

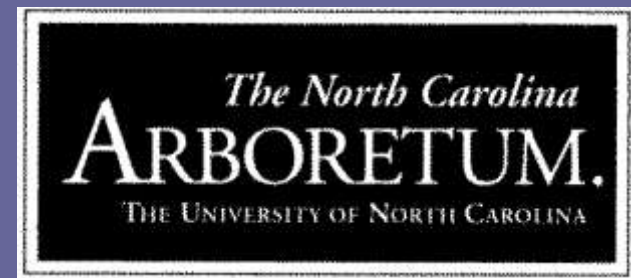
# Introduction to Green Infrastructure and Low Impact Development

*November 18, 2008*

**NC STATE UNIVERSITY**



Jon Calabria, Landscape Architect  
Upper French Broad Watershed  
Training Center Coordinator  
Water Quality Group, NCSU



# Presentation

- Introduction
- What not to
- Green Infras  
Development
- Case Study



# What is Green Infrastructure?

. . . that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for . . . communities and people.”

# What is Green Infrastructure?

“An interconnected network of:

- -waterways, wetlands, woodlands, wildlife habitats and other natural areas;
- -greenways, parks and other conservation lands;
- -working farms, ranches and forests;
- -wilderness and other open spaces



# History

- Ecological Planning Approaches
  - Land Suitability Analysis (GIS Forerunner)

# More History

- Ecological Planning Approaches
  - Human Ecology
  - Applied Ecosystem
  - Landscape Ecology
    - “Patch-Corridor-Matrix” Framework
      - (Forman/Godron)
    - Hydrologic Landscape Structure
    - Habitat Networks

# Benefits

- Reduce Heat Island Effects
  - Increases urban green space and vegetation
  - Lowers demands for air conditioning energy=decreasing emissions



# Benefits

- Improve Air Quality
  - Absorbs pollutants from air and contact removal
  - Reduce amount of respiratory illness



# Benefits

- Increase Habitat/Biodiversity
  - Increases number of potential habitats



# Benefits

Stormwater/improve water quality and quantity

- Reduces stormwater runoff volumes and reduces peak flows
- Increases amount of pervious groundcover
- Decreases volume in combines or separate sewer systems
- Recharges groundwater aquifers

# Riparian Corridor

**Habitat**—the spatial structure of the environment which allows species to live, reproduce, feed, and move.



Habitat

**Barrier**—the stoppage of materials, energy, and organisms.



Barrier

**Conduit**—the ability of the system to transport materials, energy, and organisms.



Conduit

**Filter**—the selective penetration of materials, energy, and organisms.



Filter

**Source**—a setting where the output of materials, energy, and organisms exceeds input.



Source

**Sink**—a setting where the input of water, energy, organisms and materials exceeds output.



Sink

"Stream Corridor Restoration: Principles, Processes, and Practices, 10/98, by the Federal Interagency Stream Restoration Working Group (FISRWG)."

# Riparian Car Door

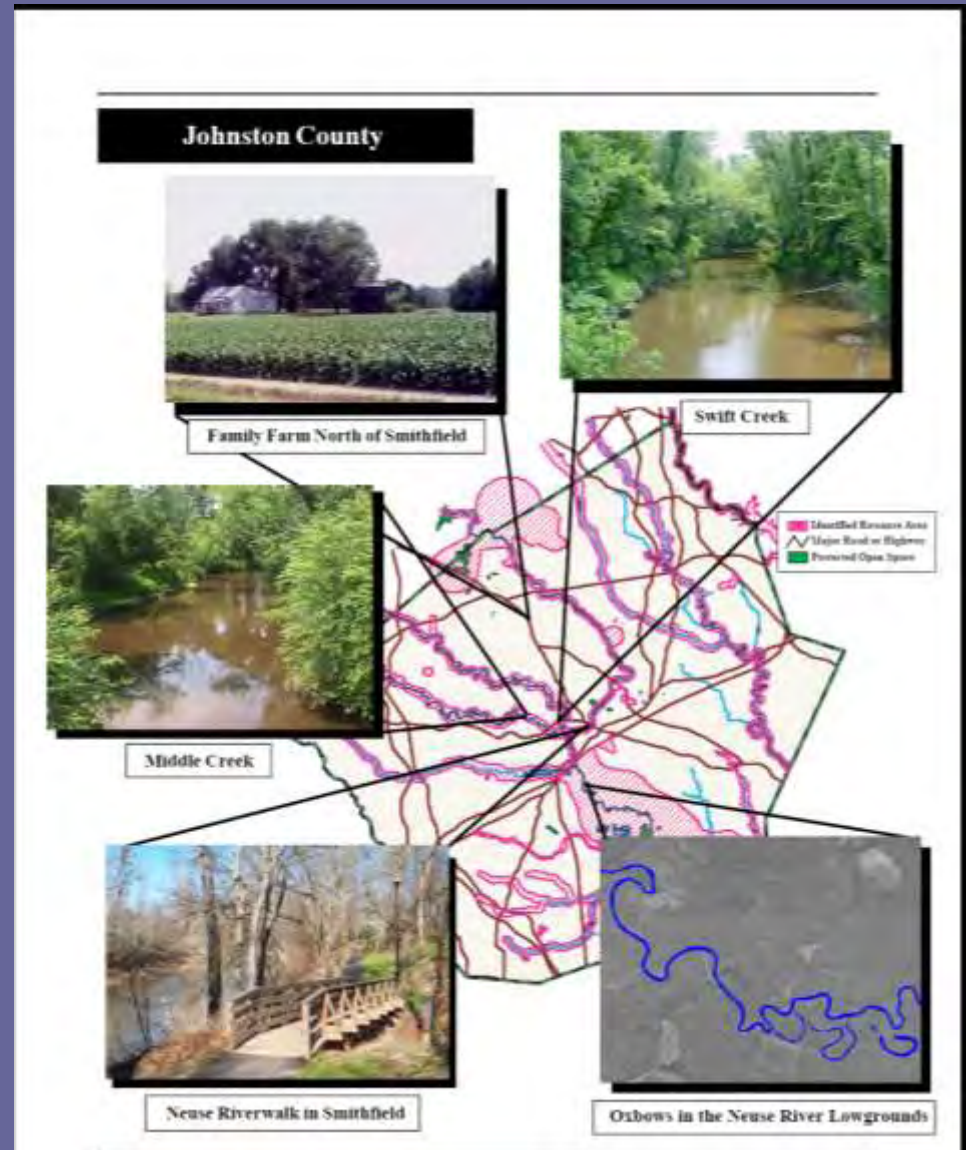


# Benefits

- Community Benefits
  - Helps with stormwater management, flood control, water quality
  - Promotes better health by vegetation and green space
  - Creates stronger sense of community
  - Increases surrounding property values
  - Improves urban aesthetics



- Triangle GreenPrint Outreach Report
- (July 2003, p 12)



# Who needs planning?



# Impacts from Sprawl

- loss of natural areas, habitat, biodiversity
- degradation of water resources
- decreased ability for nature to respond to changes
- loss of "free" natural services
- increased cost of public services
- increased taxes



# Stewardship?



# Dohhh!



# Where is treatment?



“It’s the bugs!”



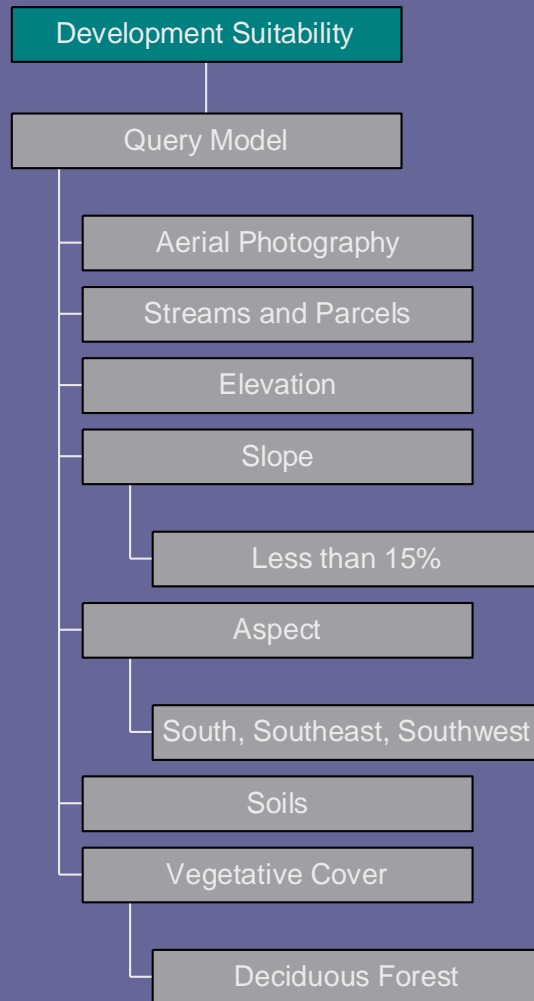


# NC Conservation Tax Credit

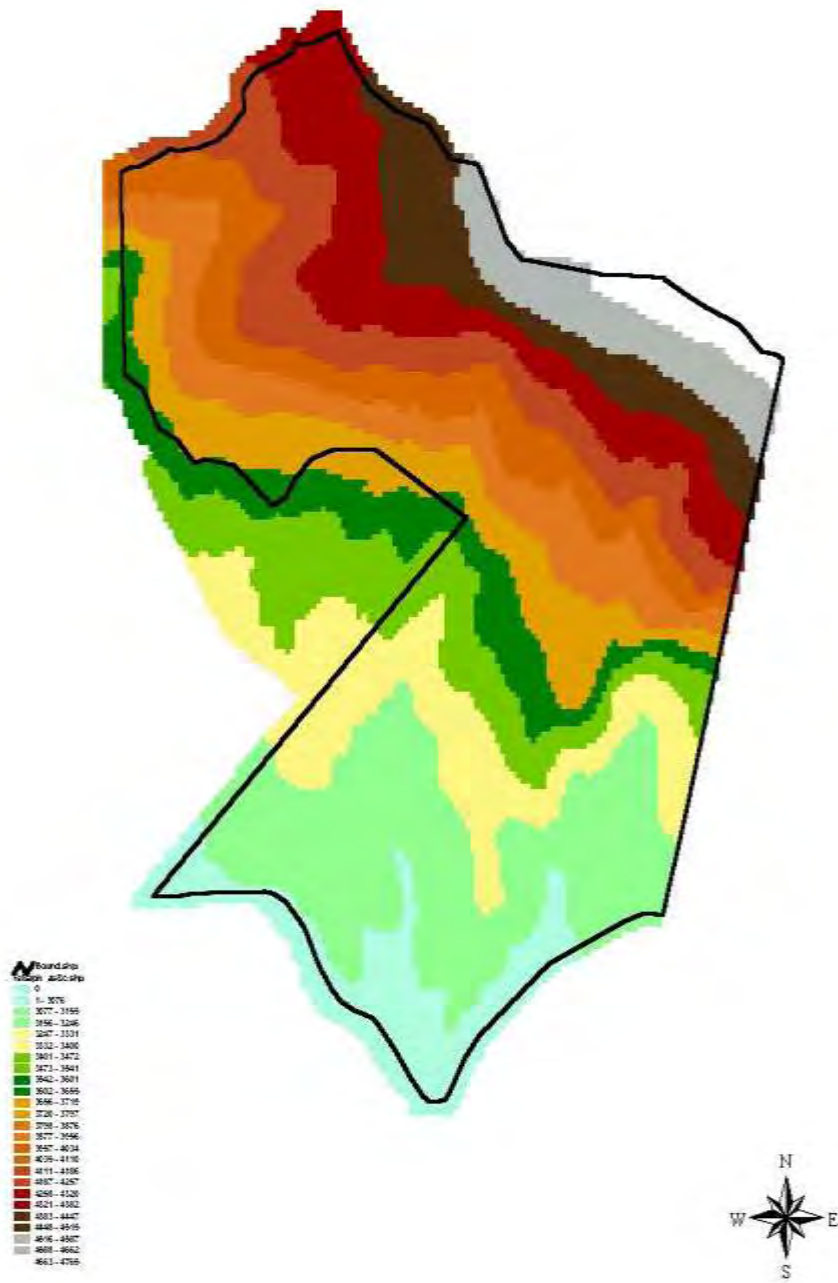
- Incentive to do what is right for the land
- Substantial income tax credit for landowners
- Fee simple where all property rights are transferred or
- Less than fee simple where landowner retains some rights and donates others, i.e. conservation easement

- Certified appraiser
- Compare appraisal of yield plan to actual development plan
- Difference in these two plans is a tax deduction over a 6 year period or more
- Contribution is deduction from federal income tax as well as state income tax
- Gift has to be given to a non-profit org./state agency/local government

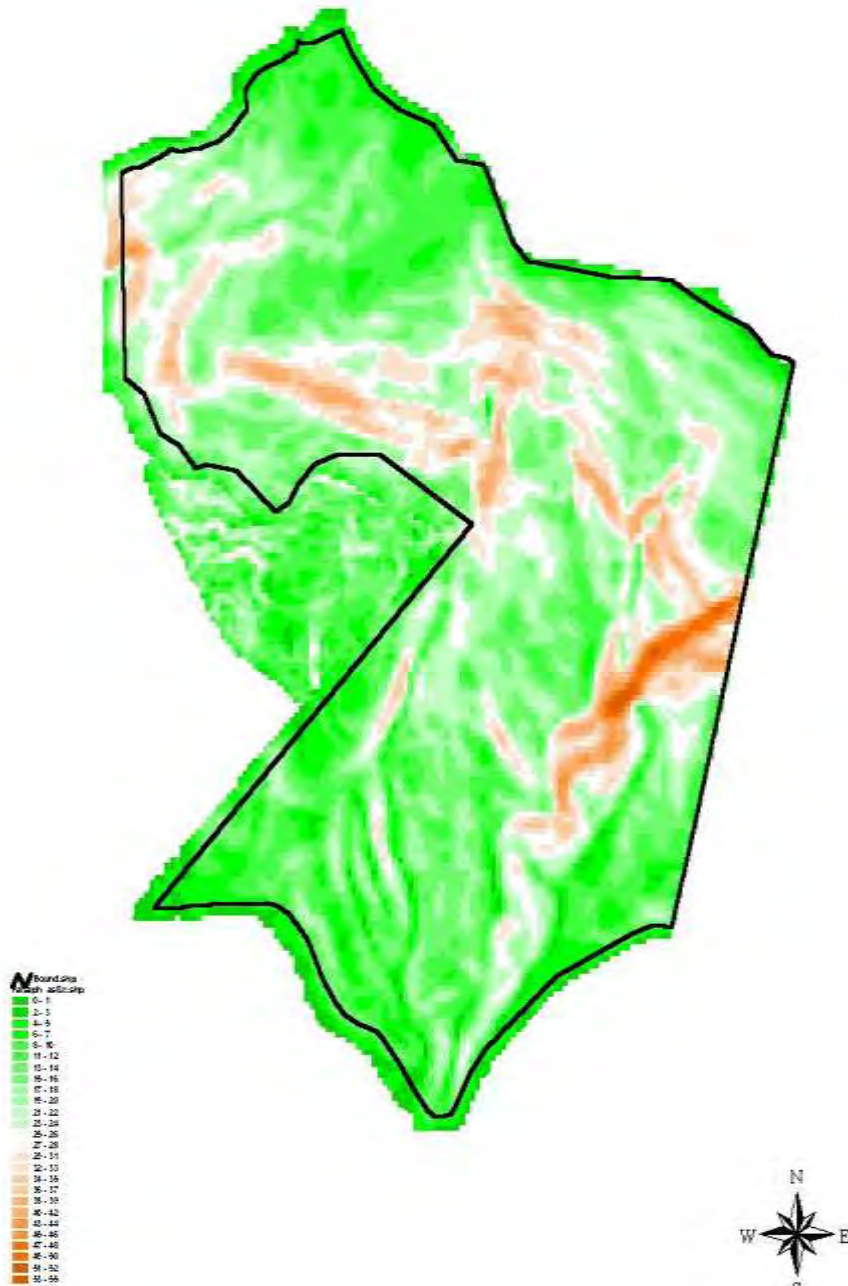
# Development Model



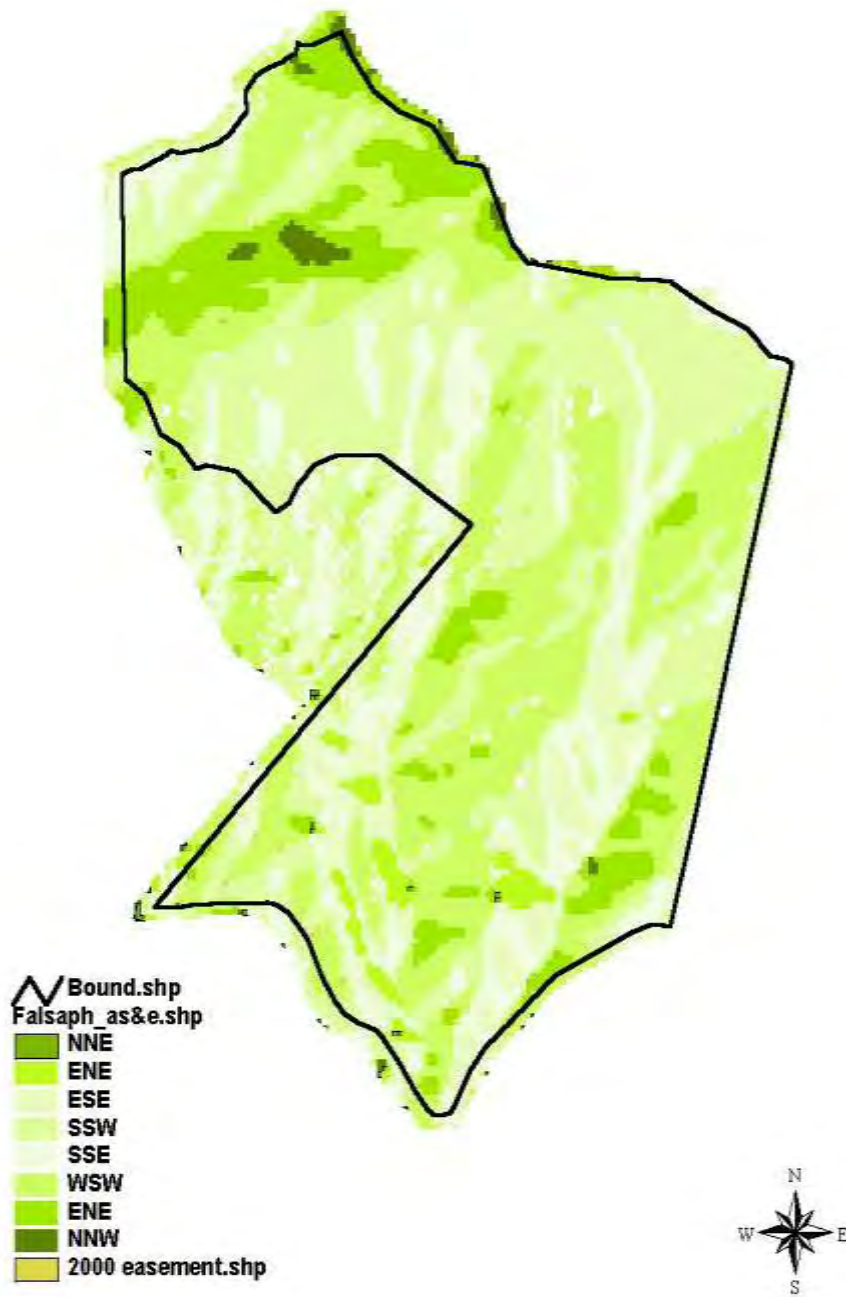
# Elevation Analysis



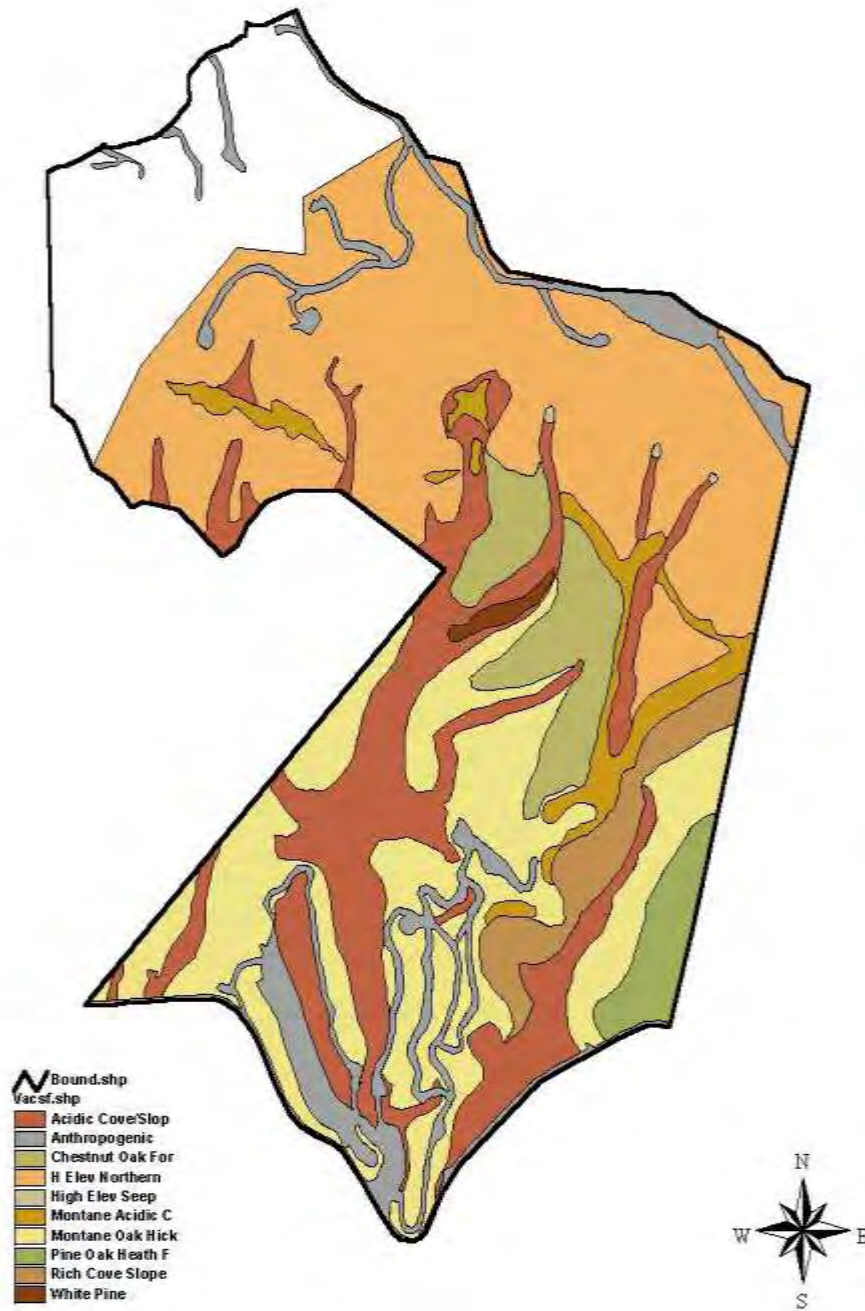
# Slope Analysis



# Aspect Analysis



# Vegetation Analysis



# Development Suitability



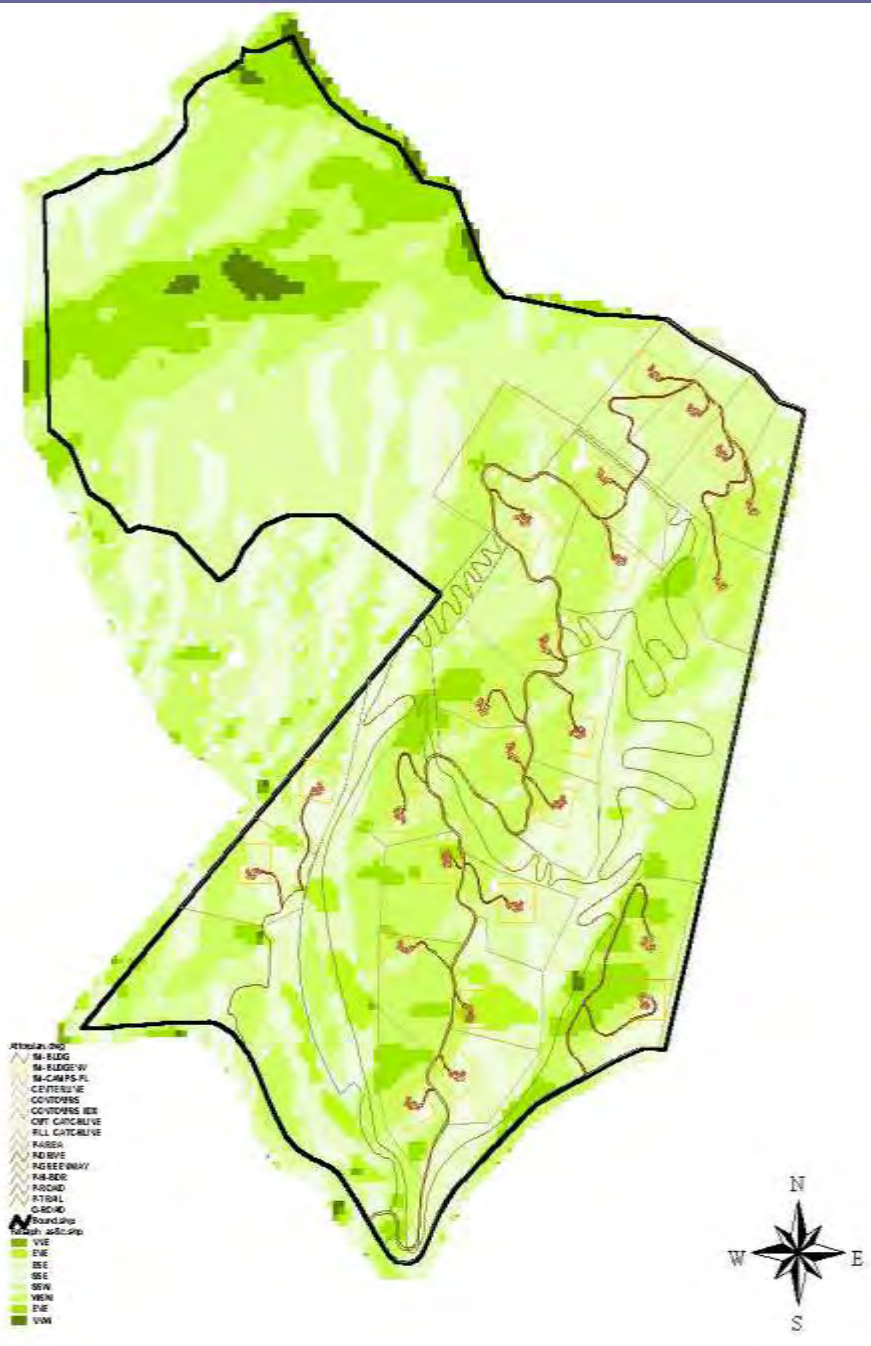


# Development Plan





# Double Check Data



# How FEW units can be placed on a tract of land and still make a profit?

## Balsam Mountain Preserve

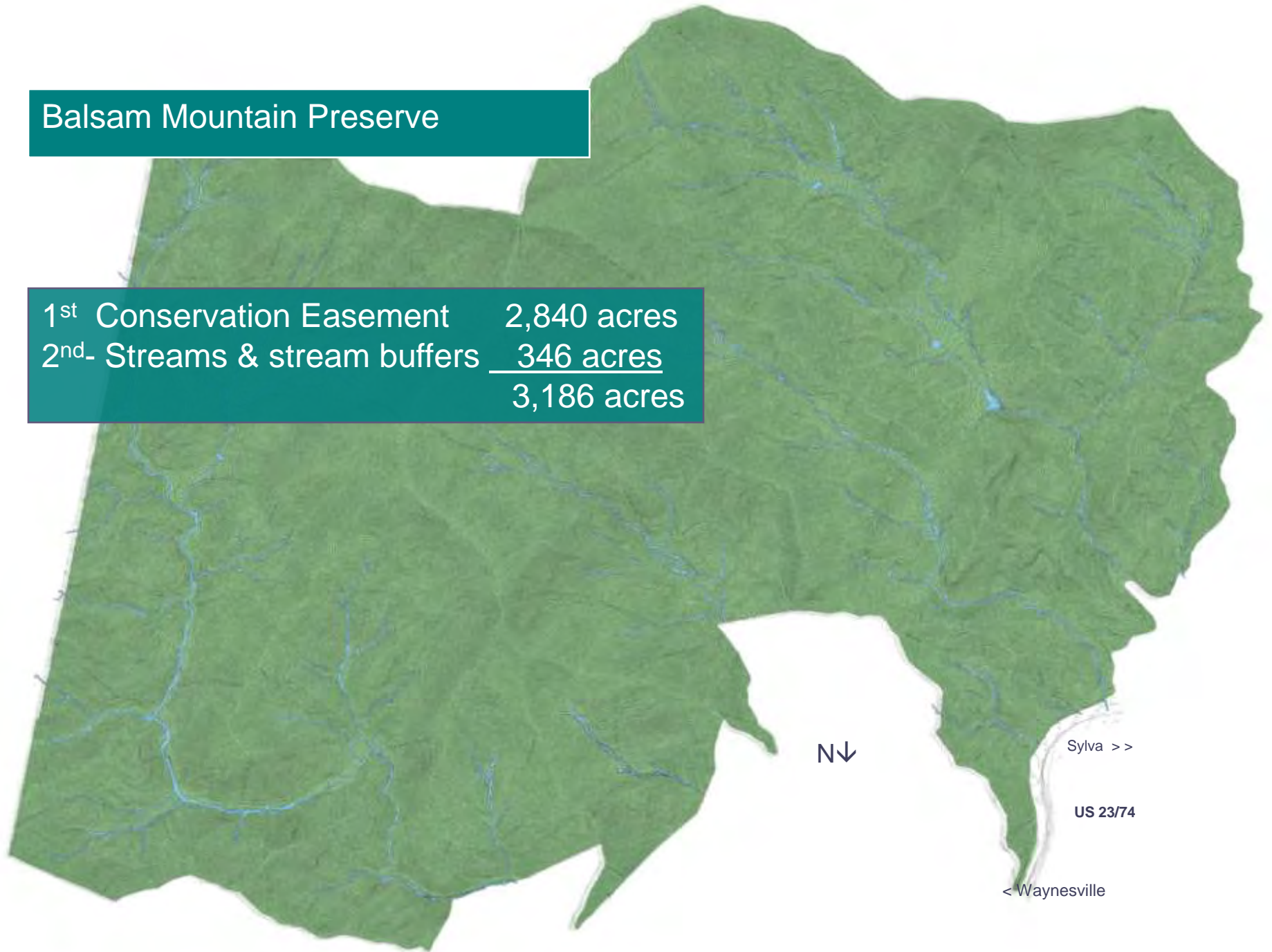
- 4,400 acres
- 350 homes on two acre homesteads
- 3,500 acres in conservation easement

## Buffalo Creek Preserve

- 3,900 acres
- 60 mountain camps with 5 acres each
- no amenities
- 3,600 acres in conservation easement

# Balsam Mountain Preserve

1 <sup>st</sup> Conservation Easement	2,840 acres
2 <sup>nd</sup> - Streams & stream buffers	<u>346 acres</u>
	3,186 acres



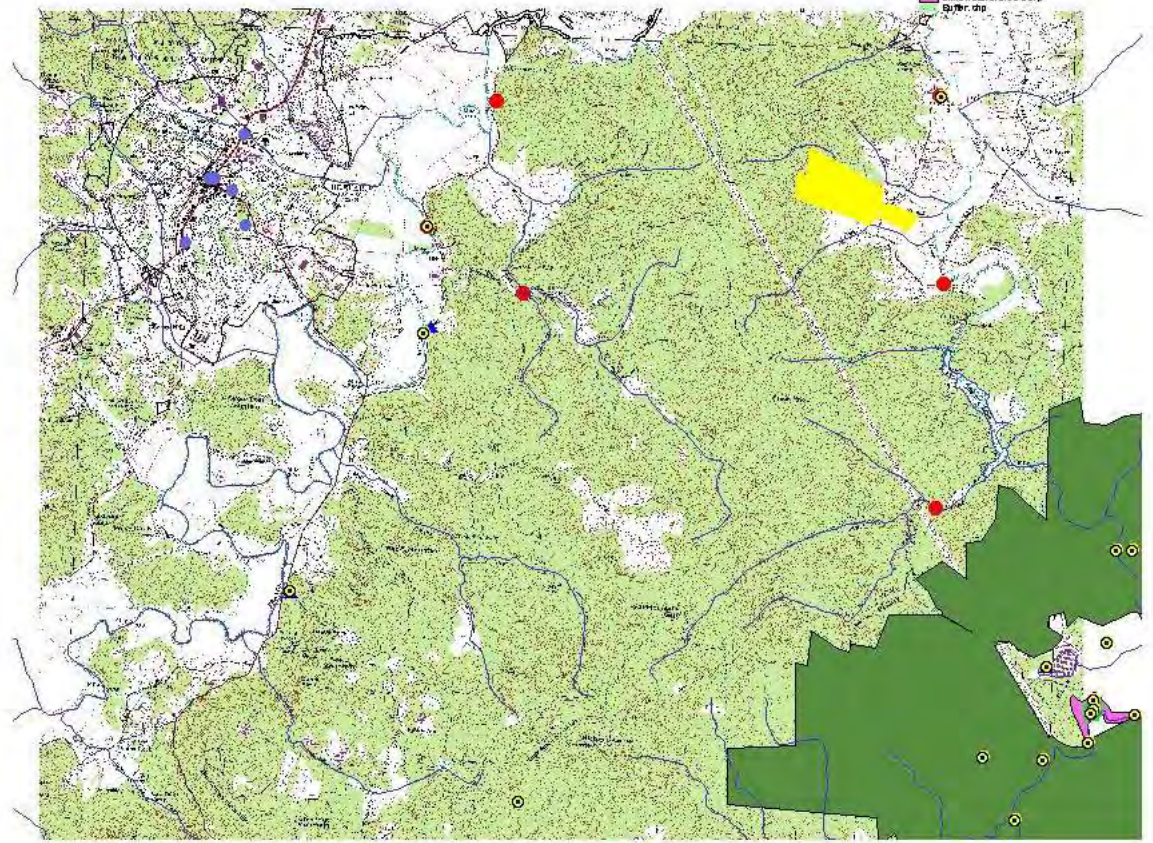


**Demonstration site for new and innovative technology in sediment and erosion control.**

# Location Map Morrithe Meadows

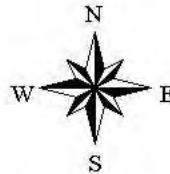


- Critical meadow
- Natural heritage corridor
- Water quality trout stream
- Water source
- Wildlife trout stream
- Wildlife game land
- Wetland
- Boreal wetland
- ▲ Point
- Animal
- Natural Community
- Special Animal Habitat
- Municipal boundary
- Historic structure
- Conservation easement
- Critical area
- Critical area
- Other

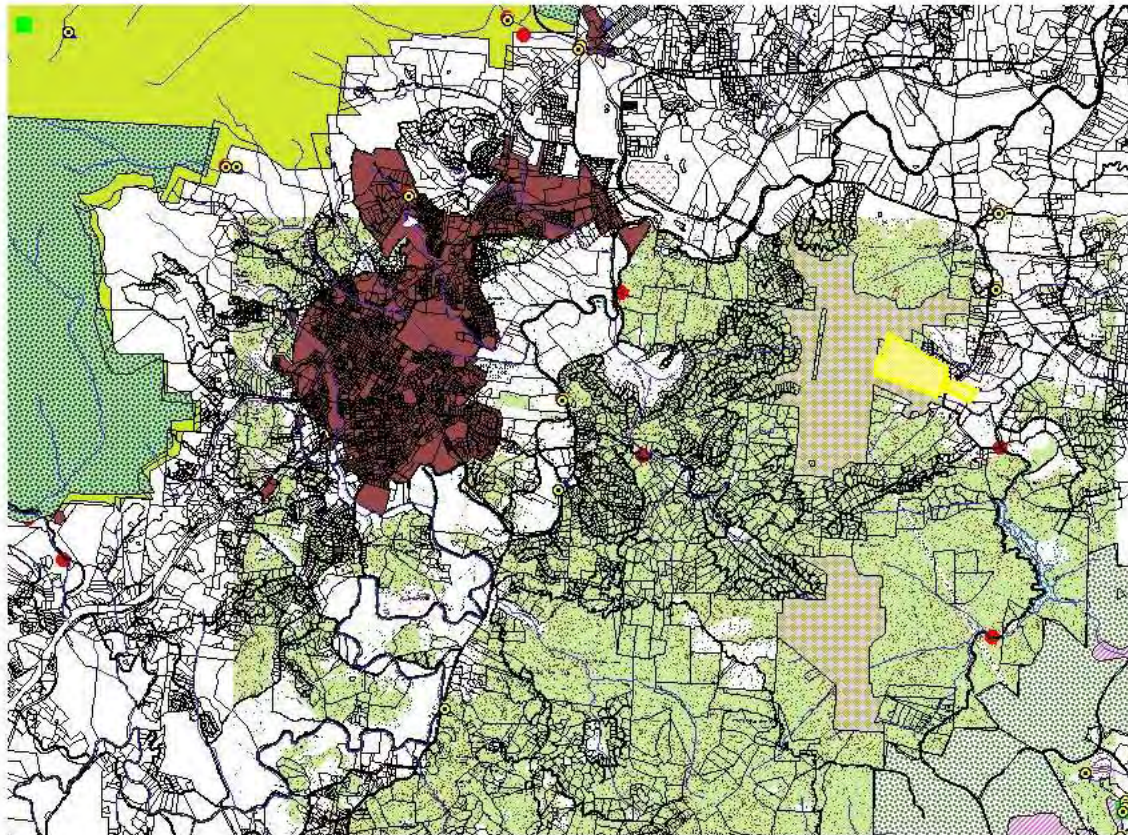


# Protected Parcels Morrithe Meadows

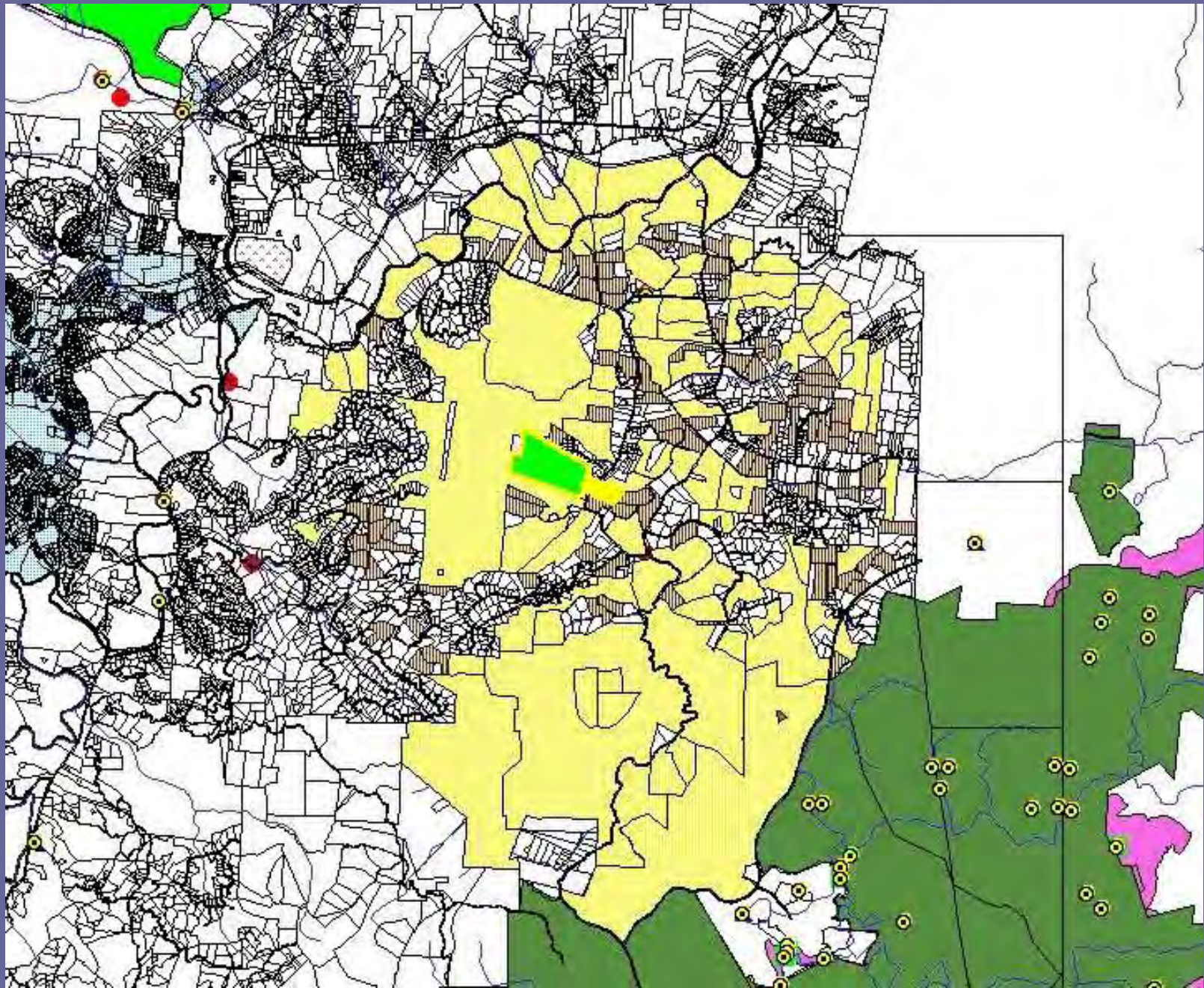
0 2 Miles

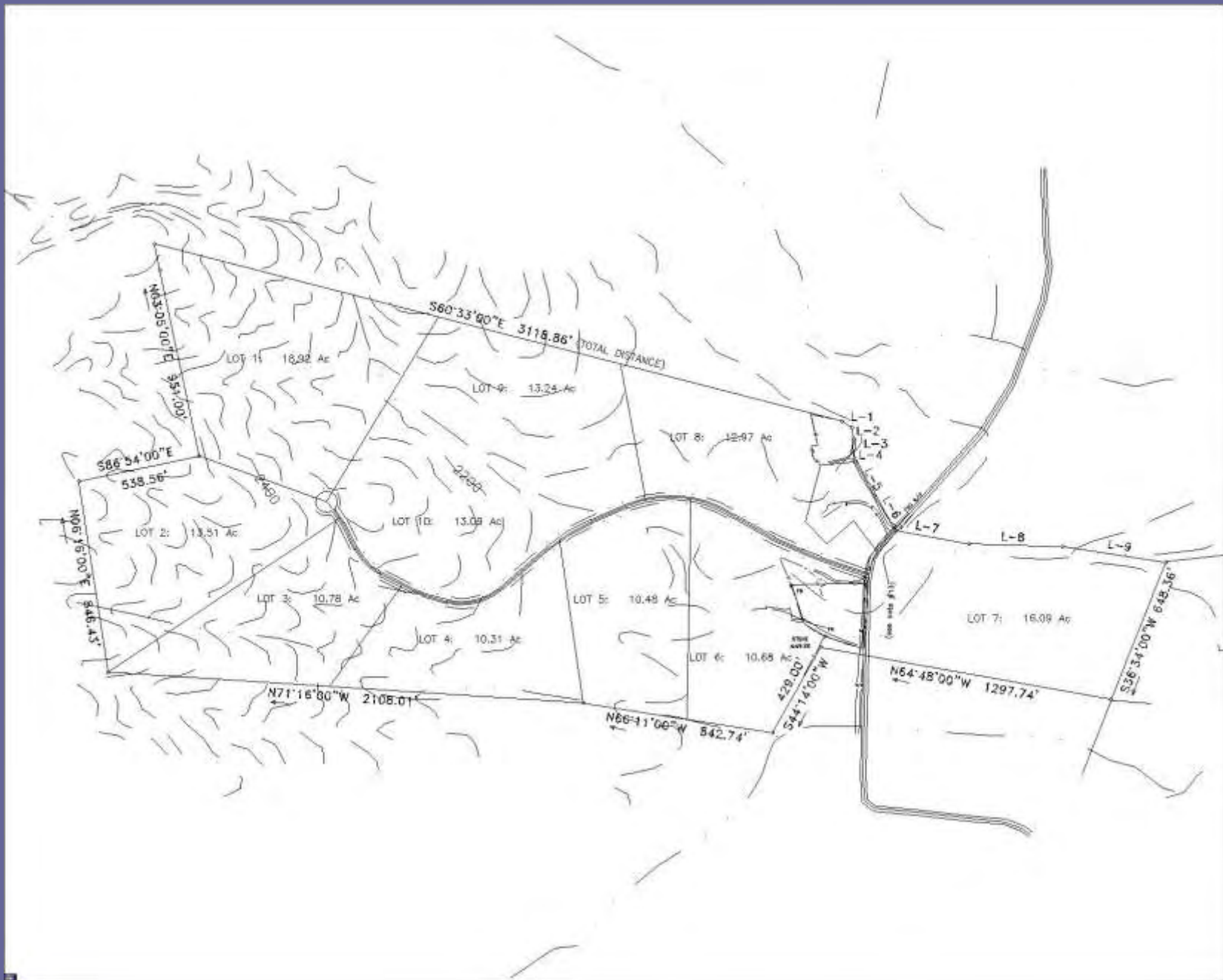



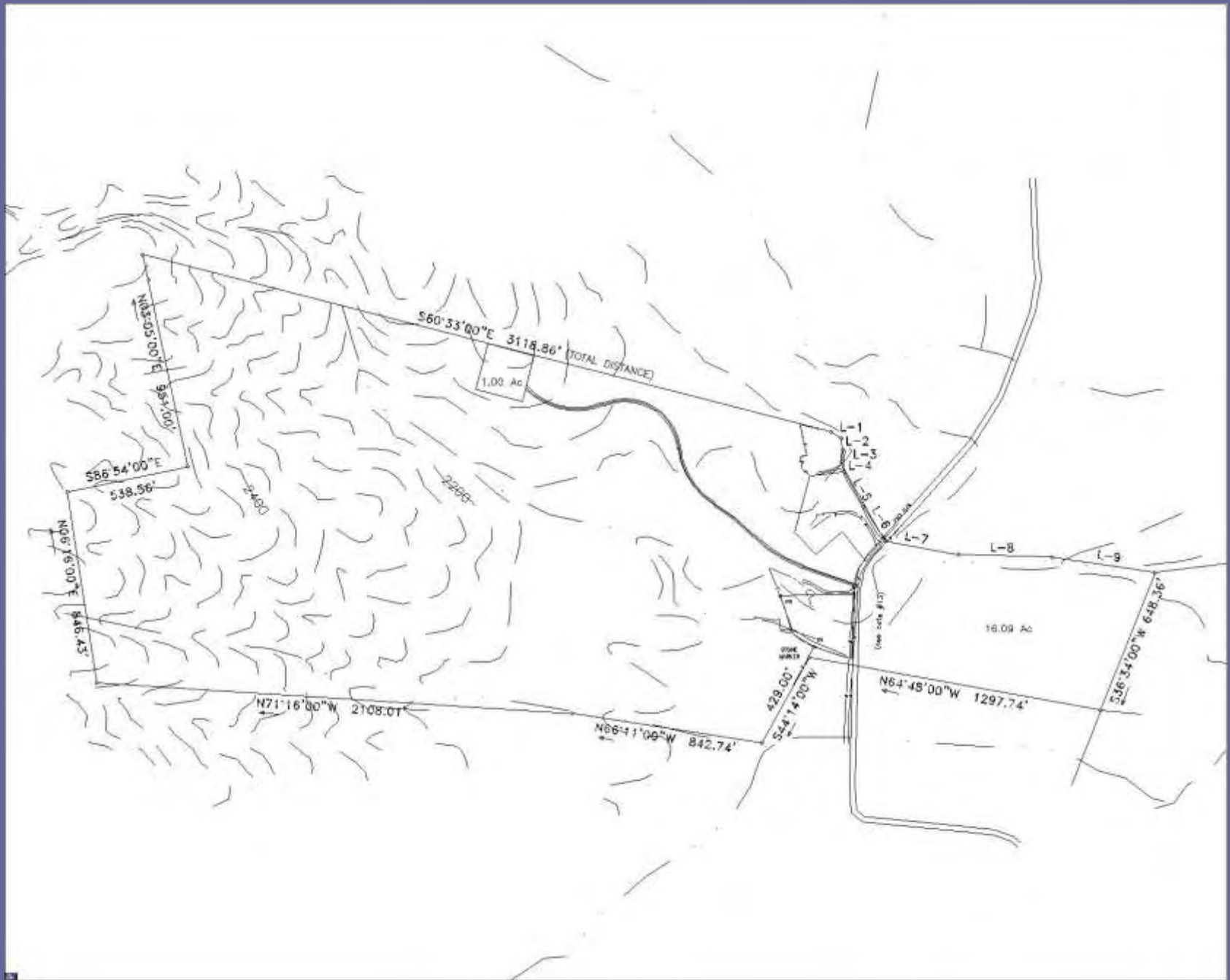
-  Sylvan habitat.shp
-  Cwmf m meadows.shp
-  Transition to sf resort.shp
-  Natural heritage occur.shp
-  Water quality trout waters.shp
-  Water course.shp
-  Transyl parcel w data.shp
-  Wildlife trout waters.shp
-  Wildlife gamelands.shp
-  Wetlands.shp
-  Nheo.shp
-  Plant
-  Animal
-  Natural Community
-  Special Animal Habitat
-  Municipal boundaries.shp
-  Historic structures.shp
-  Federal owned lands.shp
-  Conservation easements.shp
-  Cmhc property.shp
-  Cmhc natural areas.shp
-  State owned lands.shp
-  Buffer.shp













# Conventional Development

Courtesy of Richard Burns, USFS Ret.



# Low Impact Development



# Best Management Practices

BMPs are structural or nonstructural tools used to prevent or reduce the amount of pollutants entering into a waterbody through nonpoint sources (NPS).

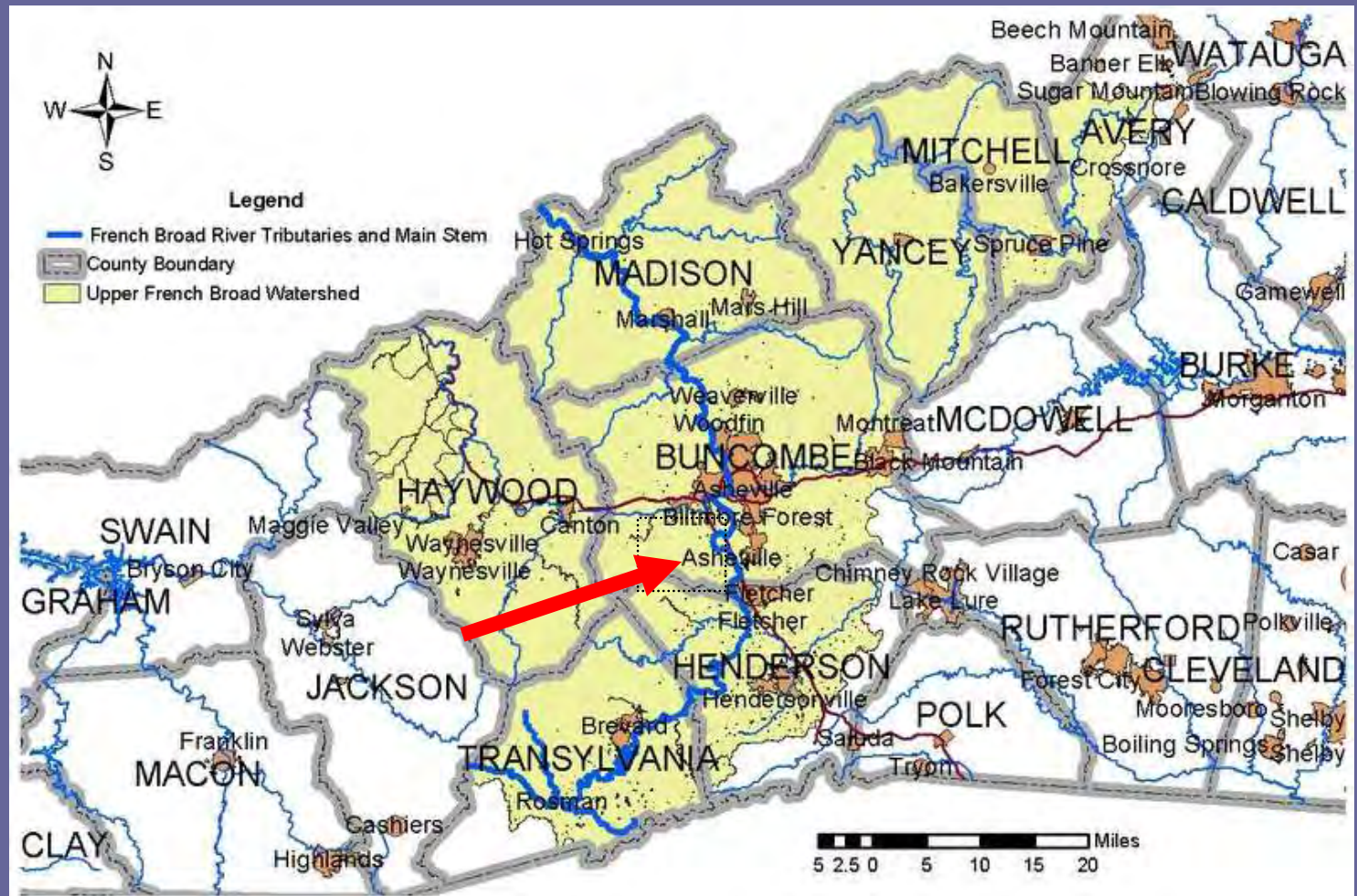




# Conventional Engineering?



# Vicinity



# Case Study

- Increase biodiversity
- Treat runoff by filtering and transforming nutrients
- Aesthetic appeal
  - (so humans will want to care for it)
- Recreation
- Almost Reforestation (Savannah style)
- Reconnection forthcoming



### Stream Restoration at the Owens-Bell Community *Asheville, North Carolina*

Environmental restoration is one of the objectives of the Owens Bell Park project. Materials were assembled to mimic naturally occurring environments. Large boulders were placed to form step pools found in higher gradient streams; the ensuing constructed pools help dissipate stormwater velocity and reduce stream bank erosion allowing these areas to be renaturalized. The banks of the stream were designed and planted with sweeps of indigenous shrubs, occasional canopy trees underseeded with a meadow mix, and wetland plant communities that will gradually give way to the maturing shrubs. The plantings will offer erosion control, habitat, and visual interest. The planned, emergent aquatic wetlands assist in filtering, sequestering, and transforming pollutants found in stormwater flowing through the site.

# 12 Bones Dress



## RIVERARTS NEWS

JANUARY 2006  
Volume 2, Issue 1

YOUR WECAN/RIVER ARTS BUSINESS DISTRICT NEWS

### FOOD FOR THOUGHT

**SO MANY CHOICES, SO LITTLE TIME....** Thanks to some enterprising folks, we can now walk to a variety of restaurants for meals that we don't have to cook ourselves...

**Clingman Avenue Coffee & Catering:** Think favorite Seattle Coffee House marries your favorite New York Italian Delicatessen. M-F 7:00AM to 4:30PM, SAT. 8:00AM to 4:30PM... (\$1.50 to \$7.75) call 828-253-2177 for to-go.

**12 Bones:** Baby Back Ribs done right (\$14.99 for 12, hence twelve bones, get it!) fish, fowl & even mushrooms right out of their own smoker. M-F 11:00AM to 4:00PM... (\$1.25 to \$7.99) call 828-253-4499 for carry-out.

**Mr. Green's Mini Mart:** Southern Fried Chicken (or fish) at its finest, with all the fixin's. M-F 11:00AM to 3:00PM... (a side of turnip greens start at \$.89 on up to \$5.49 for a chicken dinner) call 828-252-4440 with questions.

**The Silver Dollar:** The quintessential Greek Diner, southern style... where else can you get eggs and brains for breakfast with a PBR to wash it down? 7 days a week, 6:00AM to 9:00PM (\$1.25 to \$6.99) Call 828-253-9573.

**Twin Cousins Kitchen:** Wanna bite a gator? How about a little sauce with that? Native New Orleans chefs, cooking New Orleans foods. 5PM 'til the band goes home, on nights the Grey Eagle is open. (\$3.00 to \$10.99) For more info call the Grey Eagle: 232-5800 or either of the cousins at 242-4578 or 301-8373.



It may have looked better before and in the words of Miss Evie, "It will look good again". All the big yellow machines are part of the work of John Calabria's stream restoration project for the OWENS-BELL PARK.

The next PARK COMMITTEE MEETING will be held on Thursday, January 12th, 2006 at 6:00pm at the Mountain Housing Oppourtunities Community Room... We will start making plans for the built envirmment of the park itself. Hopefully, artist John Payne will be with us to share his vision for the bus shelter/entrance to OWENS-BELL PARK. Call Pattiy Torno if you have any questions at 888-3526 or 252-2699.

### CREATIVE BUSINESS ASSOCIATION MEETING AS PROMISED

There will be a meeting of those of us interested in promoting visitors to the RIVER ARTS DISTRICT. The meeting will take place at the CLINGMAN AVENUE COFFEE & CATERING on FRIDAY, JANUARY 6TH, 2006 at NOON. Up for discussion will be any and all ideas that this group might want to consider including City of Asheville & Dept of Transportation signage to help direct folks to us, creating on the ground signage to better instruct our visitors once here, creating a rack card of some variety to place all over town as well as all the North Carolina welcome centers, etc. Let's see how ambitious we really are...

**and so...CAN YOU DO ONE MORE MEETING?**

On Friday January 27th, at 10:00am, join us at Riverlink to hear from Sam Powers, who is the Economic Development Director for the City of Asheville and Gary Jackson, the new city manager. He will discuss the state economic development zone that the river is in because of the census track - this program gives credits and incentives for new job creation and equipment. For more information contact karen@riverlink.org

This paper is being published in the interest of furthering communication amongst all aspects of our neighborhood... It is all the doing of Pattiy Torno at this point... so feel free to comment, complain, cajole or in any other way co-operate with this venture. pattiykat@bellsouth.net or 828-252-2699 or 828-388-3526.. thanks

# Existing Condition



Photo Credit: Benjamin Porter

# Aggressive Exotic Vegetation Removal



# Construction Phases





# Meadow Seeding (Habitat)



# Snow revealing form



# Live staking (jumpstart biodiversity)





Local Garden  
Club:

“Garden Hoes”

Aggressive  
Exotic Removal  
Workday





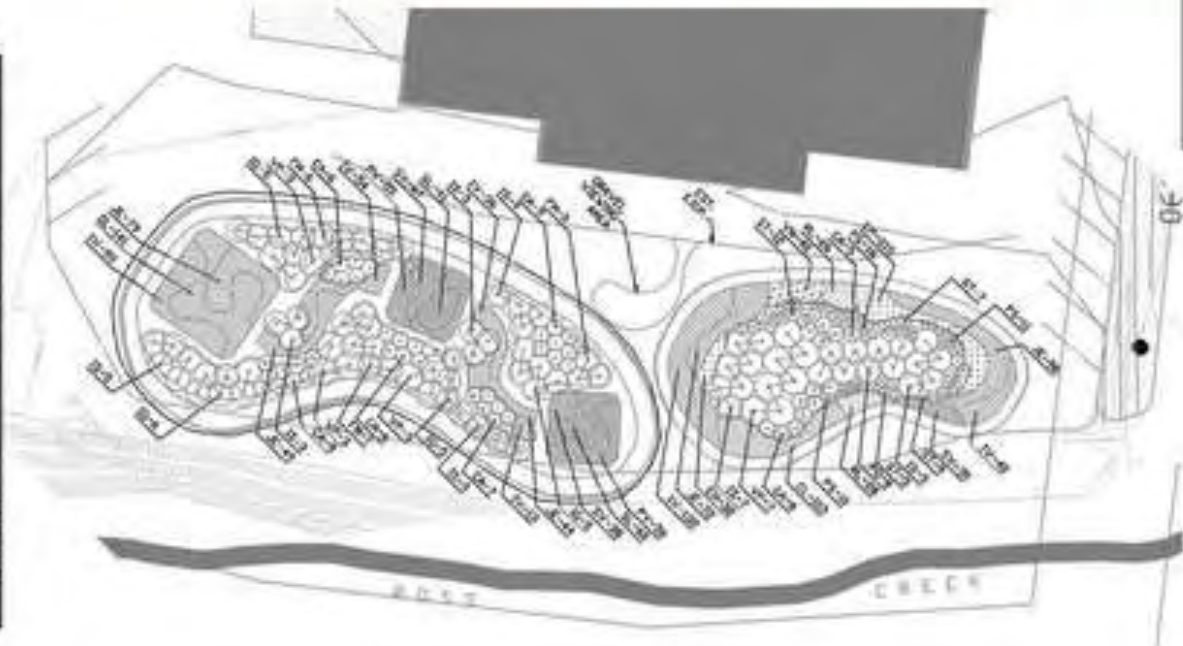
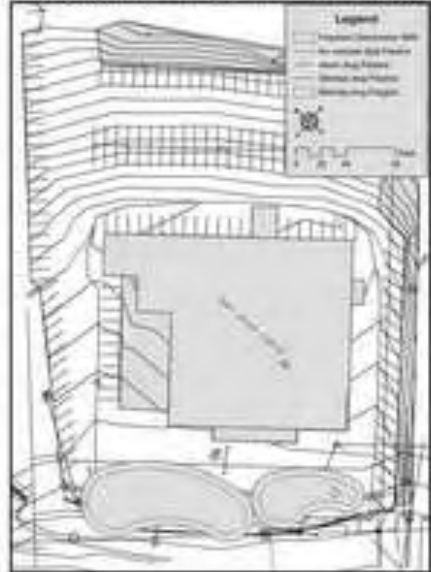
# Owens Bell



## Stormwater Wetlands at Starlanes Bowling Alley Asheville, North Carolina



Proposed Stormwater Best Management Practices











# Education



# Field Tour



# Workshop



# Conference



# Acknowledgements

These practices were installed, monitored, and interpreted with funding from NC DENR Division of Forestry, Division of Water Resources, Division of Water Quality-Planning Section's, Nonpoint Source, 319 Grant Program and Pigeon River Fund and The North Carolina Arboretum who hosts NCSU.



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**MAYBE PARTYING WILL HELP**

vital

do i look like a [redacted] role model?

ACCORD

# Thank you

Jon Calabria, Landscape Architect  
Upper French Broad Watershed Training Center Coordinator  
Water Quality Group, NCSU

hosted by:

The North Carolina Arboretum  
100 Frederick Law Olmsted Way  
Asheville, NC 28806

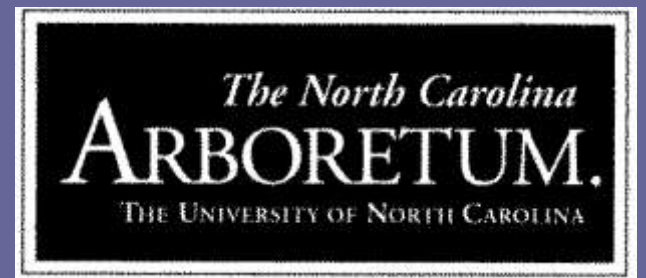
Phone: (828) 665-2492 ext. 265

Mobile: (828) 231-5135

Fax: (828) 665-2371 or (828) 665-5409

[ncsu.edu/waterquality/frenchbroad](http://ncsu.edu/waterquality/frenchbroad)

[jon\\_calabria@ncsu.edu](mailto:jon_calabria@ncsu.edu)



# Got restoration?

*Upcoming Conference:*

**Stream Restoration  
Conference**

**Nov 3-6**

**Asheville, NC**

