Comprehensive Update of the Arkansas Water Plan

Water Demand and Forecasting Technical Work Group

Overview of Water Demand Forecast Methodology

December 17, 2012

Welcome and Introduction

Surface Water

Watershed Boundary
Major Water Body
Major Stream | River

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Water Demand and Forecasting Technical Work Group - Purpose and Schedule

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Purpose of Work Group

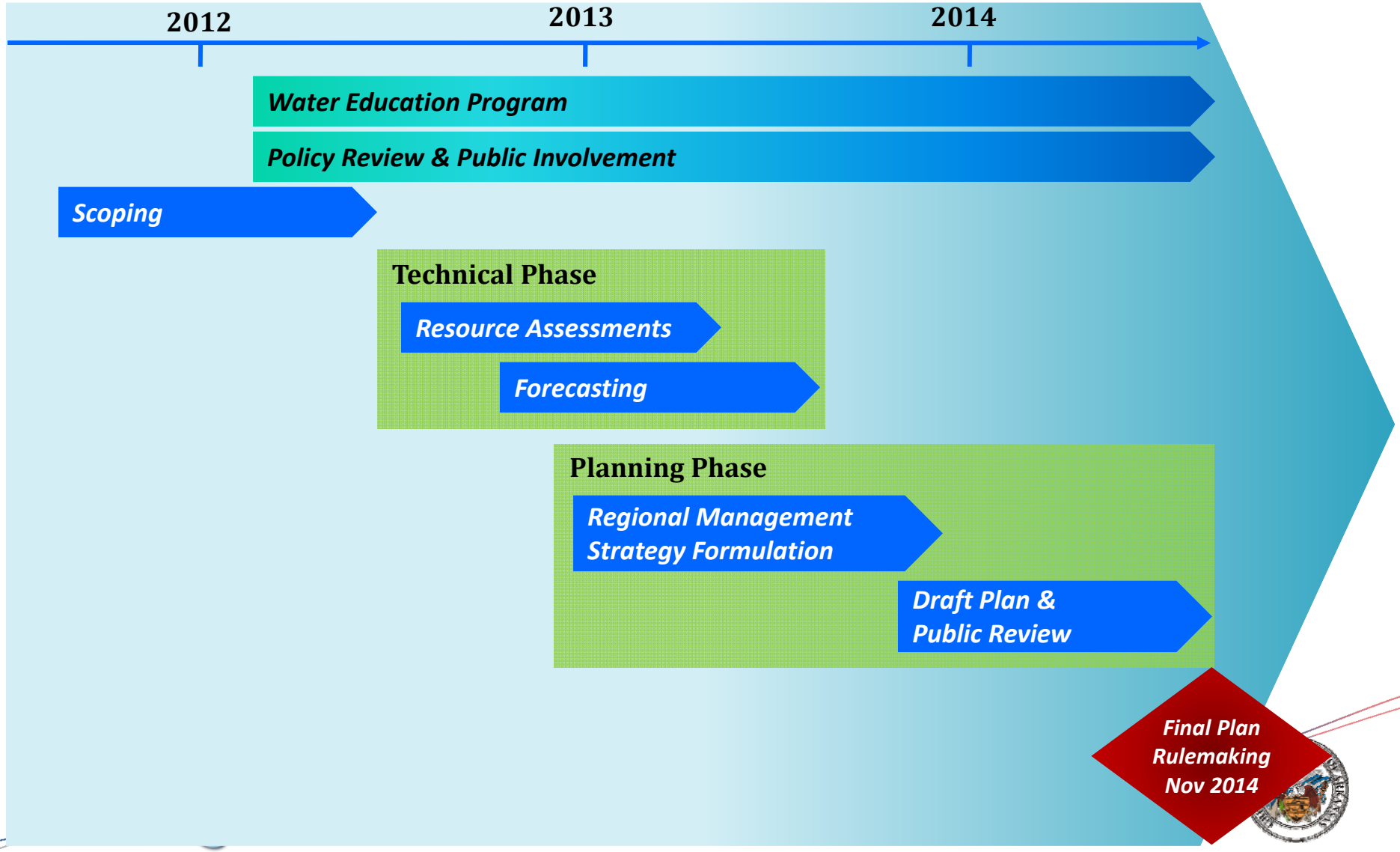
- Actively and constructively participate in the review and development of:
  1. **Water use quantification and forecast methodology**
  2. **Water use and forecast results**

- Provide information for use in the development of the water use and forecast and provide information back to their water use sectors and community

Purpose of Work Group - continued

- Help ensure a technically sound and defensible forecast of water use
- Coordinate with other technical work groups as needed as they are formed
- The work group is advisory and will work by consensus with the Arkansas Natural Resources Commission as the final decision maker

Overall AWP Schedule - *Charting the Future*



Demand Work Group Schedule – Additional Detail

Major Demand and Forecasting Technical Work Group Tasks - 2012/13 Schedule

Task	Description	December	January	February	March	April	May	June	July
1	Full Committee Meeting - Overview of Methodology White Paper								
2	Subcommittee Meetings to Finalize Sector Specific Methodologies								
3	Full Committee Meeting - If Needed								
4	Contractor Develops Draft Water Use and Forecast Results								
5	Full Committee Meeting to Review and Discuss Results								
6	ANRC/Contractor Present Draft Results to Public and Stakeholders Across the State								
7	Draft Final Water Use and Forecast Results								★

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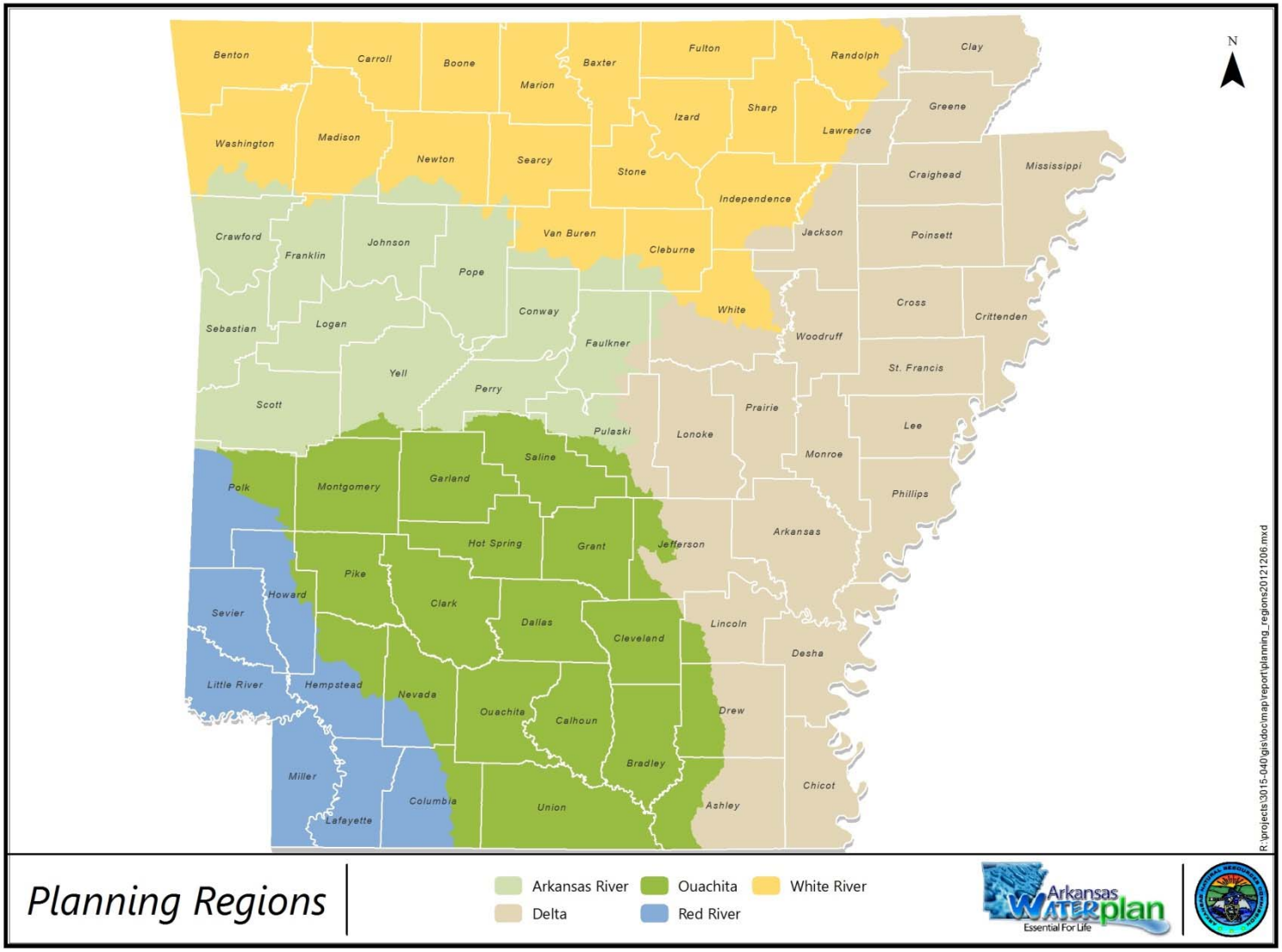
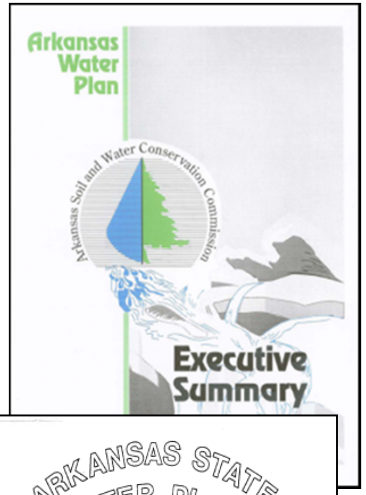
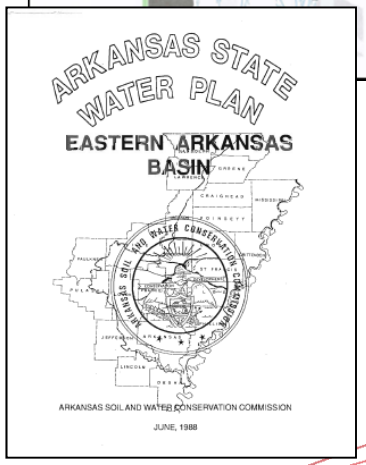
Brief Background on the Arkansas Water Plan



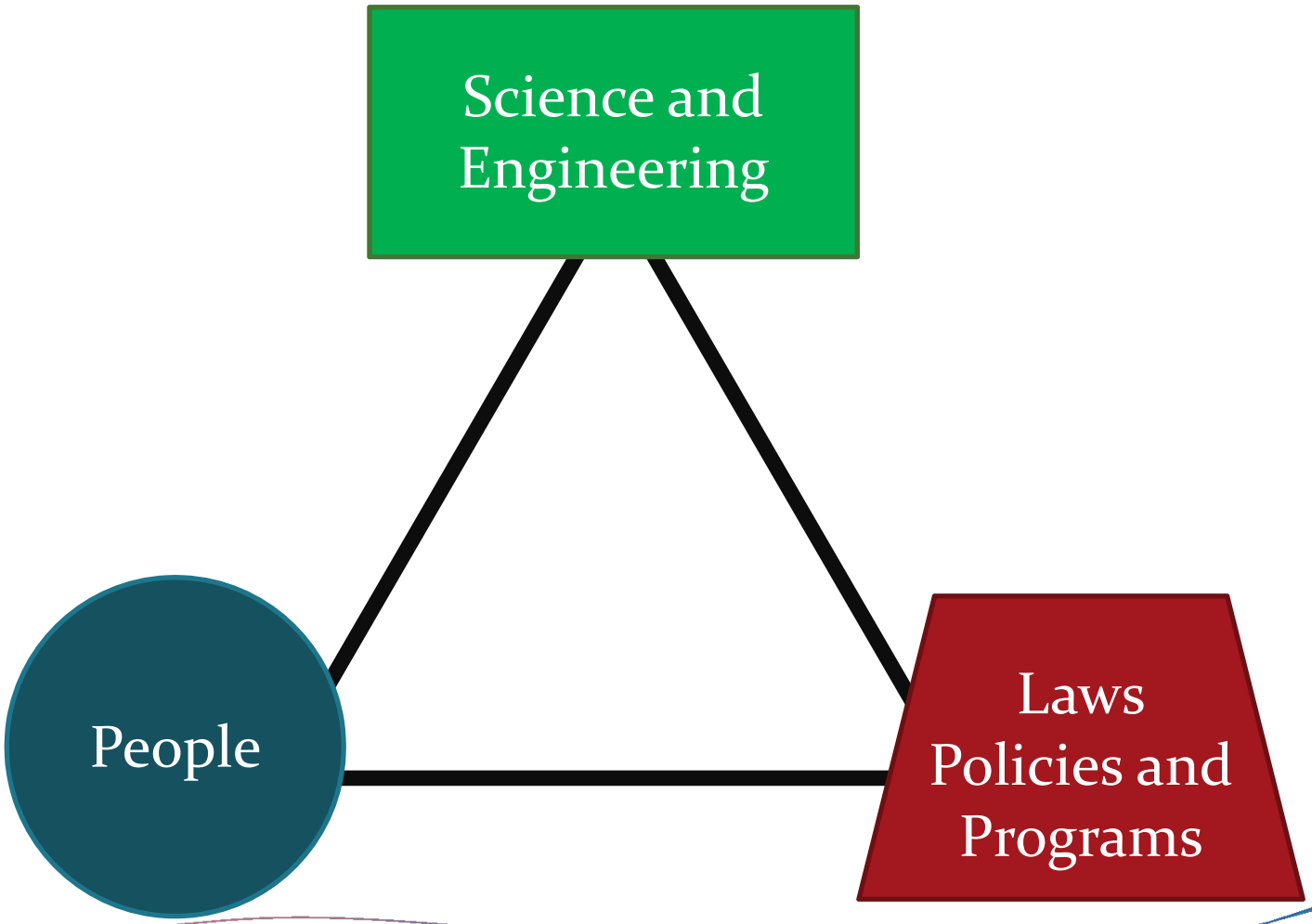
What is the Arkansas Water Plan?

- A comprehensive program for the orderly development and management of the State's water and related land resources
- The State policy for the development of water and related land resources in this State
- A planning framework to be used by all State agencies, commissions, and political subdivisions in all matters pertaining to the discharge of their respective duties and responsibilities as they may affect the comprehensive plan (1975 and 1990 are the most recent planning efforts)





What is the Arkansas Water Plan?



Why do we Need to Update the Arkansas Water Plan?

- We depend on water in sufficient quantity & quality for our very existence
- The wise use and protection of this resource is critical for current and future generations
- The existing AWP is over 20 years old
- How we use and value water has changed over this timeframe
- New data and information collection and analysis is needed to define water supply, water needs, and identify potential solutions to meet those needs
- Increasing demands on water resources requires new technical, policy, and financial tools to address identified water resource issues and needs

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Why is the Arkansas Water Plan Important to our Future?

- While Arkansas has significant water resources -- they are not infinite
- Water is vital to the social and economic well being of our communities, and our overall quality of life
- A dependable water supply requires
  - Good water supply sources (quantity and quality)
  - The ability to provide this water to our homes and businesses
- The Arkansas Water Plan will provide us with the **science and information** to make **informed decisions** on the best way to **manage water to meet the needs of our citizens and the environment**

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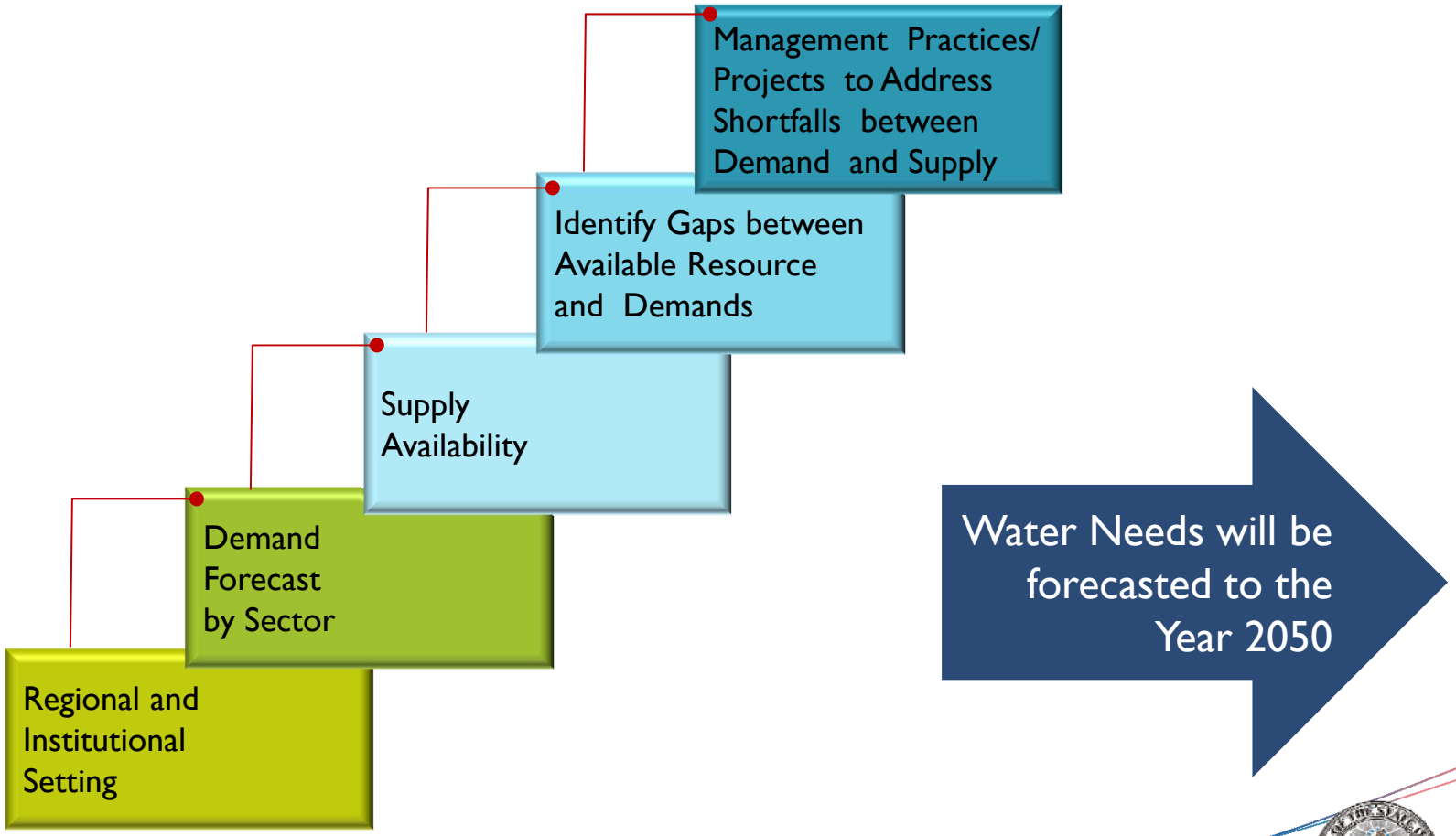
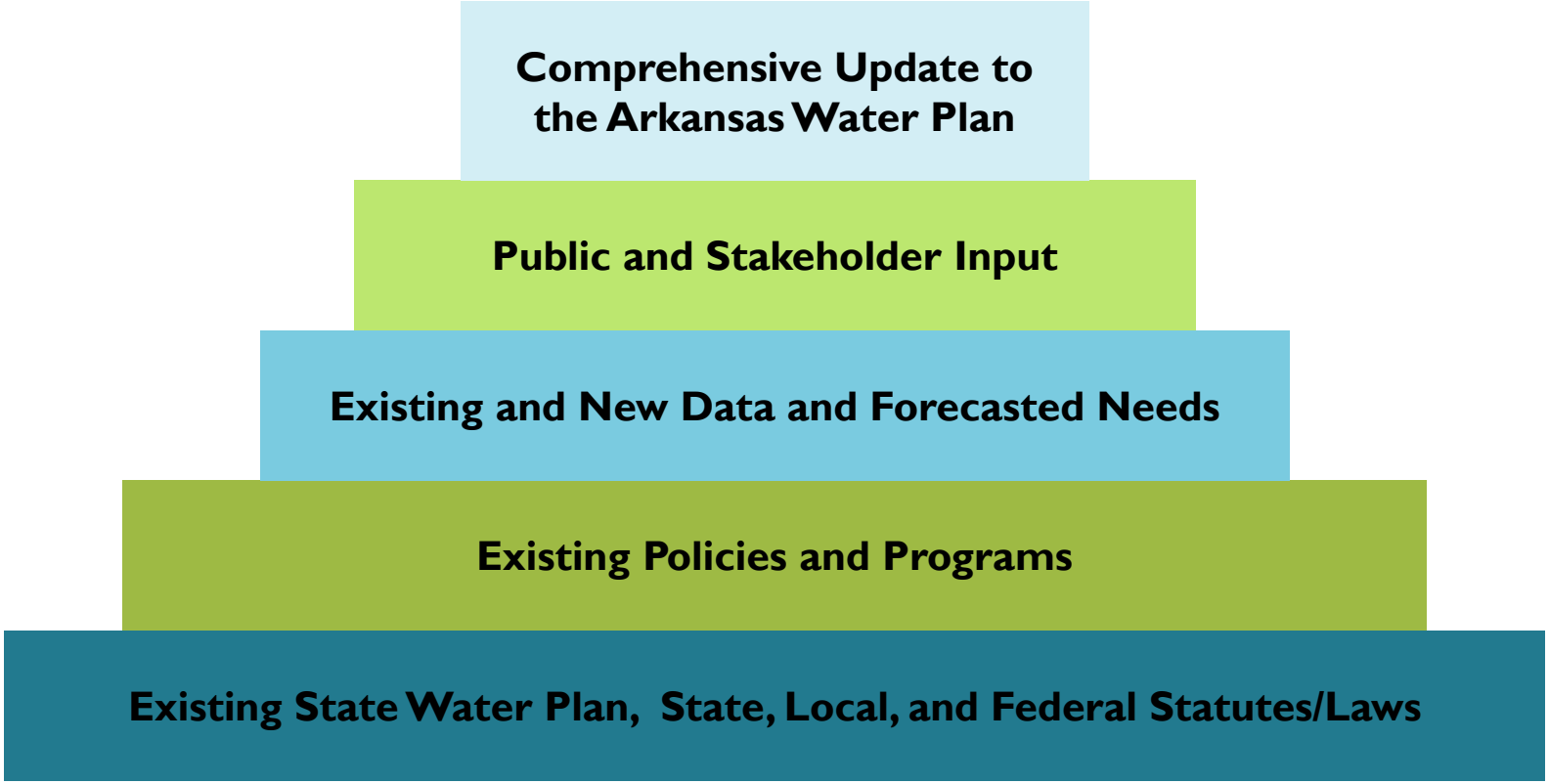
The Major Technical and Planning Elements of the Water Plan Update



Building on and Improving Existing Programs and Information

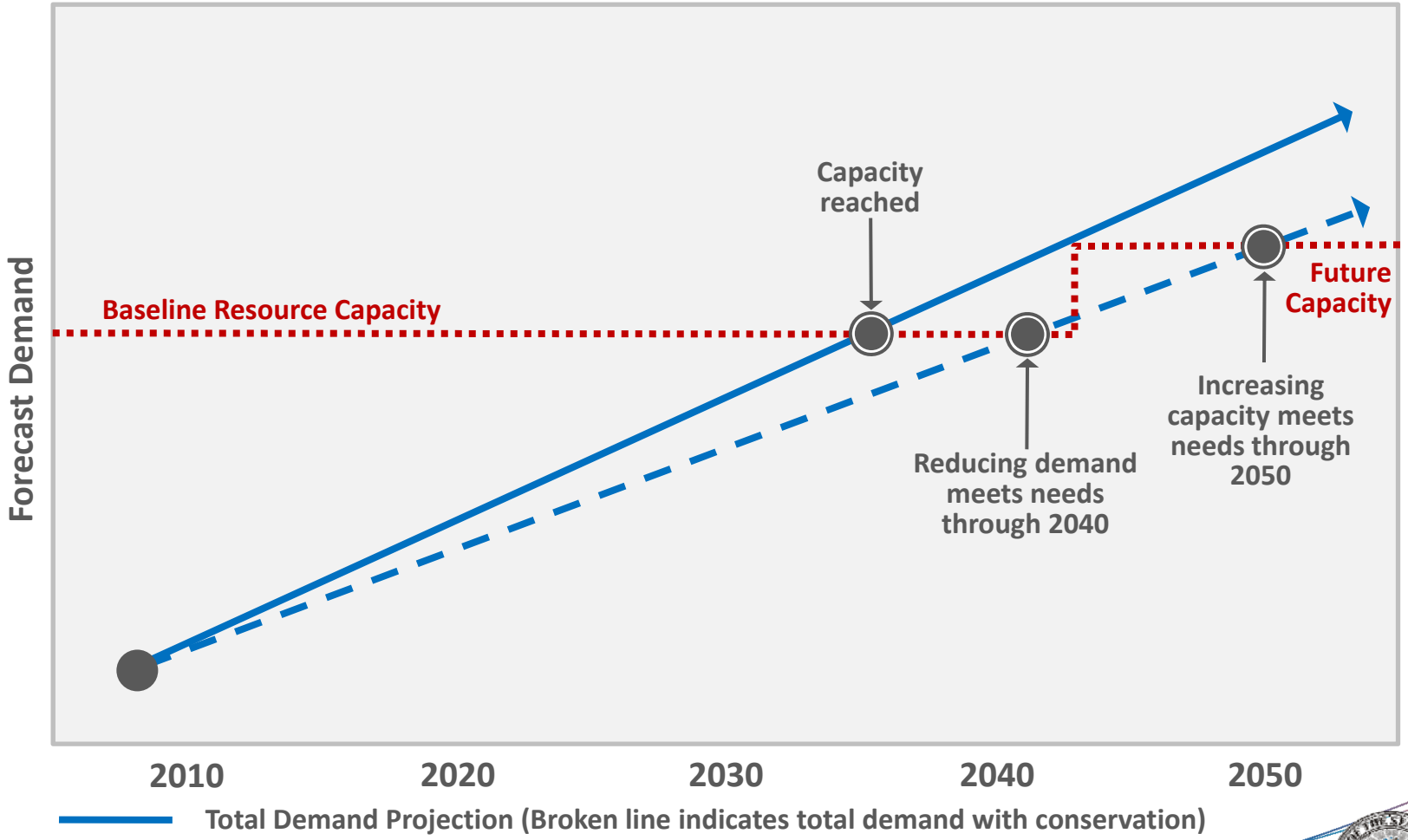


Overview and Content of the Draft Water Demand Forecast Methodology White Paper

How Much Water do we use Today and How Much will we Need by 2050?

A sound water demand forecast is critical in water resources planning

Water Supply Planning – Demand and Supply

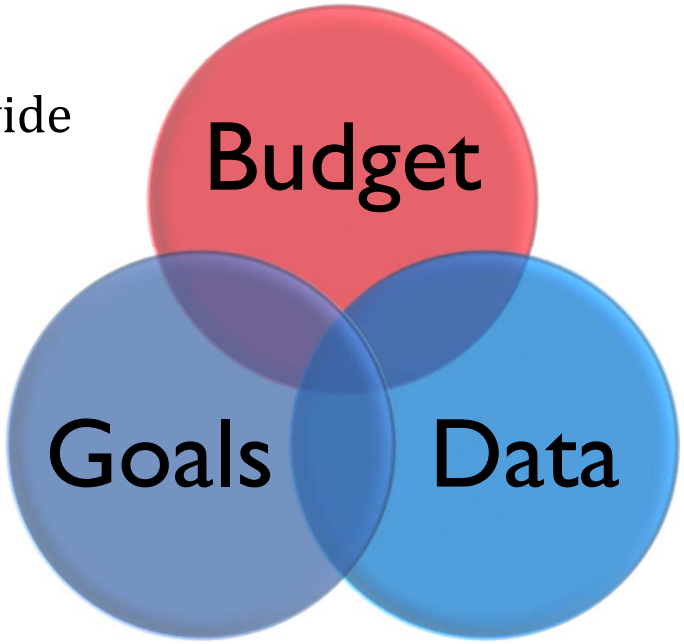


Water Use and Forecast Goals

- Develop demand forecasts by
  - County-level
  - Water use sector
  - Source of supply (groundwater, surface water)
- Have flexibility to aggregate demands by Planning Region and Statewide
- Forecast demands to 2050 at 10-year intervals
- Identify potential future water supply gaps
- Complete by April/May 2013

Criteria for Selecting a Water Demand Forecasting and Supply Approach

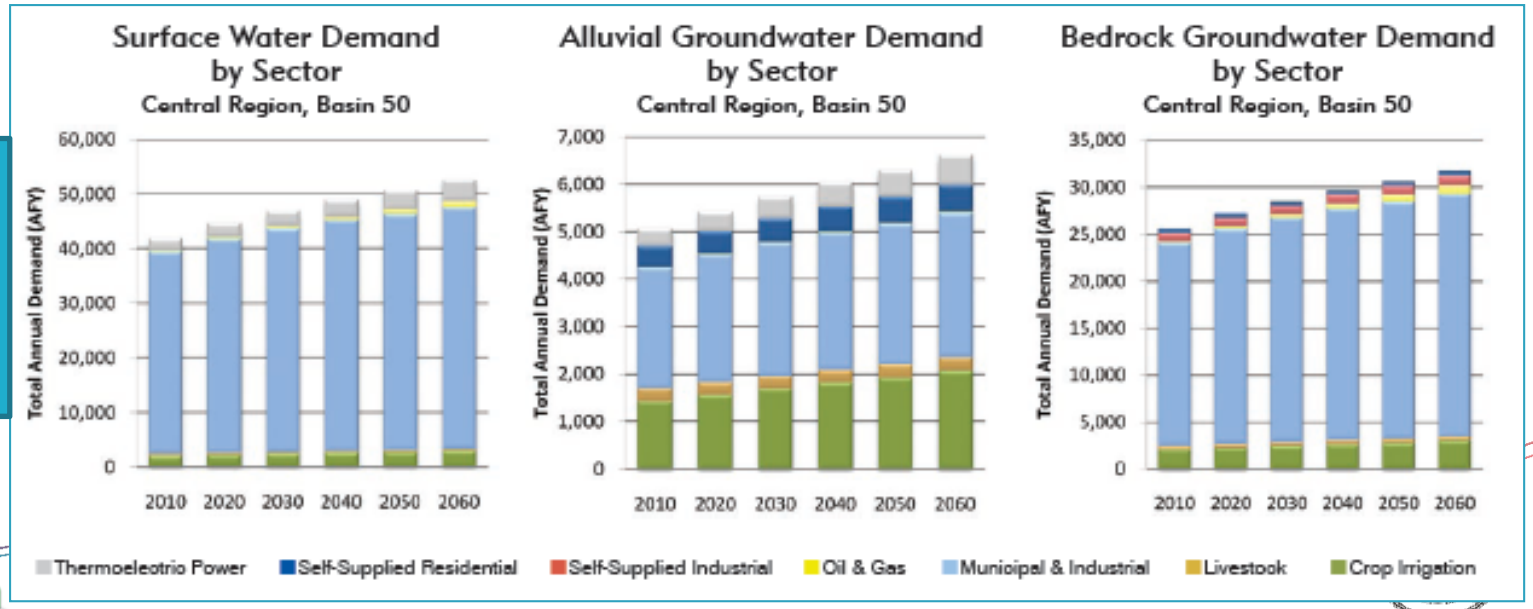
- Goals & Objectives
  - What information is needed by planners and decision-makers?
  - What type of models are needed to provide this information?
- Data Availability
  - What is available?
  - What is the quality?
  - What models will the data support?
- Budget
  - What are financial constraints?



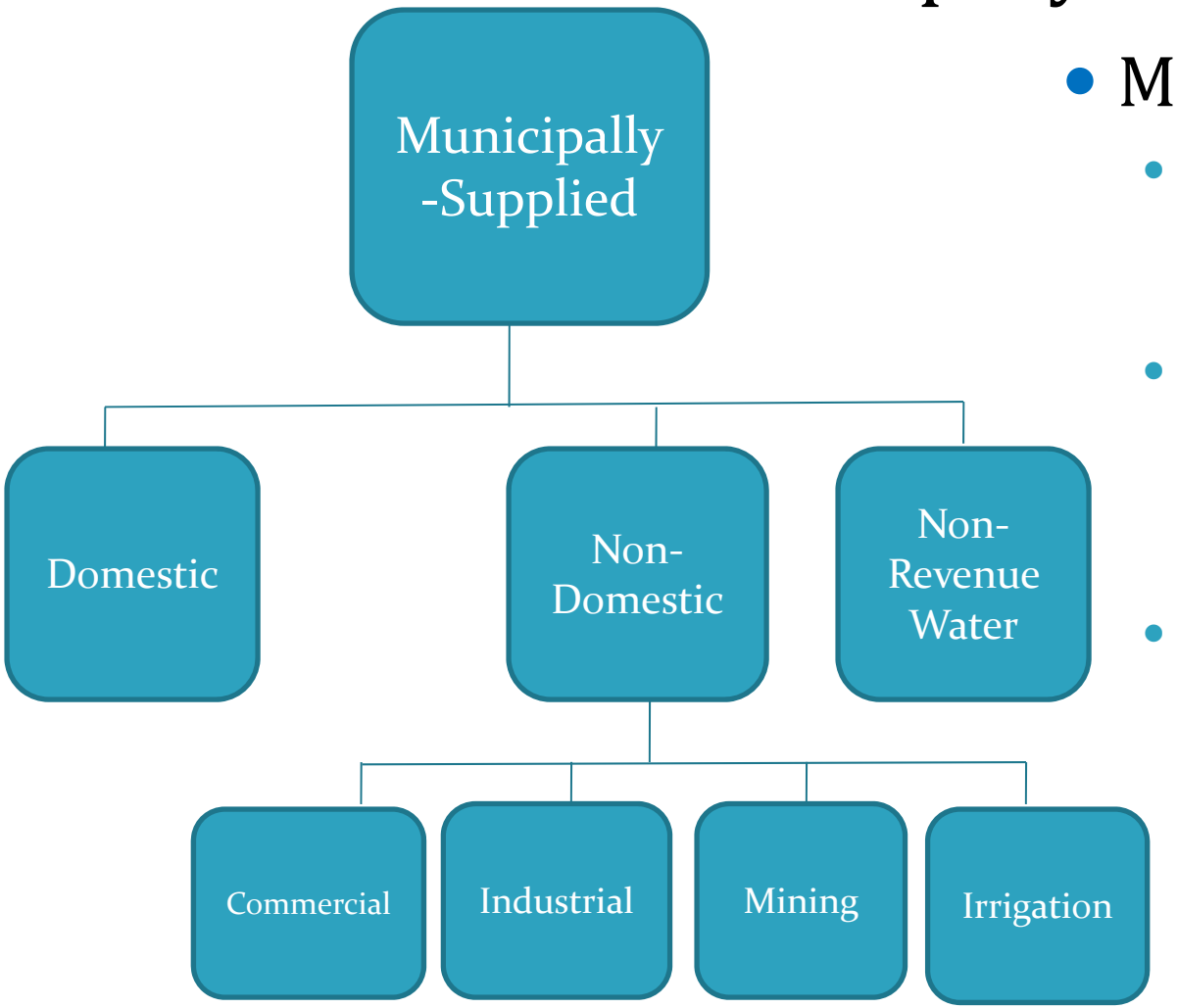
Reporting & Summarizing

- Forecast models will allow for reporting and summarizing total demands and demands by sector for:
  - Counties
  - Planning Regions
  - Groundwater Sources
  - Surface Water Sources
  - Combination (e.g., County Groundwater Demand in Planning Region)

Examples from our work in Oklahoma

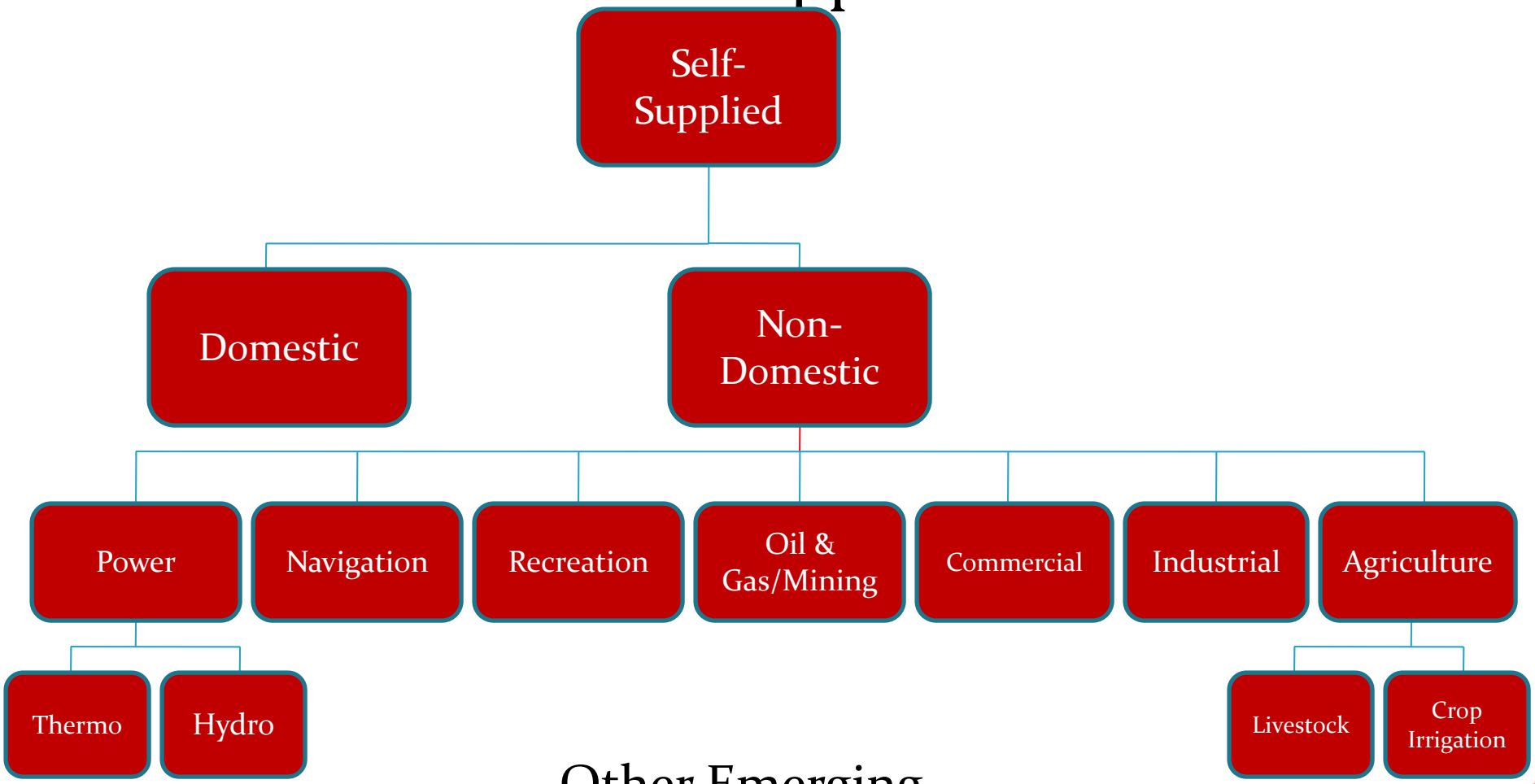


Demand Sectors: Municipally-Supplied



- Municipal Suppliers:
  - Serve at least 25 people or minimum of 15 service connections
  - About 93% of Arkansas' population are served by municipal water supply systems
  - AR Department of Public Health lists 1,070 community water systems in the state

Demand Sectors: Self-Supplied



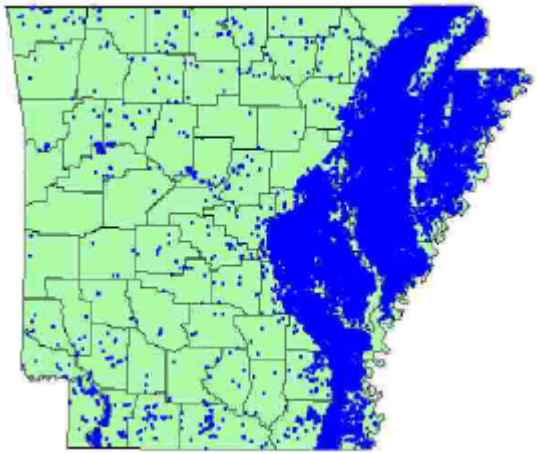
Other Emerging Demand Sectors?

Water Use Data

- Historical withdrawal data used to establish baseline levels of demand by sector and county

- ANRC Water-Use Registration Program Water Use Database (WUDBS)
  - Annual water withdrawals reported for:
    - Non-domestic groundwater users with the potential to withdraw 50,000 gallons per day
    - Any surface water user that withdrawals 1 acre-foot or more per year

49,000 Groundwater Sites



6,100 Surface Water Sites

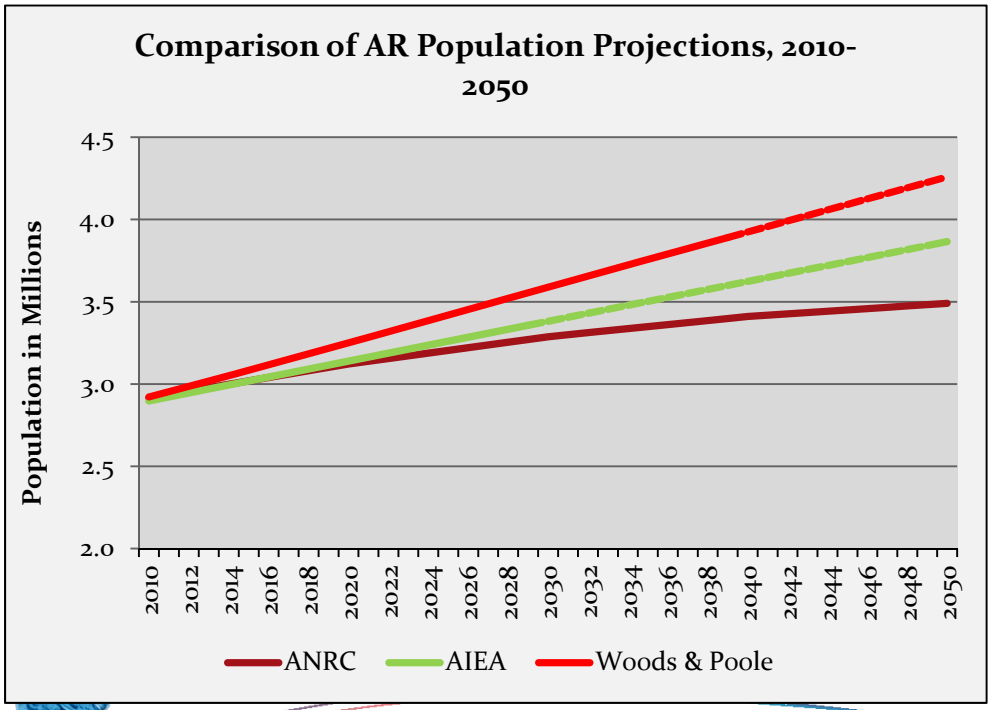
Forecast Approach: Municipally-Supplied Domestic

- Determine supplier domestic deliveries from WUDBS
- Divide domestic deliveries by supplier population served to derive supplier per capita domestic use
- Develop weighted average gallons per capita per day (gpcd) for each county
- Multiply projected county population served by county weighted average gpcd

County Domestic GPCD × County Municipally-Supplied Population = County Municipally-Supplied Domestic Water Demand

Domestic Water Demand Forecast Scenarios

- Three population projection scenarios will drive domestic demands (municipally-supplied and self-supplied):



- Are the county population projections reasonable?
- Are baseline gpcds reasonable?
- What additional data would improve estimates?

Forecast Approach: Municipally-Supplied Non-Domestic

- Commercial, industrial, and mining
- Future demands driven by employment
- Employment projections by industry groups (NAICS) through 2018 - Arkansas Department of Workforce Services
- After 2018 employment assumed to grow proportional to population through 2050
  - Employment projections grow according to the 3 population projections

Non-Revenue Water (NRW)

- Water losses that occur during the treatment and distribution of water
- Annual water losses reported to the WUDBS
- Develop county average percent NRW
- NRW added to forecasted municipal demand to derive total municipal demand including system losses
- County percent NRW estimates may be adjusted within the model

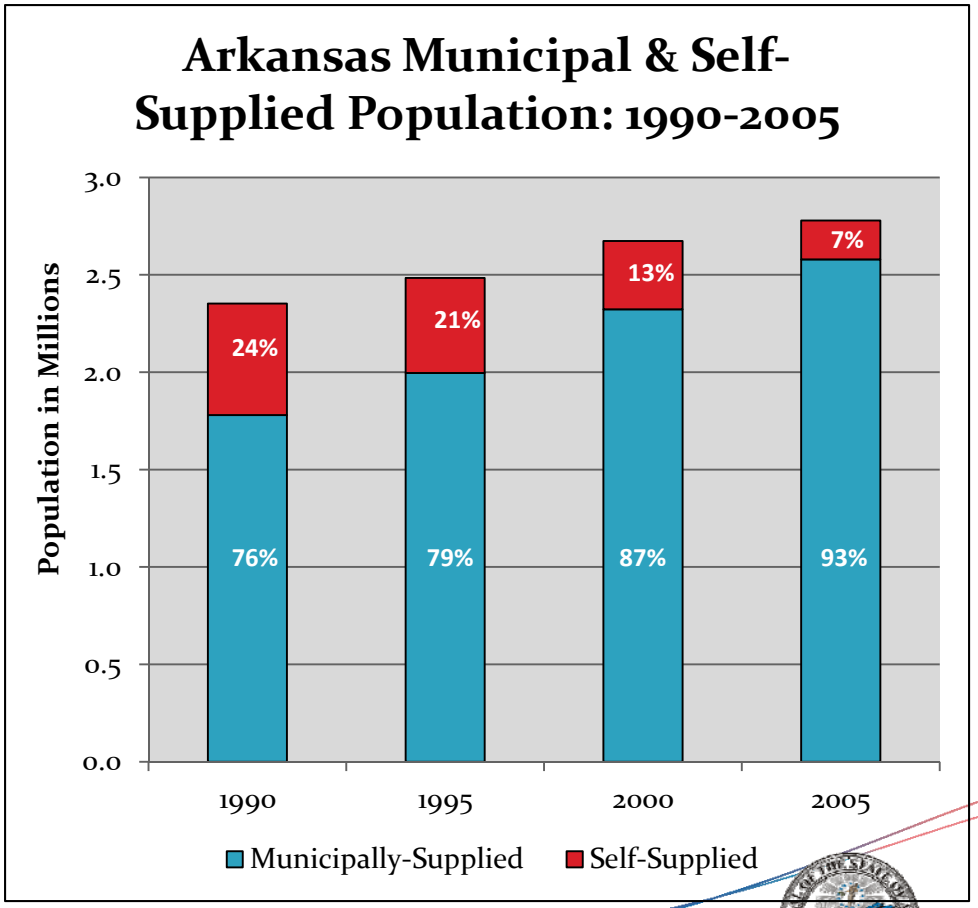
Self-Supplied Domestic

- Residential water users not connected to a municipal system
- About 7% of the State's population
- Demand driven by population
- The county municipally-supplied domestic gpcd is assumed

County Domestic GPCD × County Self-Supplied Population = County Self-Supplied Domestic Water Demand

Self-Supplied Domestic Water Demand Forecast Scenarios

- Are county gpcds acceptable?
- What portion of county population will be self-supplied in the future?



Self-Supplied Commercial & Industrial

- Establish baseline withdrawals by NAICS
  - Analyze multiple years of withdrawals to account for impact of externalities (e.g., weather, economy, etc.)
  - Baseline demand by county, NAICS, and source of supply
- Future demands driven by employment projections
- After 2018, employment assumed to remain proportional to population projections through 2050
- 3 demand scenarios based upon population/employment ratio projection scenarios

Agriculture – Crop Irrigation

- 4.5 million irrigated acres in Arkansas
  - 42% soybeans; 30% rice; 16% cotton; 11% corn
- Regional baseline crop irrigation requirement determined using the Irrigation Water Requirement, Penman-Monteith (IWRpm) program developed by NRCS
- Crop irrigation requirement (water per acre) and future irrigated acres determine future water demand

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Crop Irrigation Water Demand Scenarios

- What will influence future crop irrigation patterns in Arkansas?
- What trends are already being observed?
- What will future crop irrigation patterns in Arkansas look like?
  - More or less irrigated acres?
  - More or less water-intensive crops?
- Specialty/Other crop types?
- Demand forecast will examine potential scenarios

Agriculture - Livestock

- Major livestock groups include poultry, cattle, dairy cows, sheep, hogs, horses, and aquatic species
- Primary water demand drivers:
  - Animal inventories
  - Daily animal water requirements
- Animal water requirement and number of animals determine future water demand

Livestock Water Demand Scenarios

- Will current trends (i.e., growth) in meat and dairy consumption persist both globally and in the U.S.?

- What types of shifts in production and consumption may be expected?

Thermoelectric Power Generation

- 15,521 MW of capacity at 31 facilities statewide
- Fuel type and cooling process determine water requirement (withdrawal and consumption) per unit of power generated
- Water demand forecasted by fuel type/cooling type combination

Hydroelectric Power

- 20 hydropower plants statewide
- 1,350 MW of capacity (8% of total statewide generating capacity)
- 6% of total power generated in the state in 2010
- US Congress authorizes water project purpose(s) and USACE operates the projects to meet these purposes, including water for hydroelectric power production when it is an authorized purpose
- EIA projects no growth in hydropower generation in Arkansas regional markets

Power Generation Water Demand Forecast Scenarios

How will power be generated in Arkansas in the future?

- Facility retirements?
- Additional planned capacity?
  - Where, when, what?
- Renewable energy development?
  - Where, when, what?

Power Generation Water Demand Forecast Scenarios

EIA 2012 Outlook presents three scenarios for ***regional*** power generation through 2035:

- **Reference case** -"business as usual" given known technology and technological and demographic trends; current laws and regulations are maintained.
- **Low economic growth** – assumes lower growth rates for population and labor productivity, higher interest rates, and lower growth in industrial output, ultimately reducing demand for electricity.
- **High economic growth** – assumes high growth rates for population and labor productivity, and lower inflation and interest rates, ultimately increasing demand for electricity.

Navigation

- Perform a review and summary of federal and state laws and authorities
- Perform a review and summary of project operations and flow criteria
- Describe current management regime
- Consider and describe additional instream flow needs:
  - Interstate Compacts
  - Navigation
  - Fish and Wildlife
  - Water Quality
  - Aquifer Recharge

- What will influence the future flow requirements for navigation in Arkansas?
- Will navigation flow requirements change in the future?
- Will they stay the same?

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Mining/Oil & Gas

- WUDBS used to inventory current demands by NAICS sub-group (e.g., mining, quarrying, oil & gas activities)
- Oil & Gas withdrawals include drilling, extraction, transportation (pipeline), and processing
- Baseline level of demand determined from multi-year analysis of registered withdrawals
- EIA projections of shale gas production will drive future water demands for natural gas extraction and processing in Arkansas

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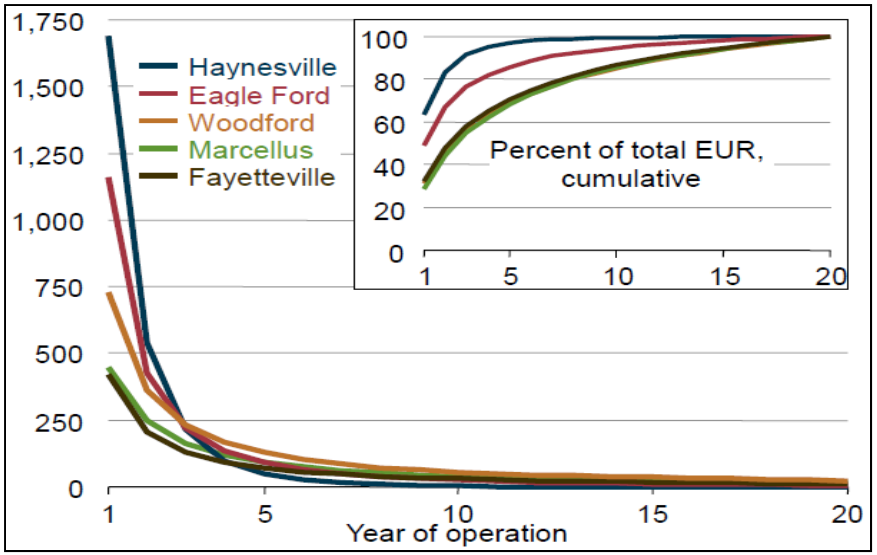
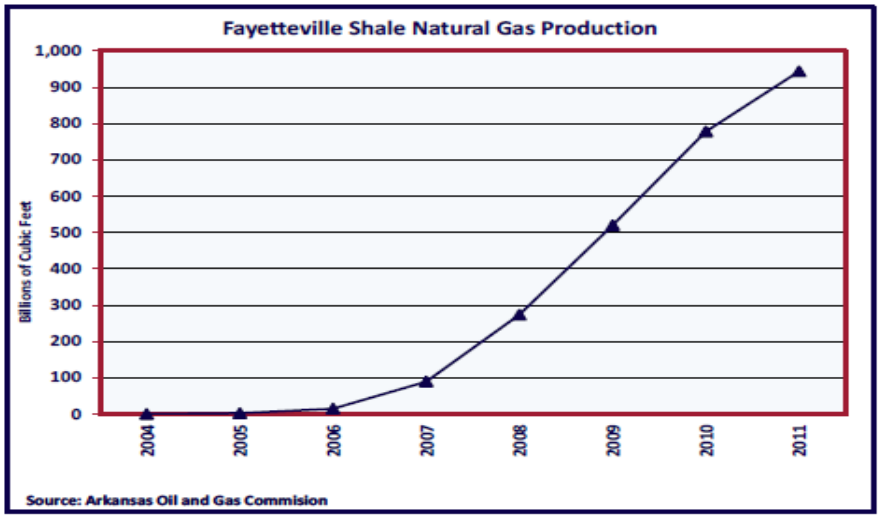
Mining/Oil & Gas Water Demand Forecast Scenarios

What trends are expected?

- Mineral resources?
- Oil & Gas?
- Where? When?
- Fayetteville Shale play sustainability?



According to the EIA, in the Fayetteville Shale, 65% of the estimated ultimate recovery (EUR) is produced in the first 4 years of operation and 100% of total EUR produced within 20 years



Consider Need for Provider Level Survey(s)

- Principally applicable to water and wastewater providers
- Potential use to determine data, funding, regulatory and other needs and challenges associated with new and existing infrastructure

Summary

- Water demands will be estimated to 2050 by county and sectors
- Each sector has a different forecast methodology, and data sources
- Most sectors have alternative projection scenarios
- County-level estimates can be summarized by water source, grouped into planning areas
- Technical work groups will help with data, assumptions and planning scenarios

Next Steps – Subcommittee Conference Calls

January 2013

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1 *New Year's Day*	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21 *Martin Luther King Day*	22	23	24	25	26
27	28	29	30	31		

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Muni

Energy

Industry

Navigation

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Additional Discussion

THANK YOU!