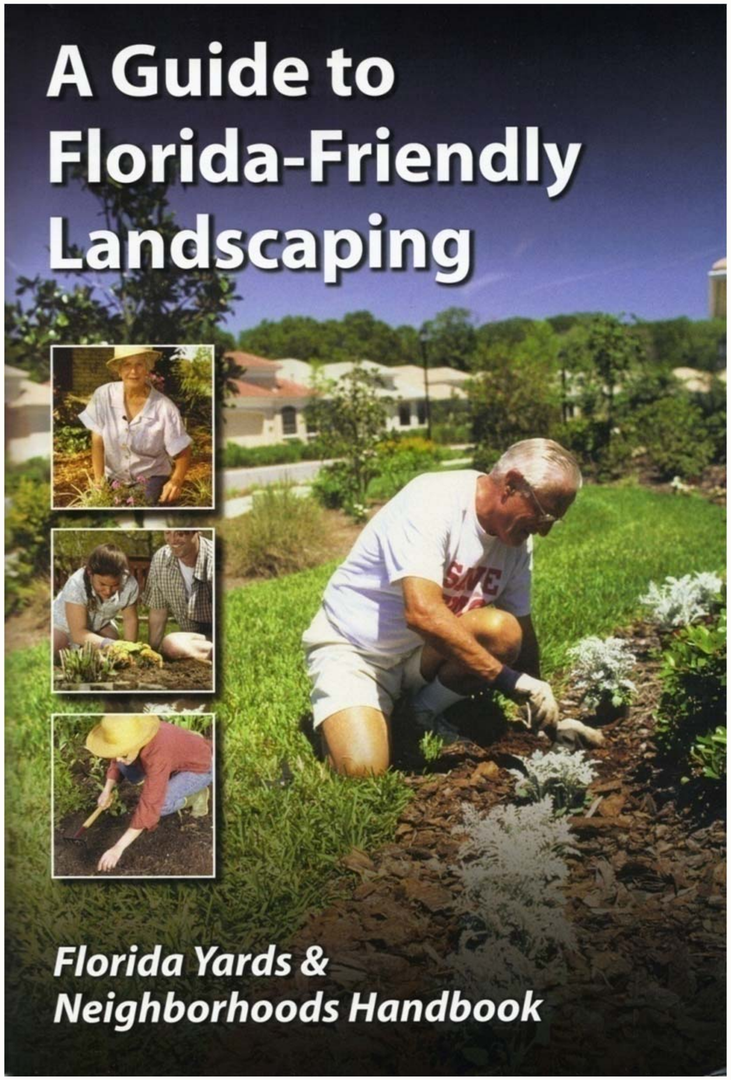


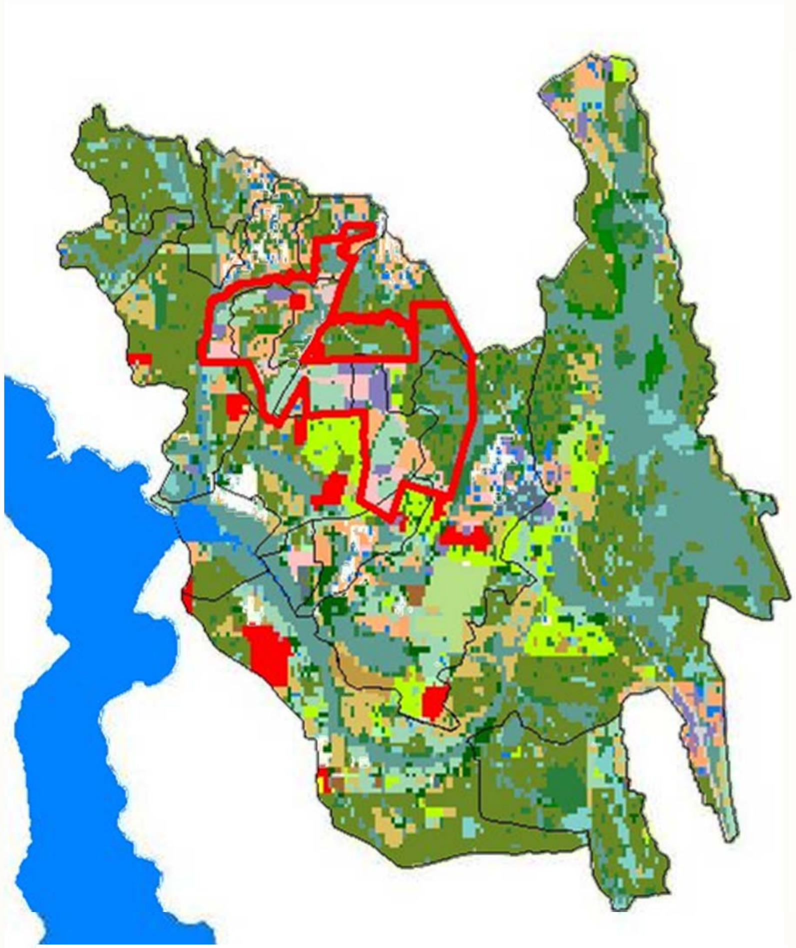

Table 2. Fertilization Guidelines for Established Turfgrass Lawns in Three Regions of Florida

| | Nitrogen recommendations (lbs N/1000 ft$^2$/year)* | | |
|---|---|---|---|
| **Species** | **North** | **Central** | **South** |
| Bahiagrass | 2-3 | 2-4 | 2-4 |
| Bermudagrass | 3-5 | 4-6 | 5-7 |
| Centipedegrass | 1-2 | 2-3 | 2-3 |
| St. Augustinegrass | 2-4 | 2-5 | 4-6 |
| Zoysiagrass | 3-5 | 3-6 | 4-6 |

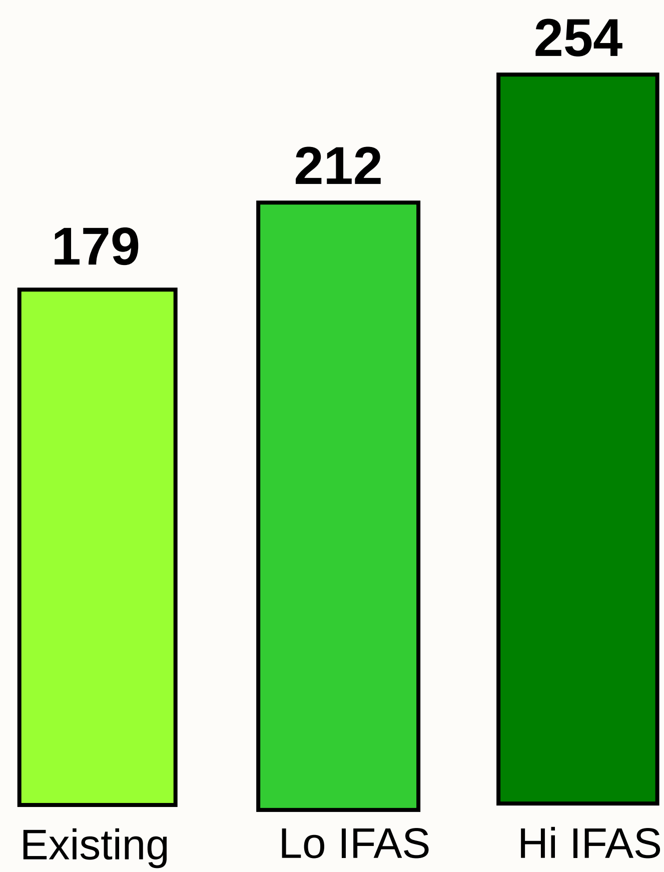
* Homeowner preferences for lawn quality and maintenance will vary, so the UF Turfgrass Science program recommends a range of fertility rates for each grass species and location. Also, effects within a localized region (for instance, shade, drought, soil conditions and irrigation) will require using a range of fertility rates. FYN generally recommends applying no more than the lowest of the recommended fertilizer ranges. These recommendations assume that grass clippings are recycled.

*Water Quality*

## Sixmile Creek Watershed



Simulated Development




Nitrogen Load (tons/year)

Coniferous Plantations   Improved Pasture   Medium Density Residential

# *Development Impacts:*

## Landscaping

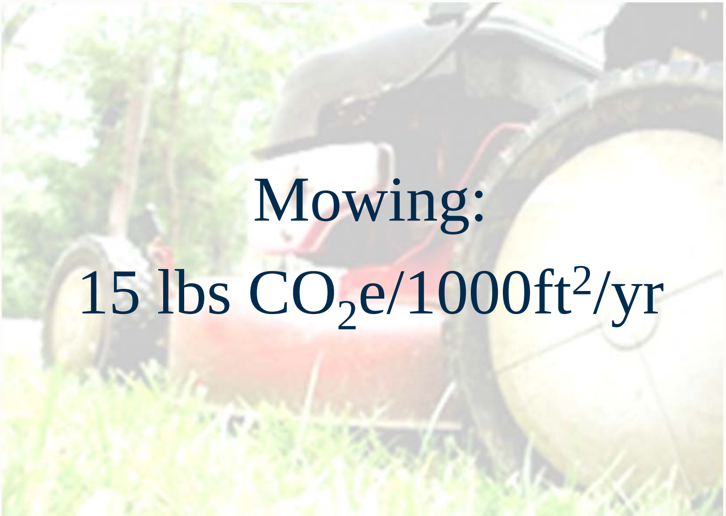
# *Landscaping Impacts*

## Conventional Practice



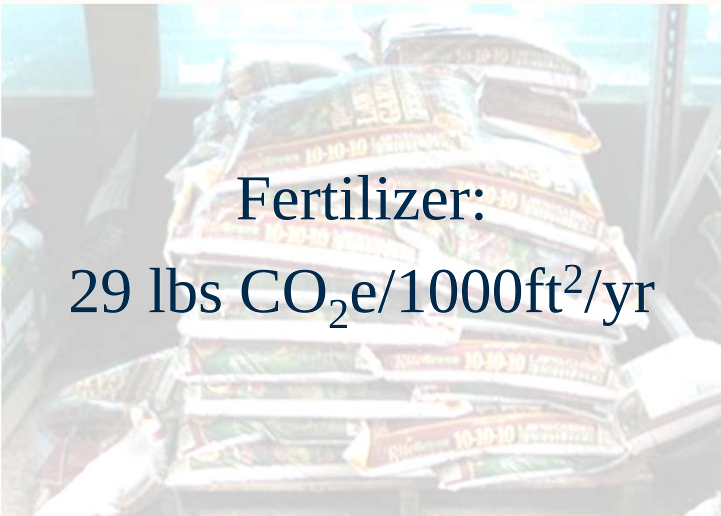
*Landscaping Impacts*

## Greenhouse Gas Accounting (Groundwater)



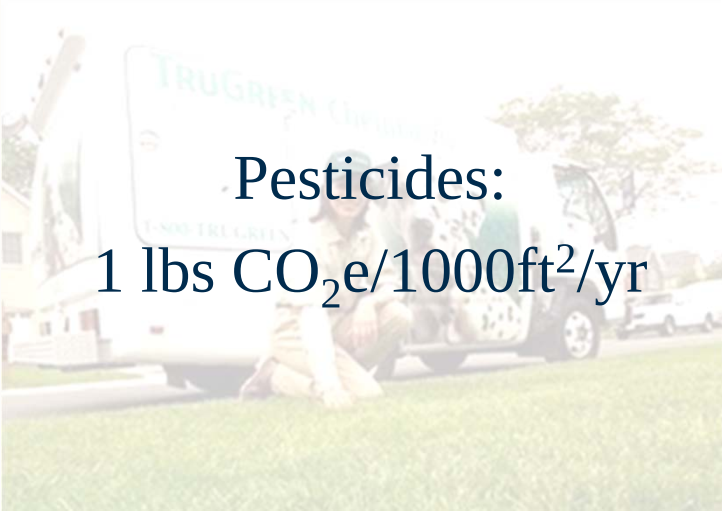
Mowing:

15 lbs $CO_2$e/1000ft$^2$/yr



Fertilizer:

29 lbs $CO_2$e/1000ft$^2$/yr



Pesticides:

1 lbs $CO_2$e/1000ft$^2$/yr

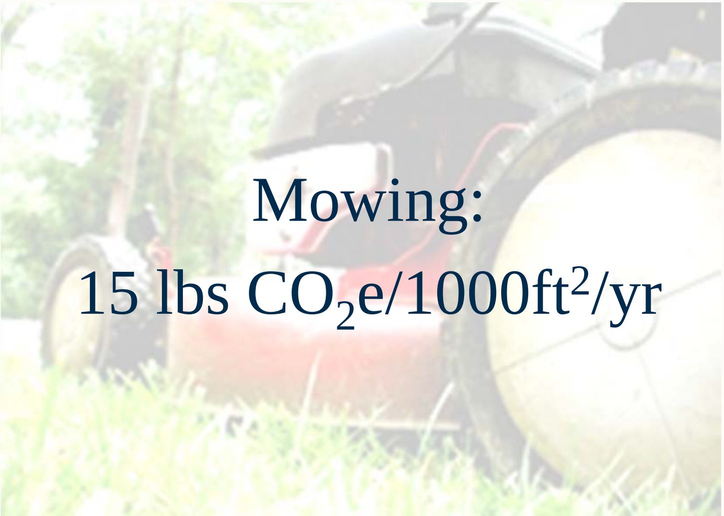
Irrigation:

34 lbs $CO_2$e/1000ft$^2$/yr

(Groundwater)

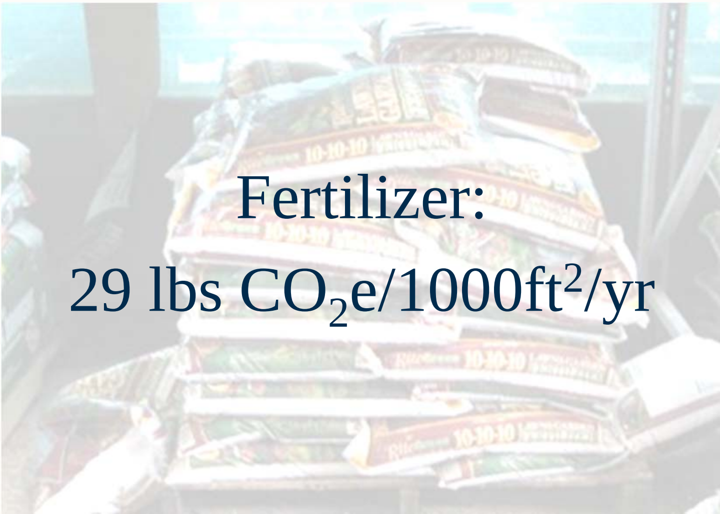
# *Landscaping Impacts*

## Greenhouse Gas Accounting (Desal)



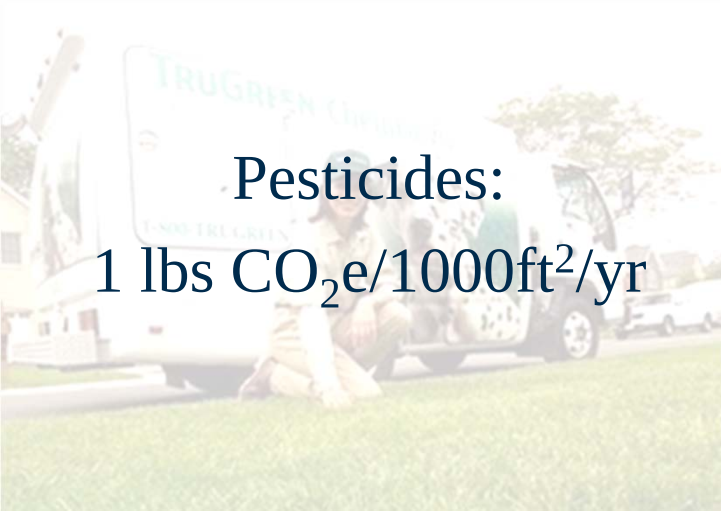
Mowing:

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



Fertilizer:

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



Pesticides:

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

Irrigation:

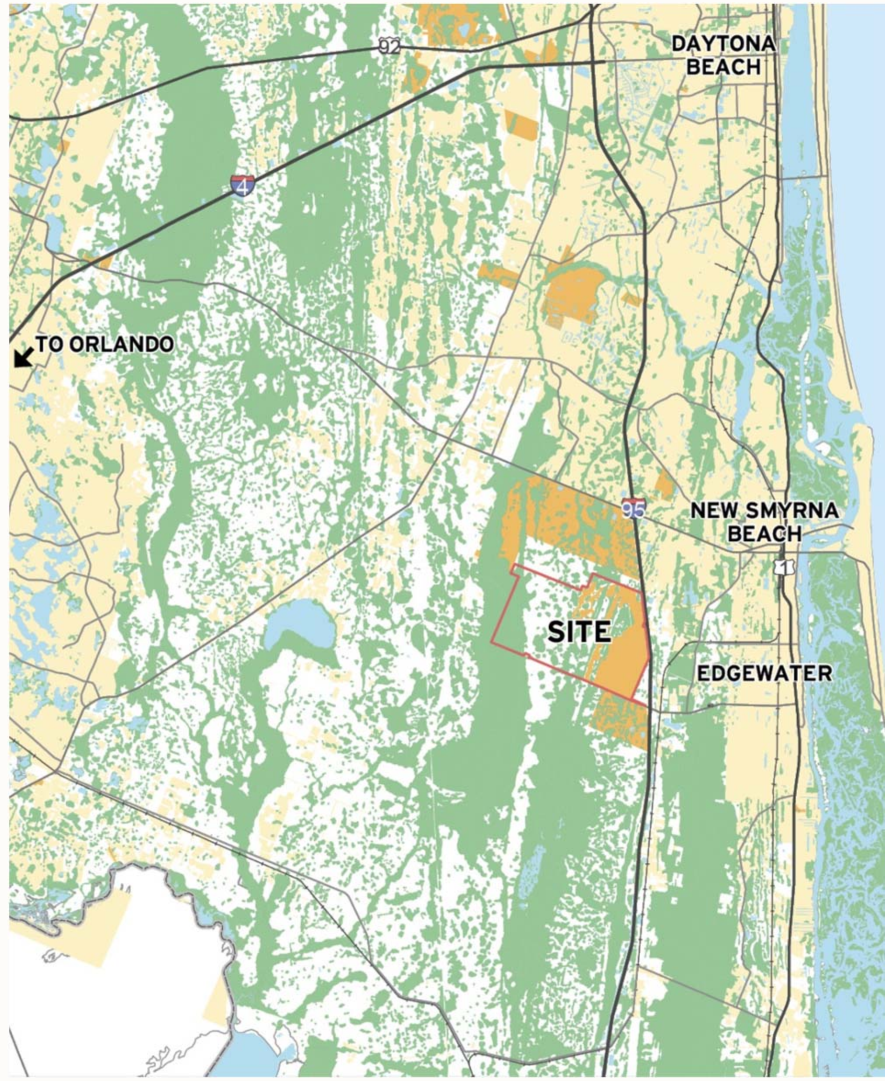
579 lbs $CO_2e/1000ft^2/yr$

(Desal)

# *Restoration's Two Designs*

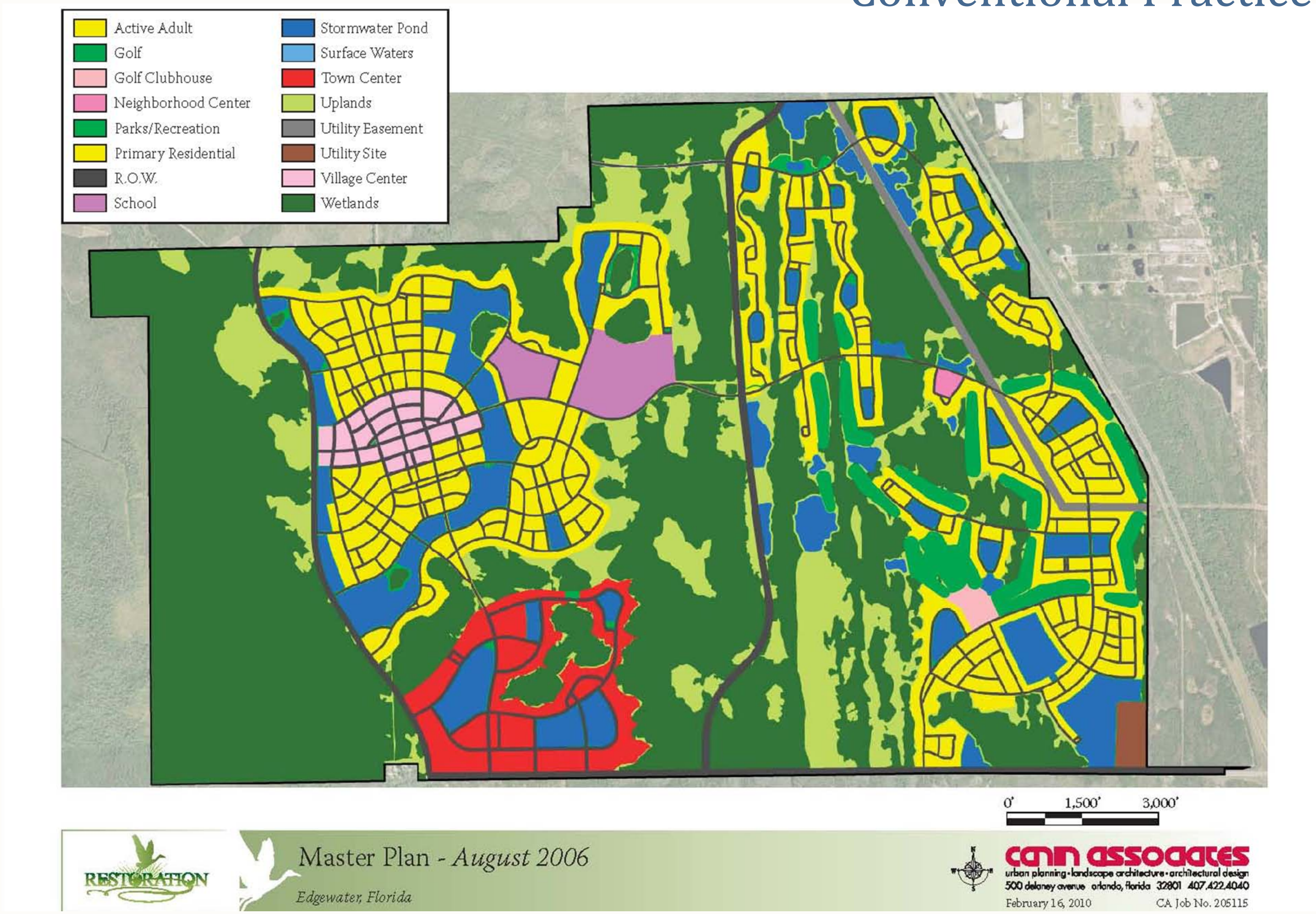
# *Restoration Case Study*

- 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.



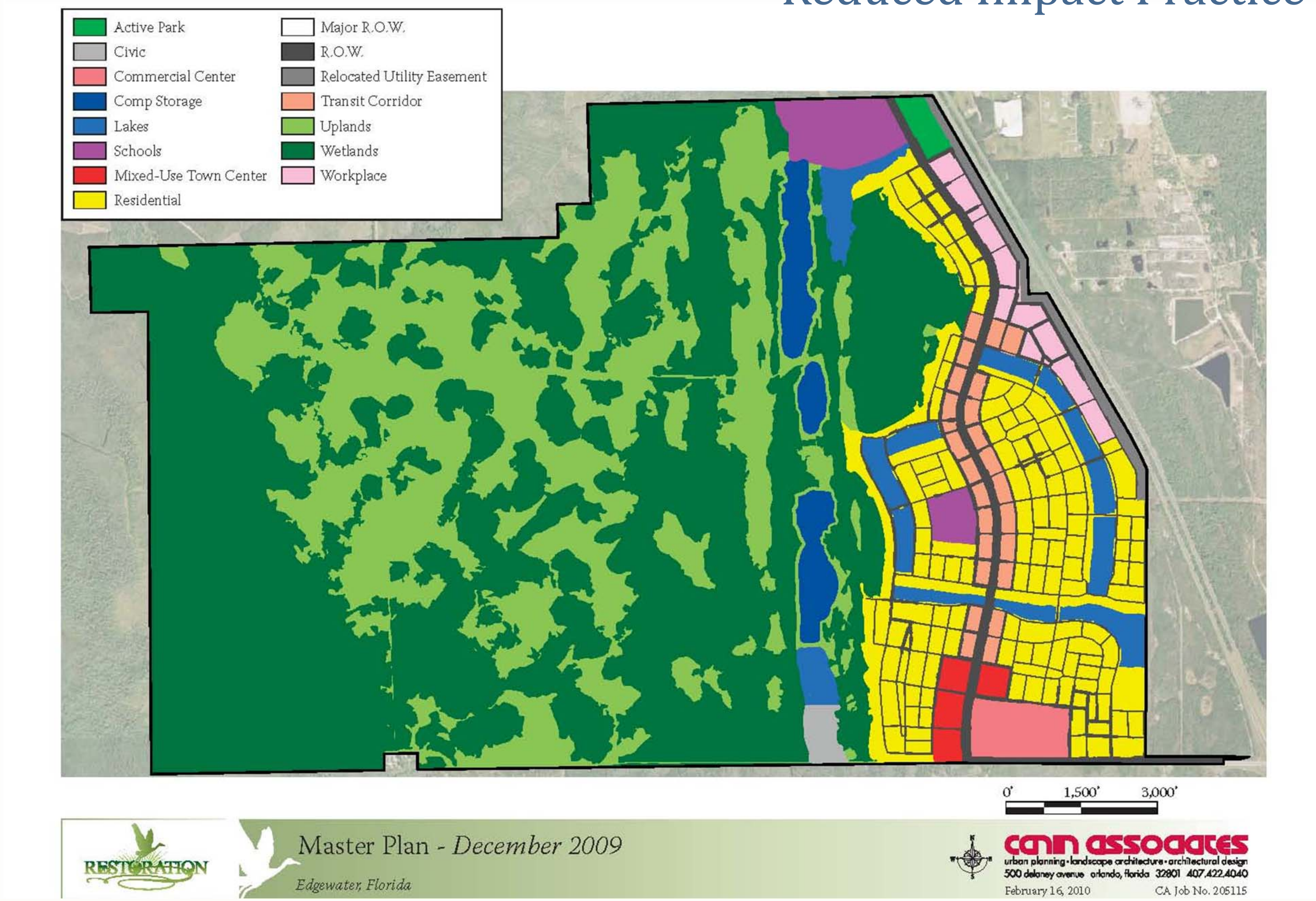
# Restoration 2006

## Conventional Practice



# Restoration 2009

## Reduced Impact Practice



## *Restoration's Two Designs - Comparison*

### Summary

| | |
|---|---|
| • Natural lands preserved | 34% more and all contiguous |
| • Density increased | 2.6 to 6.0 units per acre |
| • Natural/developed area edges | 15 miles less |
| • Average internal trip length | 1.37 miles less/trip |
| • Trips captured on-site | 150% more |
| • Vehicle Miles Traveled (VMT) | 41% reduction |
| • Impervious roadway surface | 42% less |

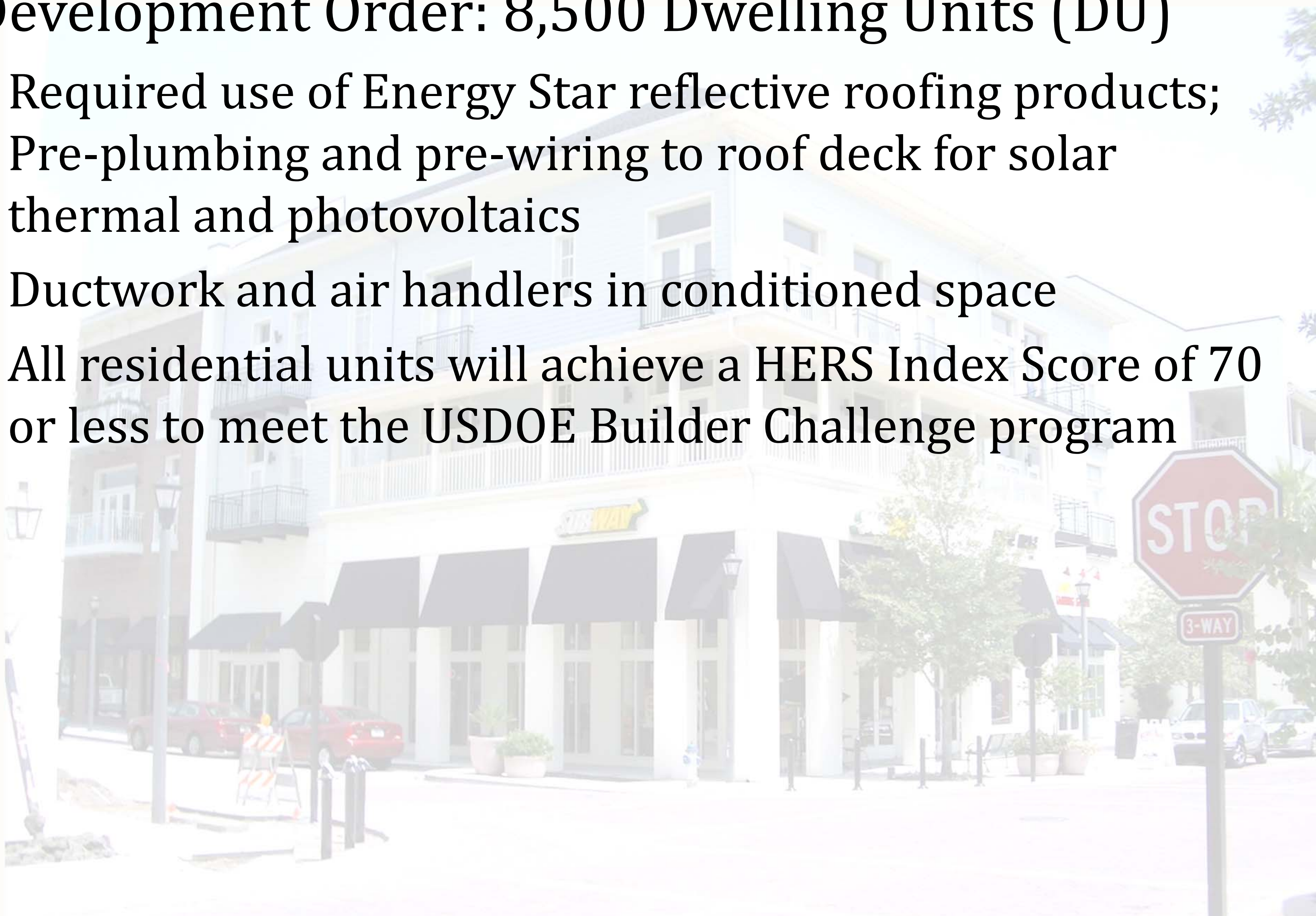
*Quantifying Performance:*

Housing

# *Restoration's Two Designs - Housing*

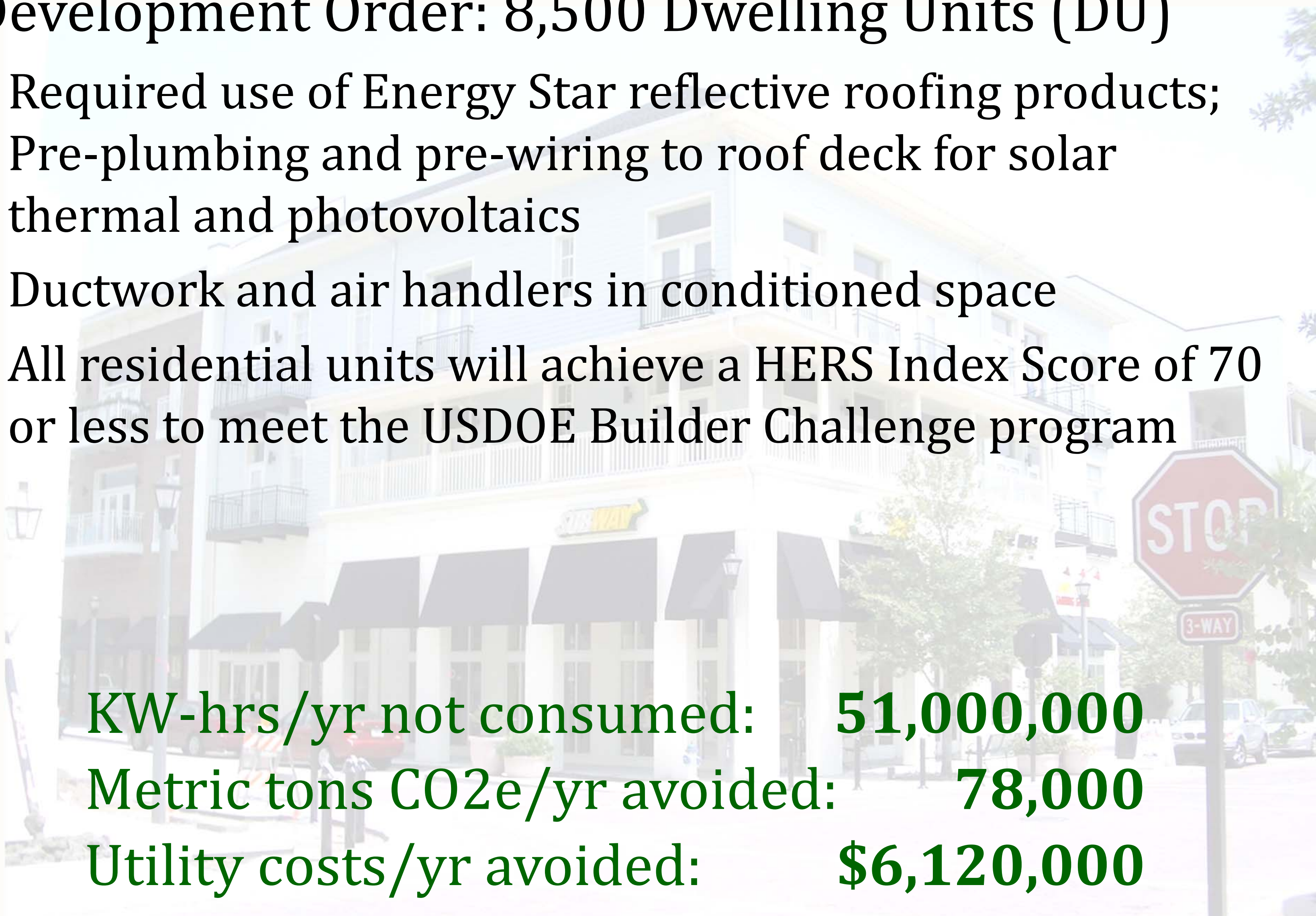
## Development Order: 8,500 Dwelling Units (DU)

- Required use of Energy Star reflective roofing products; Pre-plumbing and pre-wiring to roof deck for solar thermal and photovoltaics
- Ductwork and air handlers in conditioned space
- All residential units will achieve a HERS Index Score of 70 or less to meet the USDOE Builder Challenge program



# *Restoration's Two Designs - Housing*

## Development Order: 8,500 Dwelling Units (DU)



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- Ductwork and air handlers in conditioned space
- All residential units will achieve a HERS Index Score of 70 or less to meet the USDOE Builder Challenge program

| | |
|---|---|
| KW-hrs/yr not consumed: | **51,000,000** |
| Metric tons CO2e/yr avoided: | **78,000** |
| Utility costs/yr avoided: | **$6,120,000** |

# *Quantifying Performance:*

Transportation

# *Restoration's Two Designs - Transportation*

## 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 |

# *Restoration's Two Designs - Transportation*

## VMT Analysis

*Inputs*

| | 2006 Plan | 2009 Plan |
|---|---|---|
| • Trips: | 68,000 | 68,000 |
| • Internal trip length, miles | 1.75 | 0.38 |
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| • Total daily travel, miles | 594,000 | 349,000 |
| • Gasoline, gallons/day | 29,254 | 17,216 |

*GHG Emissions*

| | | |
|---|---|---|
| • Mtons CO2e/yr | 98,900 | 58,200 |

| | |
|---|---|
| Gallons/yr not consumed: | **4,400,000** |
| Metric tons CO2e/yr avoided: | **40,700** |
| Fuel costs/yr avoided: | **$13,000,000** |

# *Quantifying Performance:*

Roads

# Restoration's Road Infrastructure 2006 Design

## Life Cycle Analysis (50 year life)

| Location and Type | Description | Right-of-Way (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 | Right-of-Way (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 Two Designs - Roads*

### 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 |

# *Restoration's Two Designs - Roads*

## 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**

# *Restoration's Two Designs:*

## Water & Landscaping Impacts

# *Restoration's Landscaping – 2006 Design*

## Greenhouse Gas Accounting w/Desal

| *Annual Inputs* | 2006 Plan | |
|---|---|---|
| • Landscaped Area | 988 | acres |
| • Pesticides: | 2,240 | lbs a.i. |
| • Fertilizer: | 135,000 | lbs N |
| • Mowing: | 33,000 | gal |
| • Irrigation - Groundwater: | 988 | mgal |

| *Associated GHG Emissions* | |
|---|---|
| • Pesticides: | 19 |
| • Fertilizer: | 543 |
| • Mowing: | 281 |
| • Irrigation - Desal: | 10,842 |

Metric tons CO2e/yr: **11,684**

# *Restoration's Landscaping – 2009 Design*

## Low Impact Design

- The largest lots are 60' wide
- Compact homes (45'x 70') 375 ft$^2$ landscaped area and no turf
- Less than 25% of residences with lots designed for any turf

# *Restoration's Landscaping – 2006 Design*

## C&D Cottages

| Type | Bldg. Sq.Ft. | Lot Size | Lot Sq.Ft. | DU/AC (including streets) | Driveway Orientation | Parking Spaces per Unit |
|---|---|---|---|---|---|---|
| **Cottage 2** | | | | | | |
| C-1 | 1,260 | 41 x 63 | 2,583 | 7.5 | Rear | 2 |
| C-2 | 1,015 | 41 x 63 | 2,583 | 7.5 | Rear | 2 |
| D | 1,464 | 41 x 63 | 2,583 | 7.5 | Rear | 2 |
| D* | 1,464 | 43 x 63 | 2,709 | 7.5 | Rear | 2 |

Note: Does not include on-street guest parking. *Indicates corner lot.


# *Restoration's Landscaping – 2009 Design*

## Development Order: Low Impact Practices

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

# *Restoration's Two Designs - Landscaping*

## Greenhouse Gas Accounting w/Desal

| *Design* | 2006 Plan | | 2009 Plan | |
|---|---|---|---|---|
| • Landscaped Area | 988 | acres | 428 | acres |
| *Annual Inputs* | | | | |
| • Pesticides: | 2,240 | lbs a.i. | 354lbs a.i. | |
| • Fertilizer: | 135,000 | lbs N | 18,400 lbs N | |
| • Mowing: | 33,000 | gal | 4,460 gal | |
| • Irrigation - Desal: | 988 | mgal | 63 | mgal |
| *Associated GHG Emissions* | | | | |
| • Metric tons CO2e/yr: | 11,685 | | 798 | |

# *Restoration's Two Designs - Landscaping*

## Greenhouse Gas Accounting w/Desal

| | 2006 Plan | 2009 Plan |
|---|---|---|
| ***Design*** | | |
| • Landscaped Area | 988 acres | 428 acres |
| ***Annual Inputs*** | | |
| • Pesticides: | 2,240 lbs a.i. | 354 lbs a.i. |
| • Fertilizer: | 135,000 lbs N | 18,400lbs N |
| • Mowing: | 33,000 gal | 4,460 gal |
| • Irrigation - Desal: | 988 mgal | 63 mgal |
| ***Associated GHG Emissions*** | | |
| • Metric tons CO2e/yr: | 11,685 | 798 |

Metric tons CO2e/yr avoided: **10,733**

Landscaping costs/yr avoided:**~$4,000,000**

# *Restoration's Two Designs:*

Summary

# *Restoration's Two Designs - Landscaping*

## Summary of Environmental Benefits

- Reduced energy demand
- Reduced water demand
- Reduced GHG emissions (>120,000 MtonsCO2e/yr)
- Reduced pollutant loading
- Increased natural areas preserved (~3,200 acres)

# *Restoration's Two Designs*

## Summary of Developer Costs Impacts

- Reduced roadway miles (~47%)
- 160 acres of asphalt and concrete avoided
- Reduced landscaping area (~55%)
- Less area required for stormwater ponds (~33%)

Total on-site infrastructure savings: **~$199,000,000**

# *Restoration's Two Designs*

## Summary of Household Cost Impacts

| | |
|---|---|
| • Reduced utility bills | $700 |
| • Reduced transportation costs | $1,500 |
| • Reduced landscape maintenance costs | $500 |
| • Lower CDD assessments (roads) | $2,400 |
| • Lower HOA fees | <u>$400</u> |
| Total annual savings | **~$5,500** |

# *Moving Forward:*
## Florida Land Development

# *Florida Land Development*

## The New Normal

- Florida's resources are clearly becoming limiting
- For land owners and developers efficient land use and management practices are essential tools for addressing strategic risk management
- Preserving and properly valuing agricultural and natural lands is not optional
- Landscape irrigation with potable water is fundamentally irrational
- Landscape fertilization in impaired watersheds is fundamentally irrational
- Less risky alternatives are available

# *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

# *Moving Forward:*

UF Extension

# *Florida Land Development*

Opportunities




# *Florida Land Development*

## Opportunities

# *Oak Park Woman Faces 93 Days in Jail For Planting Vegetable Garden*

By ALEXIS WILEY
WJBK | myFOXDetroit.com

OAK PARK, Mich. (WJBK) - "The price of organic food is kind of through the roof," said Julie Bass.

So, why not grow your own? However, Bass' garden is a little unique because it's in her front yard.

"We thought it'd be really cool to do it so the neighbors could see. The neighborhood kids love it, they all come and help," she said.

Bass' cool garden has landed her in hot water with the City of Oak Park. Code enforcement gave her a warning, then a ticket and now she's been charged with a misdemeanor.


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