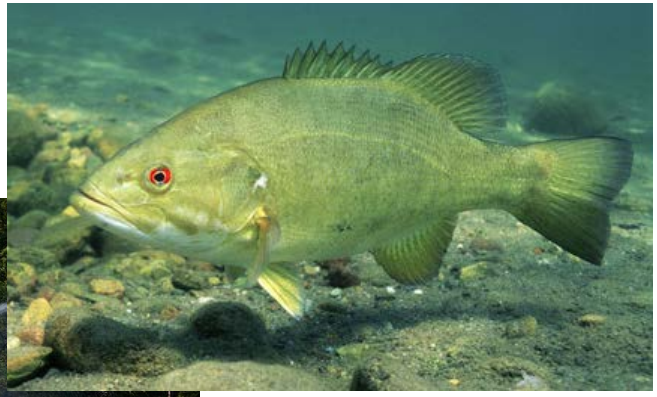
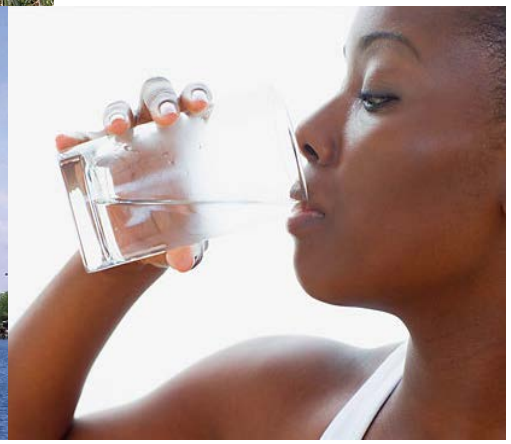
Water - Energy Nexus

WATER - Balancing all interests

A shared Resource

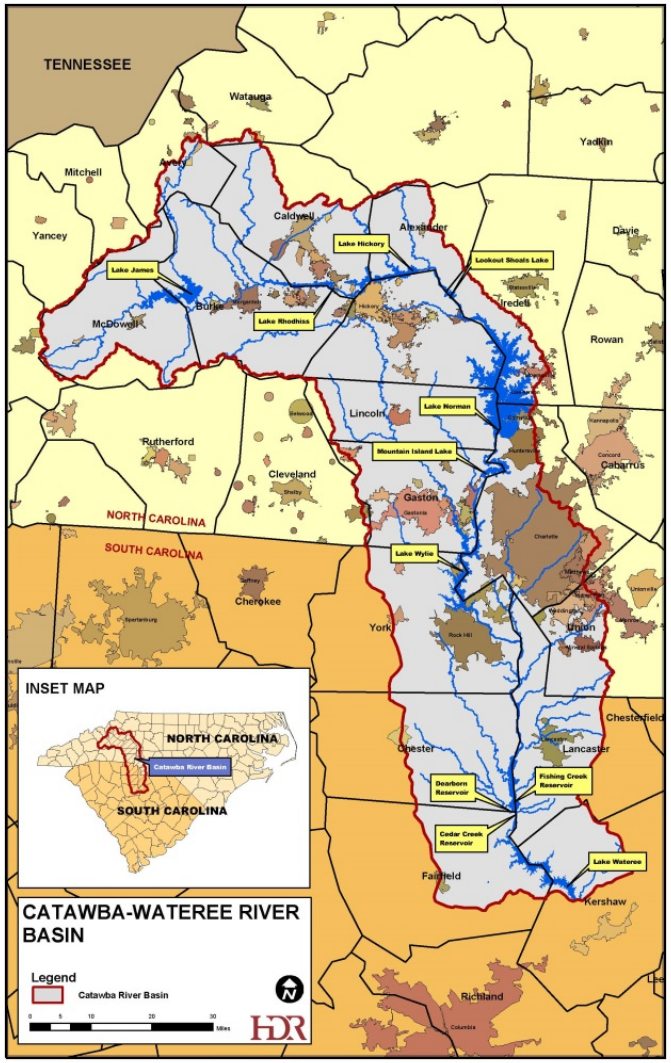


A shared Responsibility

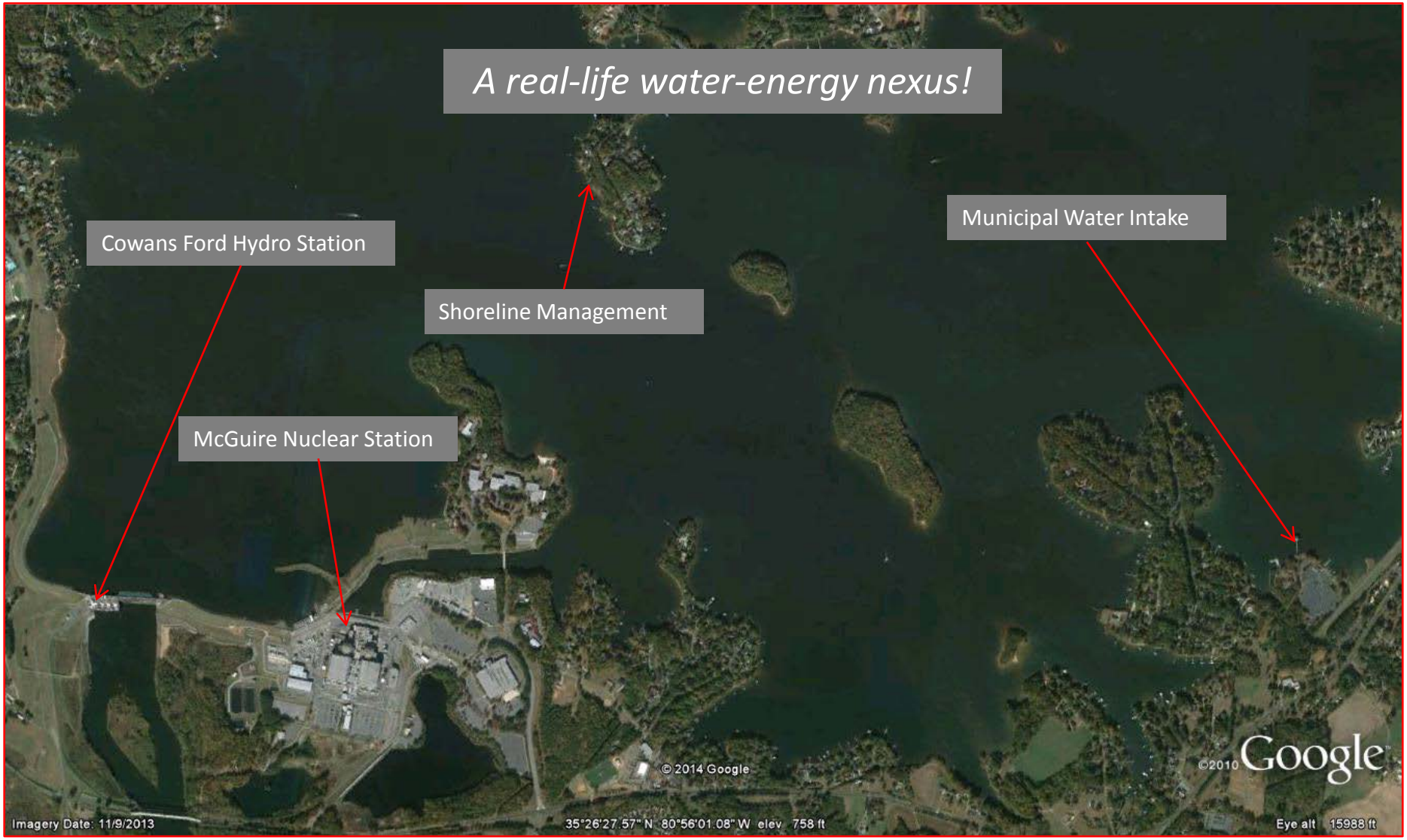


Catawba-Wateree River Basin (NC & SC)

- 11 interconnected reservoirs - Completed 1904-1963 (spanning 225 river miles)
- Duke Energy electric generation – 8,591 MW (25% of Carolinas generation)
  - 845 MW conventional hydro
  - 4,516 MW nuclear
  - 3,230 MW coal
- Modest water inflow – 5,880 cubic feet per second (cfs) (Markland Hydro = 115,000 cfs - Indiana – Ohio River)
- Most densely populated river basin in NC
- Reservoirs serve as the drinking water source for 18 public water systems (2 million customers)
- Several large industrial water intakes



Catawba-Wateree River Basin – Lake Norman



Catawba-Wateree Hydro Relicensing

- 1958 vintage federal license
- Drought of record 1998-2002
- Stakeholder negotiations underway 2003-2006
- 70 parties signed the Comprehensive Relicensing Agreement (CRA) in August 2006 – *(state and federal agencies, local governments, non-government organizations, etc.)*
- Application for a new 50-year license filed with the FERC in August 2006
  - Low Inflow Protocol (LIP) a.k.a. drought plan
  - Drought Management Advisory Group (DMAG)
  - C-W Water Management Group (WMG)

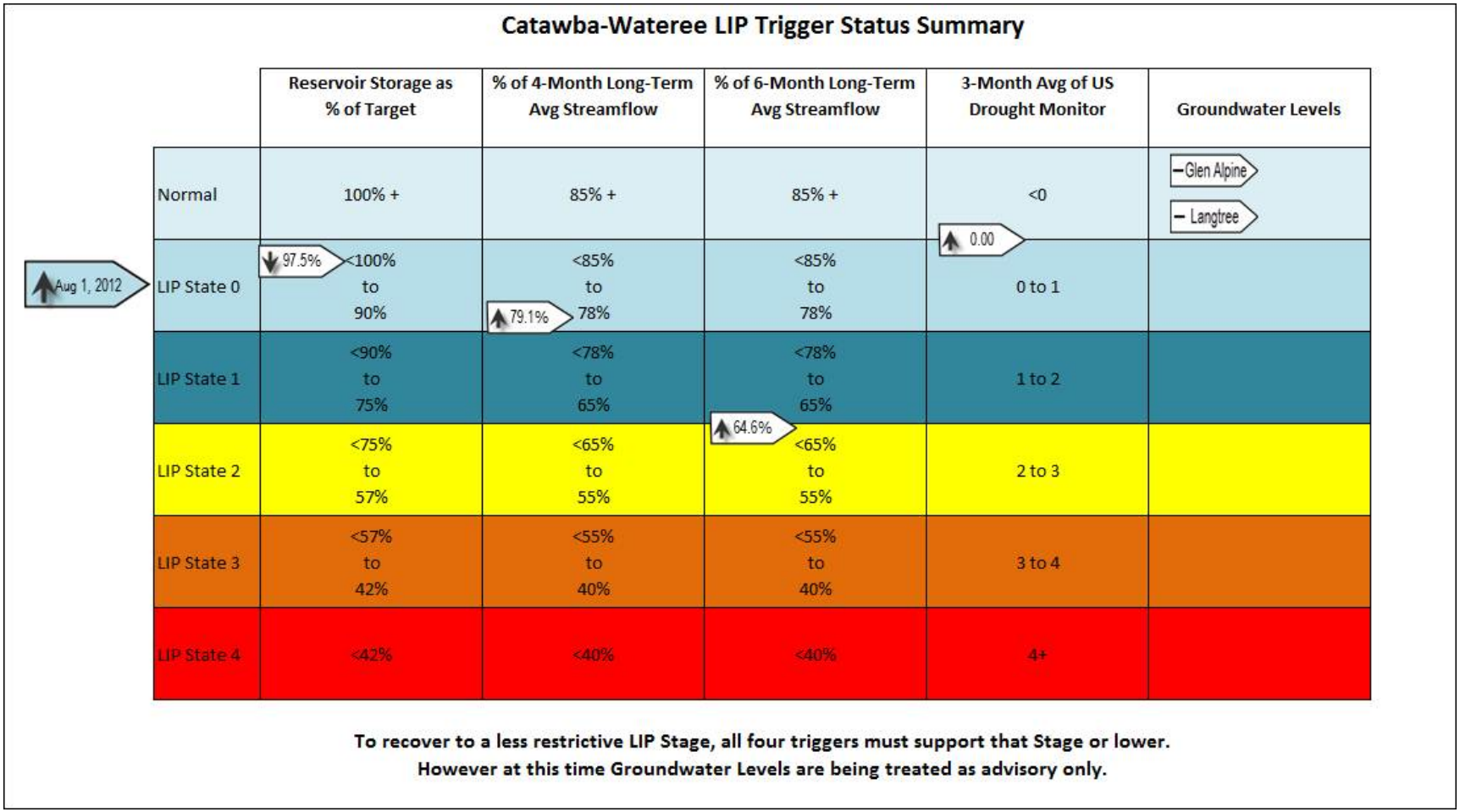
Low Inflow Protocol (LIP)

Intended to buy time for rainfall to return and restock the water supply

- Objective measures
  - Reservoir remaining usable storage as a % of target
  - U.S. Drought Monitor in the basin (3 month average)
  - USGS stream flows (rolling 4 and 6 month average) as a % of long term average
  - Groundwater levels

- LIP Stages
  - 0 = Watch (prepare)
  - 1 = Voluntary restrictions - reduce water consumption (voluntary) 3-5%
  - 2 = Mandatory restrictions - reduce water consumption 5-10% (or more)
  - 3 = Mandatory restrictions - reduce water consumption 10-20% (or more)
  - 4 = Mandatory restrictions - reduce water consumption 20-30% (or more)
- LIP specifies actions to be taken by Duke Energy and other water users
- Towns, cities, and counties passed consistent resolutions allowing their staff to act consistently

Low Inflow Protocol (LIP)



Drought Management Advisory Group (DMAG)

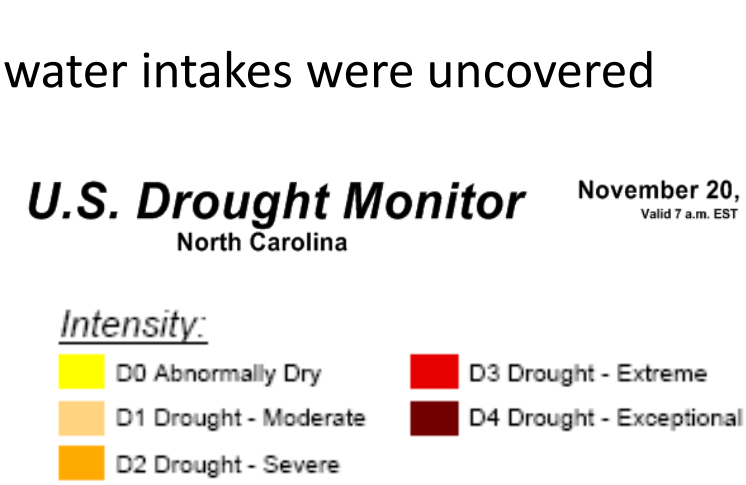
- Called to action when the LIP is initiated
- Meet as necessary to ensure a consistent basin wide response to a LIP condition (actions driven by LIP stage)

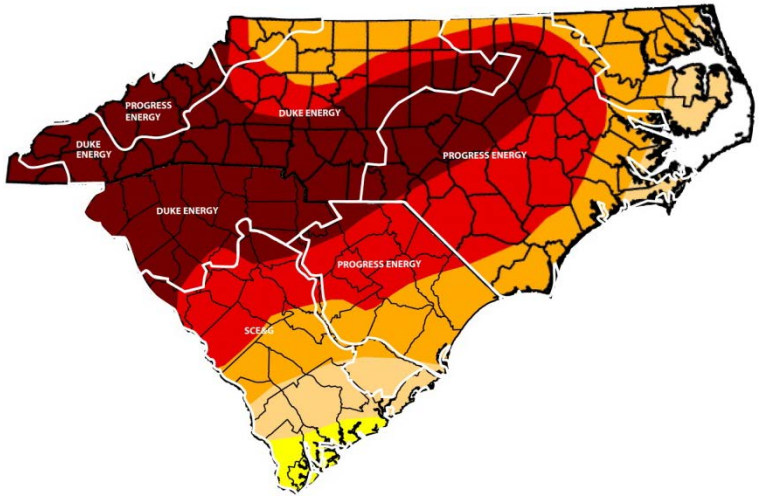
- DMAG composition
  - Owners of large water intakes (1 mgd or greater)
  - NC agencies (Wildlife Resources Comm., Dept. of Environment & Natural Resources)
  - SC agencies (Dept. of Natural Resources, Dept. of Health & Environmental Control)
  - U.S. Geological Survey
  - Duke Energy (serves as DMAG coordinator and assesses LIP measures)

LIP and DMAG Put to the Test

It started to rain less frequently in Spring 2007 and by Summer it completely stopped raining and record heat arrived –
A new Drought of Record

- The basin reached LIP stage 1, then stage 2 and ultimately stage 3 in a few months where we stayed for 15 months
- All DMAG members took the prescribed steps and actions
- No water intakes were uncovered





- Residential water use remains (in 2014) below 2006 use levels

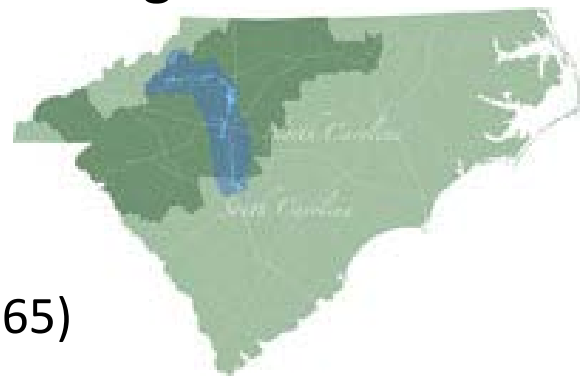
Water Management Group (WMG)

Mission – Pursue projects to enhance the river's ability to provide for human needs, while maintaining its ecological health.

- **Non-Profit** 501(c)(3) organization formed in 2007
- **Members** = 18 public water utilities + Duke Energy
- **Funding** – Annual dues ($550k/yr) + Grants + Cost-sharing
- **WMG Projects** - Completed several beneficial projects, e.g., installation of additional USGS groundwater gauges, lakeside irrigation study (smart irrigation systems), reservoir sedimentation study, etc.
  - **Water Supply Master Plan** (completed May 2014)

WMG Water Supply Master Plan

What – A written plan focusing on long-range prospects for region's water supply and identifying actions the region can take to extend it



- Main components
  - Updated water demand projections (through 2065)
  - Enhanced water quantity model (CHEOPS™)
  - Scenario-based analyses
  - Determines "water yield" for each of 11 Duke Energy lakes – identifies time when economic growth would become water quantity-limited
  - Identifies mitigating actions / steps

Benefits of the Water Supply Master Plan

- **Extends water yield by 200+ million gallons per day (mgd) = 50 years**
  - Instead of reaching *modeled water yield* in 2050, we'd reach it in 2100
  - Sustains future Basin growth potential
- Improves drought resiliency for vulnerable intakes
- Prepares us for future climate change and population growth
- Promotes cooperation between water users and stakeholders in the river basin
- Balance of strategies (supply, demand, drought response) for enhancing water supply

Water