



How Is It Working?

# Sustainable Rest Area Design

## U.S. 421 Wilkes County



## History

- North Carolina's rest area program started in 1948.
- 1959 First Interstate rest areas opened.
- Today there are 60 rest areas in N.C.
  - 41 Interstate sites
  - 19 Primary sites
  - 9 Welcome centers
  - 11 Visitor centers
- Nearly 25 million visitors in 2012.
- Unique Project – Partnership with Local Governments
  - Wilkes County purchased the land
  - Wilkesboro paid for water installation
  - N. Wilkesboro paid for sewer installation

Saved NCDOT about \$1 million





# What does sustainable mean?



- Sustainable designs aim to produce places, products, and services in a way that improves energy efficiency, reduces use of non-renewable resources and minimizes environmental impacts.



# Wilkes County U.S. 421- 3+ Years Later





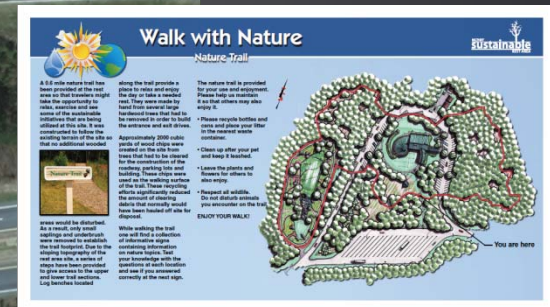
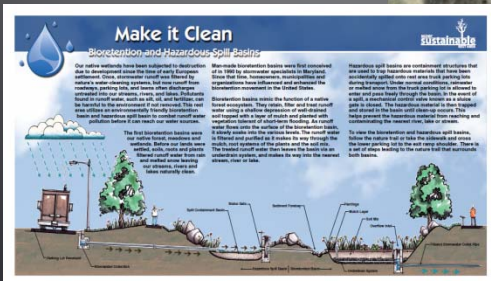
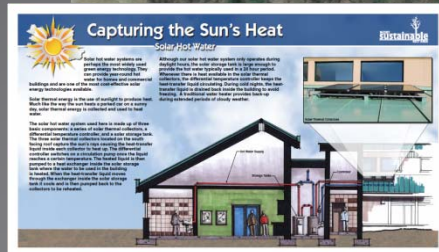
## Challenges Faced Looking Back

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- This was NCDOT's first LEED project (Leadership in Energy and Environmental Design)
- Limited number of contractors / subcontractors with LEED / sustainable experience
- Large amount of grading / land disturbance required was not conducive to LEED
- Found that highway related projects are not easily incorporated into the LEED system
- LEED project cost is more than a traditional project, but the percentage is unknown.
- Success rate, do all of the LEED strategies work as designed?



# Actual Aerial Photo of Site

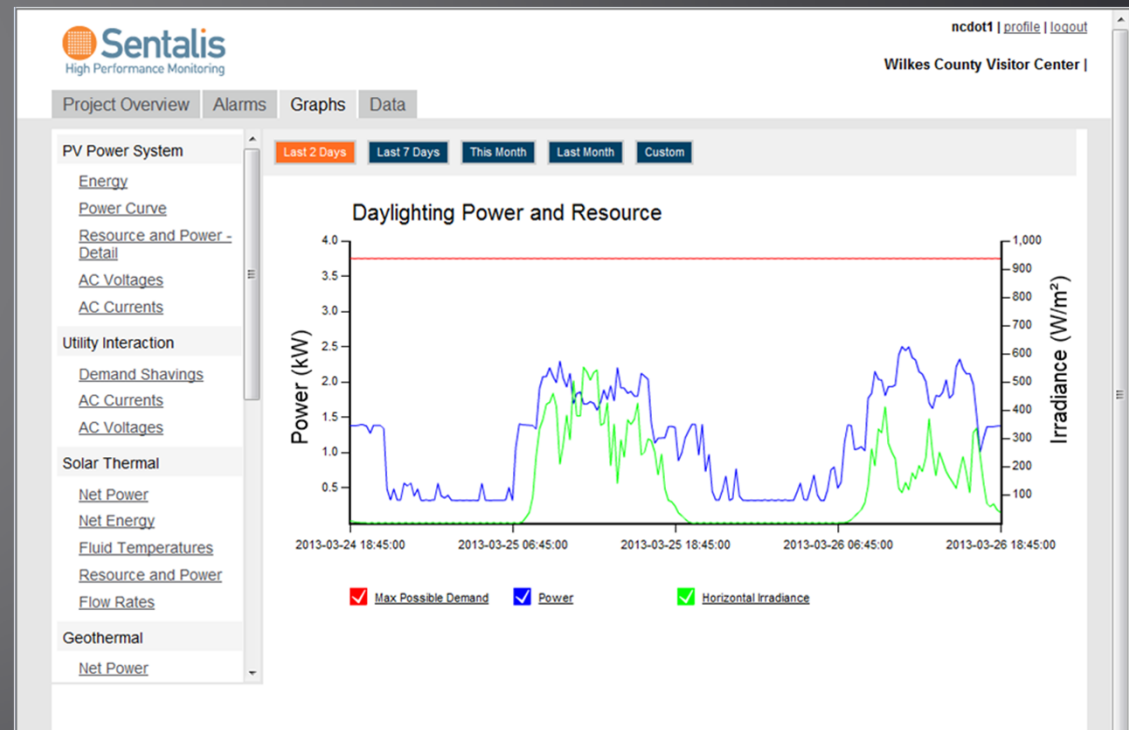


# Key Design Strategies



## Daylighting

The main building areas have been situated and designed to allow for the maximized use of natural light during the day.







# On-Site Educational Signage



## Utilizing Daylight

### Daylighting

Daylighting is a technical term given to the centuries-old practice of man using natural light to illuminate building spaces. A renewed interest in the practice of daylighting has been seen in recent years as energy conservation becomes ever more important. Daylighting creates appropriately lit spaces while saving energy.



Daylighting involves placing windows and reflective surfaces within a building so that natural light can provide effective internal lighting during the day. Daylighting strategies require careful planning and design of both the building and site in order to capitalize on the natural light available. A successfully daylit building is the result of a combination of art and science, of architecture and engineering.

The Rest Area public areas and restrooms have been carefully designed to integrate several daylighting strategies. Orientation of the building such that the majority of its windows and other openings face south not only introduces daylight to public places but also provides the opportunity for passive solar heating to temper the building environment during the winter months. The integration of techniques such as carefully placed overhangs above windows and other openings provide shade to help protect the building from excessive heat gain in the summer months. Light colored walls provide reflectivity magnifying the available natural light. And the integration of daylight sensors, motion detectors, and dimming ballast help keep electric lighting use to a minimum.



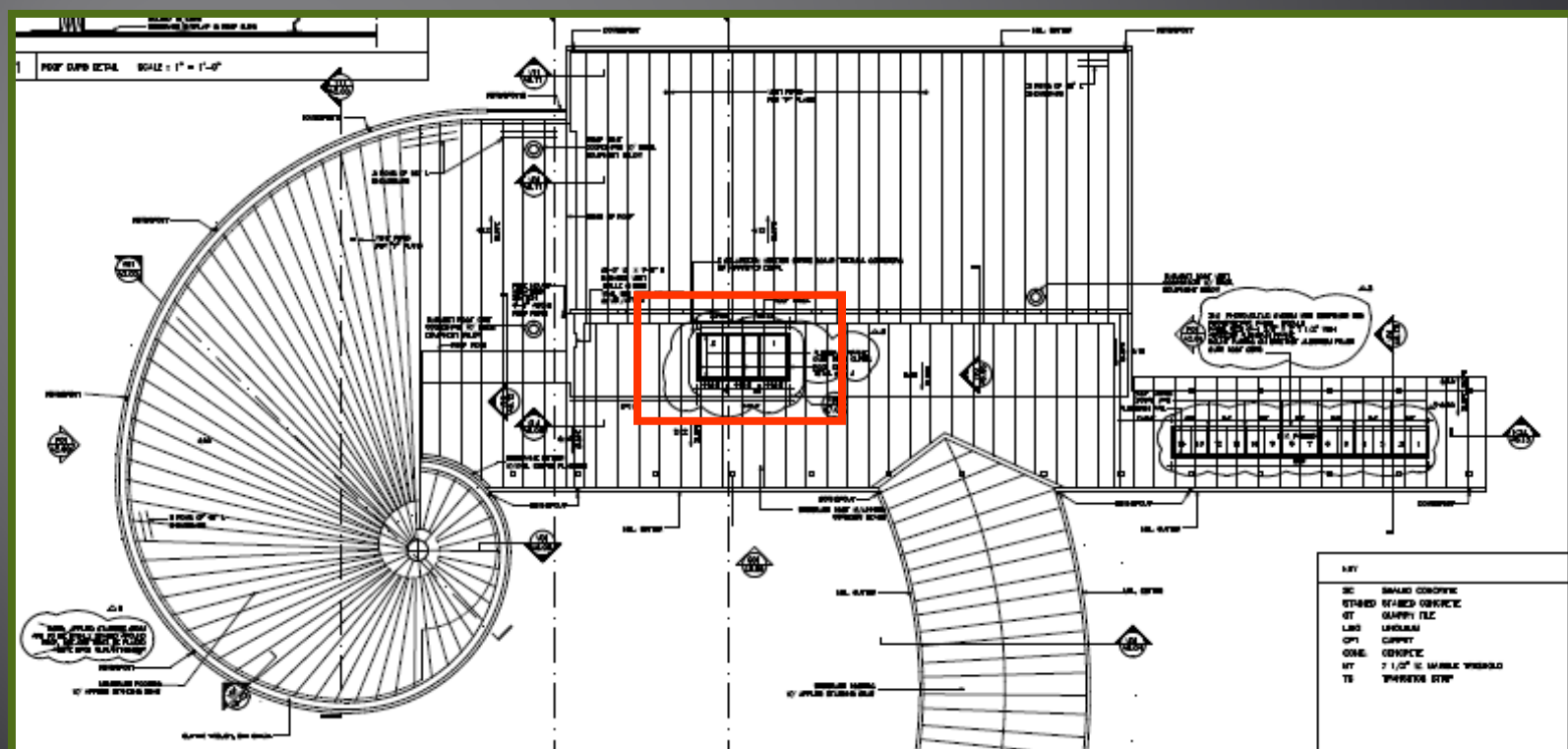
Daylighting can significantly reduce daily energy consumption. Rather than relying solely on electric lighting, daylighting illuminates the building with natural light during the day at a fraction of the cost and creates a more pleasant environment for the building's occupants and visitors by giving them a connection to the great outdoors.



# Domestic Solar Hot Water (DSHW)



A total of three solar panels above the entrance canopy will preheat the hot water for the restrooms.





## Domestic Solar Hot Water (DSHW)

The average US home uses 39.2 million Btu's (39,200,000 Btu's) per year.\*

This DSHW system has generated 51,599 kBTU's of energy over 3+ years. (51,599,000 Btu's) That is equivalent to providing well more than all the energy needed for 1 US home for 1 year.



\*[http://www.greatlakesenergyservice.org/documents/comparing\\_energy\\_consumption.pdf](http://www.greatlakesenergyservice.org/documents/comparing_energy_consumption.pdf)

# Photovoltaic Panels



Fourteen panels are located on the walkway canopy to convert solar energy into DC electricity and through an inverter into AC power, which the building can use.



# Photovoltaic Panels

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- From January 1, 2012- December 31, 2012 the Rest Area generated 4,803 kWh, or 13.16 kWh/day
- In 2011 the average annual electricity usage for residential customers was 11,498 kWh or 31.5 kWh/day
- Therefore the rest area generates daily the equivalent of 42% of the power needed to operate 1 household in the US.
- However, over the same period of time the Rest Area used a total of 199,345 kWh , therefore the PV panels only provided 2.4% of the total electricity needed to operate the rest area.



# Rainwater Catchment



26,000 gallon Cistern



# Rainwater Catchment



- Calculations showed that with normal Wilkes County rain fall, 309,000 gallons of rain could ideally be harvested annually. The reality is that about 170,000 gallons were collected last year.
- The rest area used about 445,665 gallons last year, so the cistern provided 38% of the water.
- The size and configuration of the tank, pump tank, and pump make the difference on how much can be collected.
- We have found that our filter, pump tank and pump are not large enough to handle the volume of water from heavy summer storms, thus we lose a fair amount of water even though we have a large enough cistern to handle all of it. We are exploring ways to upgrade the system so that more water can be collected faster.



# Geothermal Heat Pump



Thirteen wells are designed as part of the system to heat and cool the building. Each well is 300 feet deep.

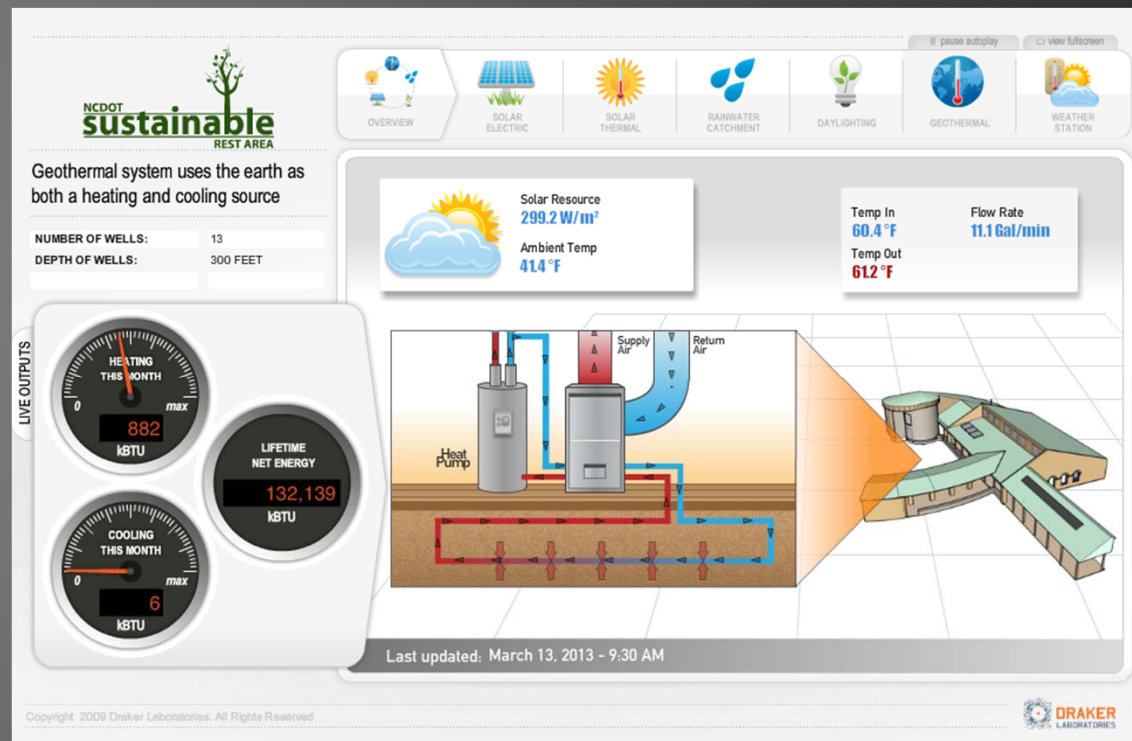




# Geothermal Heat Pump



- Over the 3.5 year life of the system, it has dumped or extracted 132,139 MBTU's from the ground.
- There are no back up heat strips in this system. All the heating and cooling for this building comes from water circulating through the ground.



# Green Building Materials

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- Materials with recycled content used on this project - carpeting, ceiling tiles, countertops, concrete, masonry, guardrail, asphalt.
- Local and regional (within 500 miles) materials have been used and are a critical LEED element.
- 50+ percent of the wood used on the project is from a source certified with the Forest Stewardship Council.

# Constructed Hazardous Spill Basin and Bio-Retention Basin



- Designed for sustainable stormwater management. Most of the site stormwater is captured for on-site infiltration, through the hazardous spill basin and bio-retention basin.





# Recycling Systems and Waste Management



- Construction Recycling
  - Metal Banding
  - Cardboard
  - Concrete
  - Wood / Lumber
  - Drywall
  - Plastics



- Our goal for the project was to divert at least 50 percent of the construction waste from the landfill. The Contractor actually diverted over 91 percent.
- All stumps were ground into mulch.
- All small trees were chipped for use on the walking trail.
- Large logs were made into benches.





## Quick Facts



- The project received a Gold LEED rating in mid 2011 with 45 LEED points.
- Opening Day was October 1, 2009
- The Rest Area has had 1.1 million visitors since opening and uses less than 1.5 gallons of water per person.
- The public can monitor green technology systems at <http://ncdot.technology-view.com/wilkes>



# Strategies We Continue To Use



- Daylighting
- Solar Thermal
- Geothermal
- Rainwater Catchment
- Recycling

