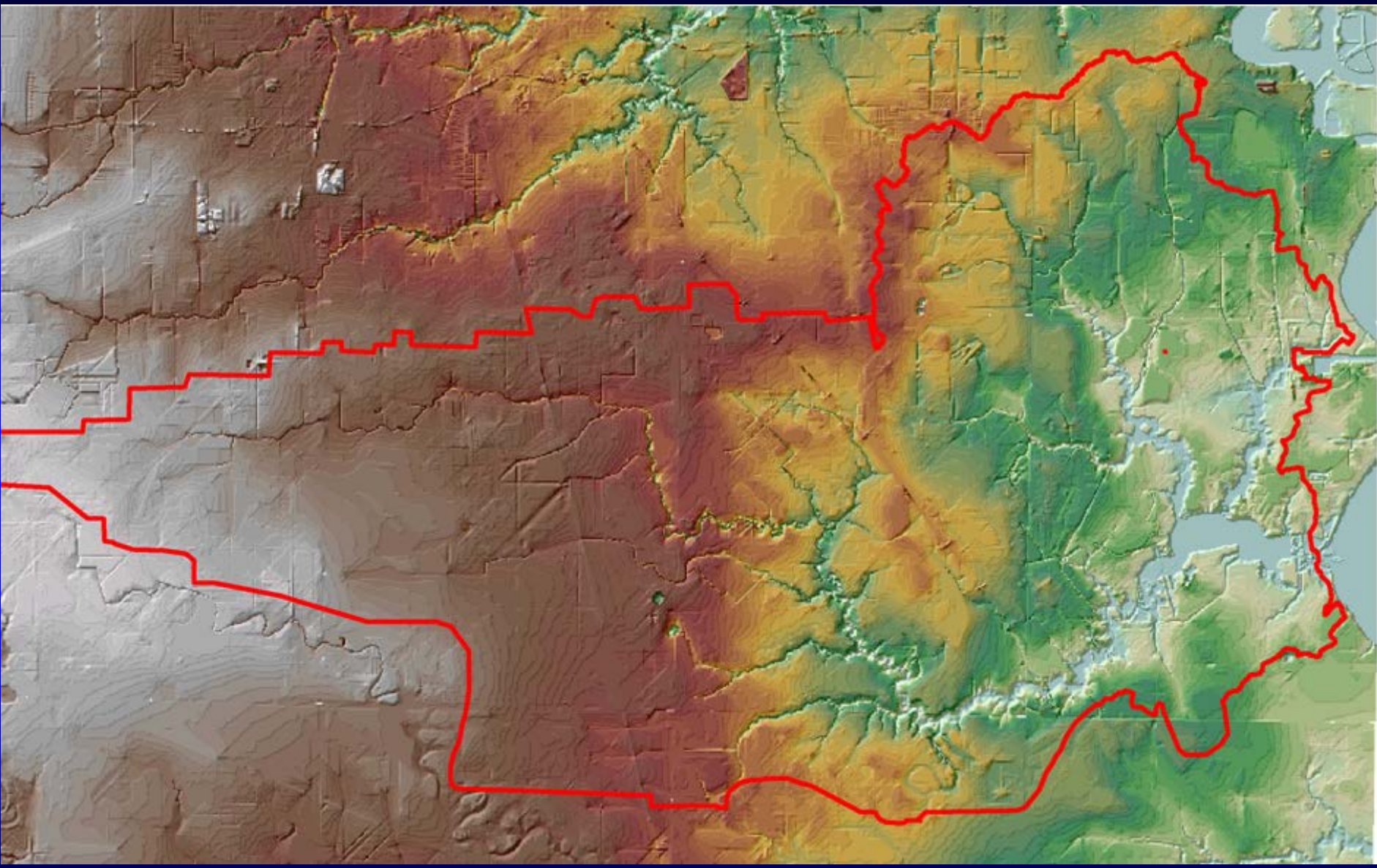
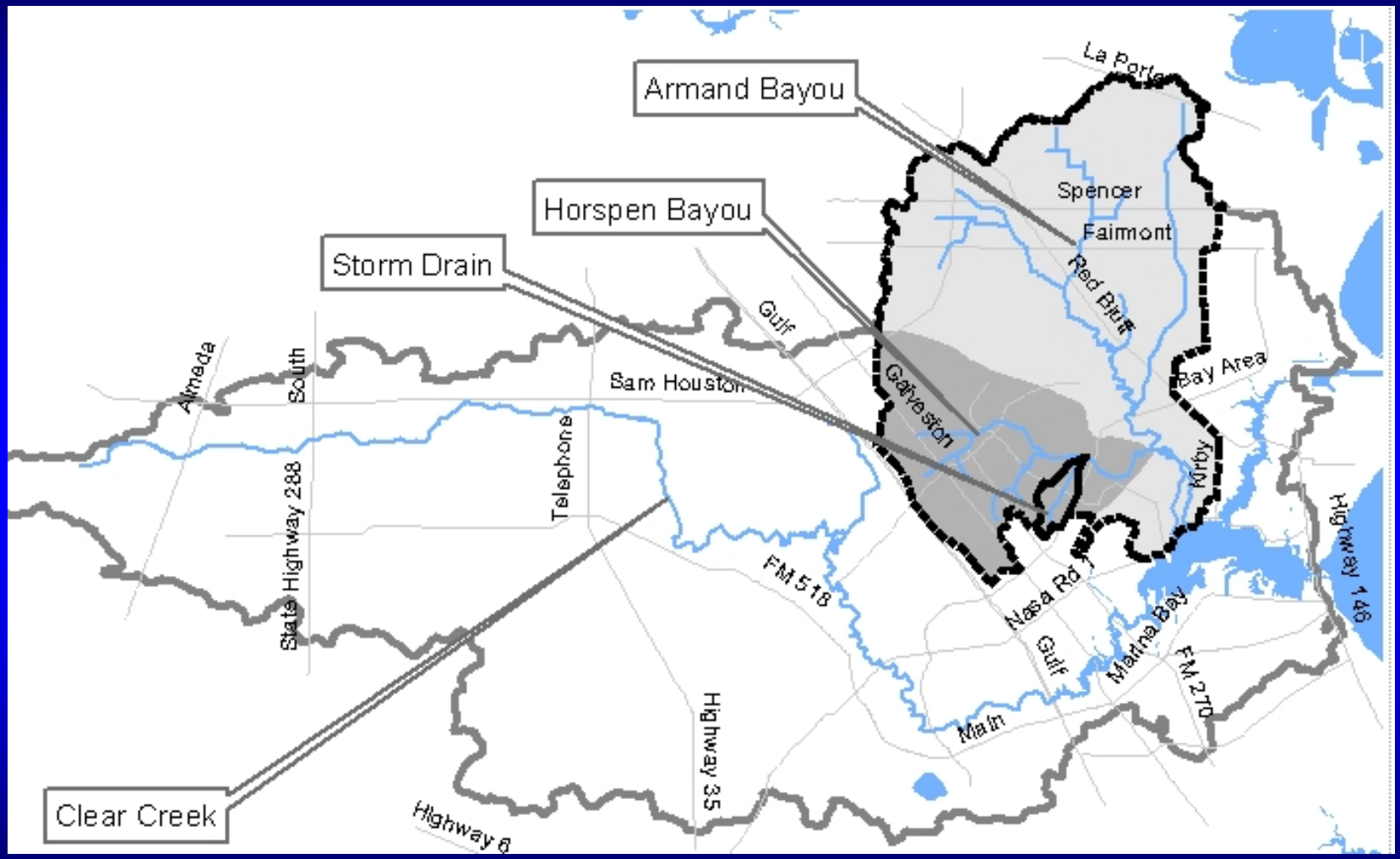
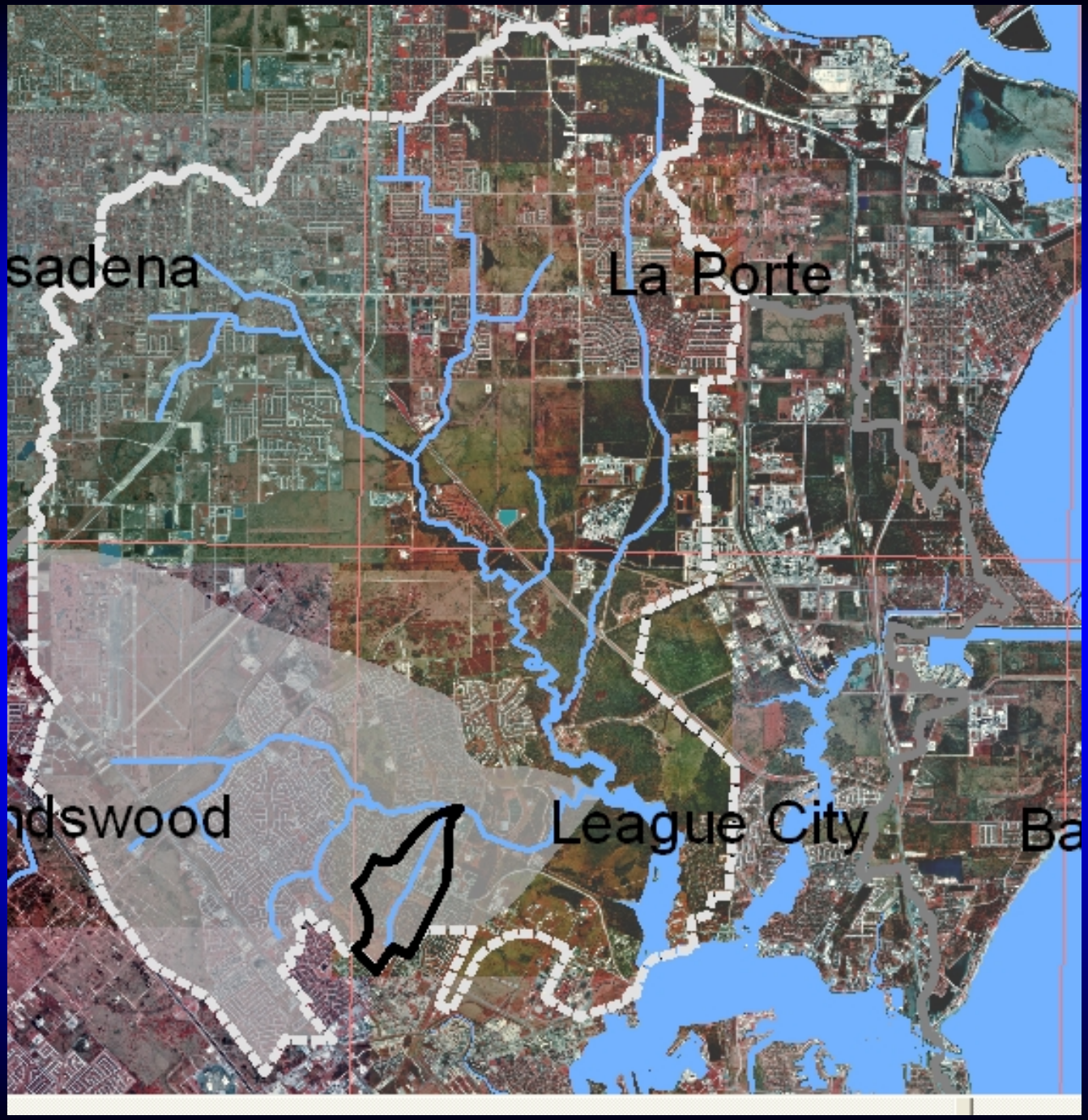
Whole Ecology, Watersheds and Walkability

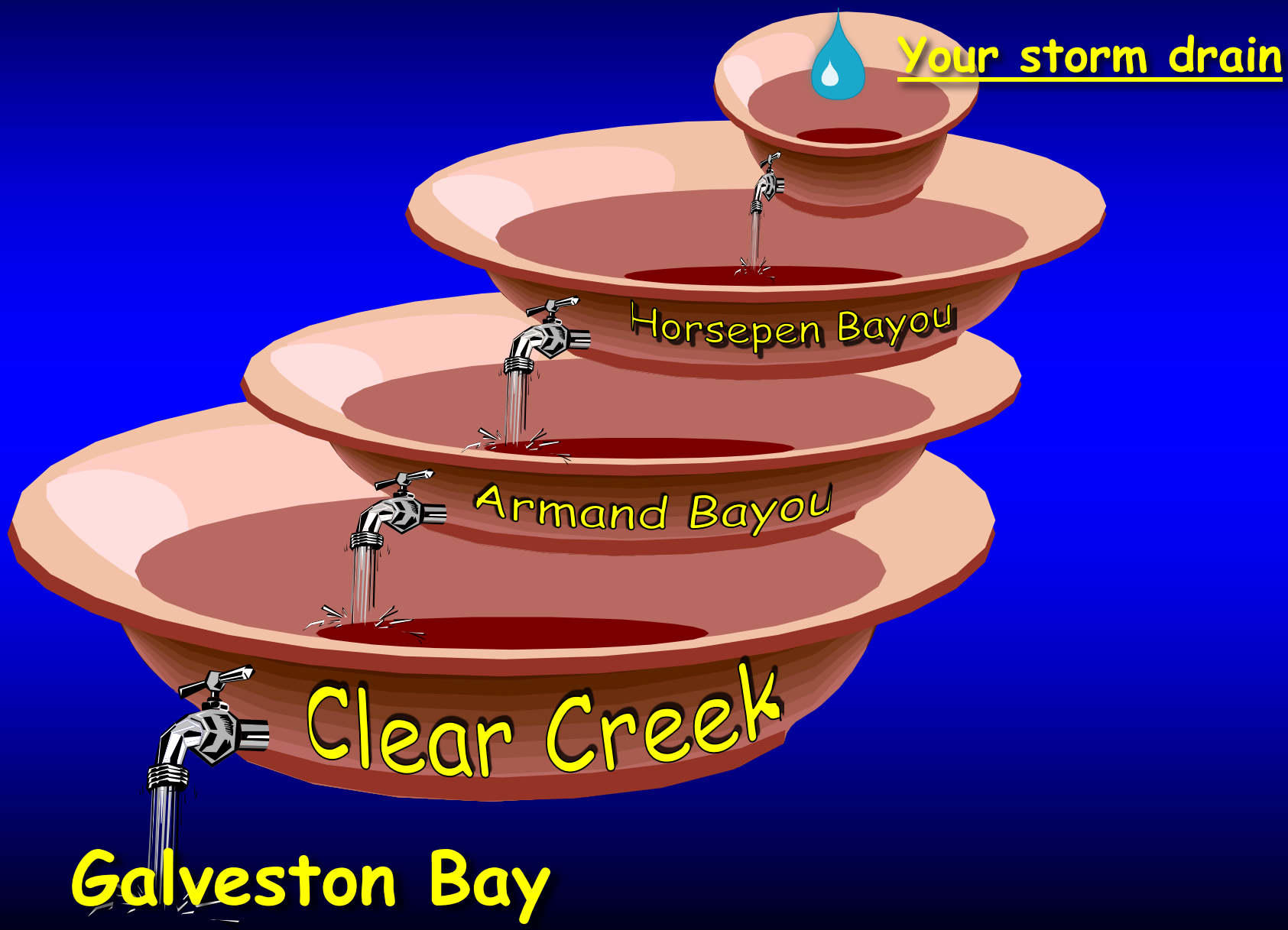
John S. Jacob, Ph.D.
Texas Sea Grant and Texas Agrilife Extension

TEXAS COASTAL WATERSHED PROGRAM




Armand Bayou
Horspen Bayou
Storm Drain
Clear Creek
La Porte
Spencer
Fairmont
Red Bluff
Bay Area
Kirby
Highway 146
Galveston
Gulf
Sam Houston
Telephone
Almeda
South
State Highway 288
FM 518
Nasa Rd 1
Gulf
Marina Bay
FM 270
Main
Highway 35
Highway 6


sadena
La Porte
ndswood
League City
Ba


Your storm drain
Horsepen Bayou
Armand Bayou
Clear Creek
Galveston Bay

Don’t
Runoff!

LOW IMPACT?!

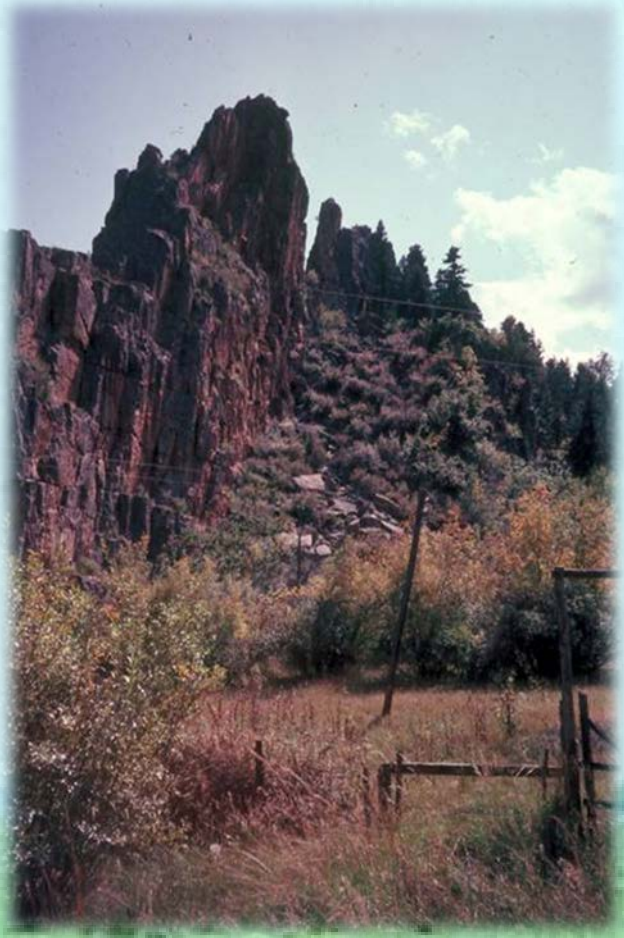
What is Green Infrastructure?

Our-natural *life-support* system

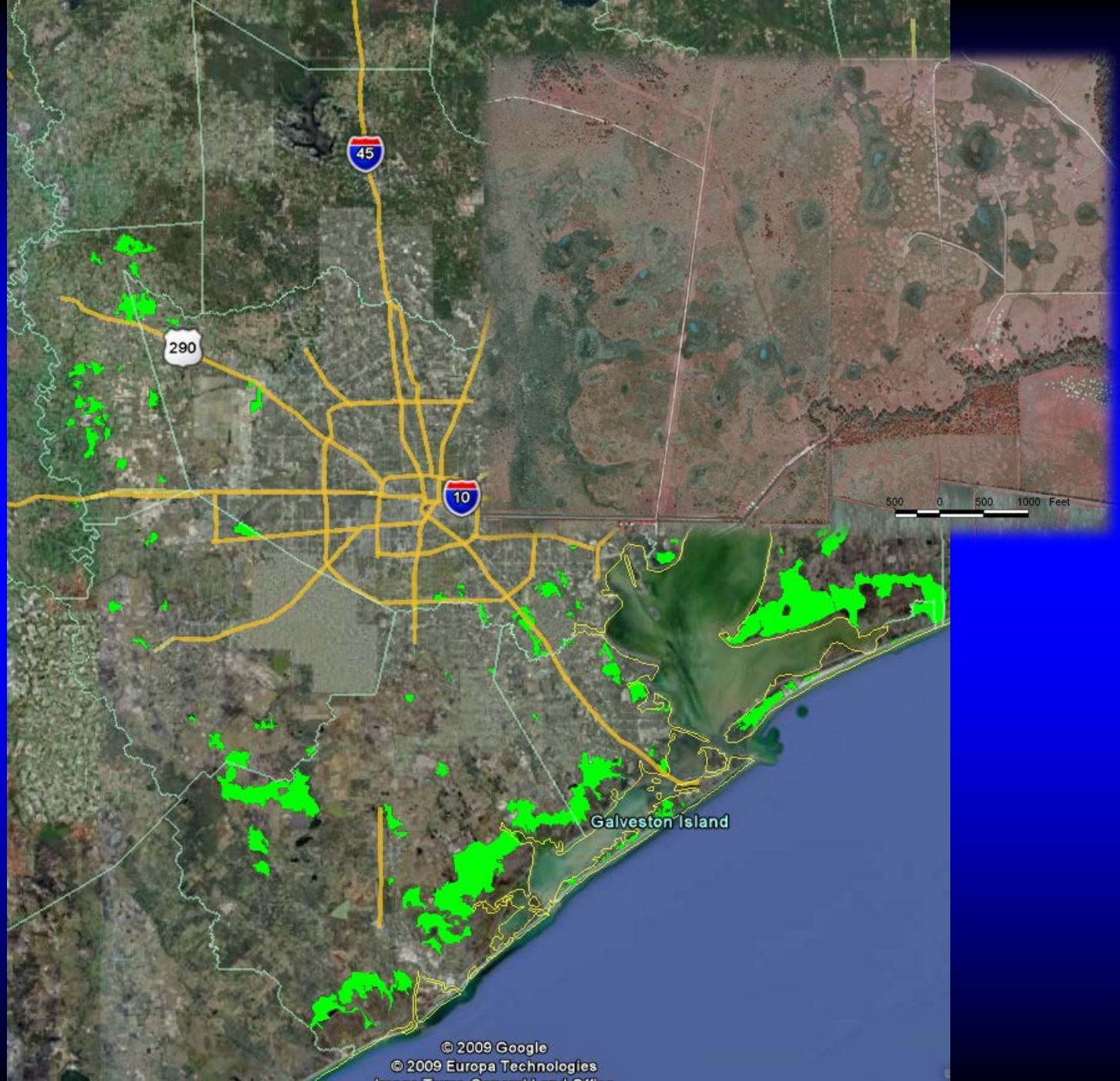
Green infrastructure is the ecological framework for environmental, social, and economic health

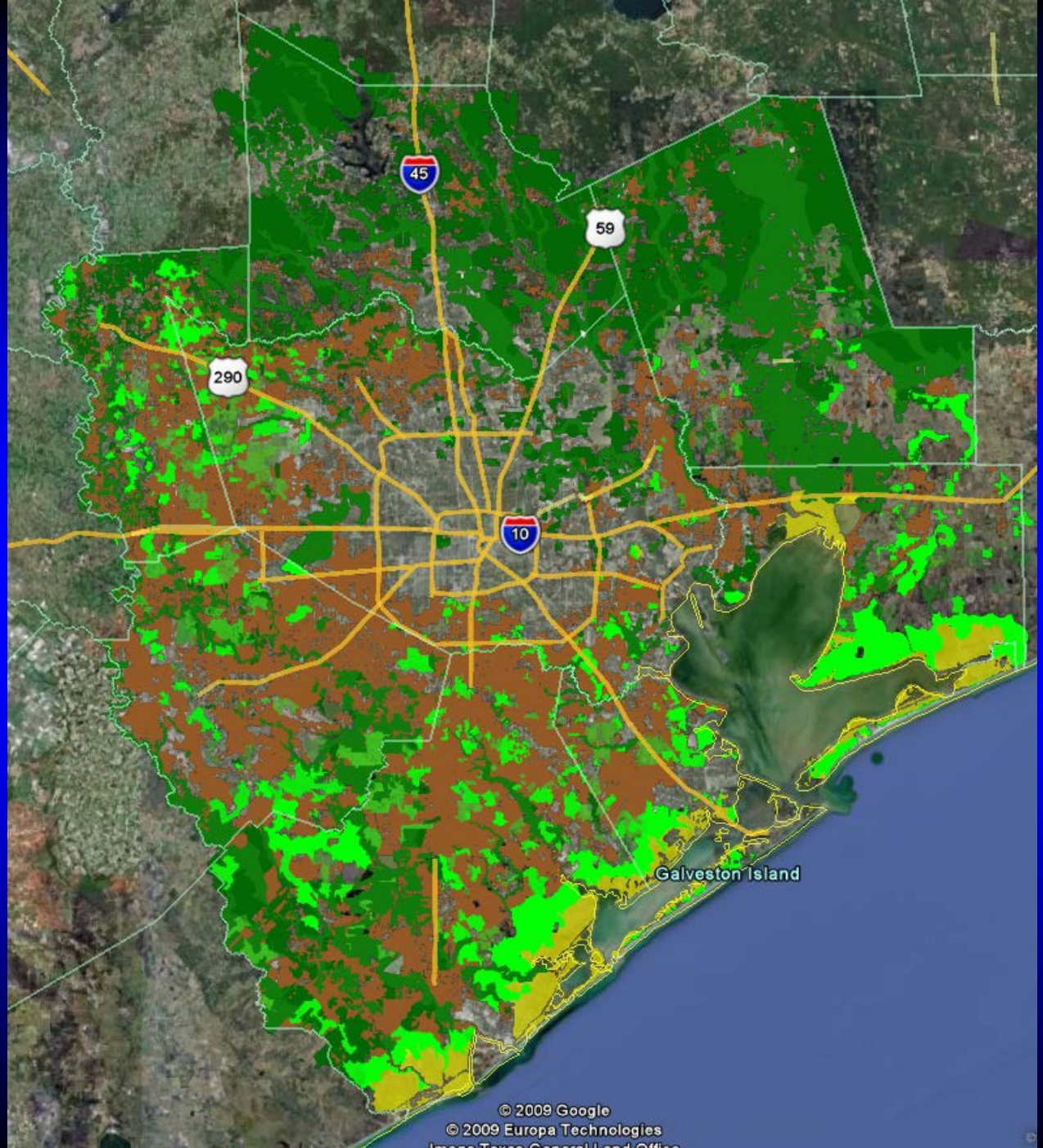
Benedict and McMahon, Green Infrastructure

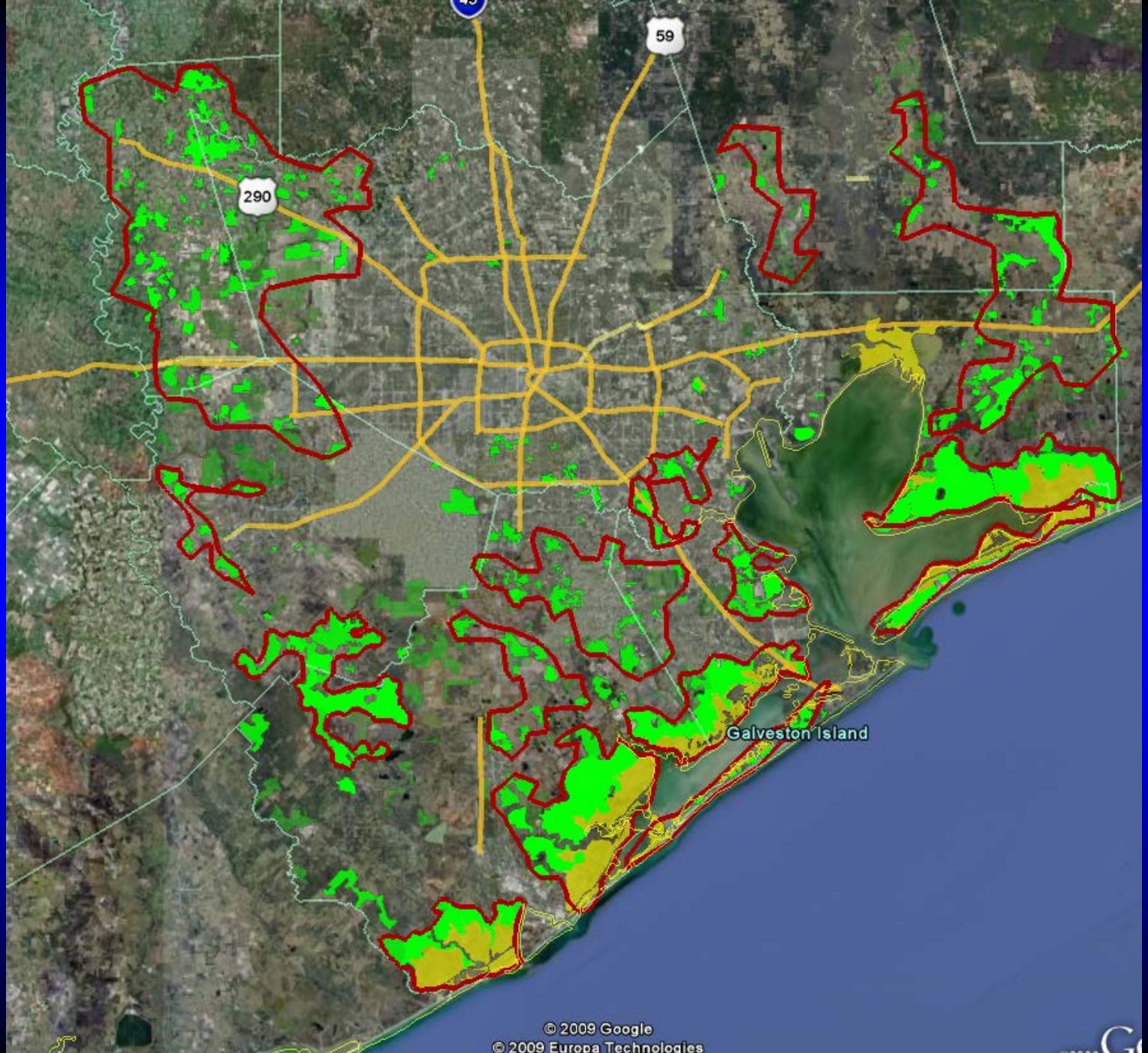
Green
Infrastructure



500
0
500
1000
Feet


45
290
10
Galveston Island
500 0 500 1000 Feet
© 2009 Google
© 2009 Europa Technologies


45
59
290
10
Galveston Island
© 2009 Google
© 2009 Europa Technologies


59
290
Galveston Island
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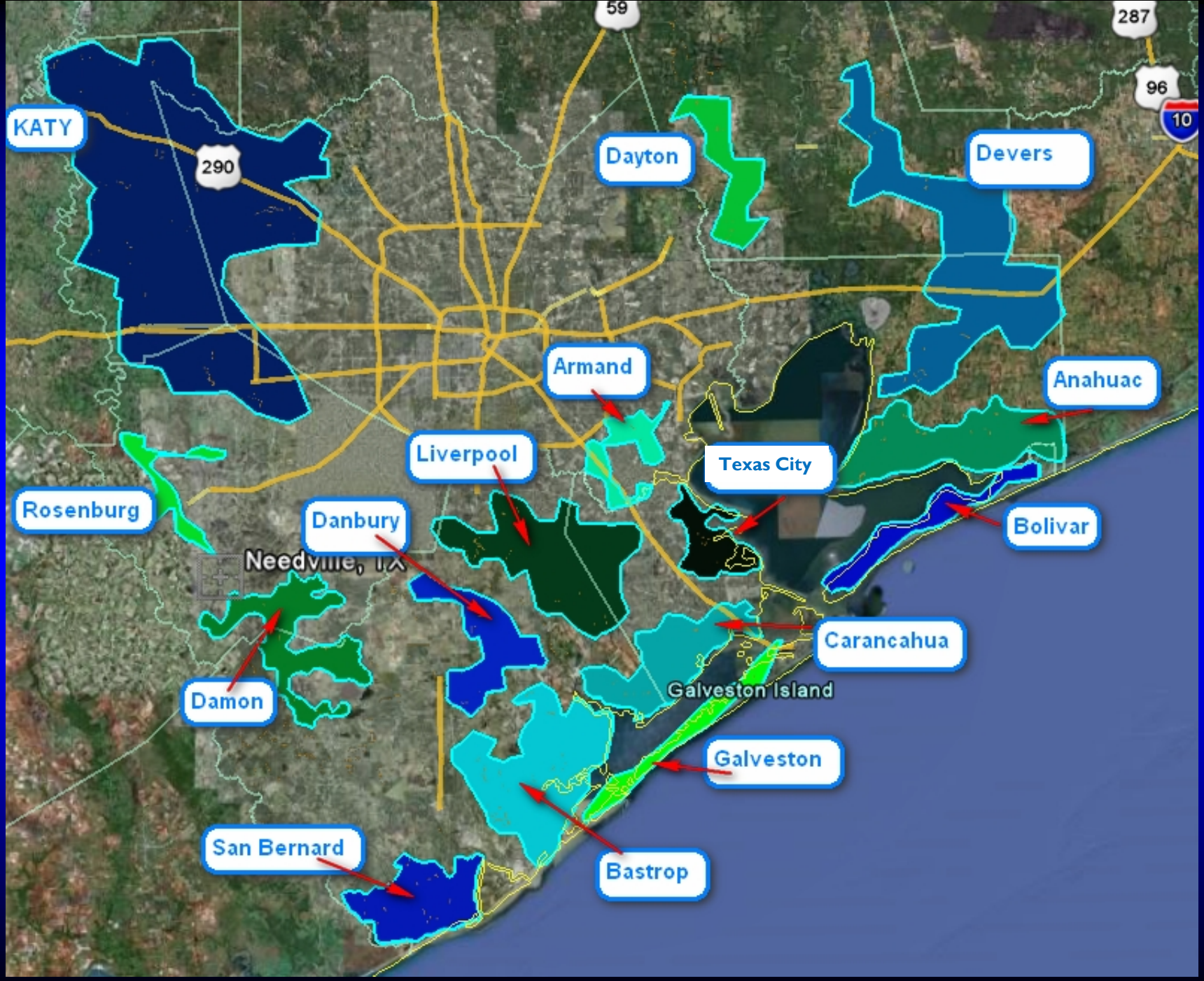
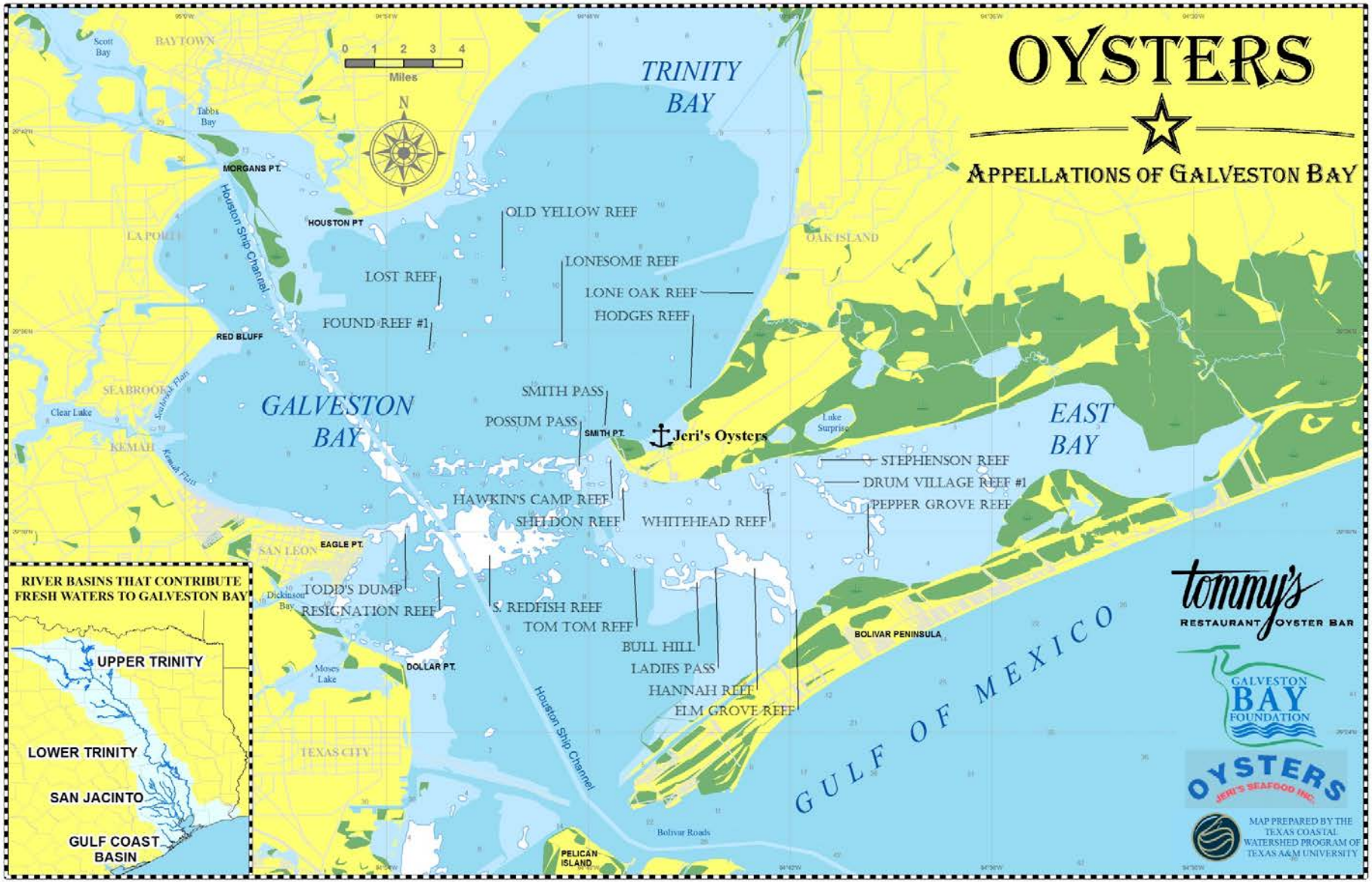
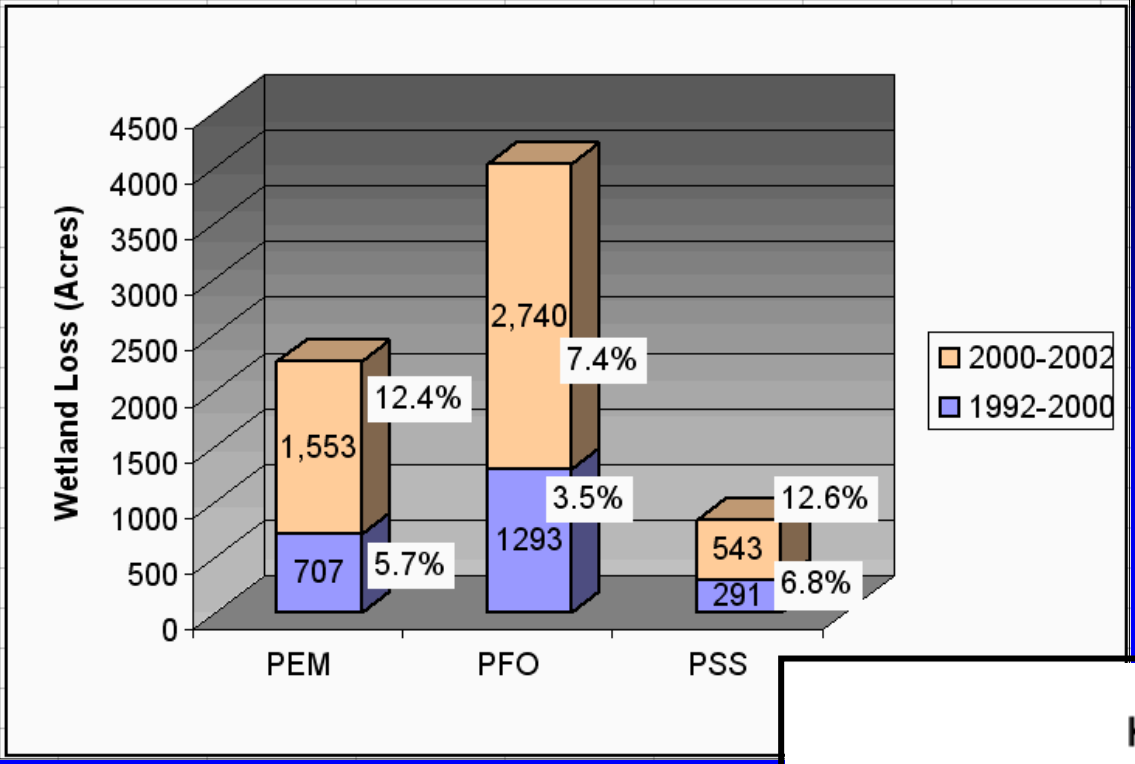
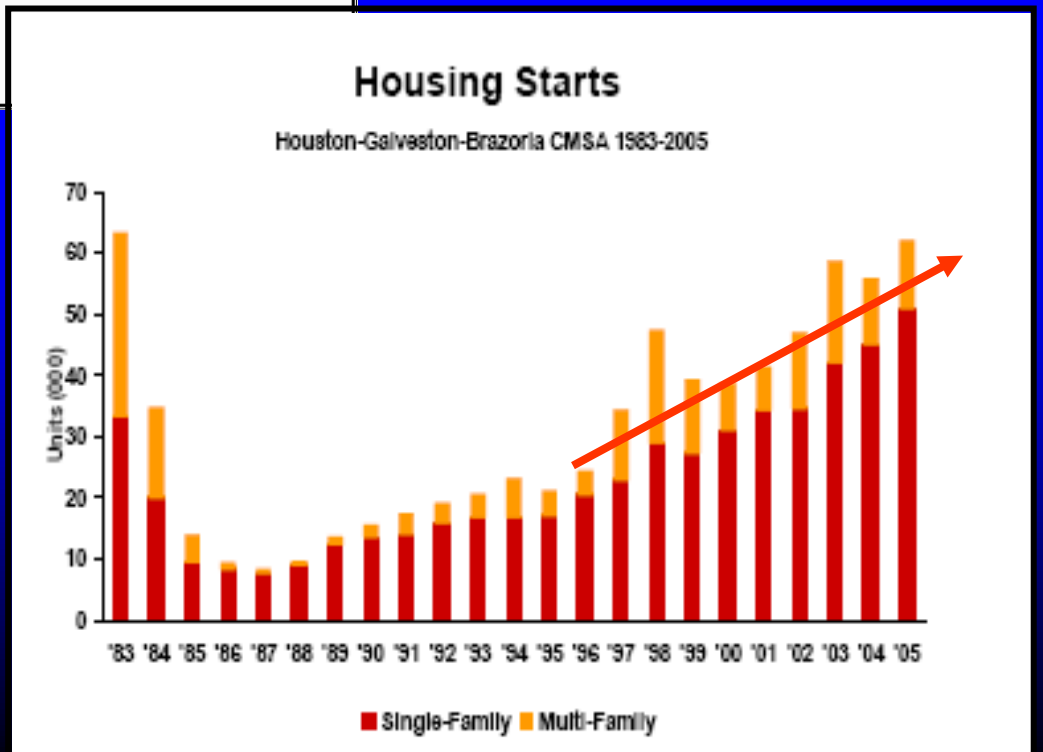
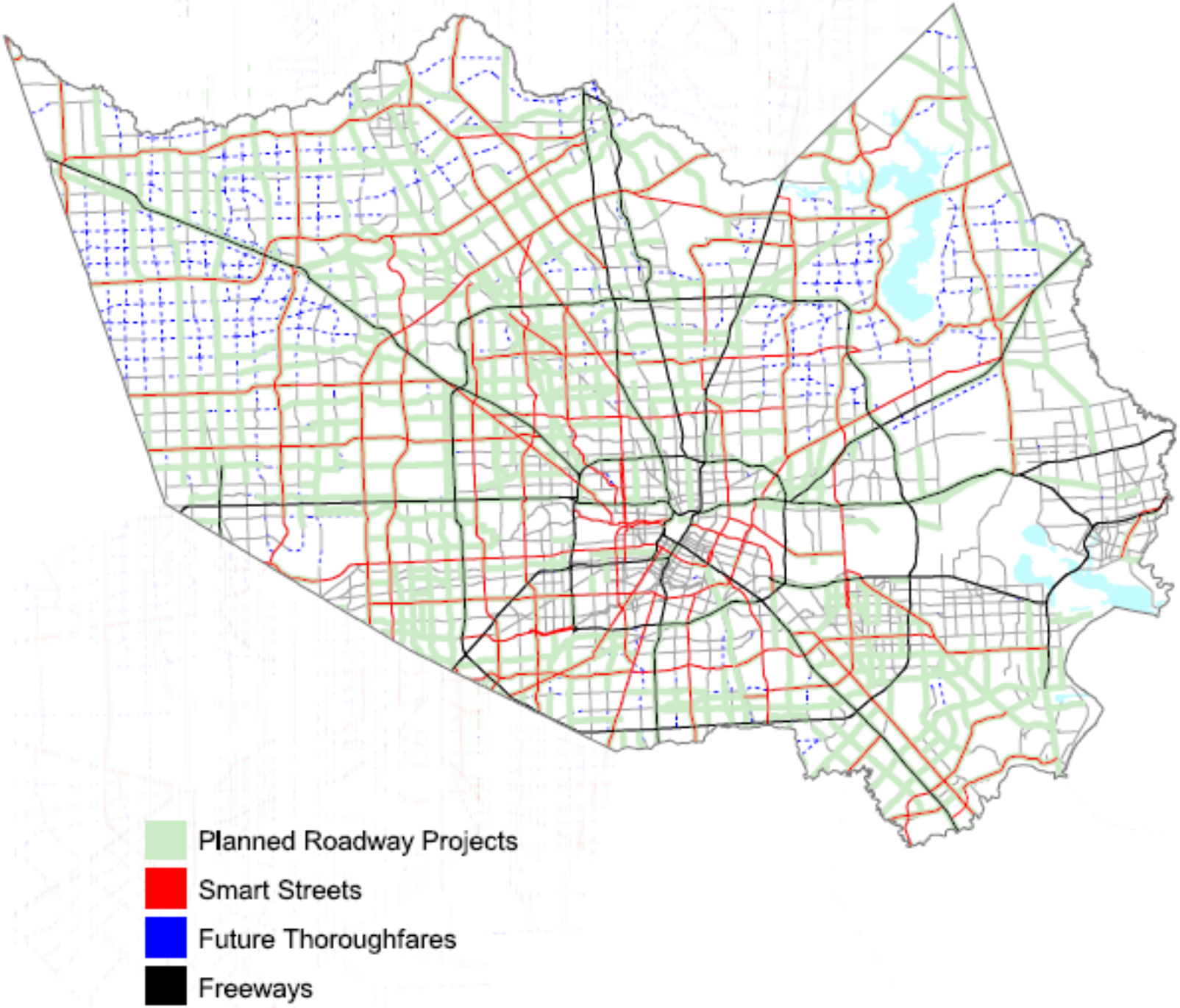
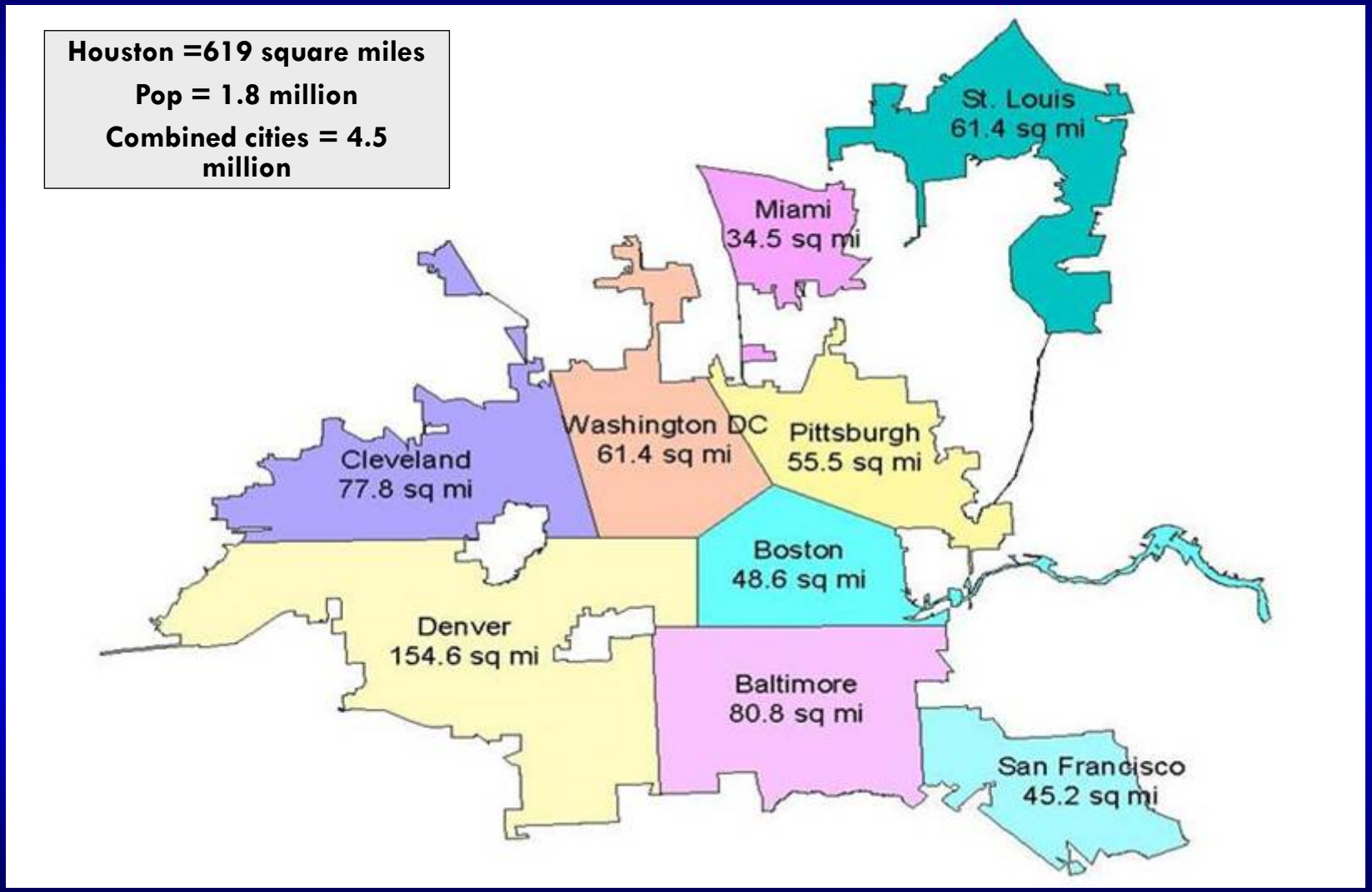

KATY
290
59
287
96
10
Dayton
Devers
Armand
Anahuac
Liverpool
Texas City
Rosenburg
Danbury
Bolivar
Needville, TX
Carancahua
Damon
Galveston Island
Galveston
San Bernard
Bastrop


OYSTERS
APPELLATIONS OF GALVESTON BAY
TRINITY BAY
GALVESTON BAY
EAST BAY
GULF OF MEXICO
0 1 2 3 4
Miles
N
Scott Bay
BAYTOWN
Tabbs Bay
MORGANS PT.
HOUSTON PT
LA PORTE
Houston Ship Channel
RED BLUFF
SEABROOK
Clear Lake
KEMAH
Kemah Flats
SAN LEON
EAGLE PT.
Dickinson Bay
Moses Lake
DOLLAR PT.
TEXAS CITY
PELICAN ISLAND
Bolivar Roads
BOLIVAR PENINSULA
OAK ISLAND
Lake Surprise
OLD YELLOW REEF
LONESOME REEF
LOST REEF
LONE OAK REEF
HODGES REEF
FOUND REEF #1
SMITH PASS
POSSUM PASS
SMITH PT.
Jeri's Oysters
STEPHENSON REEF
DRUM VILLAGE REEF #1
PEPPER GROVE REEF
HAWKIN'S CAMP REEF
SHELDON REEF
WHITEHEAD REEF
TODD'S DUMP
RESIGNATION REEF
S. REDFISH REEF
TOM TOM REEF
BULL HILL
LADIES PASS
HANNAH REEF
ELM GROVE REEF
RIVER BASINS THAT CONTRIBUTE FRESH WATERS TO GALVESTON BAY
UPPER TRINITY
LOWER TRINITY
SAN JACINTO
GULF COAST BASIN
tommy's
RESTAURANT OYSTER BAR
GALVESTON BAY FOUNDATION
OYSTERS
JERI'S SEAFOOD INC.
MAP PREPARED BY THE TEXAS COASTAL WATERSHED PROGRAM OF TEXAS A&M UNIVERSITY


Wetland Loss (Acres)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1,553
12.4%
707
5.7%
2,740
7.4%
1293
3.5%
543
12.6%
291
6.8%
PEM
PFO
PSS
2000-2002
1992-2000

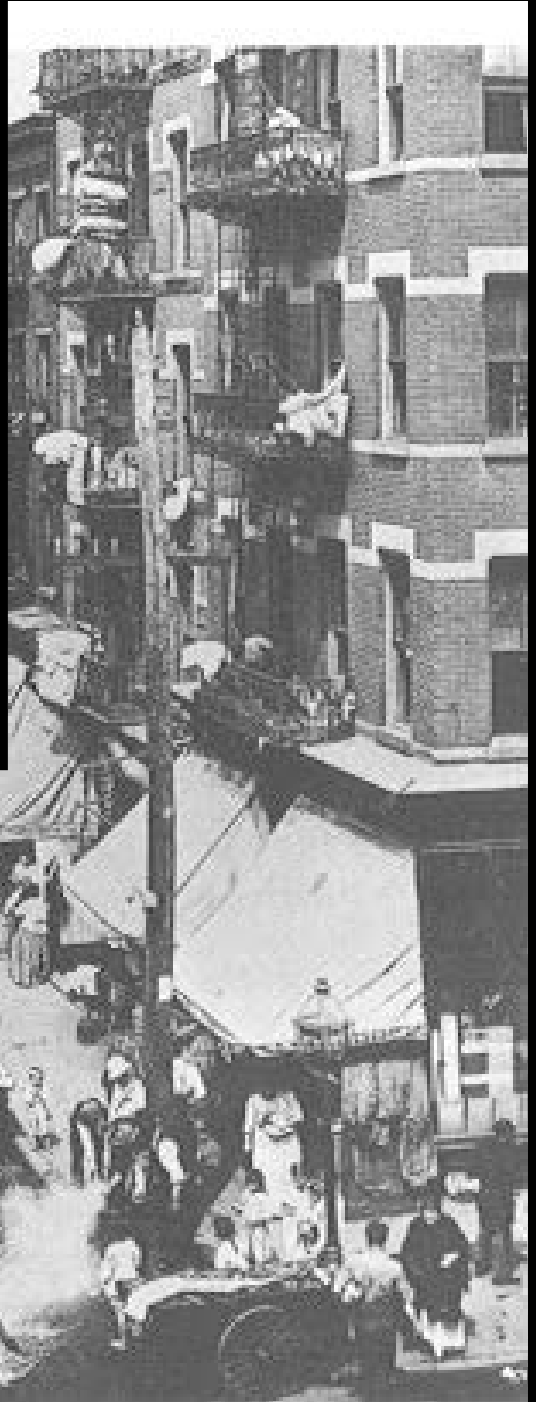

Housing Starts
Houston-Galveston-Brazoria CMSA 1983-2005
Units (000)
70
60
50
40
30
20
10
0
'83 '84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05
Single-Family
Multi-Family


Planned Roadway Projects
Smart Streets
Future Thoroughfares
Freeways



Graphic by City of Houston Planning & Development Department, 2001.

BRAZIL



5162

LAGCOE
DODGE

Exit 22
• Never See Vehicles
• Never See Neighbors
004420
CLEAR CHANNEL

STOP

Street trees

1. Create a Range of Housing Opportunities and Choices
2. Create Walkable Neighborhoods
3. Encourage Community & Stakeholder Collaboration
4. Foster Distinctive, Attractive Communities with a Strong Sense Place
5. Make Development Decisions Predictable, Fair and Cost Effectiv
6. Mix Land Uses
7. Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas
8. Provide a Variety of Transportation Choices
9. Strengthen and Direct Development Towards Existing Communi
10. Take Advantage of Compact Building Design

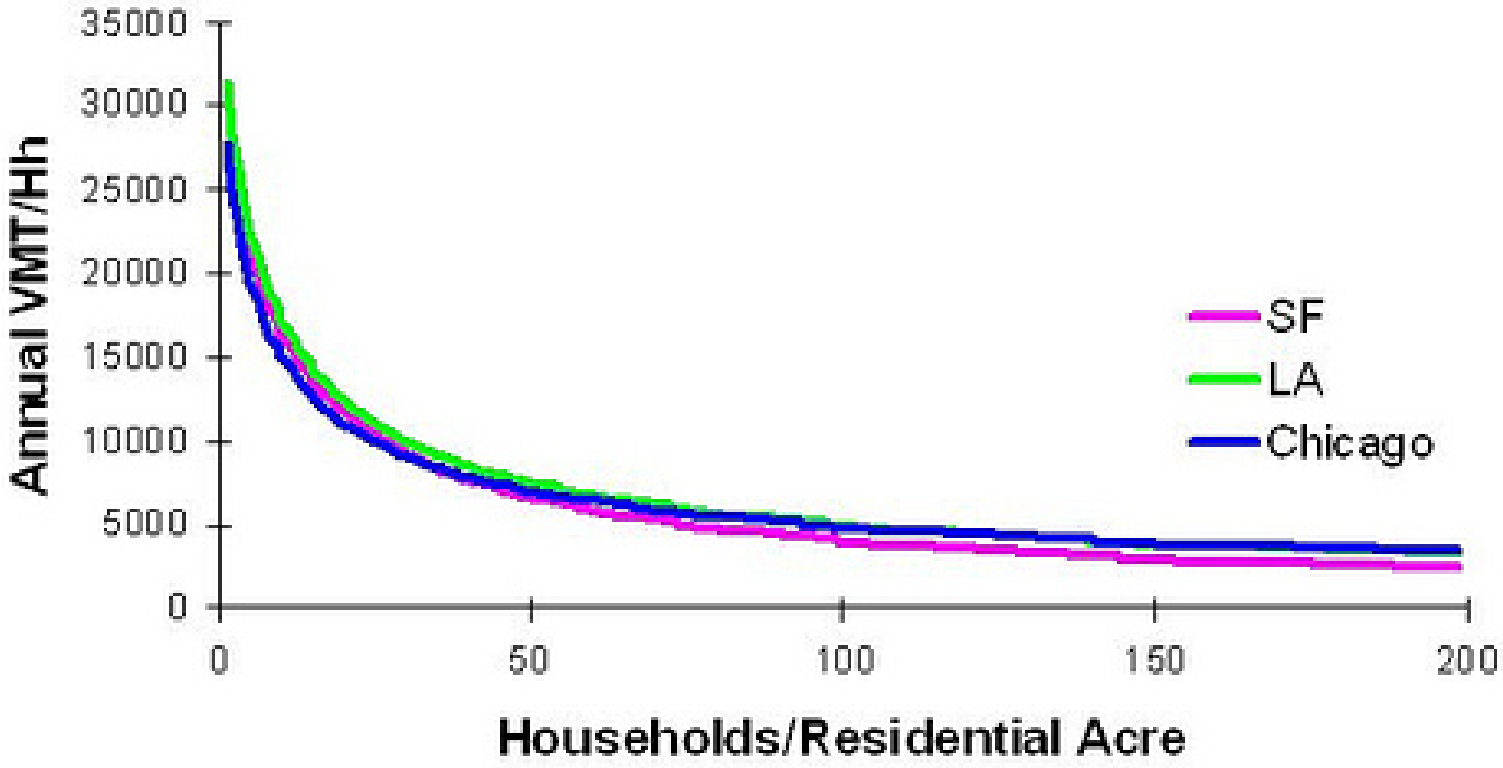
Popsicle Test
Smooch Test
Kid Test
Seniors Test
Commons Test

2D
3D
Microsoft
Virtual Earth™
680 yds
© 2006 Microsoft Corporation

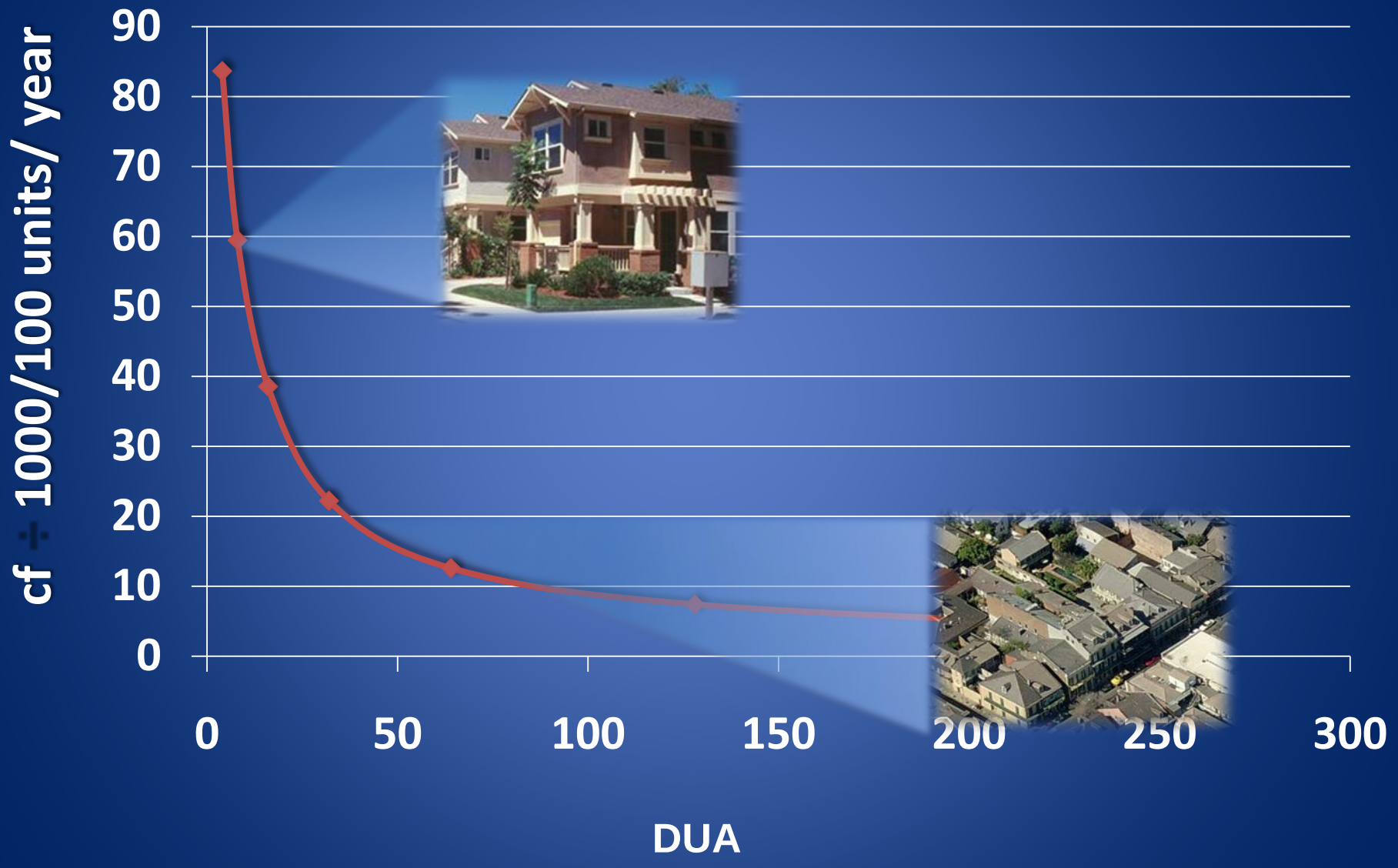
What makes a "Place"?
•People
•Proximity
•Parks/ Civic Space
•Diversity
•Access (transportation)

LEFT TURN
YIELD
ON GREEN
STREET GALLERY

Driving vs Residential Density

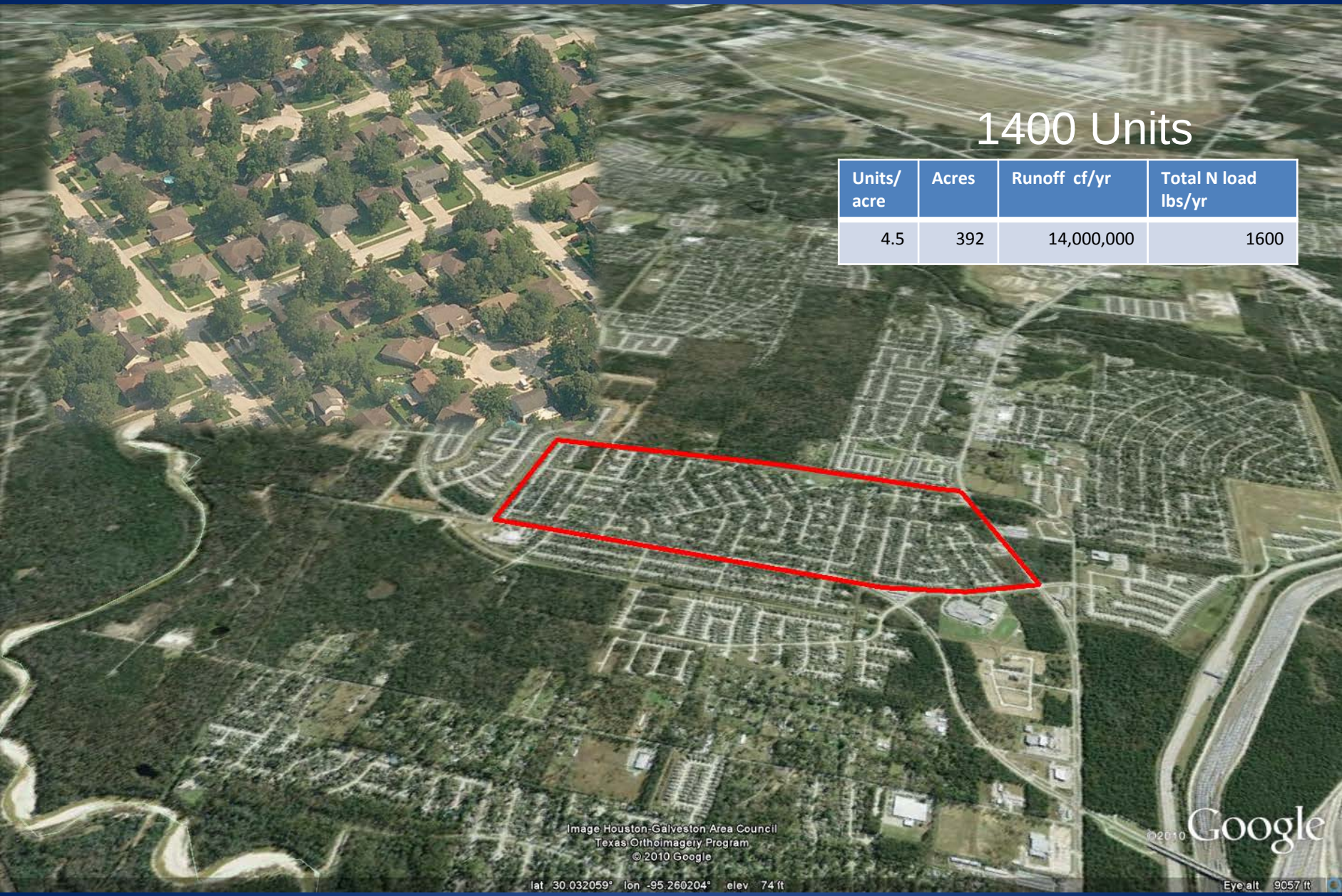


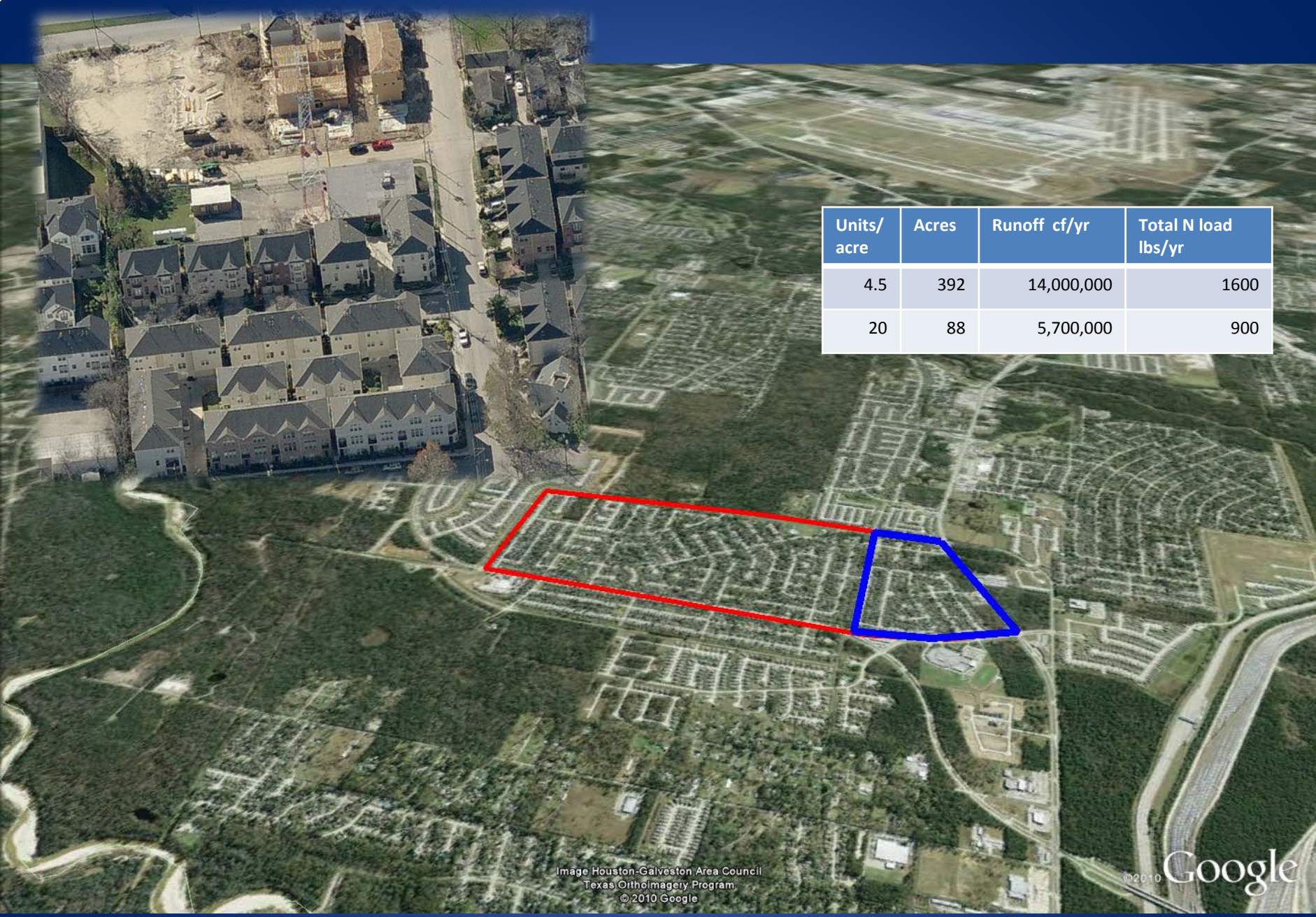
Runoff Volume per 100 units



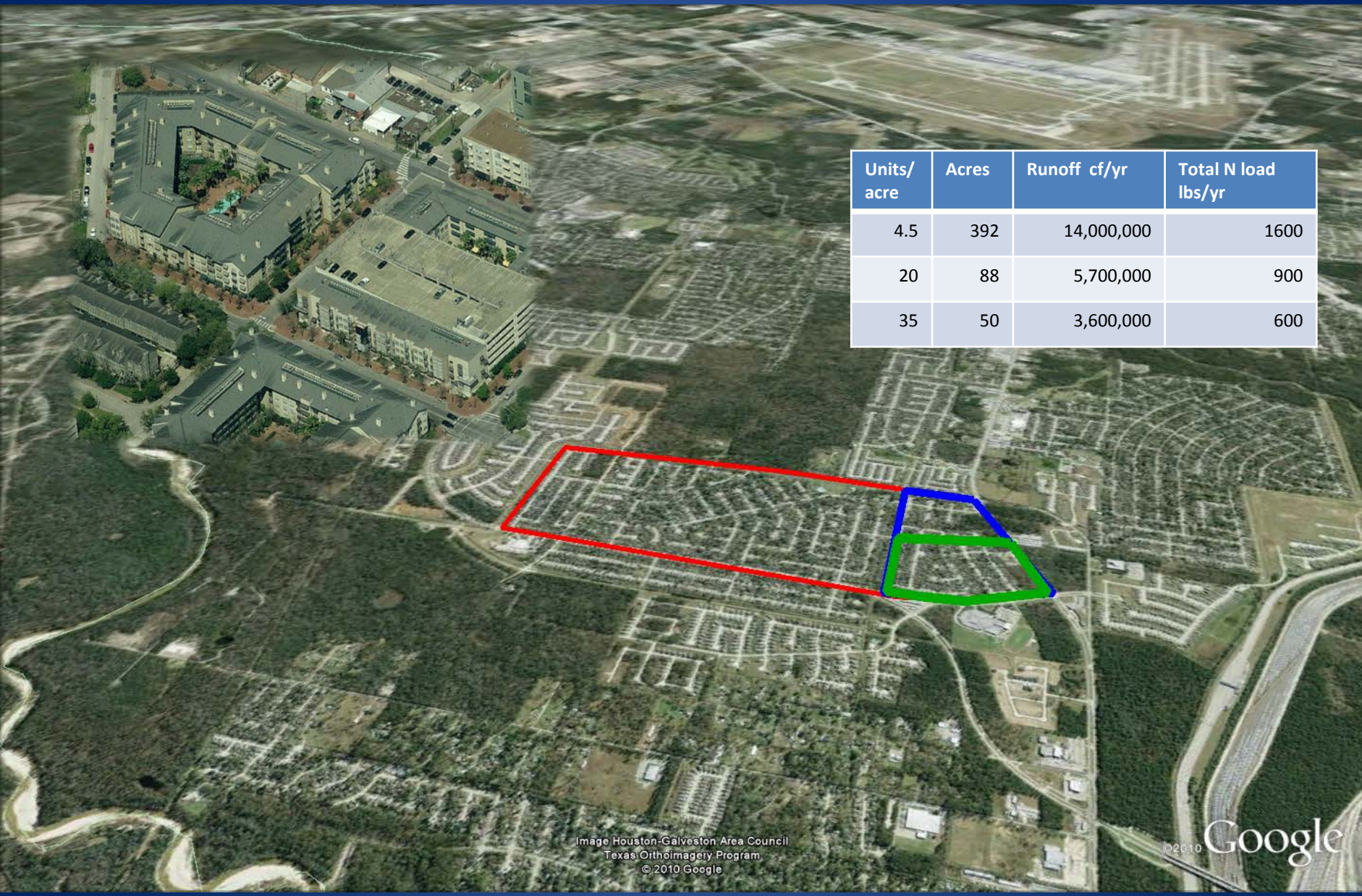
1400 Units

Units/ acre	Acres	Runoff cf/yr	Total N load lbs/yr
4.5	392	14,000,000	1600

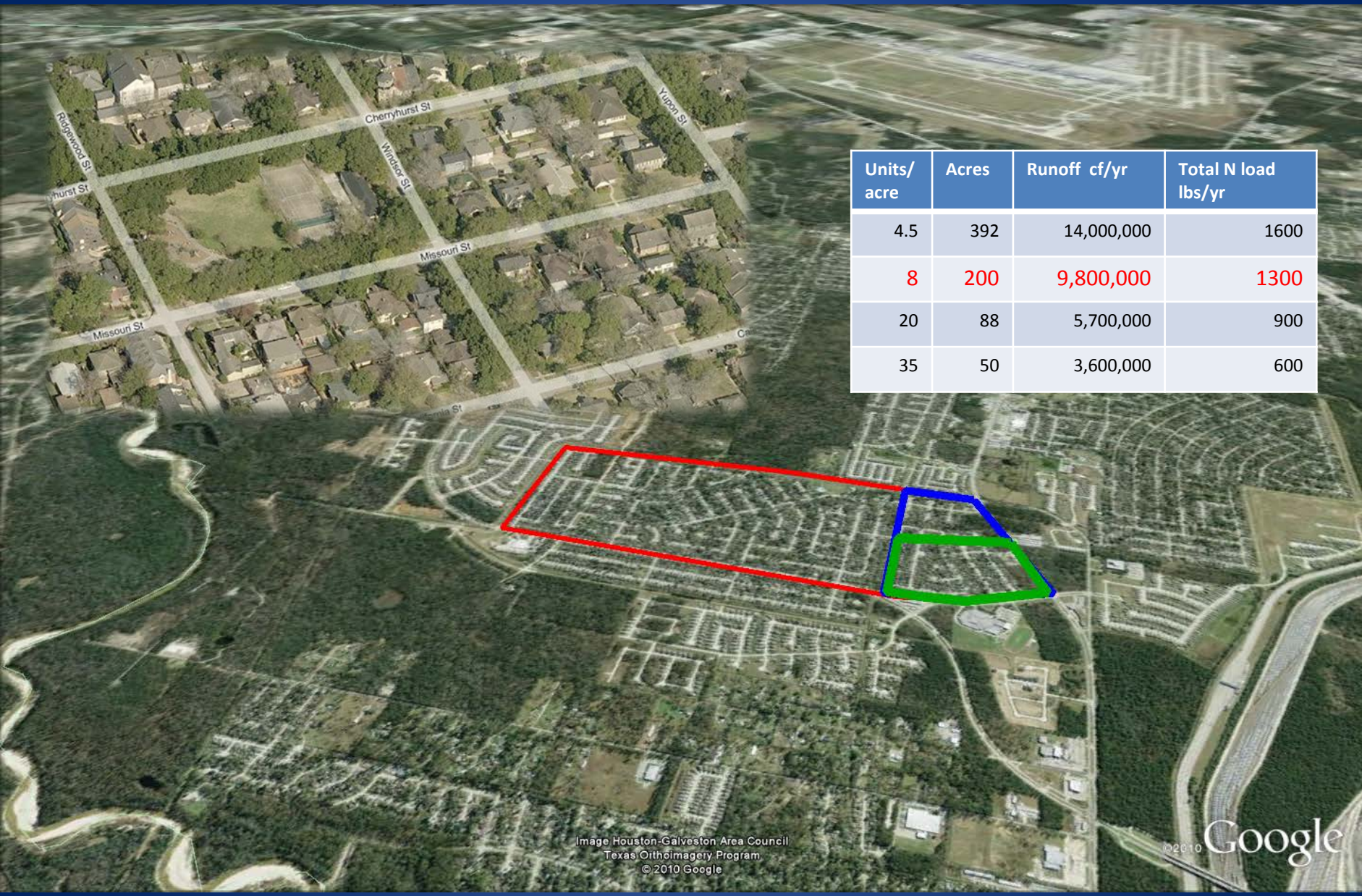




Units/ acre	Acres	Runoff cf/yr	Total N load lbs/yr
4.5	392	14,000,000	1600
20	88	5,700,000	900

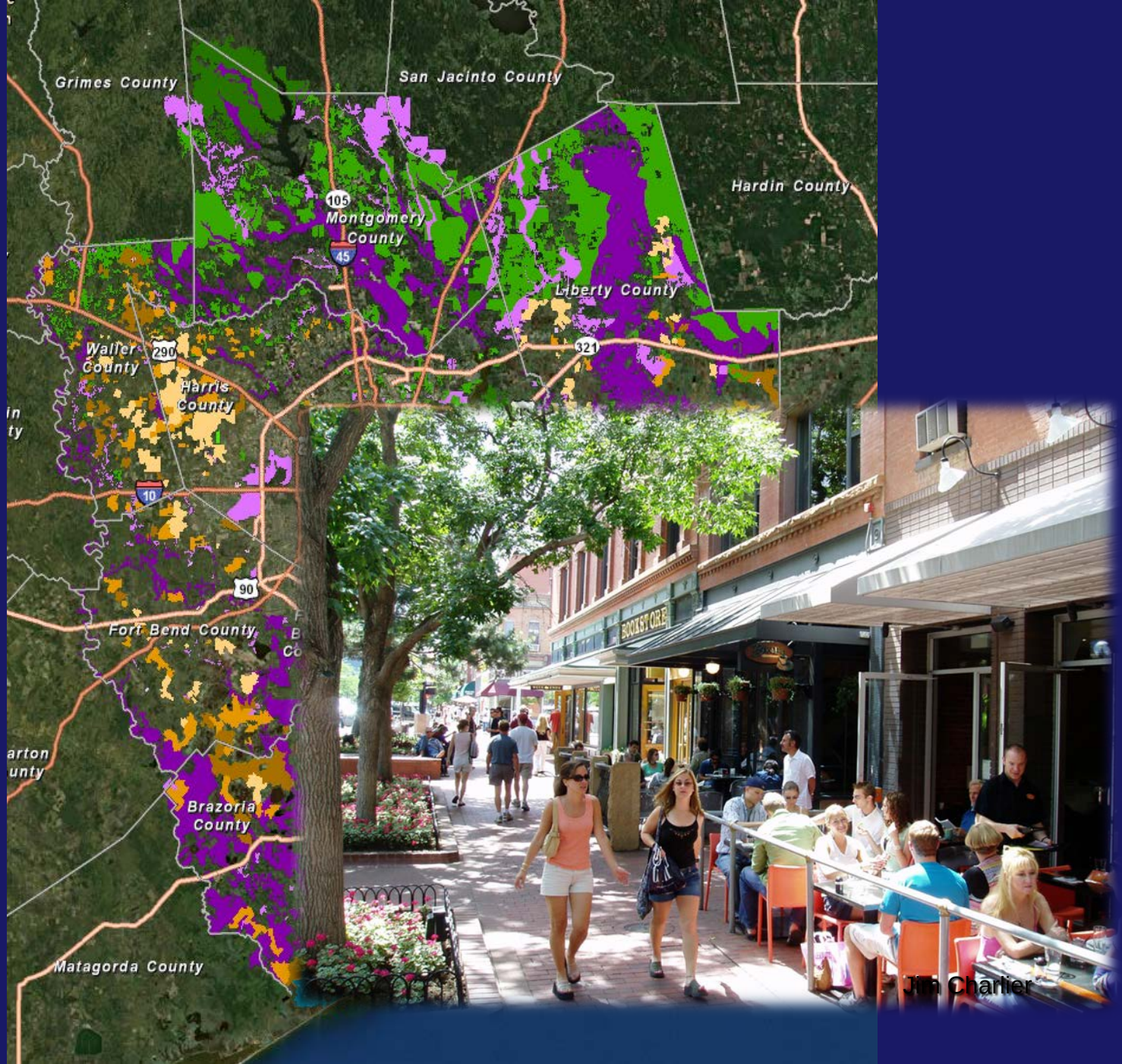


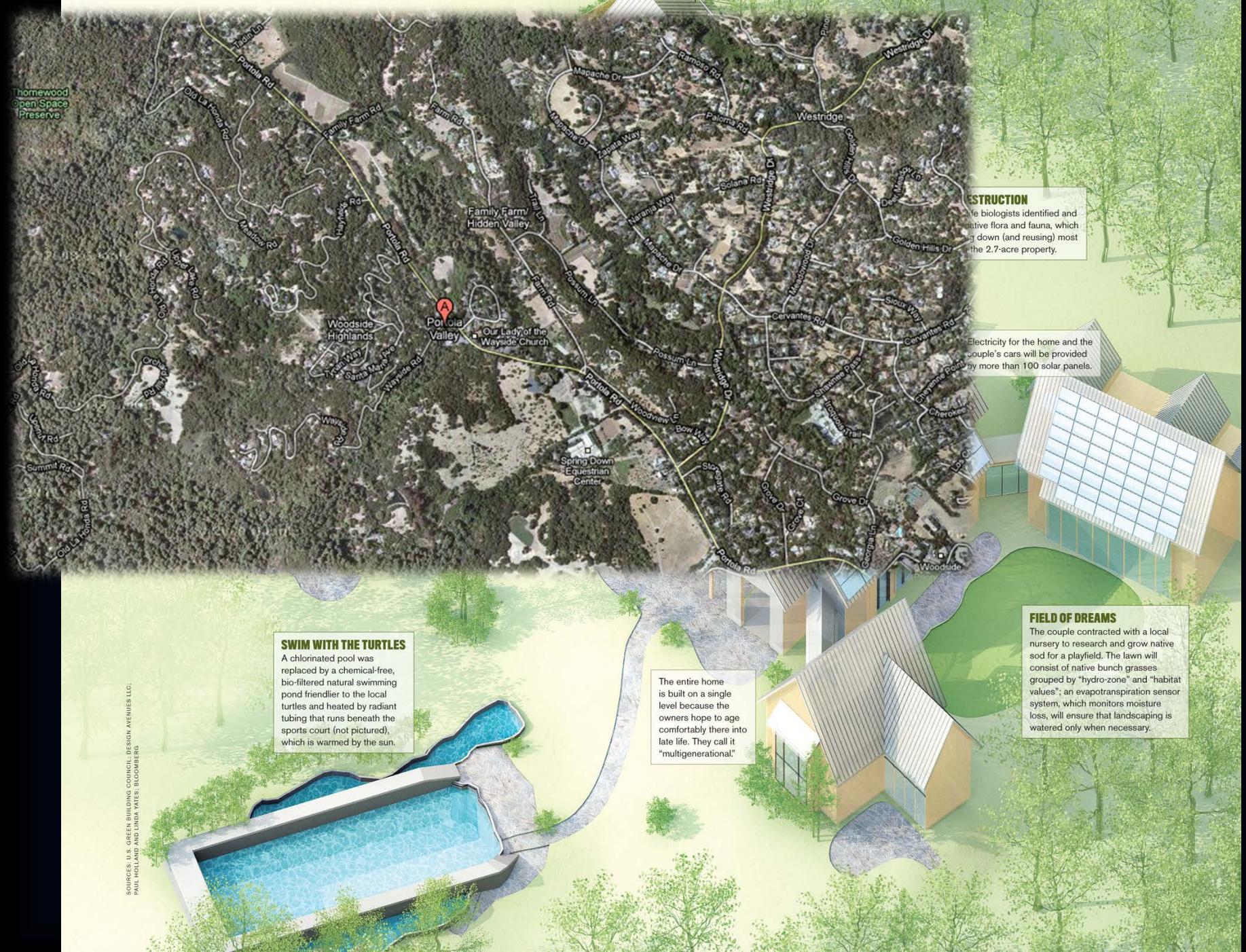
Units/ acre	Acres	Runoff cf/yr	Total N load lbs/yr
4.5	392	14,000,000	1600
20	88	5,700,000	900
35	50	3,600,000	600



Units/ acre	Acres	Runoff cf/yr	Total N load lbs/yr
4.5	392	14,000,000	1600
8	200	9,800,000	1300
20	88	5,700,000	900
35	50	3,600,000	600

Neartown/Montrose Study Area


Grimes County
San Jacinto County
Hardin County
105
Montgomery County
45
Liberty County
321
Waller County
290
Harris County
10
90
Fort Bend County
Brazoria County
Matagorda County
BOOKSTORE
Jim Charlier



ESTRUCTION

...ife biologists identified and ...ative flora and fauna, which ...g down (and reusing) most ...the 2.7-acre property.

Electricity for the home and the couple's cars will be provided by more than 100 solar panels.

FIELD OF DREAMS

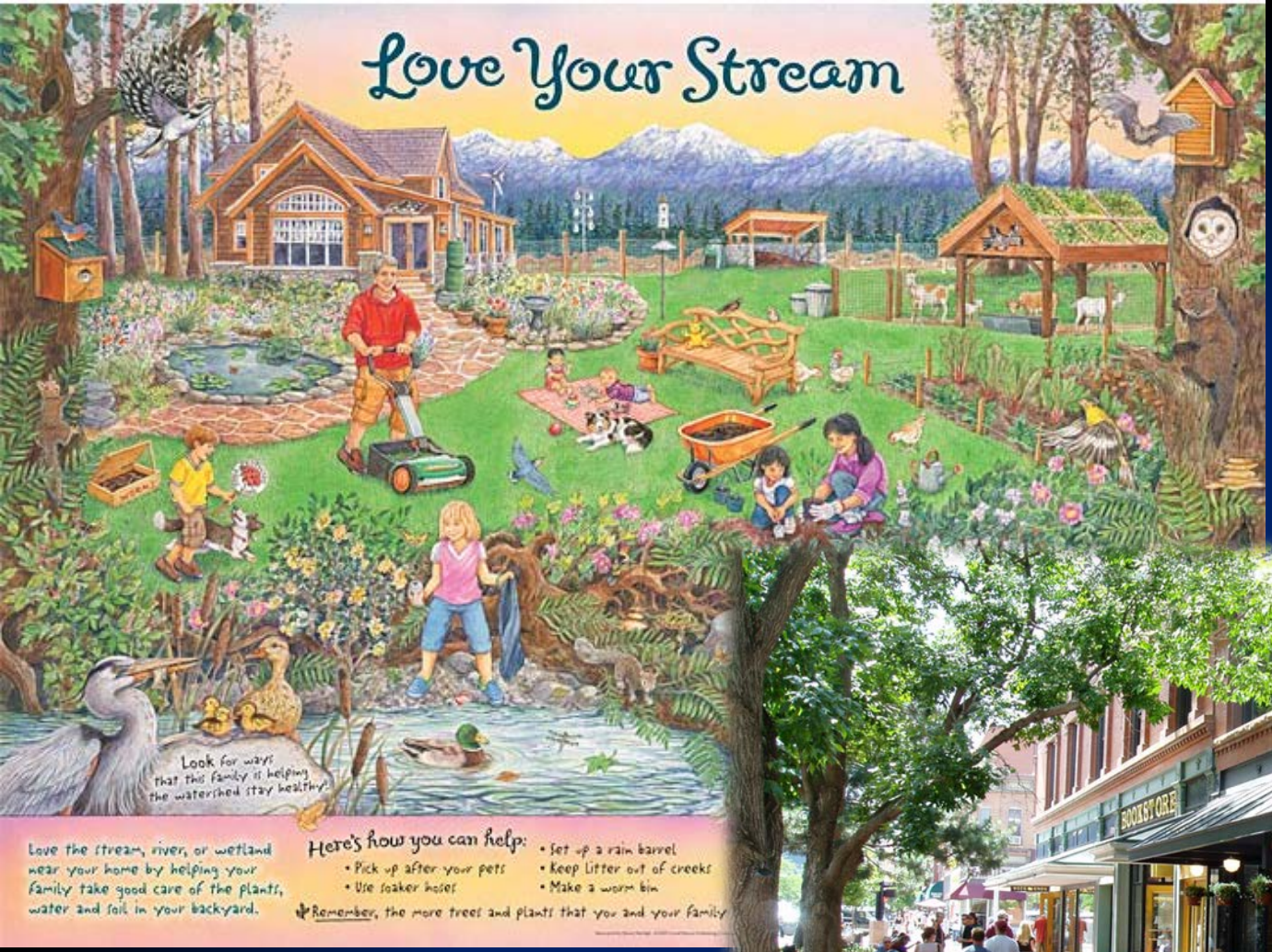
The couple contracted with a local nursery to research and grow native sod for a playfield. The lawn will consist of native bunch grasses grouped by "hydro-zone" and "habitat values"; an evapotranspiration sensor system, which monitors moisture loss, will ensure that landscaping is watered only when necessary.

The entire home is built on a single level because the owners hope to age comfortably there into late life. They call it "multigenerational."

SWIM WITH THE TURTLES

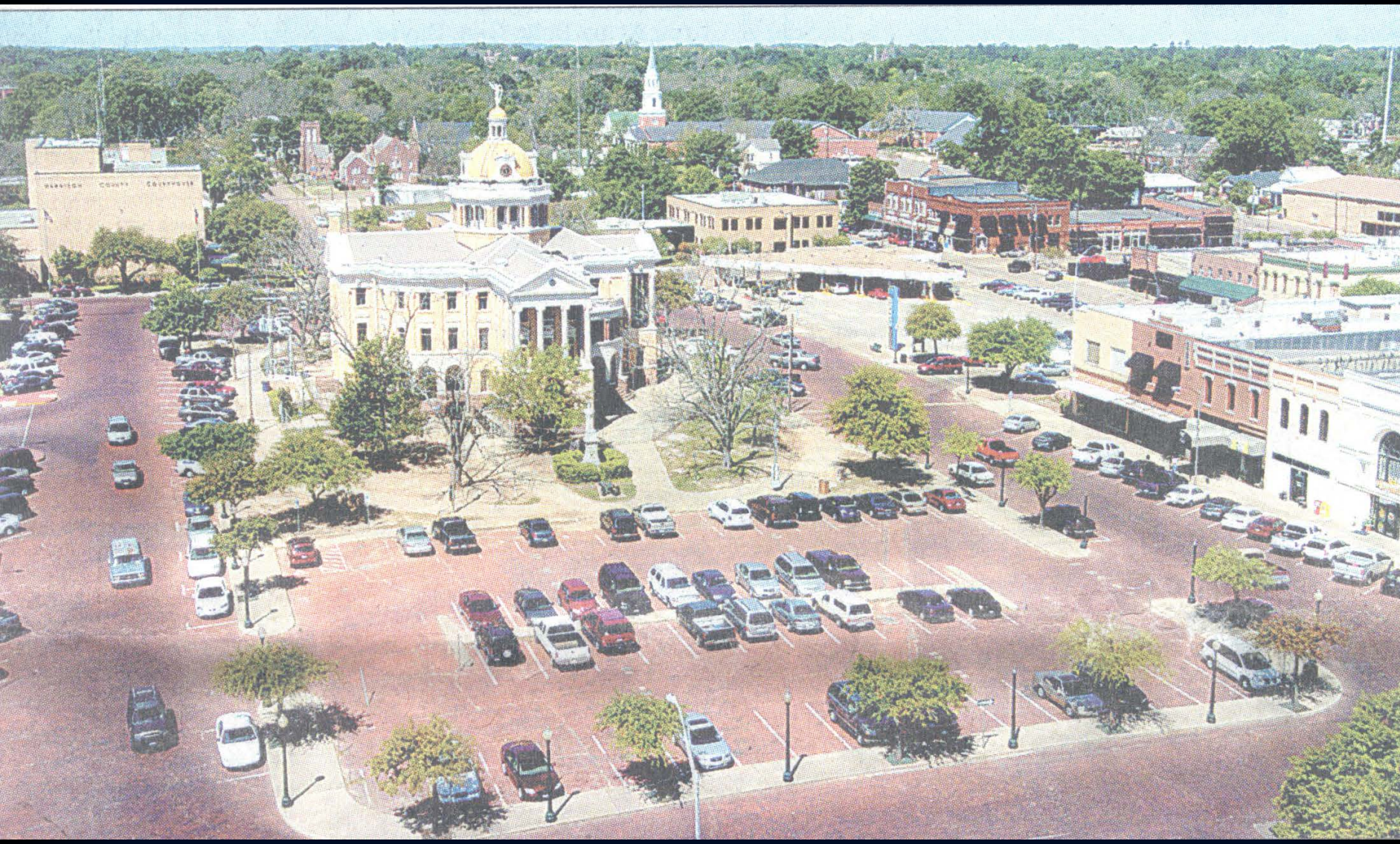
A chlorinated pool was replaced by a chemical-free, bio-filtered natural swimming pond friendlier to the local turtles and heated by radiant tubing that runs beneath the sports court (not pictured), which is warmed by the sun.

SOURCES: U.S. GREEN BUILDING COUNCIL; DESIGN AVENUES LLC; PAUL HOLLAND AND LINDA YATES; BLOOMBERG



Sherry Neidigh ©2009 Good Nature Publishing Company

Jim Charlier

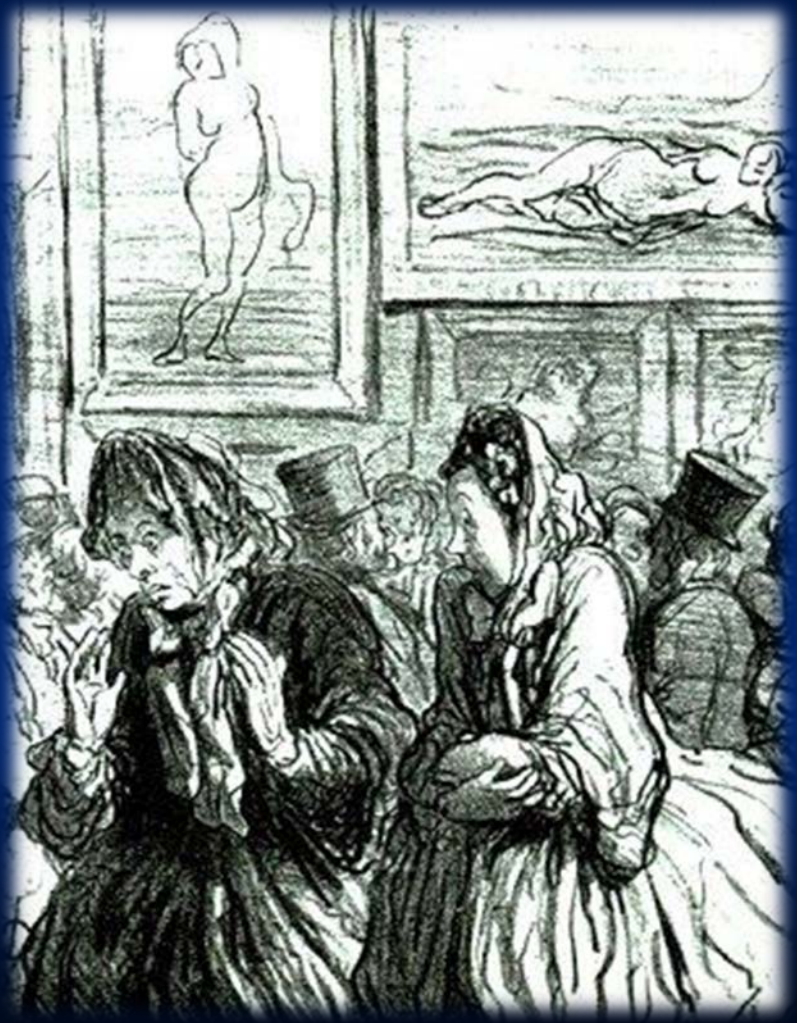


UPTOWN
AUTO BODY

© Carolyn Fannon

DRILL SITE
COMMERCIAL
50' X 115'
62.16
COMM
Katy ISD to Drainage Ditch
LAN A

Salon des Refuses



Low Impact Design

Via
Traditional Neighborhoods

Complete

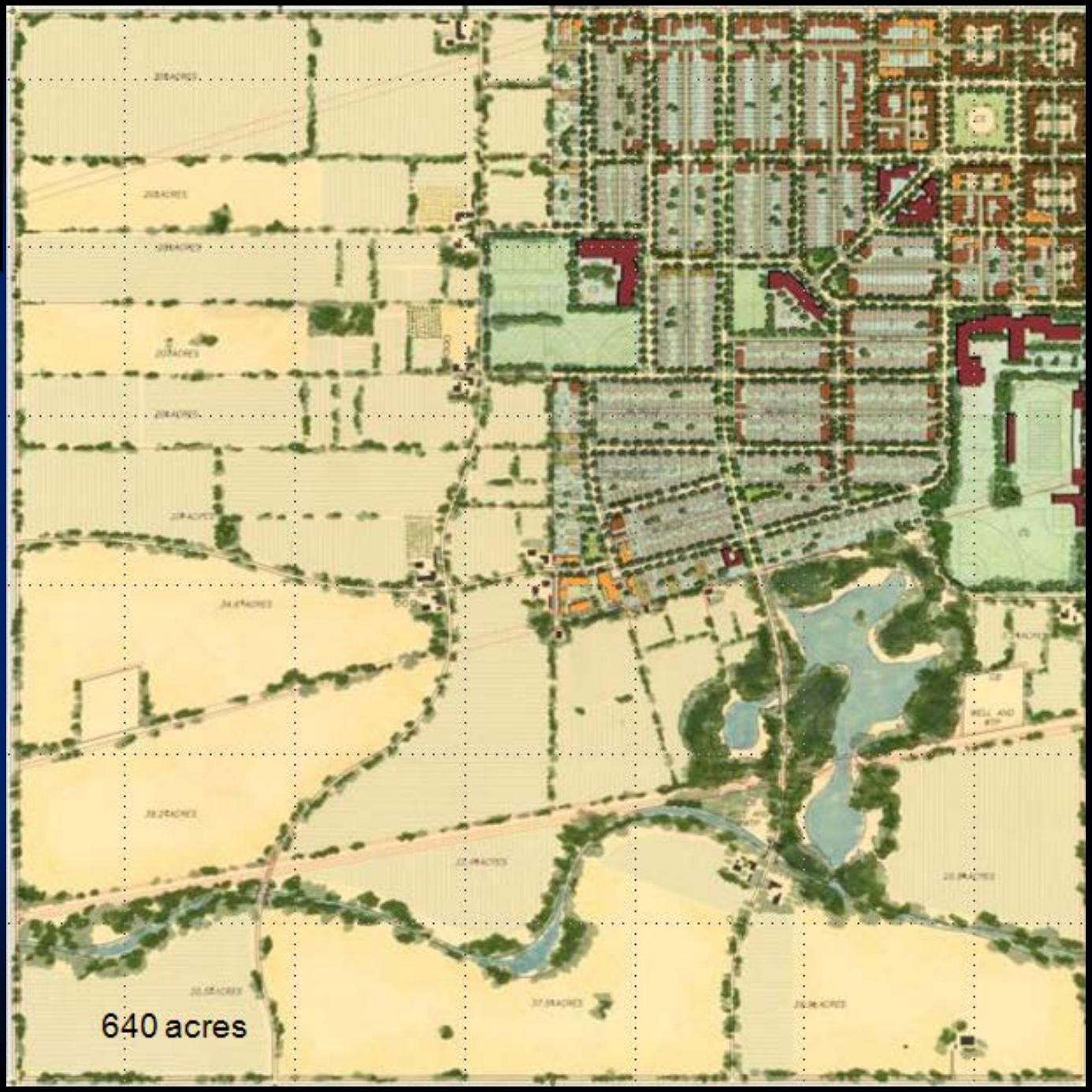
Connected

Compact

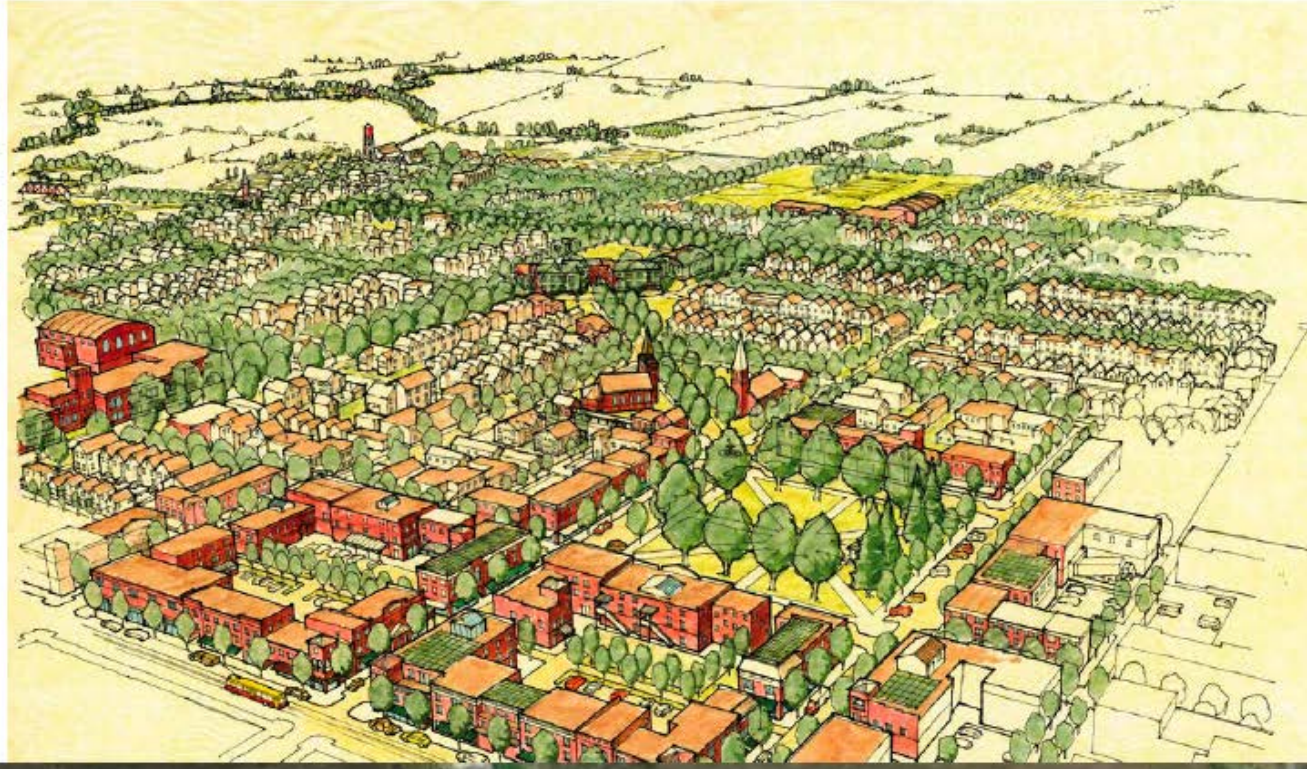
Complex

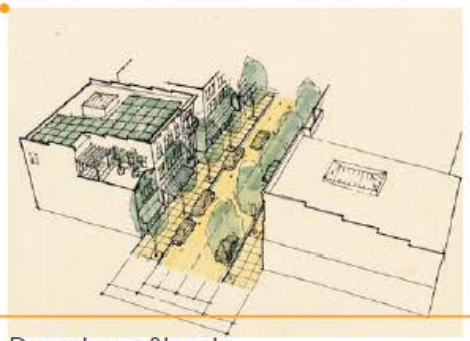
Convivial

Homes, Workplaces, Schools integrated into traditional neighborhoods and connected to surrounding agriculture



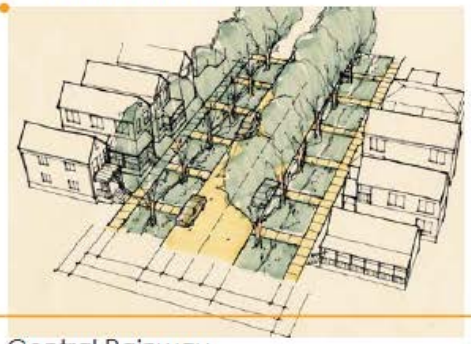
Central Rainway





Downtown Streets

Green Streets, Rain Gardens



Central Rainway

Green Alleys

Direct LID Elements

Green Streets
Pervious Paving at all streets

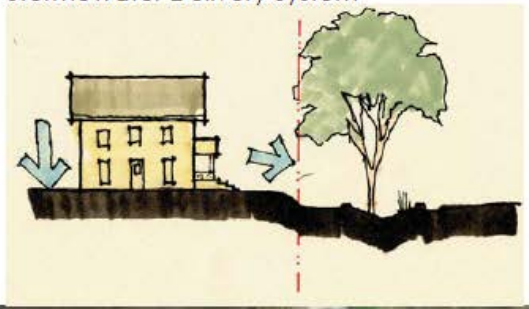
Watershed / Urban Symmetry
Traditionally Integrated Rainways / Rain Gardens

No private elements required for improved performance over natural conditions.
Private elements optional and don't require regualtion.

Indirect LID Elements:

Compact Urban Form
Retained Agricultural Lands representing 75% of developed lands.

Rainways / Pervious Streets as Primary Stormewater Delivery System



Compact Urban Form as Universal BMP

Kiam
CLARKS
THE MAIN EVENT PARTY!
AT ALL STAR WEEK
Budweiser
KING OF BEERS
UTILITY WORK AHEAD

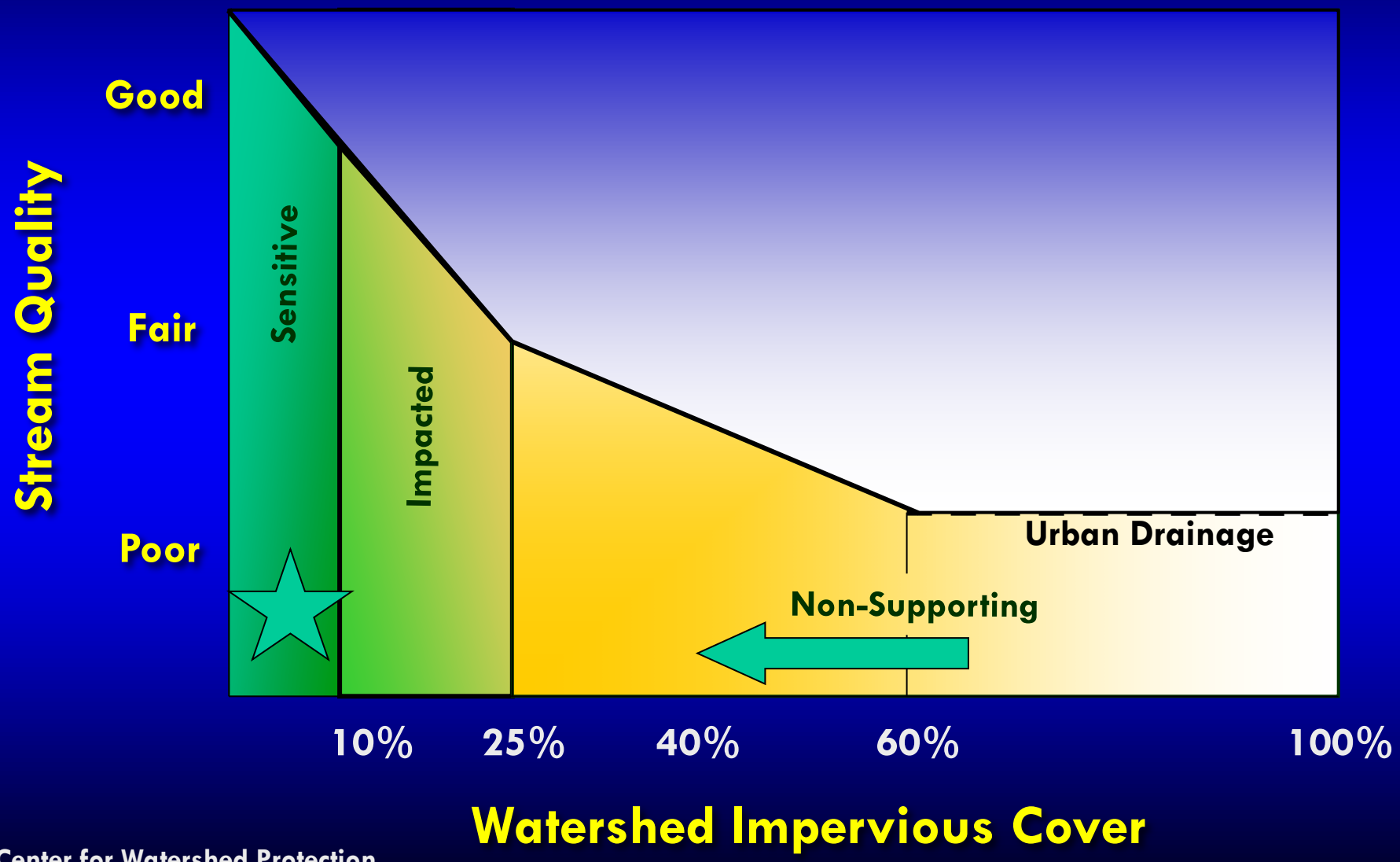
Lucky
Lucky FOOD CENTER
CARDBOARD ONLY

Commissioned by the Friends of Baxter Creek

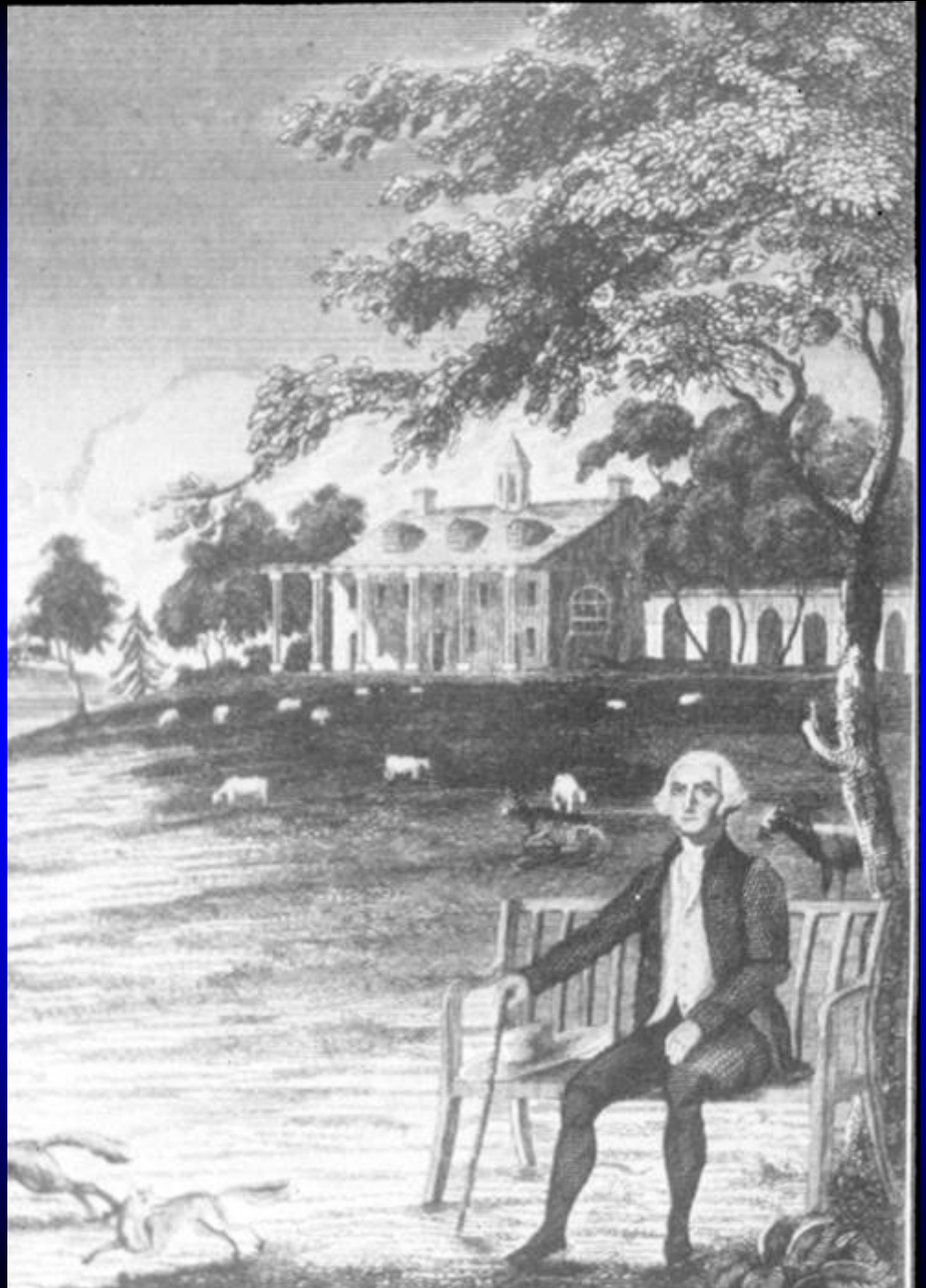
Preserve Open Natural Area and Farmland
Reduce Polluted Runoff
Live in a walkable neighborhood

TEXAS COASTAL WATERSHED
P R O G R A M

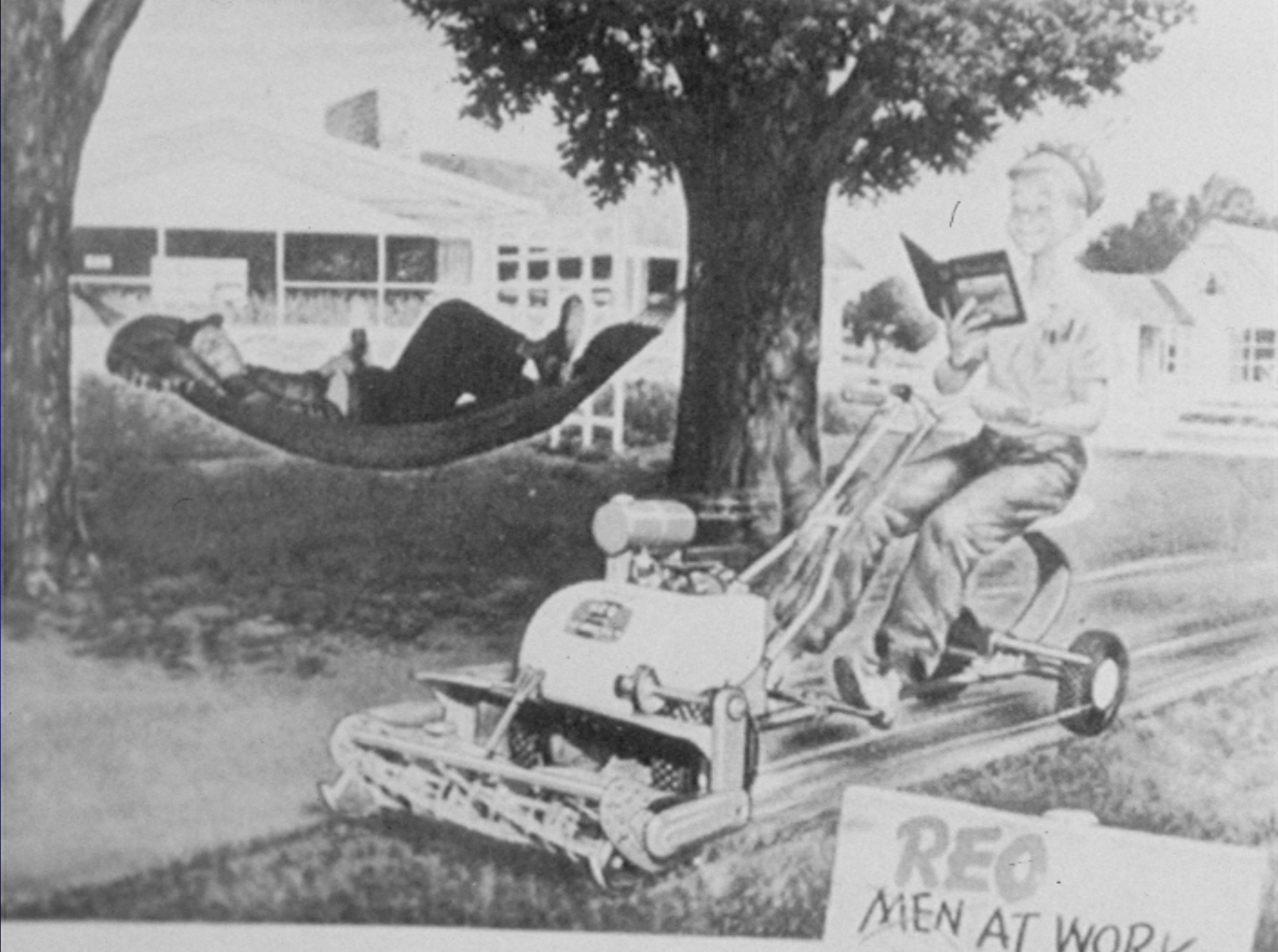
Impervious Cover Model



Center for Watershed Protection



MURPHY


REO
MEN AT WORK

"A good Lawn builds Morale"

OUTDOOR LIVING
REQUIRES A SEED
MIXTURE ADAPTED TO
YOUR GROWING CONDITIONS

Your local Woodruff dealer carries the mixture **adapted** to your local soil and climate requirements. High content of perennial grasses for permanent, weed-deterrent growth.

ASK FOR

WOODRUFF
Adapted* LAWN *Seed
F. H. WOODRUFF & SONS, Inc., MILFORD, CONN.

Low Impact

Conventional

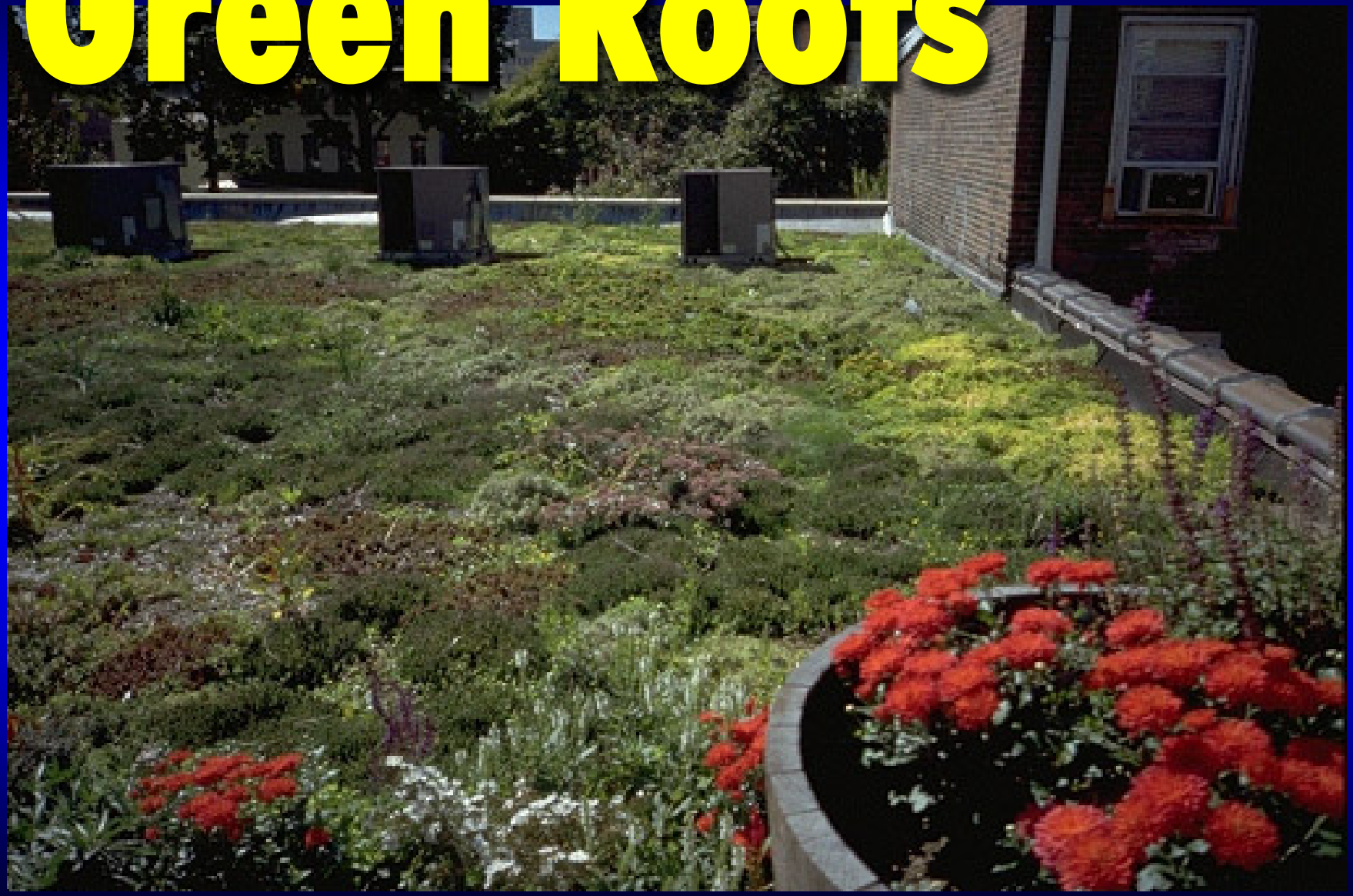
Functional Landscape Design

Bioretention
"Treatment Train"
Bioretention Cell
Flow Path
Grass Swale
Grass Filter
Strip
Bioretention Cell
Storm Drain System

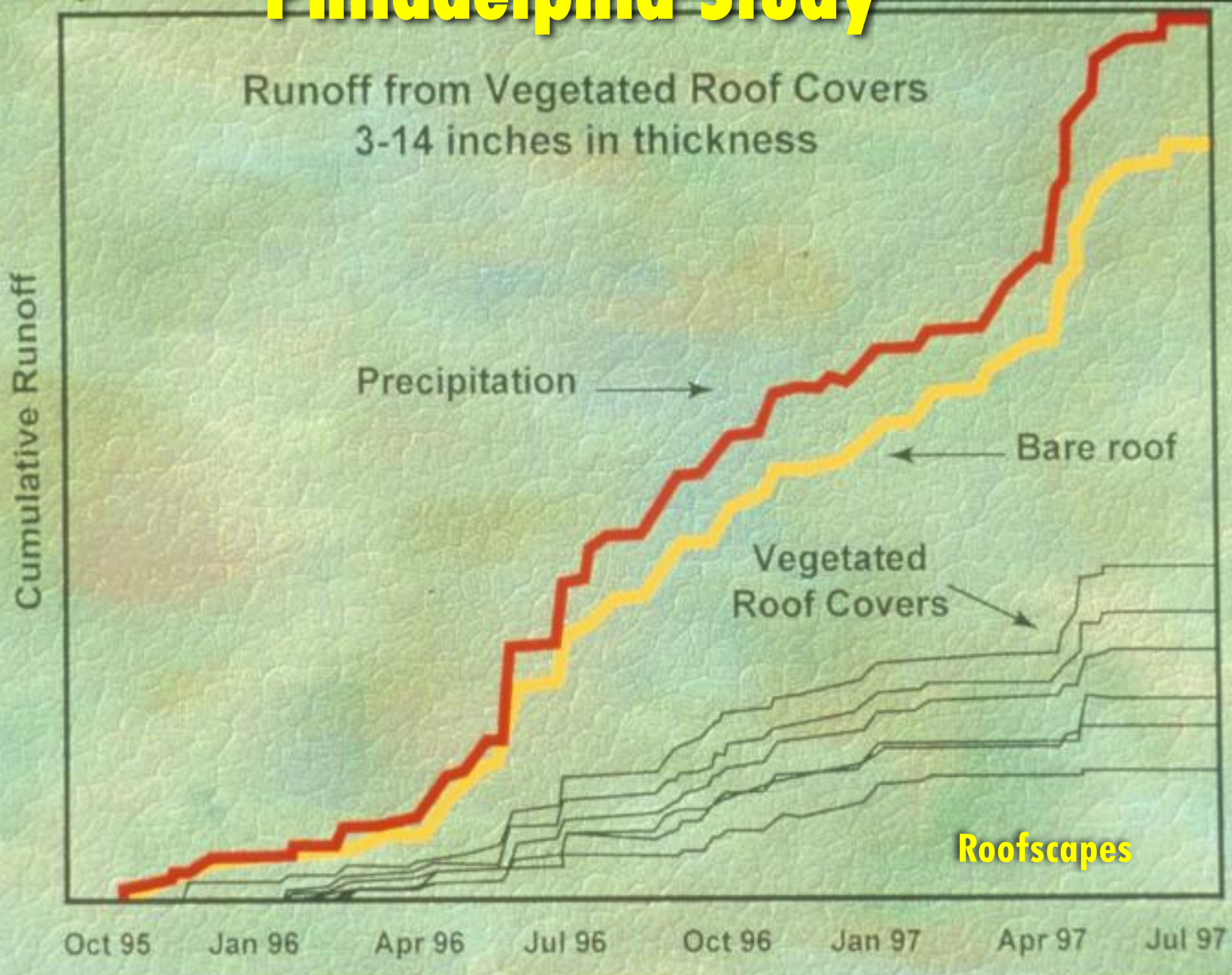
Seattle's Street Edge Alternatives Program

After Completion - January 2001

Green Roofs



Philadelphia Study



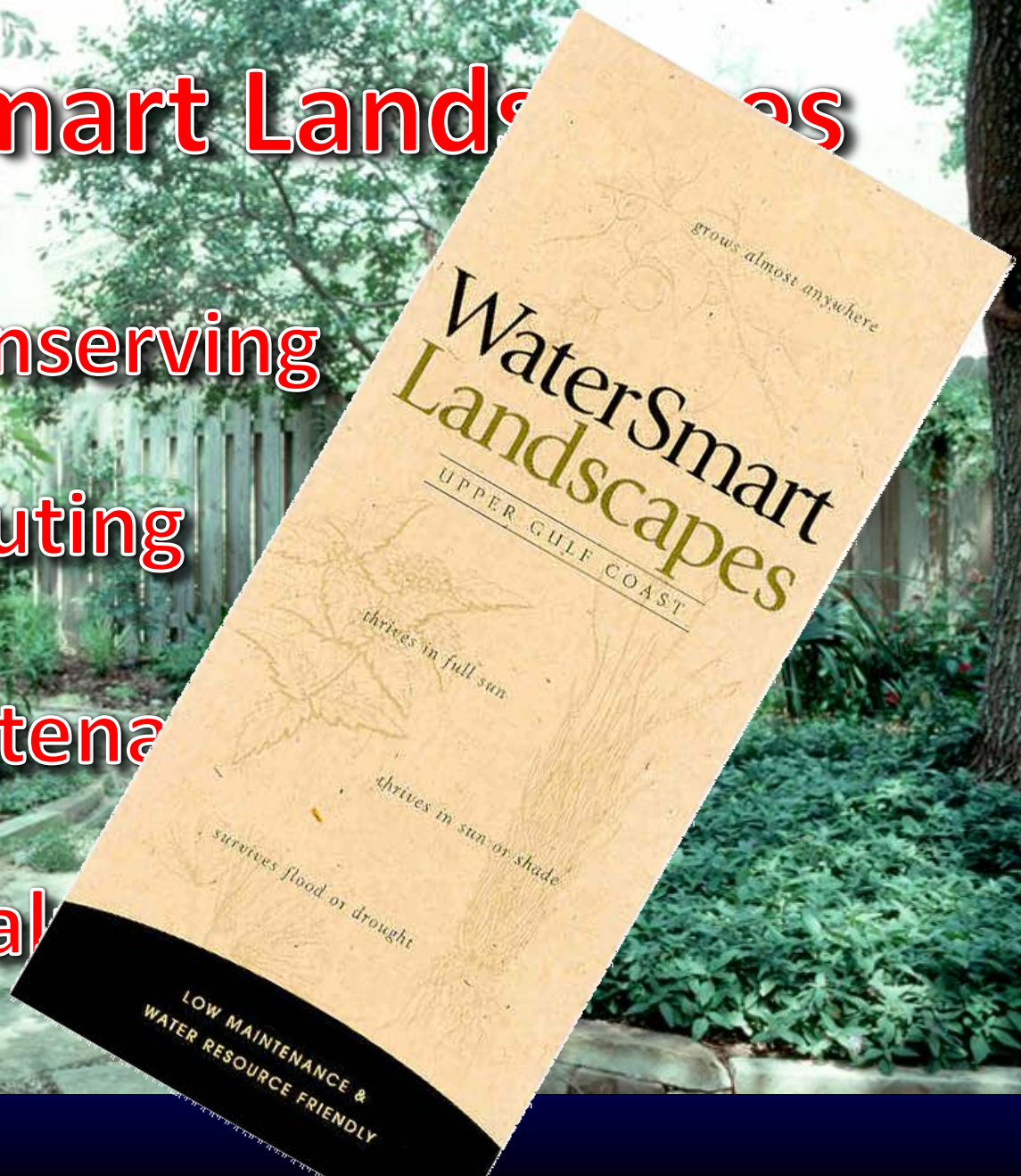
Ben DeSoto
Houston Chronicle, Jul 15, 2001

The Freedom Lawn

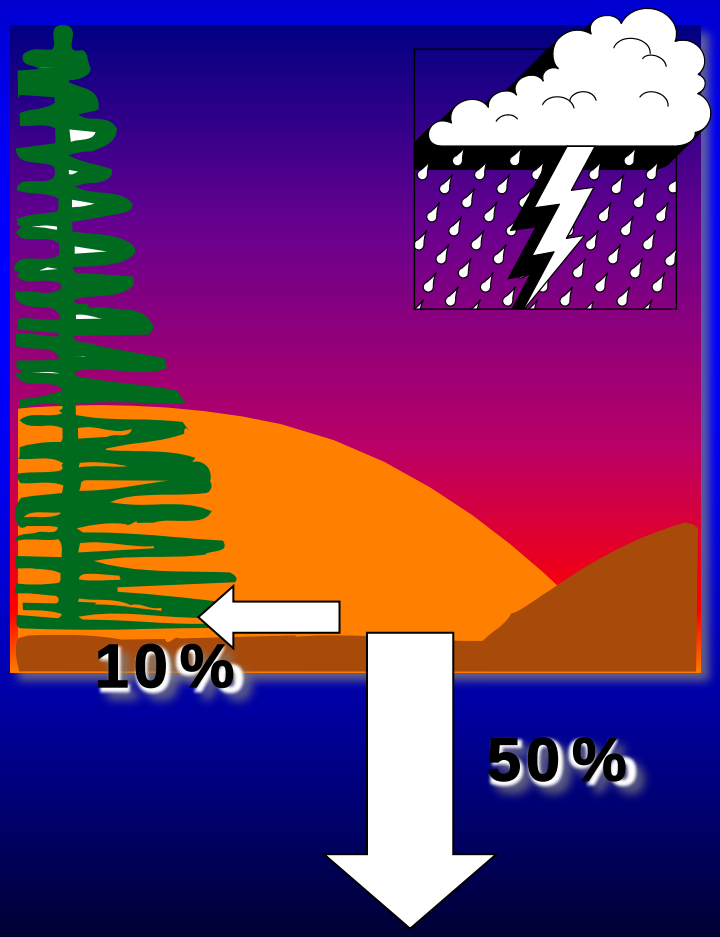
- Mow high
- Don’t Bag It!
- Water when it wilts
- Compost/ Organic Fertilizer
- Toleration!

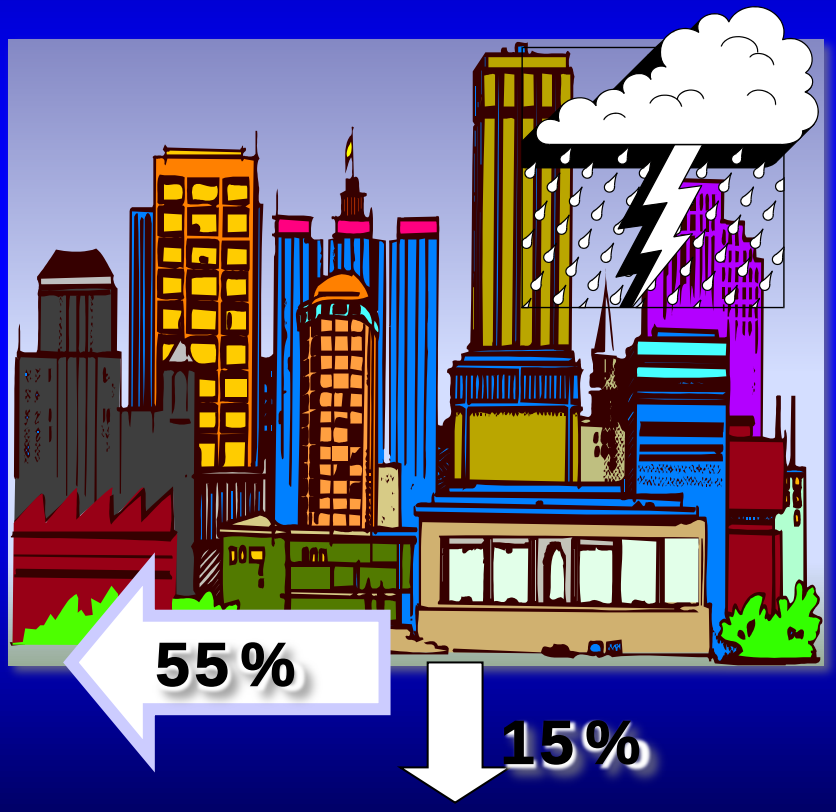
Watersmart Landscapes

- water conserving
- non polluting
- low maintenance
- habitat value



Development Impacts on the Water Cycle





Development Impacts on Water Quality

Increased quantity

Decreased quality

Nutrients

Pathogens

Sediment

Toxic Contaminants

Debris

Thermal Stress

INTENSITY OF LAND USE

IMPERVIOUS SURFACE

WATER QUALITY PROBLEMS

Impervious Surfaces

Materials like cement, asphalt, roofing, and compacted soil that prevent percolation of runoff into the ground

Alternative Parking

MENSCH.HAUS AG
gesund wohnen ökologisch bauen

Build Good Soil