Measuring the Impact of Climate Change on Water Supplies East and West of the Cascades

Government View

2007 Water Law Conference

June 4-5, 2007

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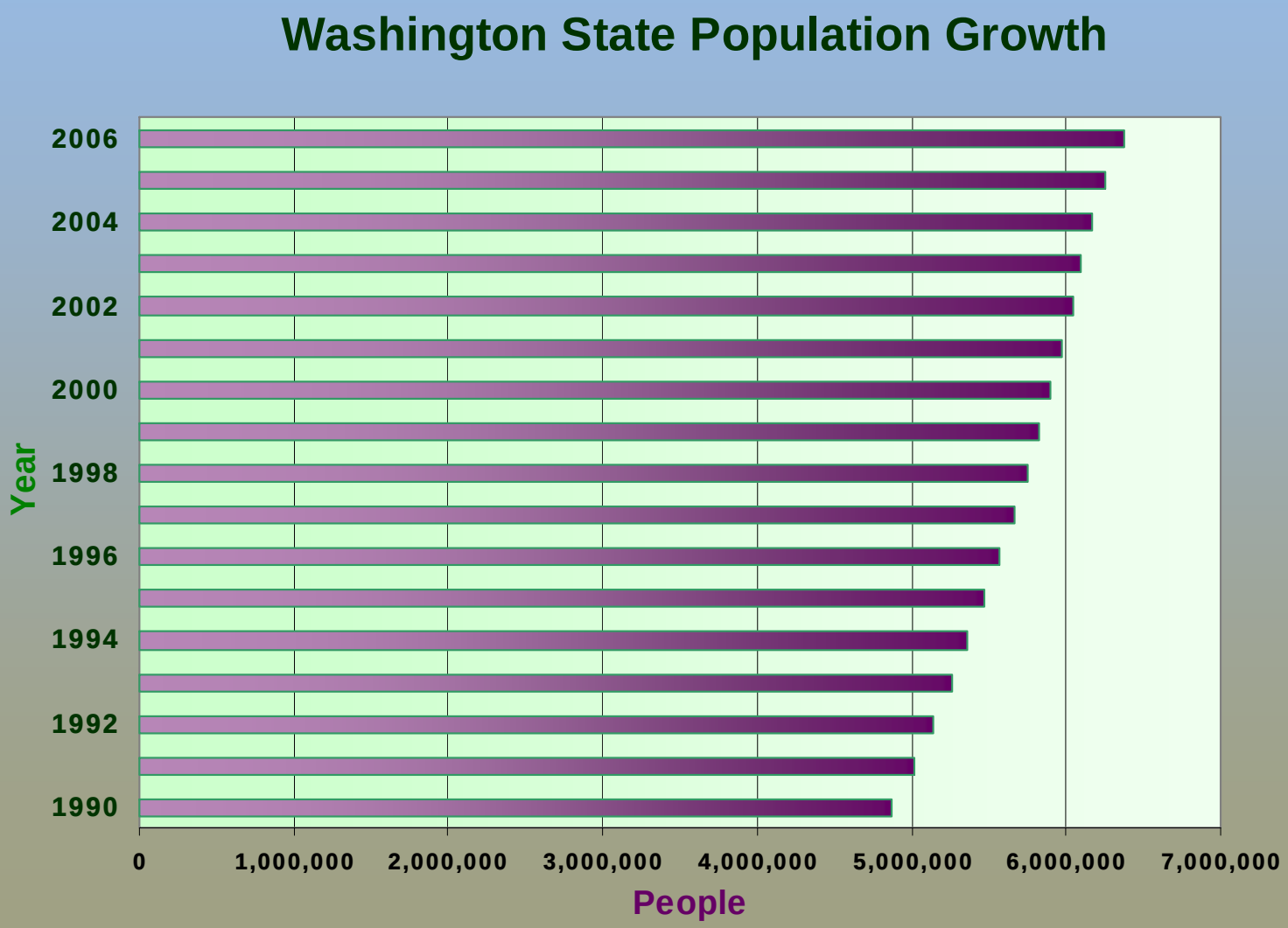
The Issues - *a la D.H. Rumsfeld*

- Known knowns – “The things we know we know”
  - Climate change will mean less water when it’s needed most
  - People need water
  - Everything else needs water too
  - Climate change needs to be incorporated into decision making
- Known unknowns – “The things we know we don’t know”
  - What will our streams look like in a climate changed future?
  - Assuming we govern the same way, what’s the result?
  - Assuming we don’t, how can we adapt?
  - How much water are people using?
  - How do we incorporate climate change into decision making?
- Unknown unknowns - “The things we don’t know we don’t know”

Climate Change Will Mean Less Water When It's Needed Most

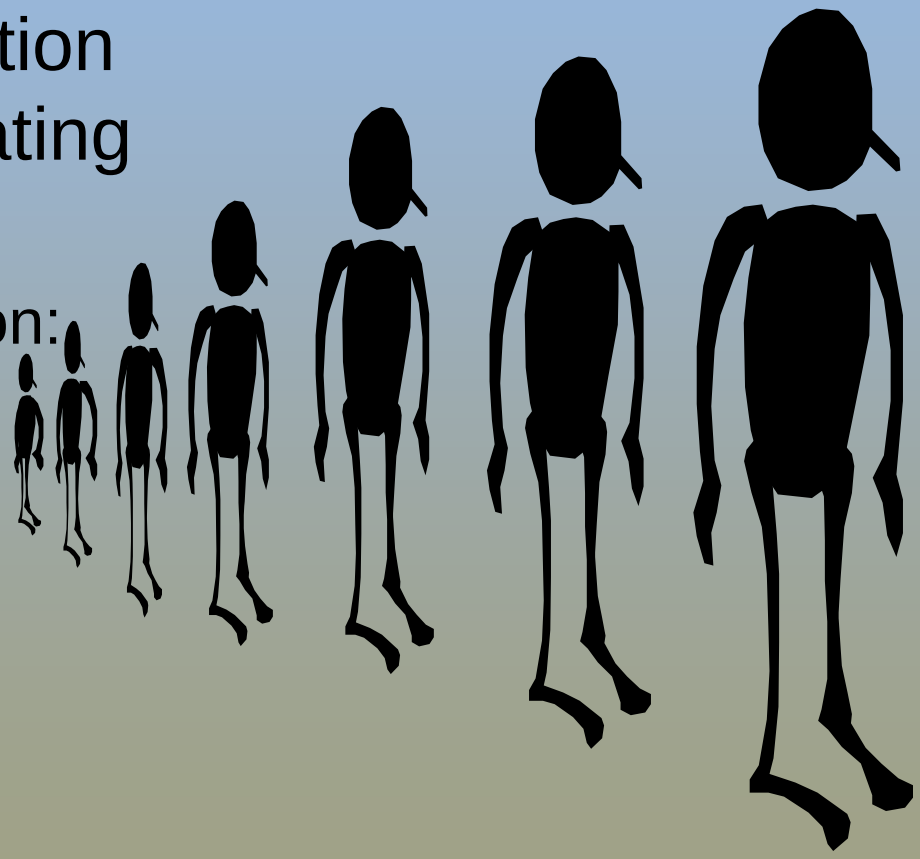
- Spilling water for salmon vs. generating power
- Less water means warmer water
- Less groundwater means warmer surface water
- Water for fish vs. water for ag vs. water for people
- Warmer air means crops need more water
- Warmer air means more need for power (AC, water)
- Spilling water for salmon vs. generating power
- Factor in population, Governor's Executive Order on climate change

Population Growth: People Need Water

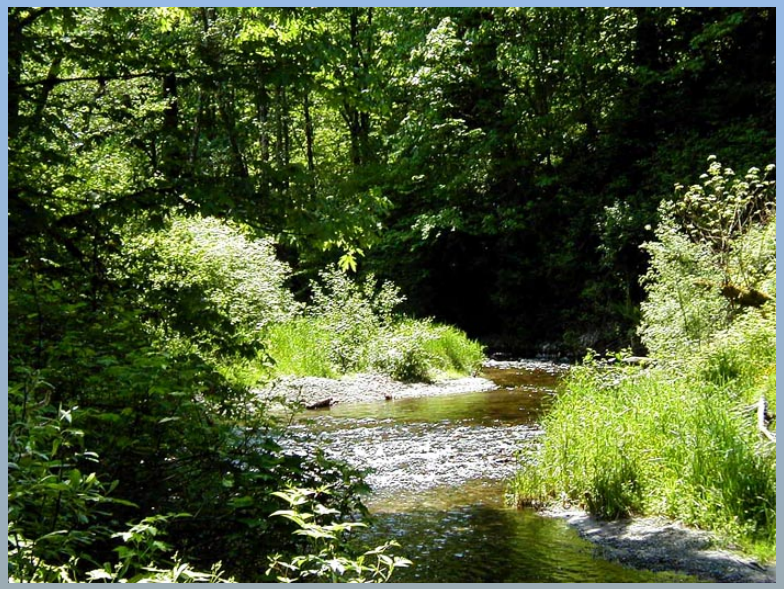


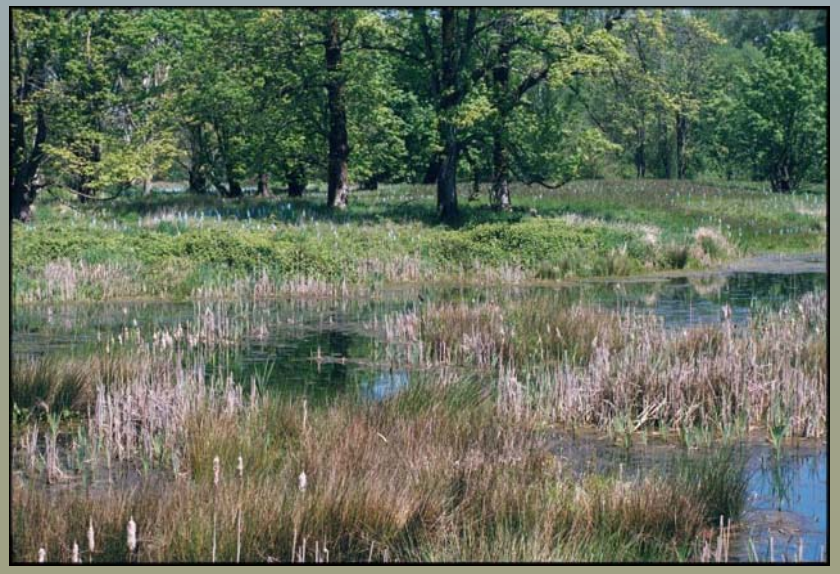
Population Growth: People Need Water

- Projected population growth (extrapolating current trends)
  - Current population: ~6.3 million
  - 2025 population: ~8.1 million
  - 2050 population: ~10.3 million

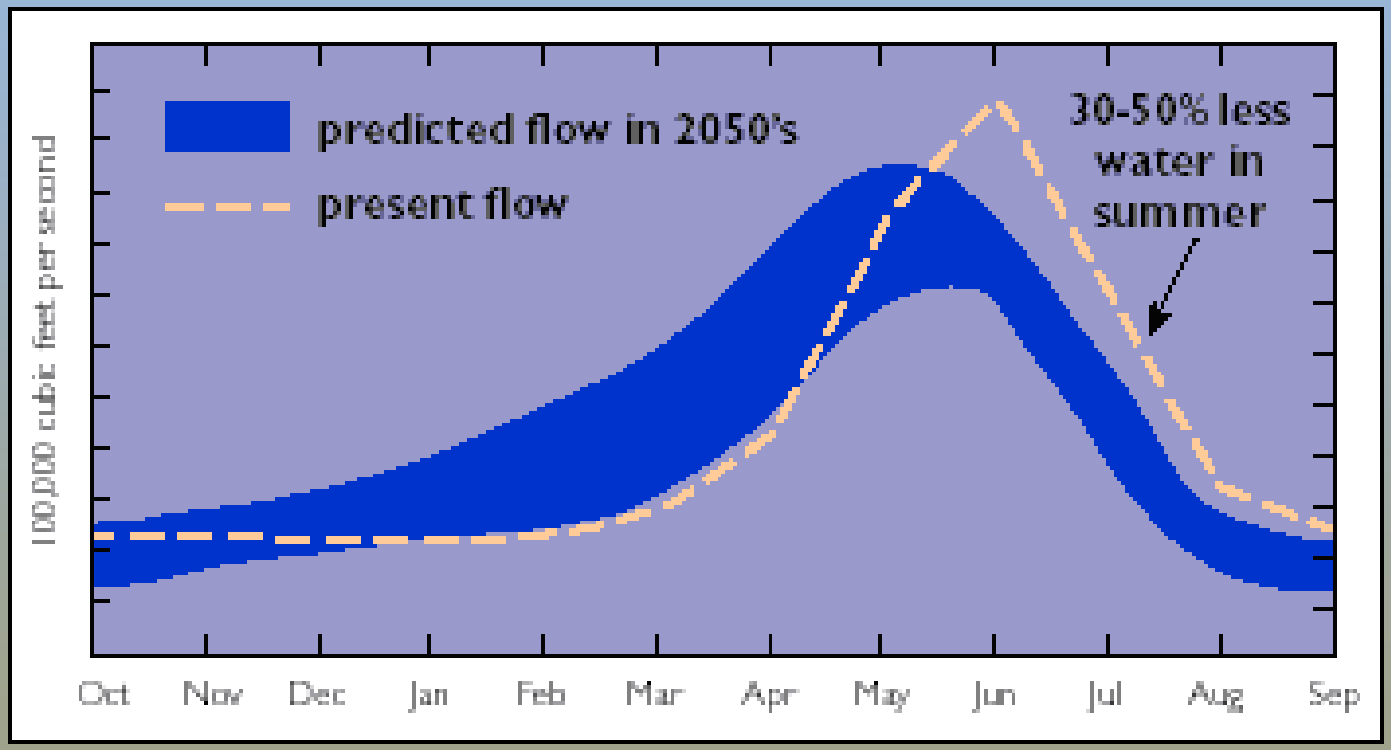


Everything Else Needs Water Too

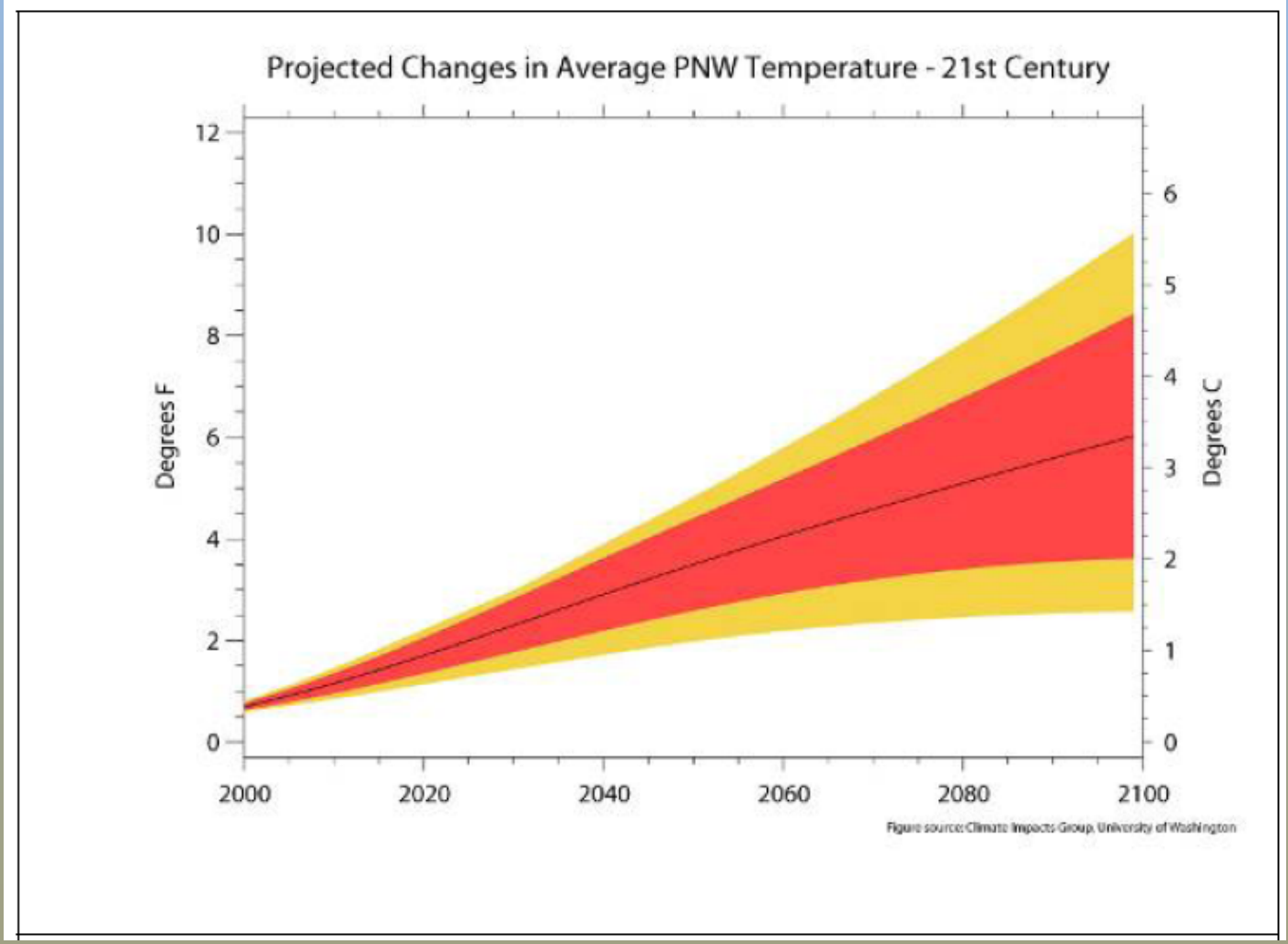




Incorporating Climate Change into Decision Making: The Need for Action



Incorporating Climate Change into Decision Making: Dealing with Uncertainty



Governor's Executive Order: Washington Climate Change Challenge

- By 2020, reduce greenhouse gas emissions (GHG) to 1990 levels
- By 2035, reduce GHGs to 25% below 1990
- By 2050, reduce GHGs to 50% below 1990

- Population Context
  - Population in 1990: ~4.8 million
  - Population in 2050: ~10.3 million

Incorporating Climate Change into Decision Making: Columbia River Basin (CRB) Study

- Water planning must be conducted at a wide range of spatial scales
- Fine-scale
  - provide detailed hydrologic information at the watershed scale
  - prohibitively expensive to implement over large scales needed for basin-wide planning efforts
- Large-scale
  - Done at 1/8th degree (NWPCC) for Mainstem
    - 1/8th degree in CRB ~ 8.8 miles x 6.25 miles = 55 sq. miles
  - Limited ability to accurately resolve sub-basins

Climate Impacts Group (CIG) – Ecology CRB Study

- Large scale Variable Infiltration Capacity (VIC) model across entire CRB at 1/16th degree
  - 1/16th degree ~ 4.4 miles x 3.1 miles ~ 13.6 sq. miles
  - 4X better resolution than 1/8th degree
- 4 pilot small scale Distributed Hydrology Soil Vegetation Model (DHSVM) at 150m resolution
  - Methow, Okanogan, Walla Walla, and Yakima
  - Changing water temperature
- Compare and contrast VIC and DHSVM
  - Changing flood risks
  - Changing summer low flows, stream temps

CIG – Ecology CRB Study: Defining the Parameters

- What future times?
  - 2020, 2050, 2080 (31 year slices)
- How many global circulation models?
  - 10 of available 24 IPCC and an average
- How many scenarios (demographics, politics, economics, technology)?
  - A2 (business as usual)
    - 832 CO_2 ppm in 2100
    - 15.1 billion people in 2100
  - B1 (optimistic)
    - 547 CO_2 ppm in 2100
    - 7.2 billion people in 2100

CIG – Ecology CRB Study: Defining the Deliverables

- What will our streams look like in a climate changed future?
  - VIC, DHSVM comment on natural or naturalized flow
- What's natural/naturalized flow?
  - Headwaters
  - Streams with no regulation

- Not many streams in the west are natural
- Solution: naturalize

Concurrent Study: Flow Naturalization in CRB

- Gather data from Natural Resource Conservation Service (NRCS) and USDA et al
- Estimate diversions on a decadal average
- Estimate return flows, evapotranspiration
- Make a lot of assumptions
- Adjust historic record of USGS gages to reflect a naturalized record

Why Naturalize?

- Flow naturalization work does necessary first step for smaller purveyors to build models the BPA and larger utilities use
- Naturalized flows can be used:
  - to calibrate VIC and DHSVM models, and
  - to estimate what regulated streams will look like (diversion “bias” is reinserted)
    - Assumes current regulatory approach will not change
  - To create supply and demand system dynamic models
    - Vet climate change adaptation strategies
    - Compare and contrast

CIG – Ecology CRB Study: Big Picture

- Inclusion of other CRB stakeholders will help create data consistency
  - Idaho (??)
  - Oregon
  - British Columbia
  - BPA
  - NWPCC

CIG – Ecology CRB Study: Big Picture

- Governor's Executive Order (WA Climate Change Challenge)
- Ecology – CTED Response: Climate Advisory Team (CAT)

Goals of the CAT

1) Review, approve WA GHG inventory and forecast of GHG emissions from 1990 to 2020,
2) Review, assess policy actions taken in ’05, ‘06 to reduce GHG emissions and their impact on reaching 2020 goal, develop recommendations,
3) Develop recommendations for comprehensive set of policies, strategies that can fully achieve Governor’s Exec Order,
4) Assist in active involvement by WA in regional, national climate policies,

Goals of the CAT, cont.

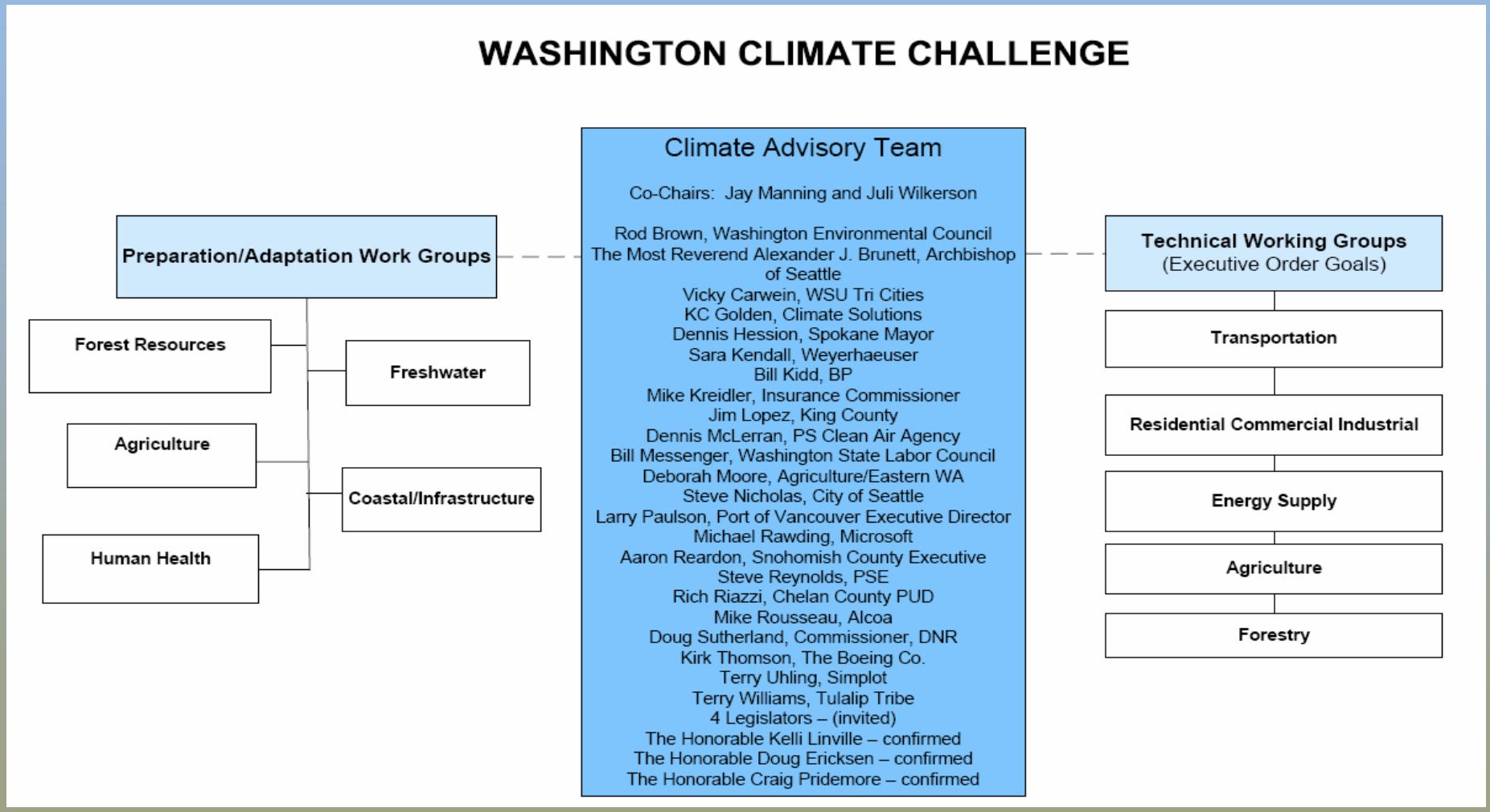
5) Recommend how WA can reduce its GHG emissions,

6) Coordinate with local governments on local, state climate initiatives,

7) Public involvement, develop recommendations for education, outreach,

8) Advise on specific steps WA should take to prepare for climate change impacts.

The CAT, PAWGs and TWGs



CIG – Ecology CRB Study: Big Picture - Freshwater PAWG

- Take the CRB study statewide (provided there's funding)
  - Build on efforts already underway in King County et al
- Incorporate climate change into law, make new laws, policies, rules
  - Brainstorming
  - Low hanging fruit at first
  - Task forces to study/work more complicated issues
  - Evolving, continuing process

Known Unknowns:
Where's All the Water Going?

- We need more, better, consistent data
  - Gaging (surface and groundwater)
  - Metering
  - Exempt wells, rain barrels
  - Wet vs. paper water rights

- Adjudications

How Do We Incorporate Climate Change Into Decision Making? A Primer

- Less snowpack means less storage
  - Big storage ($$$$$)
  - Little storage ($$$)
  - Aquifer storage and recovery ($$)
  - Individual storage, rain barrels ($)
  - How flat a hydrograph do we want?
  - Conservation/Efficiency
- What does drought mean?
  - If a drought occurs every summer, is it a drought?

How Do We Incorporate Climate Change Into Decision Making? 2nd Primer

- Setting and achieving instream flows
  - What does achieve mean?
  - What would it cost?
  - How much is a fish, ecosystem worth?
- Encouraging reclaimed water
  - What's impairment?
- What's "waste"?

How Do We Incorporate Climate Change Into Decision Making? 3rd Primer

- Encouraging low impact development (LID)
  - Graywater, wastewater treatment
  - Permeable surfaces
  - Mimic natural hydrology, canopy, soils, vegetation
  - Rain harvesting
- Water banking beyond Yakima
- Enforcement
- SEPA/GMA
- Etc., etc.

Unknown Unknowns:

Questions?