A Practical Framework for Integrating Climate Risk and Water Management

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CH2MHILL®

Translating climate science and water management for implementable solutions

- Climate science research
- Complex and growing practical challenges faced by our clients and the world at large
- We fill the gap between research and implementation for sustainable climate risk and water management
- Always looking for partners to leverage and share dynamic solutions for practical challenges

Population

Water Scarcity

Energy /Carbon

Environment

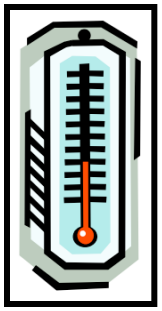
Regulations

Climate

Sustainability*

Multiple Issues Create Complex Challenges

Managing climate risk-the ultimate complex challenge–impacts to the water cycle



Temperature

Storm Frequency and Intensity

Sea Level

Droughts and Floods

Ocean Conditions

- *Average annual temperature*
- *Precipitation duration and intensity*
- *Drought duration/intensity*
- *Early snow melt and sublimation*
- *Flood and storm surge*
- *Sea level rise*
- *Ocean conditions*
- *Overall uncertainty*

Multiple impacts create complex water challenges

Source Water

Flow uncertainty
Intakes
WQ Issues
Evaporation
Groundwater
Seawater Intrusion

Water Treatment

WQ/additional treatment requirements
Siting elevations/ facility flooding

Wastewater

Outfall elevations
Siting elevations
SSO and CSO frequency
Temp-dependent processes
Receiving WQ

Agriculture

Increased water demand
Crop yields
Water quality
Growing season

Stormwater

Localized flooding
Regional flooding
Increased CSOs
WQ issues
Drainage

Energy and Industrial

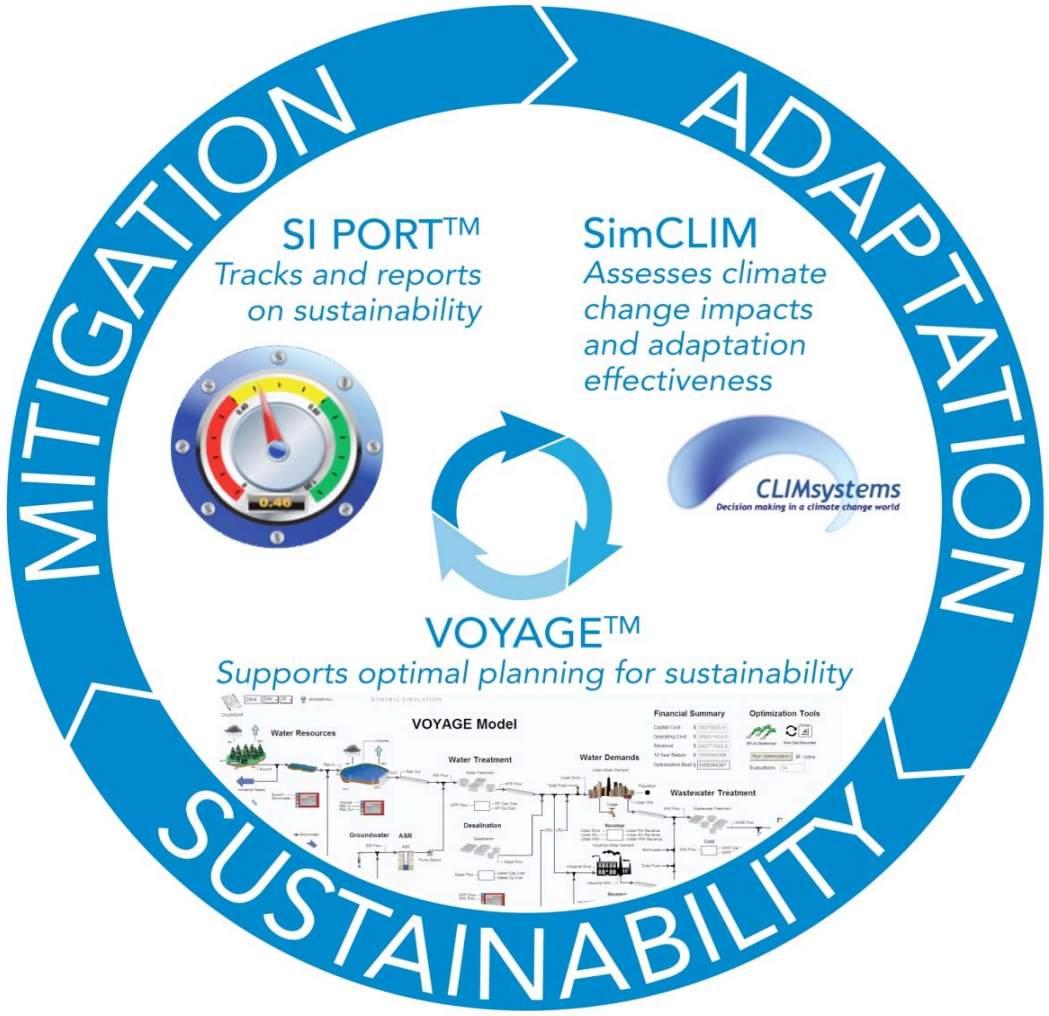
Extraction water use
Production water use
Flow/Quantity uncertainty
Intake/outfall elevations
WQ issues

Ecosystems

Species extinctions
Fishery collapse
Ecosystem services
Basic food web collapse

Integrated solutions rely on inter-related approaches and tools

We have developed inter-related approaches and tools to create integrated solutions for our most complex climate risk and water management challenges.



SI PORT Modules Support Custom Solutions

Mitigating GHG emissions:

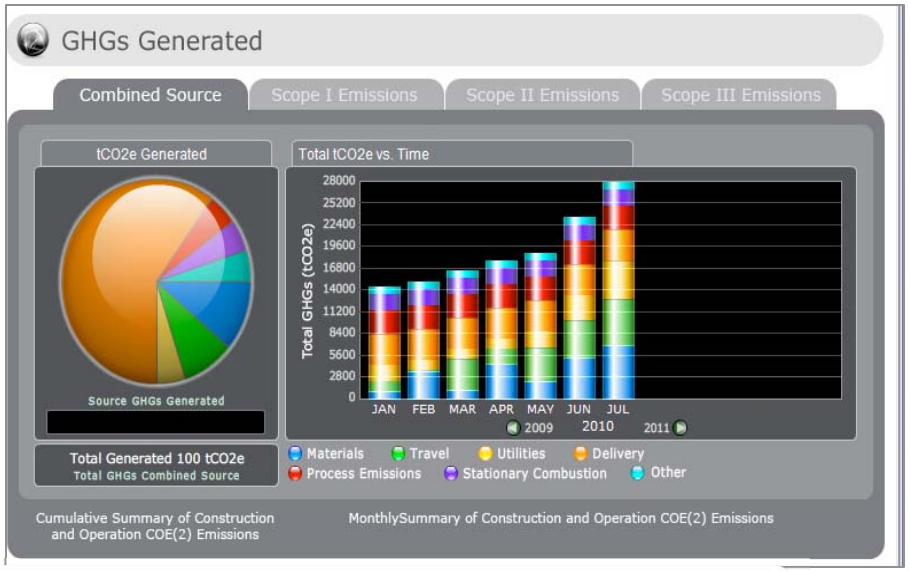
- *Material and Chemical Use*
- *Energy Use*
- *Mobile and stationary Combustions*
- *Wastewater Process Emissions*
- *Waste to Energy Management*
- *Air Travel*

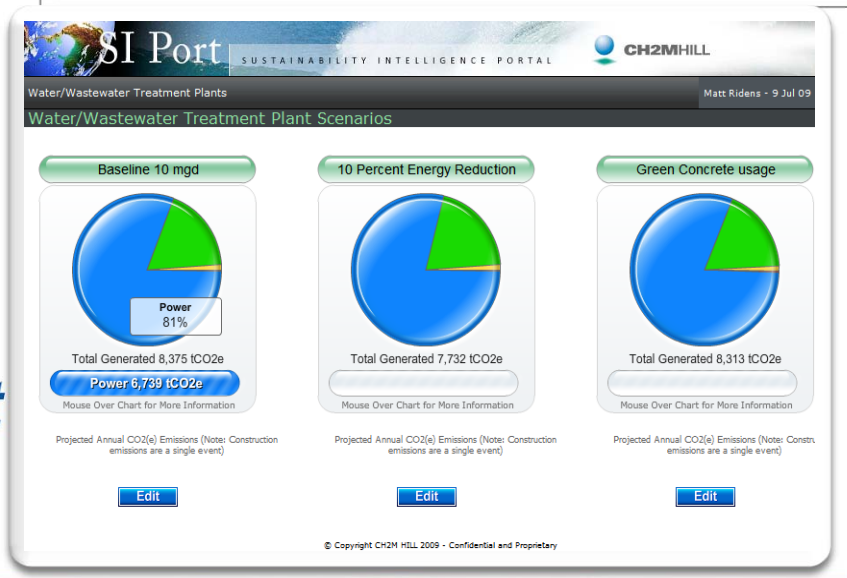
Key Performance Indicators

Water Footprint

Data QA/QC

Sustainability Code of Conduct Reporting



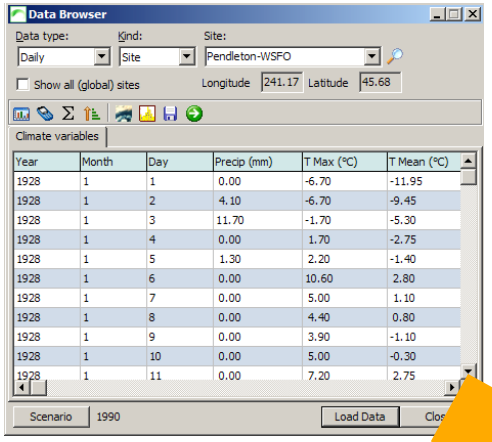


Adaptation and Sustainability: CLIMsystems and CH2M HILL

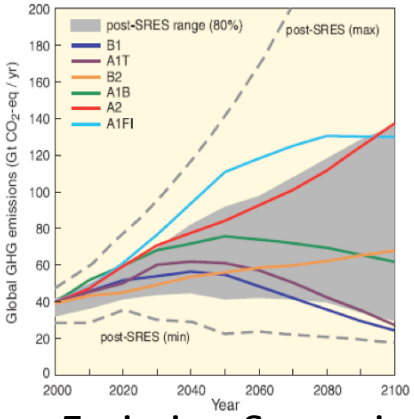
CLIMsystems: customizable, scientifically defensible, user-friendly software systems for assessing impacts and adaptations to climate change

CH2M HILL: globally recognized climate change risk decision processes, risk assessment, creating and testing implementable engineering solutions for climate resilience.

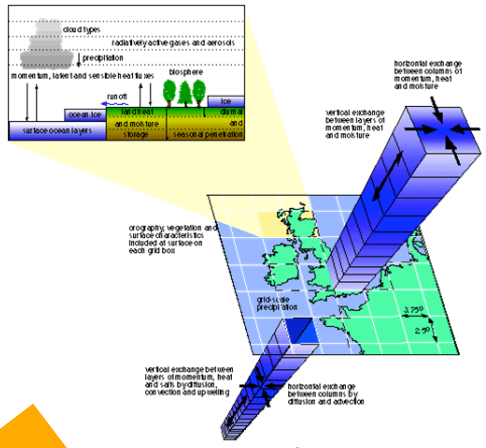
SimCLIM Input and Output



Observed Data

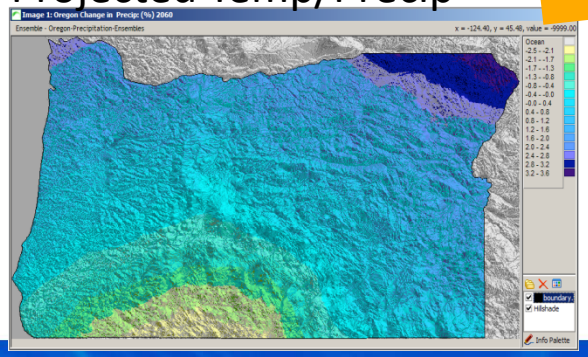


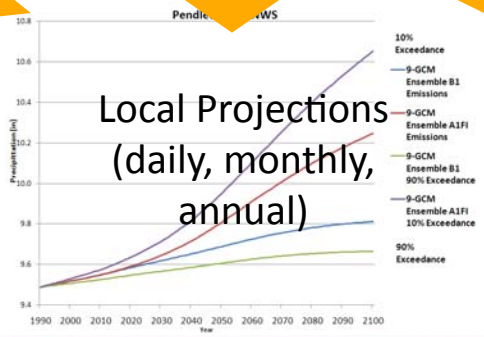
Emission Scenarios



GCM Results

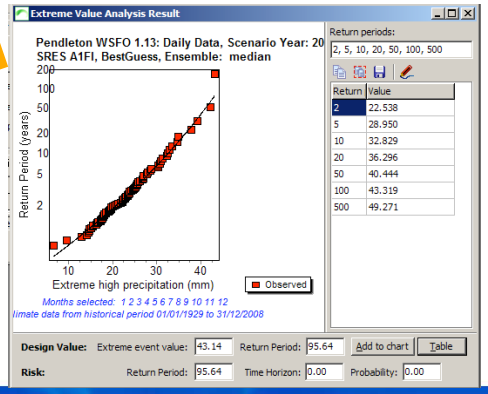
Projected Temp/Precip



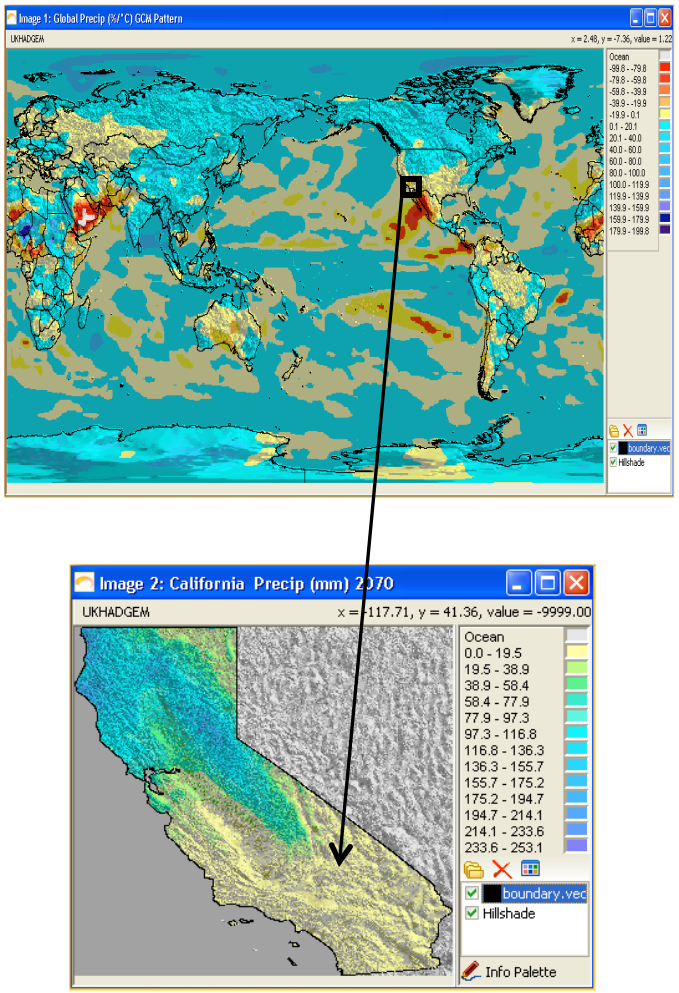


Local Projections (daily, monthly, annual)

Precipitation Intensity



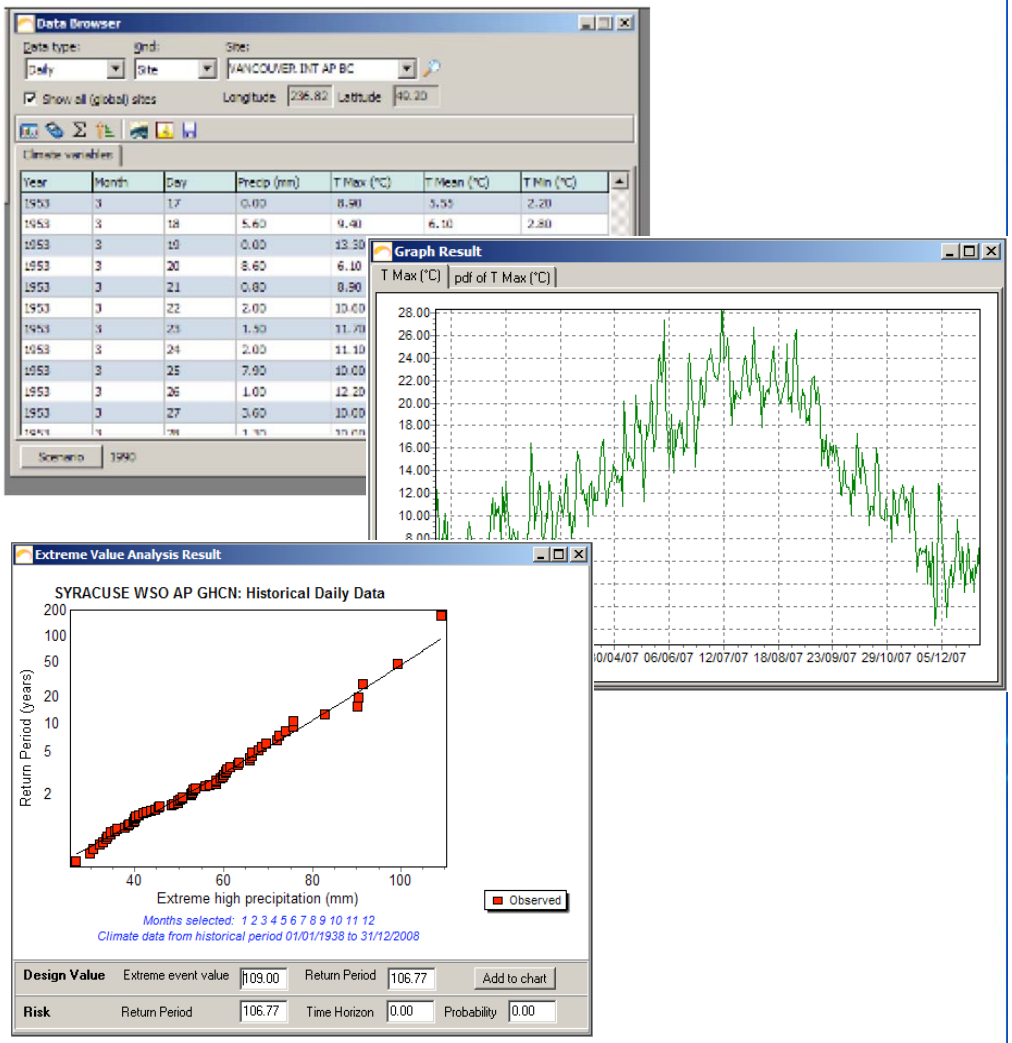
How it works:



- *SimCLIM: assesses impacts of climate change geographically and over time*
- *Efficiently combines GCM output and GHG scenarios*
  - *projected temperature and precipitation*
  - *projected extreme precipitation frequency and amount,*
  - *sea level rise*
- *Exports to hydrologic, operations, and models--directly applicable to local conditions*
- *Quantifies likelihood of local scale climate impacts, reliably and FAST!!*
- *Tests potential adaptations*

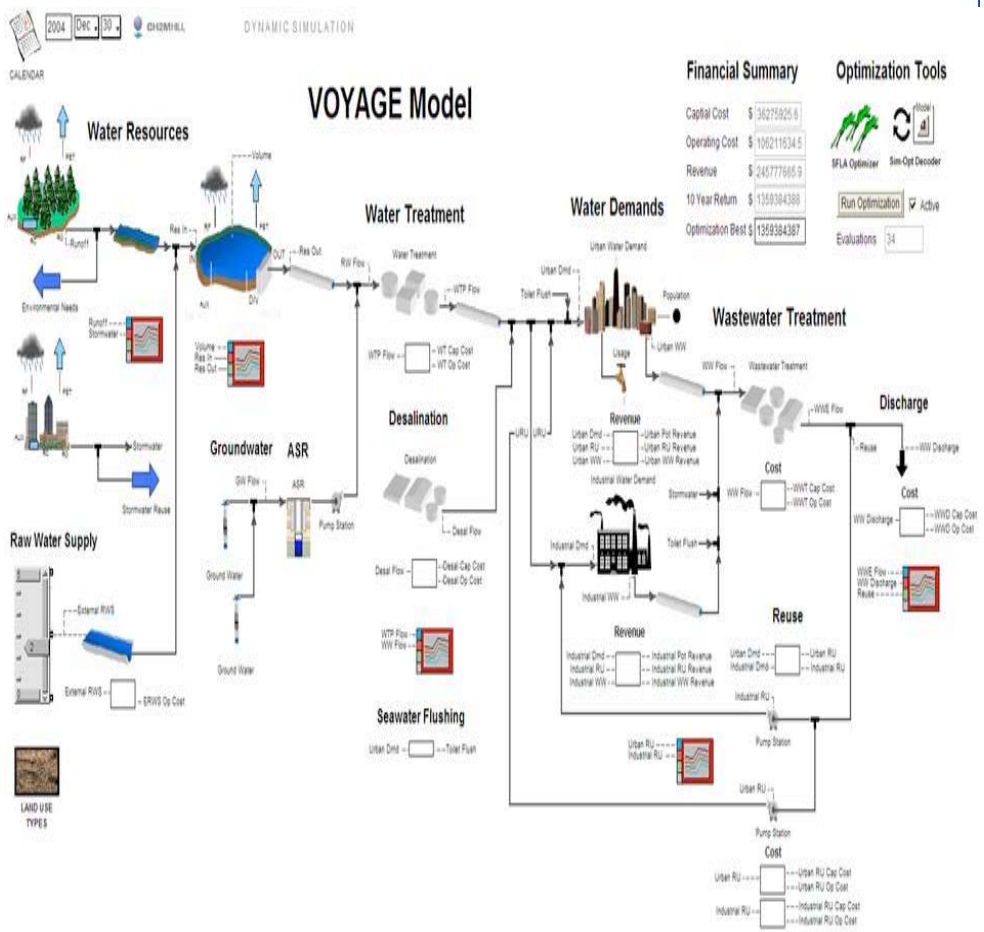
CLIMsystems tools + CH2M HILL Approaches and Engineering offer Climate Resilient Solutions

- *Climate Data Browser*
- *Impact Modules*
  - *Agriculture*
  - *Coastal SLR*
  - *Water Resources*
- *Scenario Development*
- *Extreme Value Analysis*
- *System Building Tools*
  - *Data Import Wizard*
  - *Impact Model Management*
  - *Image Importer*
  - *Site Data Manager*
  - *Area Browser*
- *Image Viewer*



Voyage™: Optimized planning, infrastructure, and operations for sustainable water solutions

- *Interactive, dynamic simulation scaleable for built and natural infrastructure and operations systems*
- *Interfaces with SimCLIM climate change planning to optimize adaptation options*
- *Provides input to SI Port so GHG footprint and water footprint of adaptation and other infrastructure can be measured and optimized.*



Project Example:

Preliminary Climate Change Adaptation Costs for the US Water and Wastewater Sectors

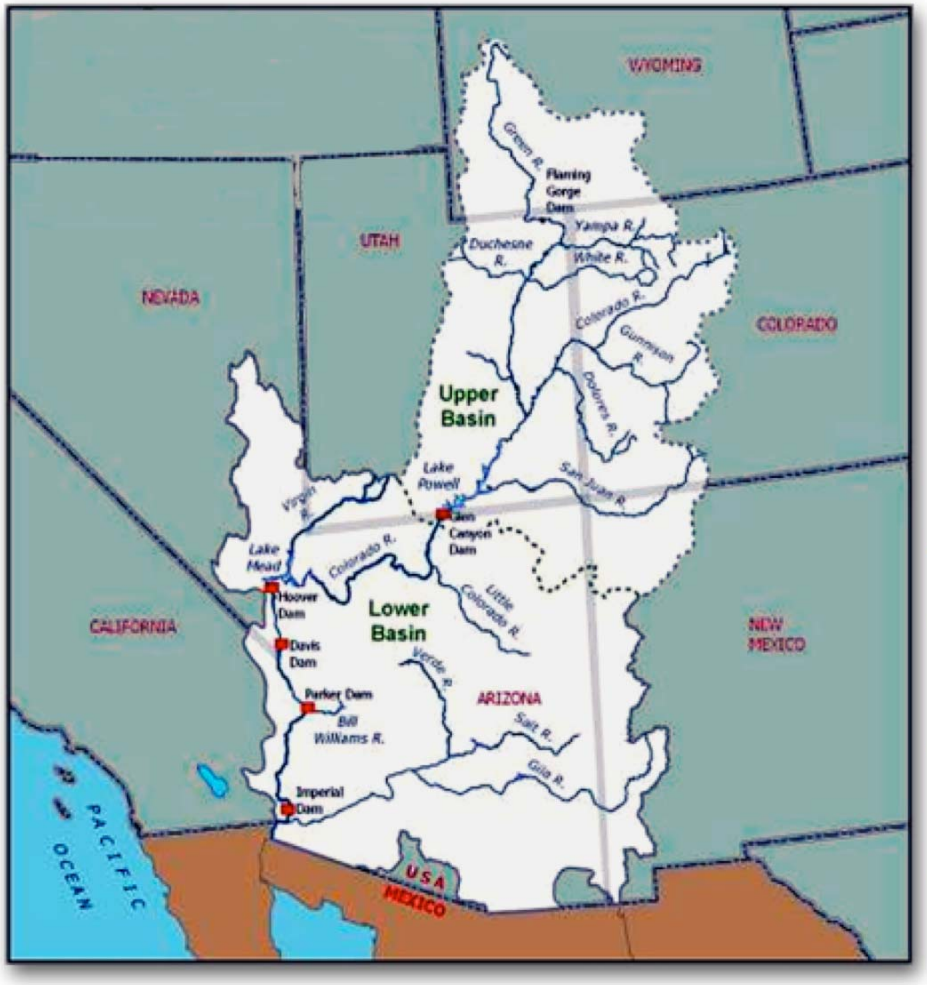
CONFRONTING CLIMATE CHANGE:

An Early Analysis of Water and Wastewater Adaptation Costs

October 2009

Project Example:

Integrated, sustainable solutions for the Colorado River Basin-The CRB Study

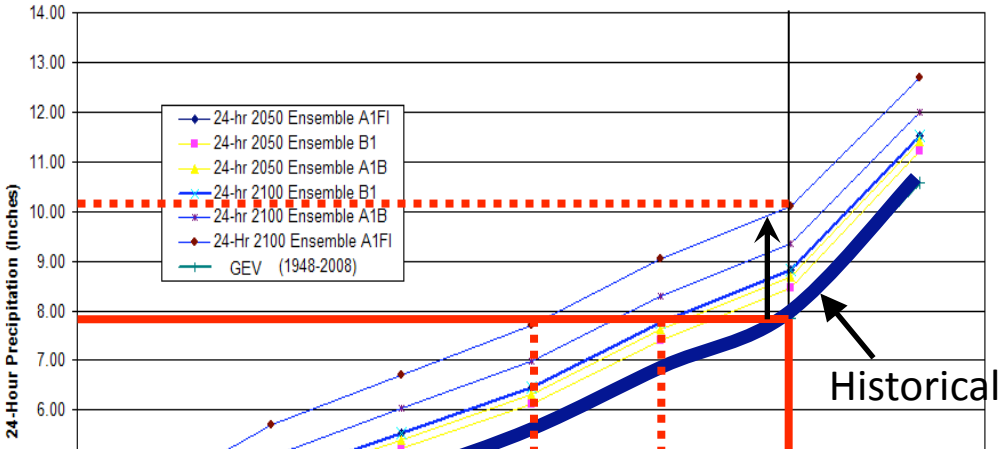


- *Reclamation and 7 States, Tribes, NGOs*
- *Current and Future Gaps*
  - *M&I*
  - *Agriculture*
  - *Energy*
  - *Ecosystems*
  - *Recreation*
  - *Economics*
- *Projected Climate Change*
- *Assess risks, develop and test adaptations*
- *Create plan for long-term water sustainability*
- *Integrated approaches and tools assess risk, adaptation, and sustainable water management*

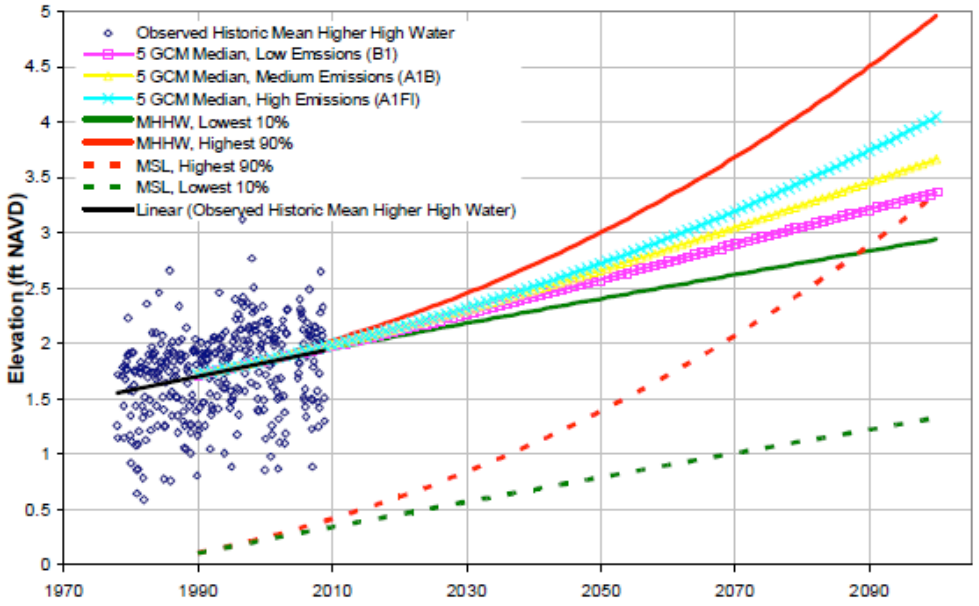
Project Example:

Storm Sewer Infrastructure Planning with Climate Change Risk - A Case Study

- The City of Alexandria, Virginia, has experienced repeated and increasingly frequent flooding events
- Reviewed of stormwater design criteria and potential impacts of climate change
- Used climate change model projections for 2050 and 2100 to assess rainfall intensity, duration, and frequency; and sea level rise
- Evaluating infrastructure adaptation options to reduce impacts from sea level rise and flooding from more intense and frequent storms



Projected Mean Higher High Water Relative to Historic Trends
Washington D.C. 8594900



Bridging the Gap between Climate Science and Water Management Needs

Climate science

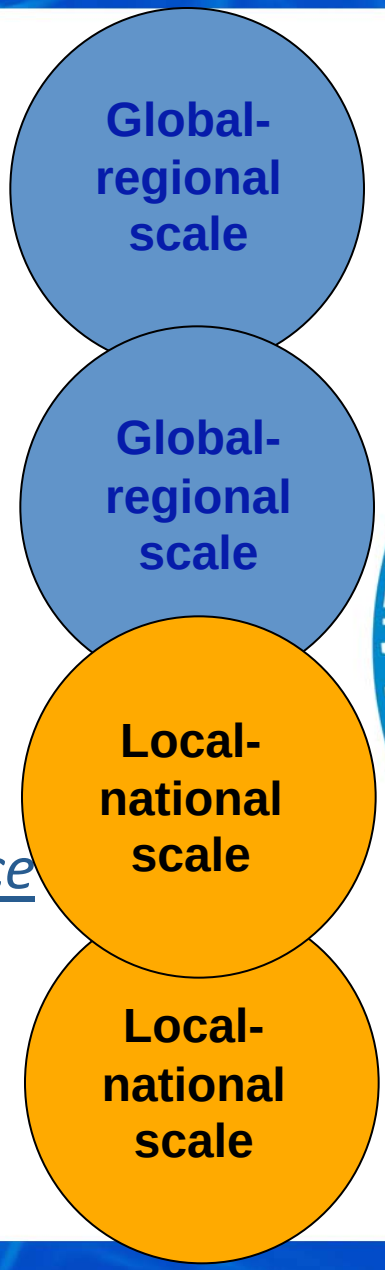
- Global climate models
- Scenarios of change
- Bio-physical impact assessment

e.g. IPCC assessment

Vulnerability and resilience

- Adaptation
- Sustainable development
- Risk-based assessments

e.g. reducing coastal flooding risks



Thank You