



Colorado's Water Supply Future



Rio Grande Basin Roundtable

Alamosa, Colorado

June 9, 2009

Agenda

- Scenarios for Colorado's Water Supply Future
- Conservation Strategy
- Agriculture Transfer Strategy
- New Supply Development Strategy
- Feedback on Strategies and Next Steps

Examine the Engineering Evaluation Elements for Strategies

- Description of strategy or project elements – water source, conveyance and storage, water quality
- Capital costs – permitting, mitigation, land acquisition, pumps, pipe, treatment
- Annual O&M costs – energy, equipment maintenance and replacement

Purpose

Ability to begin to compare tradeoffs between strategies

Further Evaluation of Strategies will Include:

- Identification of:
 - Project benefits
 - Implementation issues
 - Potential attributes/additional options
 - Acceptability
- Other evaluation elements:
 - Additional cost elements (water rights or storage)
 - Discuss potential attributes/additional options for ag transfer and new supply development options with Basin Roundtables
 - Incorporate other conservation elements such as sharing of conserved water and the infrastructure and institutional arrangements required
- Qualitative description of how each strategy meets the Vision Statement and Vision Goals

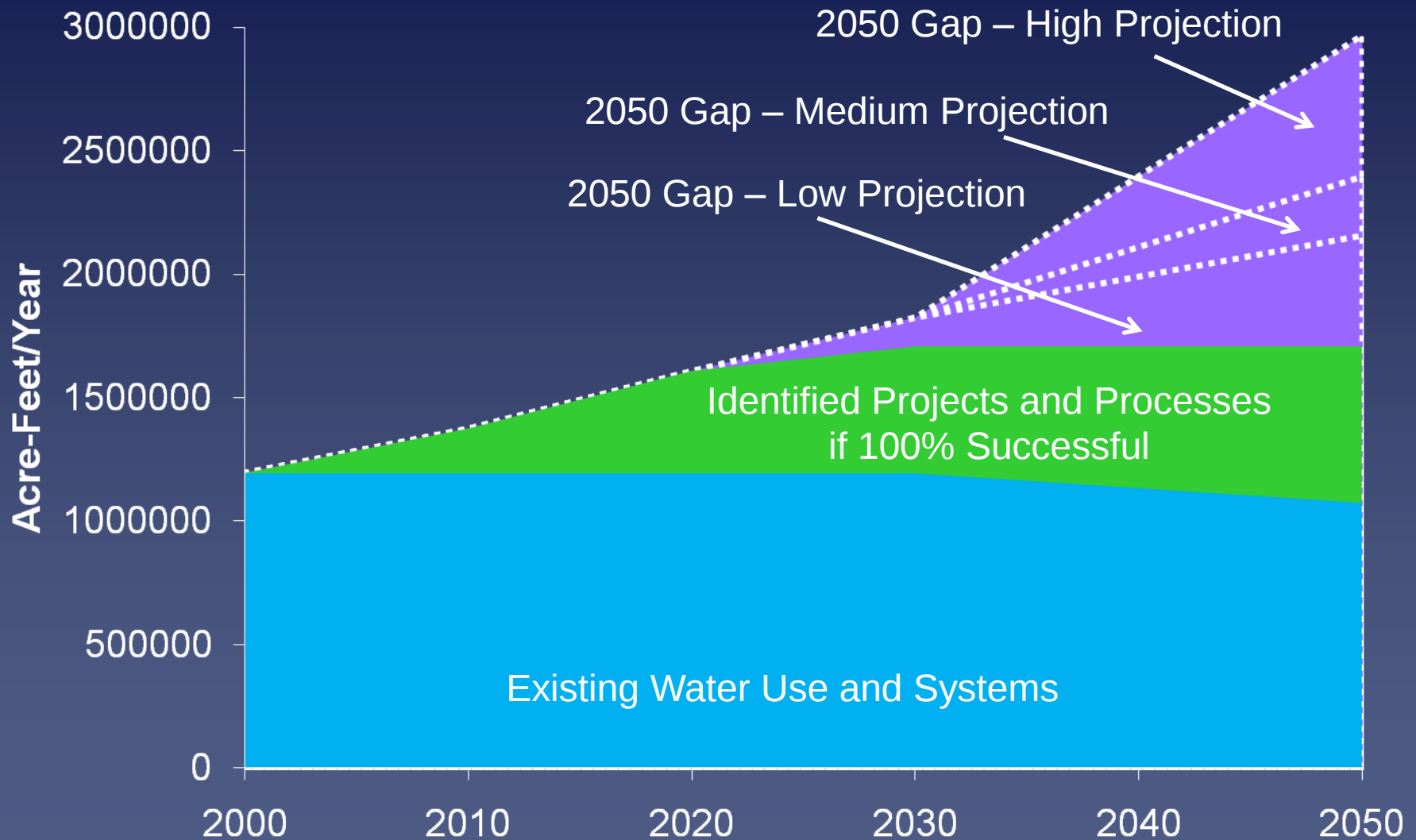
Scenarios for Colorado's Water Supply Future

Scenarios will Address the Following Water Needs

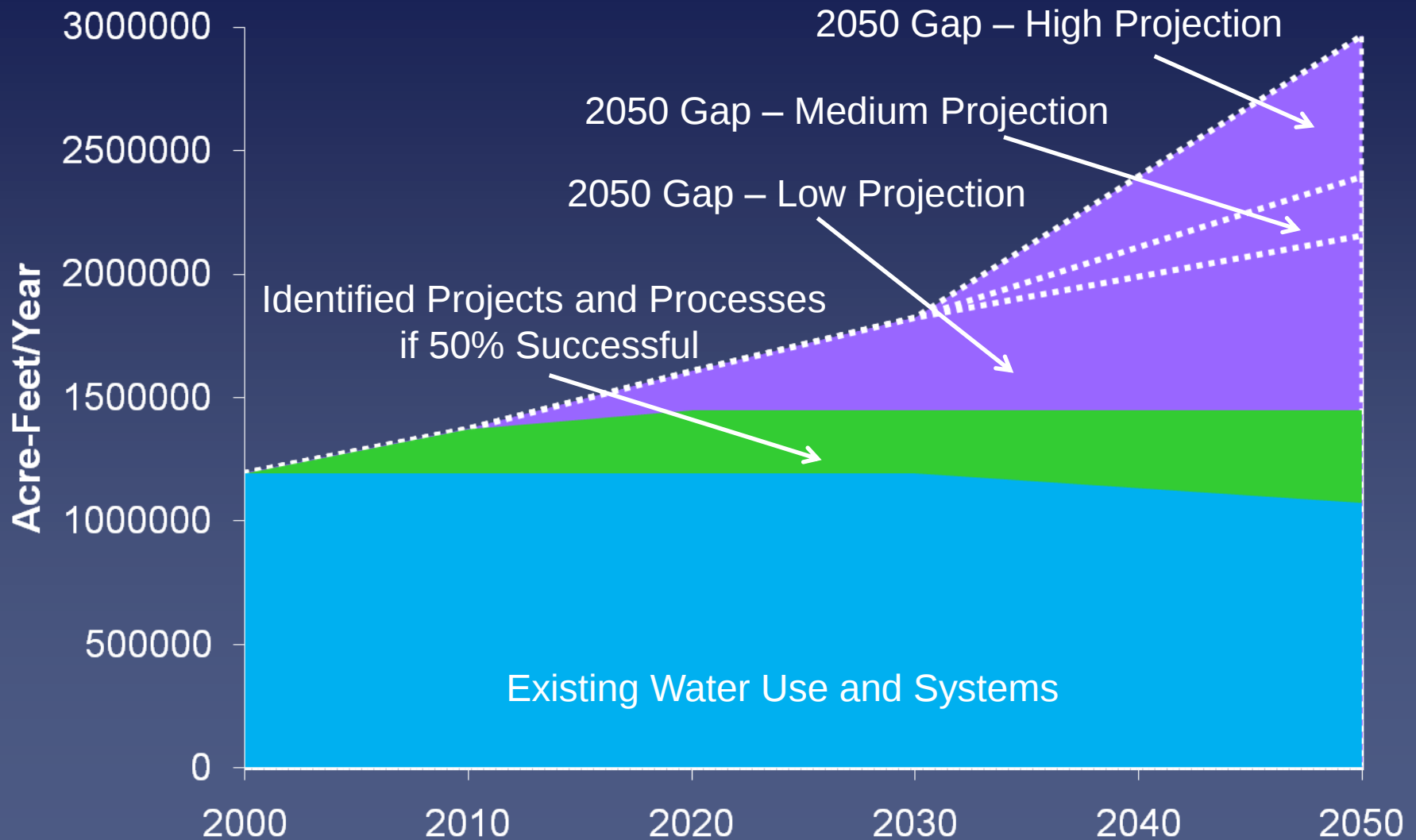
- Municipal & Industrial
- Agricultural
- Environmental & Recreational



State of Colorado Projected M&I Water Use and Gaps

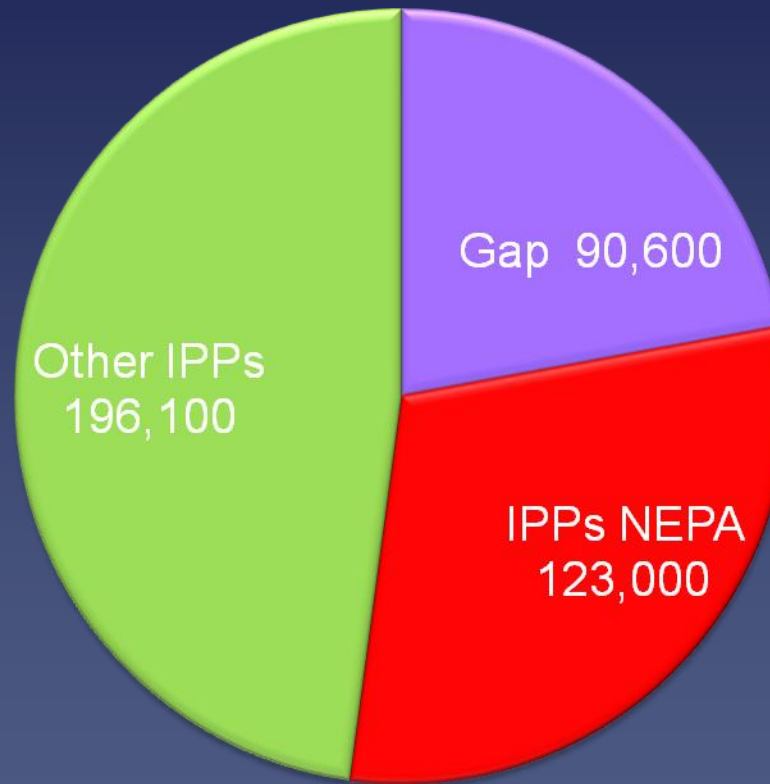


State of Colorado Projected M&I Water Use and Gaps



In 2030, the South Platte and Metro Basins will have 409,700 of New M&I Demand

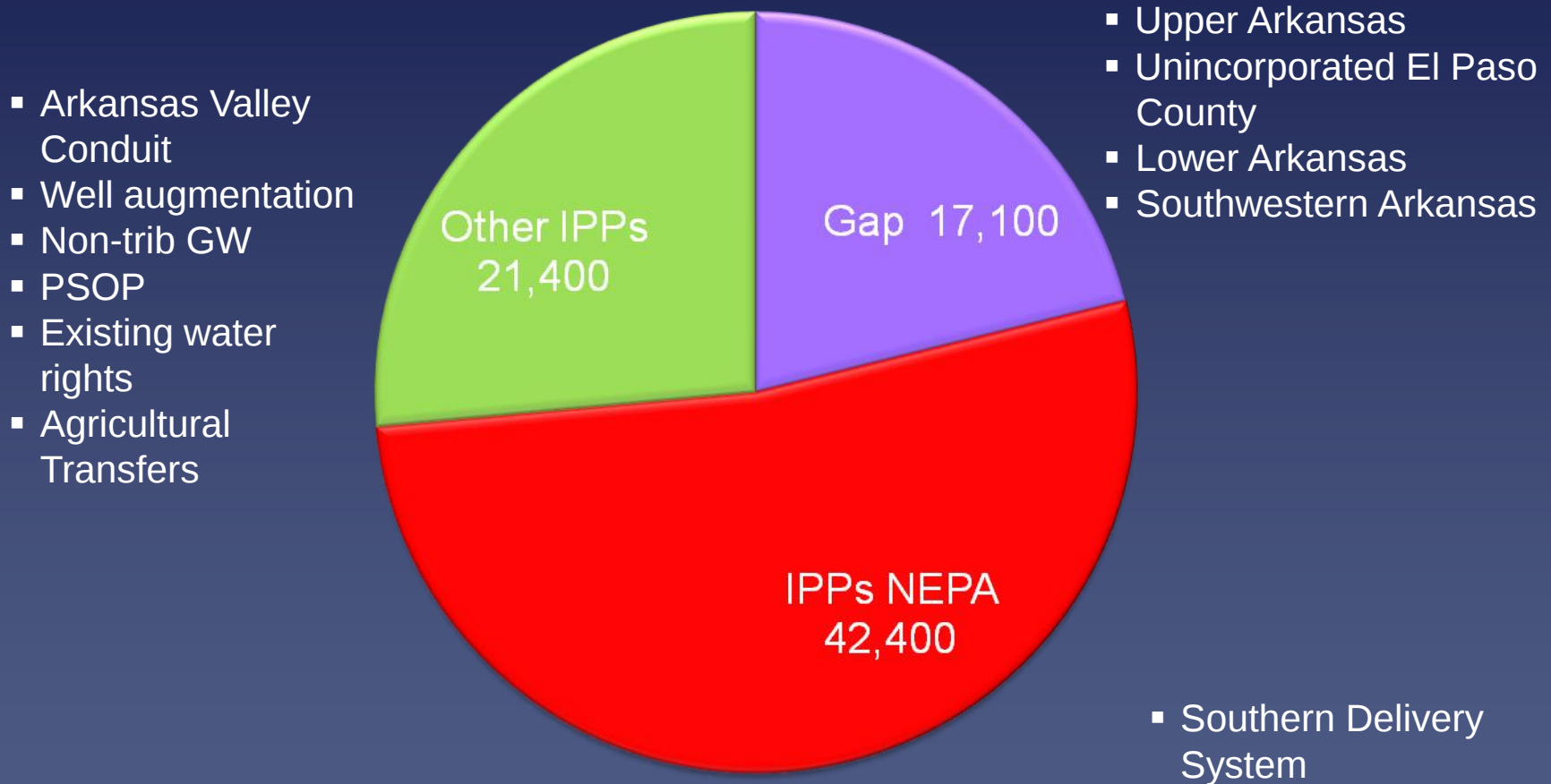
- South Metro Counties Rueter-Hess
- ECCV Northern
- Non-trib GW
- Denver Metro Counties
- Aurora Prairie Waters
- Thornton Poudre Pipeline
- Ag Transfers
- Gravel Lakes
- Northern Counties CBT acquisitions, ag transfers and local storage



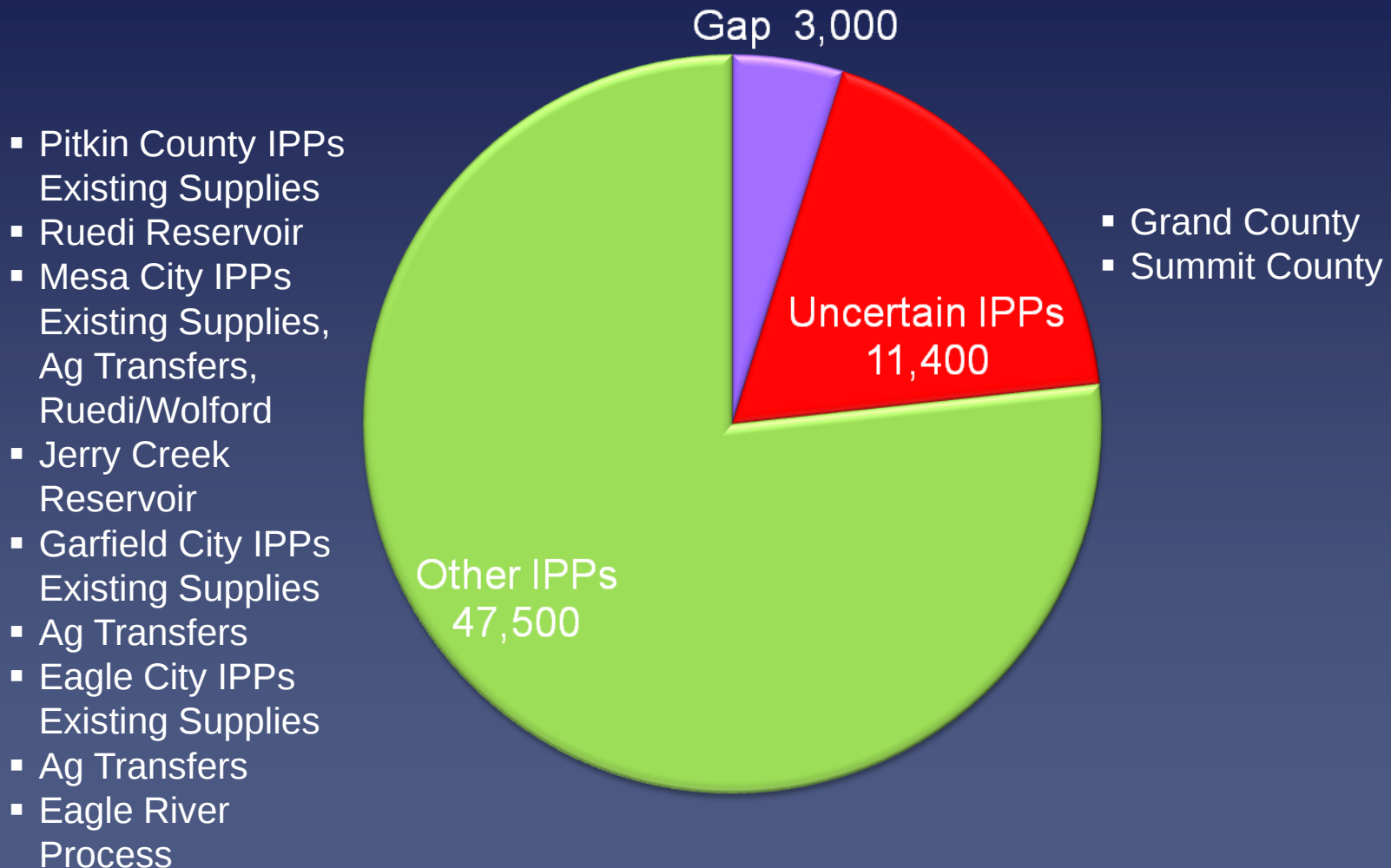
- South Metro
- Denver Metro
- Northern
- Upper Mountain
- Lower Platte

- Moffat Firming
- Windy Gap Firming
- NISP
- Halligan-Seaman

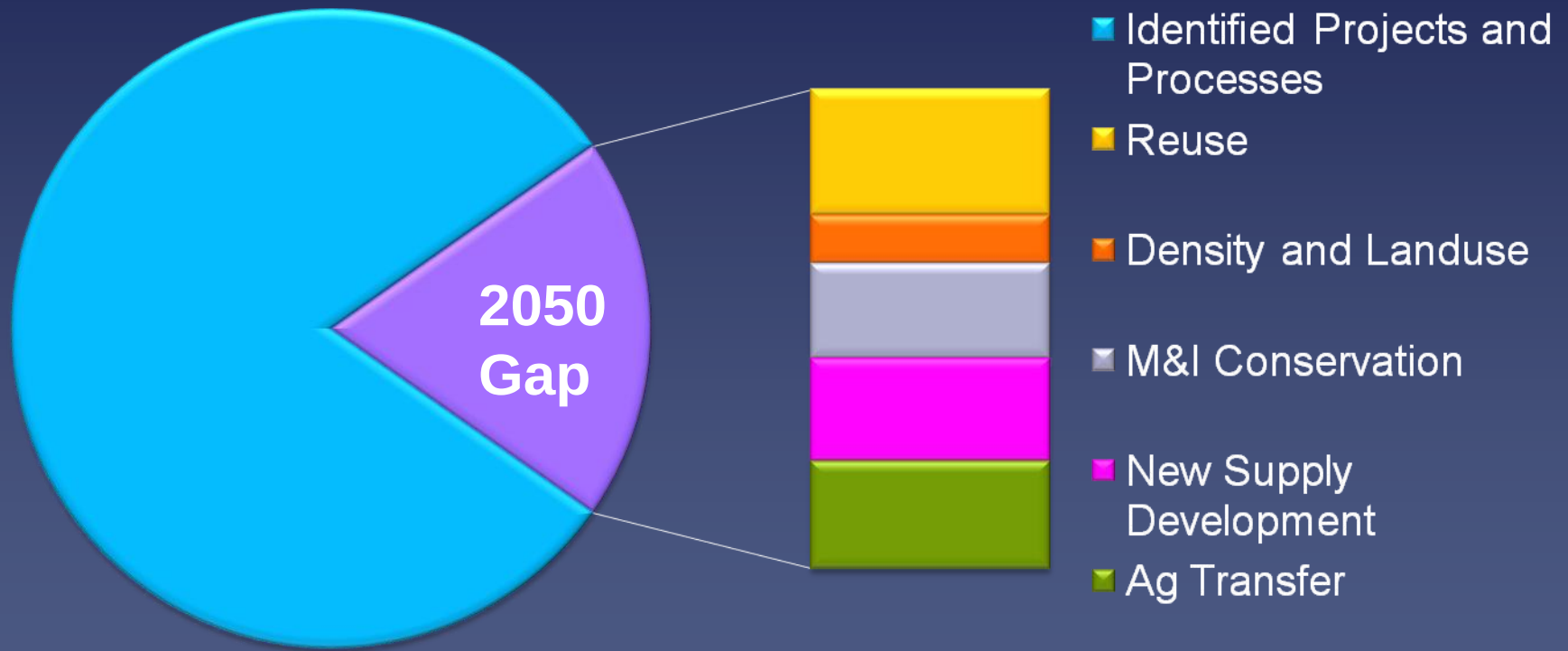
In 2030, the Arkansas Basin will have 80,900 of New M&I Demand



In 2030, the Colorado Basin will have 61,900 of New M&I Demand



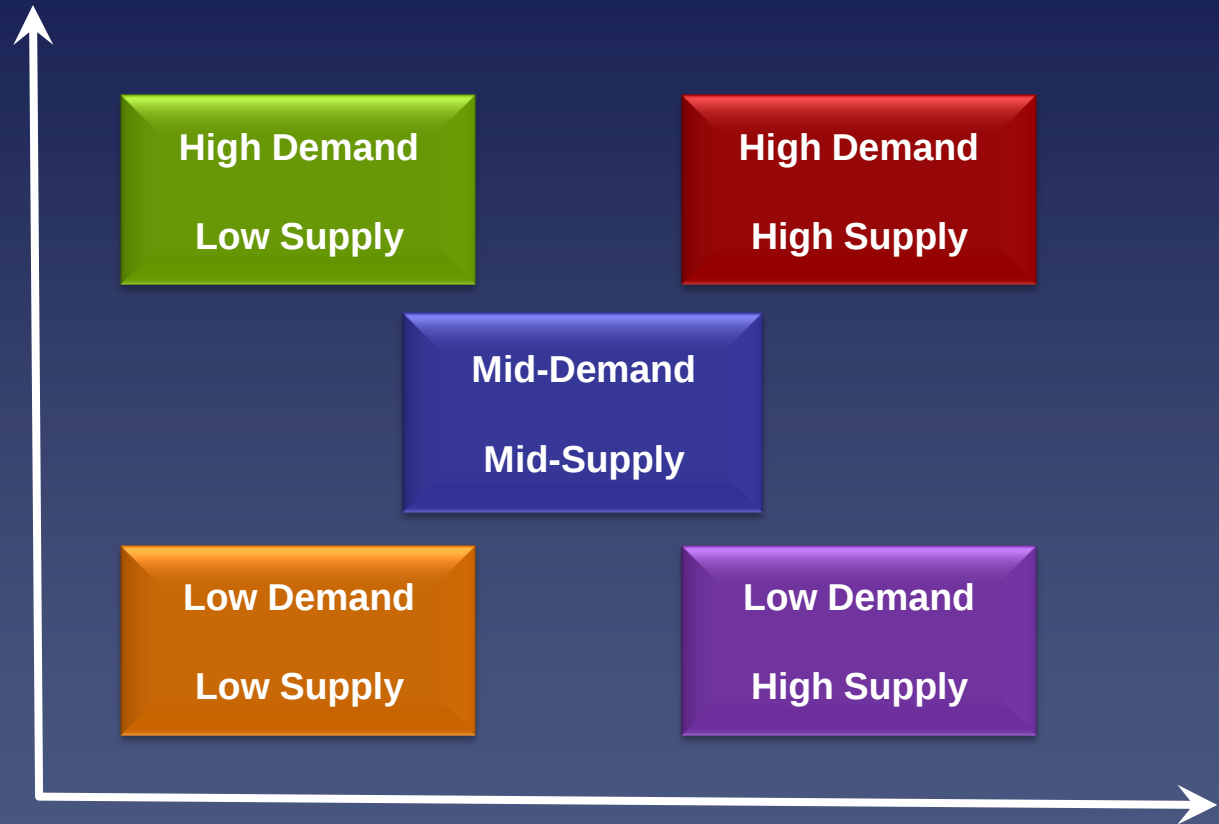
Example of Portfolio to Meet 2050 M&I Needs



2050 Planning Horizon for Colorado's Water Supply Future

Demand Factors:

- M&I Growth
- Energy Demands
- Identified Projects and Processes Uncertainty

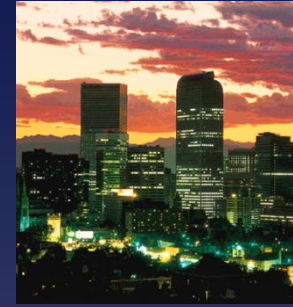


Supply Factors:

- Colorado River Hydrologic Variability
- Climate Change
- Compact Considerations

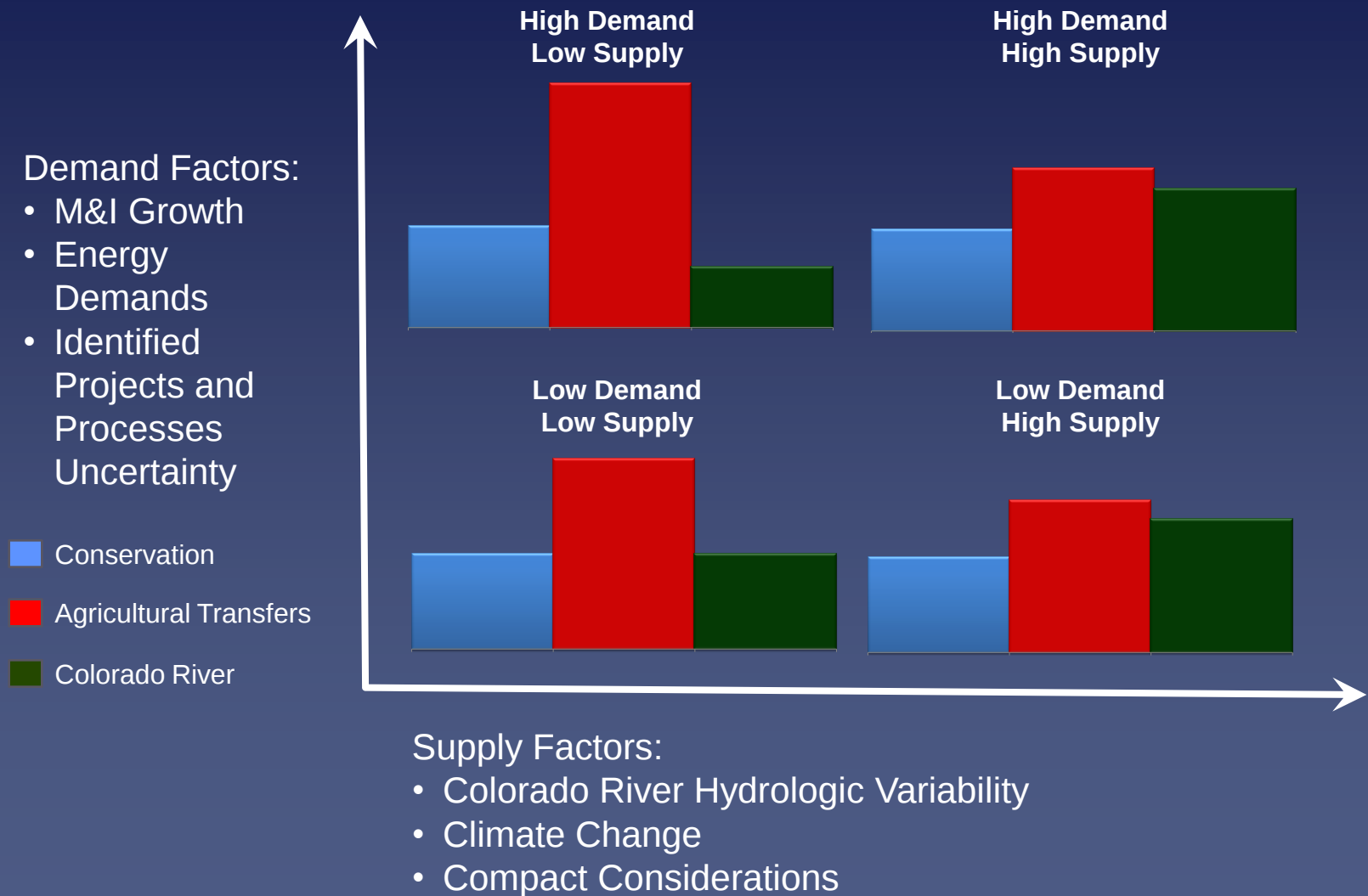
Water Supply Strategies

- Water Conservation
- Agricultural Transfers
 - Conventional and alternative transfers
- Development of New Supplies
 - West Slope M&I and Energy
 - Transbasin



These strategies address M&I needs, but options to address agricultural and nonconsumptive needs will be added as strategies are evaluated

2050 Planning Horizon for Colorado's Water Supply Future



Conservation Strategy

Conservation Strategy

- 20%, 30%, and 40% savings analyzed for each basin
- Management practices identified
- Overview of initial results
- Feedback on how much this strategy will reduce overall 2050 demands

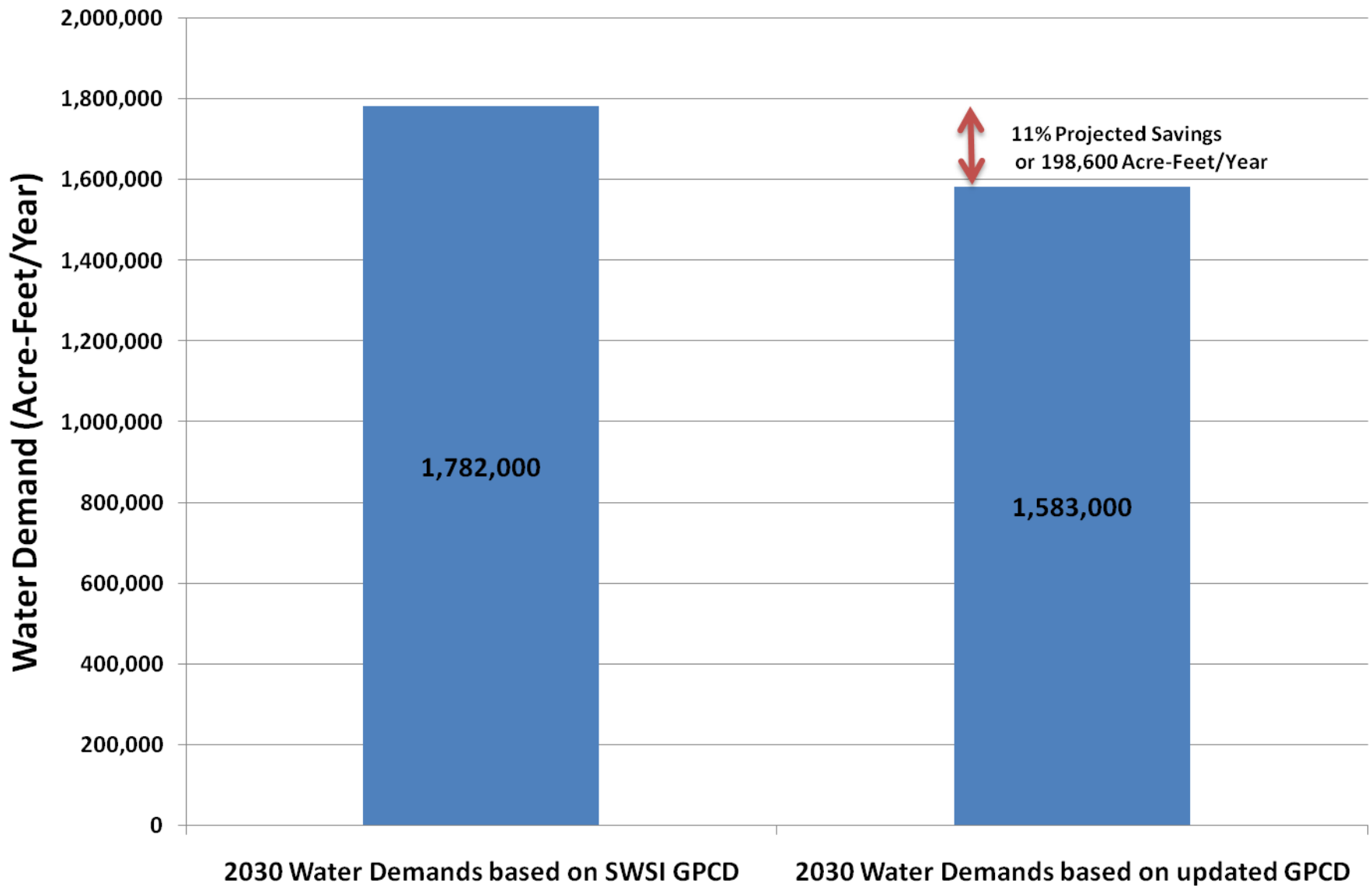
Overview of Conservation Strategy Approach

- Used SWSI 1 as baseline
- Estimated percent reduction in water usage at 2050 at 20 percent, 30 percent, and 40 percent reduction levels from SWSI 1
- Examine measures identified in SWSI 2 that could be utilized to achieve reduction levels
- Review results with major water providers and Basin Roundtables
- Summarize findings

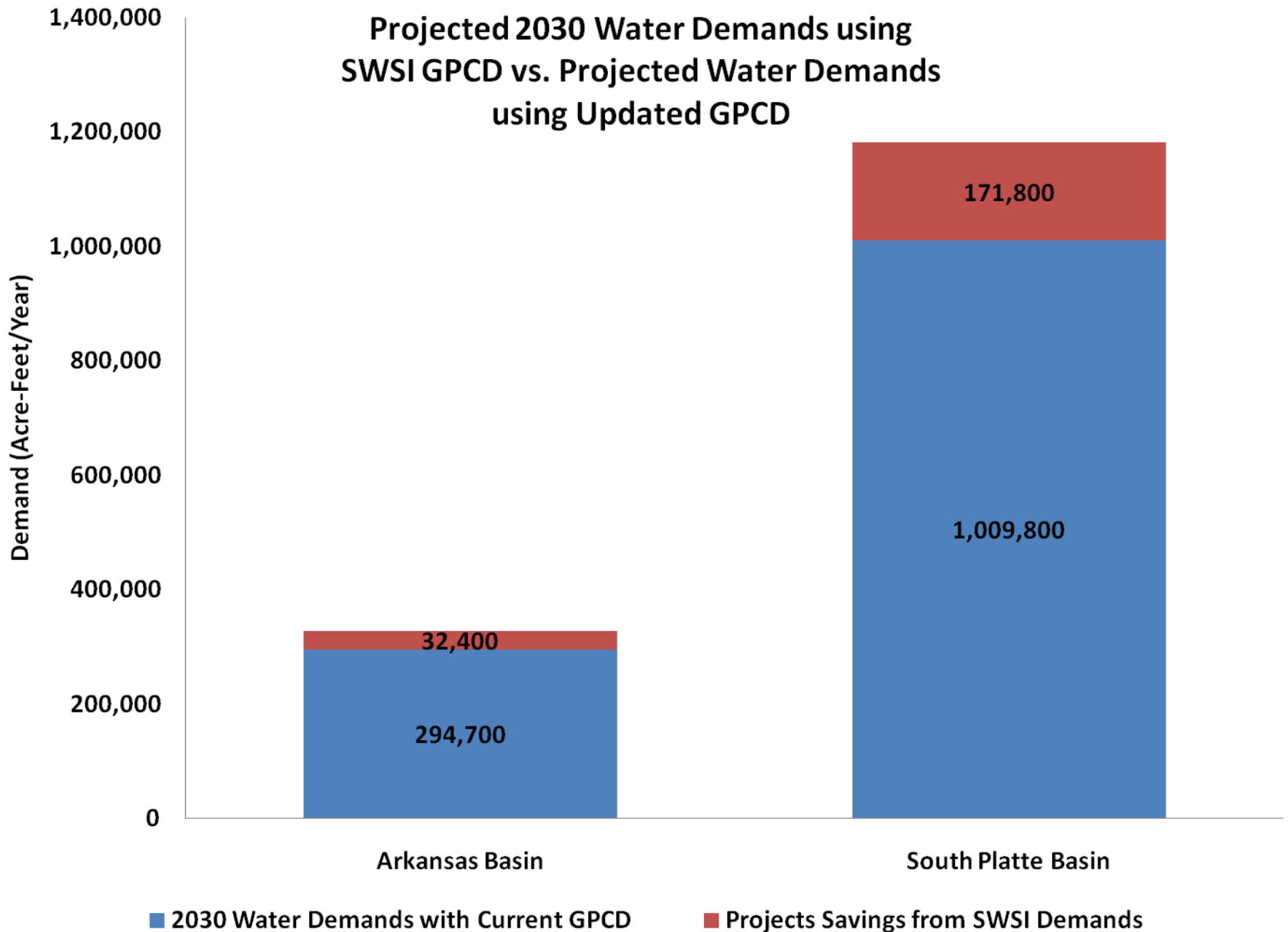
Initial Results

- What progress have we made in meeting 2030 demands with respect to demand reductions from conservation?
- What demand reductions should be implemented by 2050?
- What conservation best management practices could be used to implement these reductions?
- What do other states require regarding conservation or demand reporting?

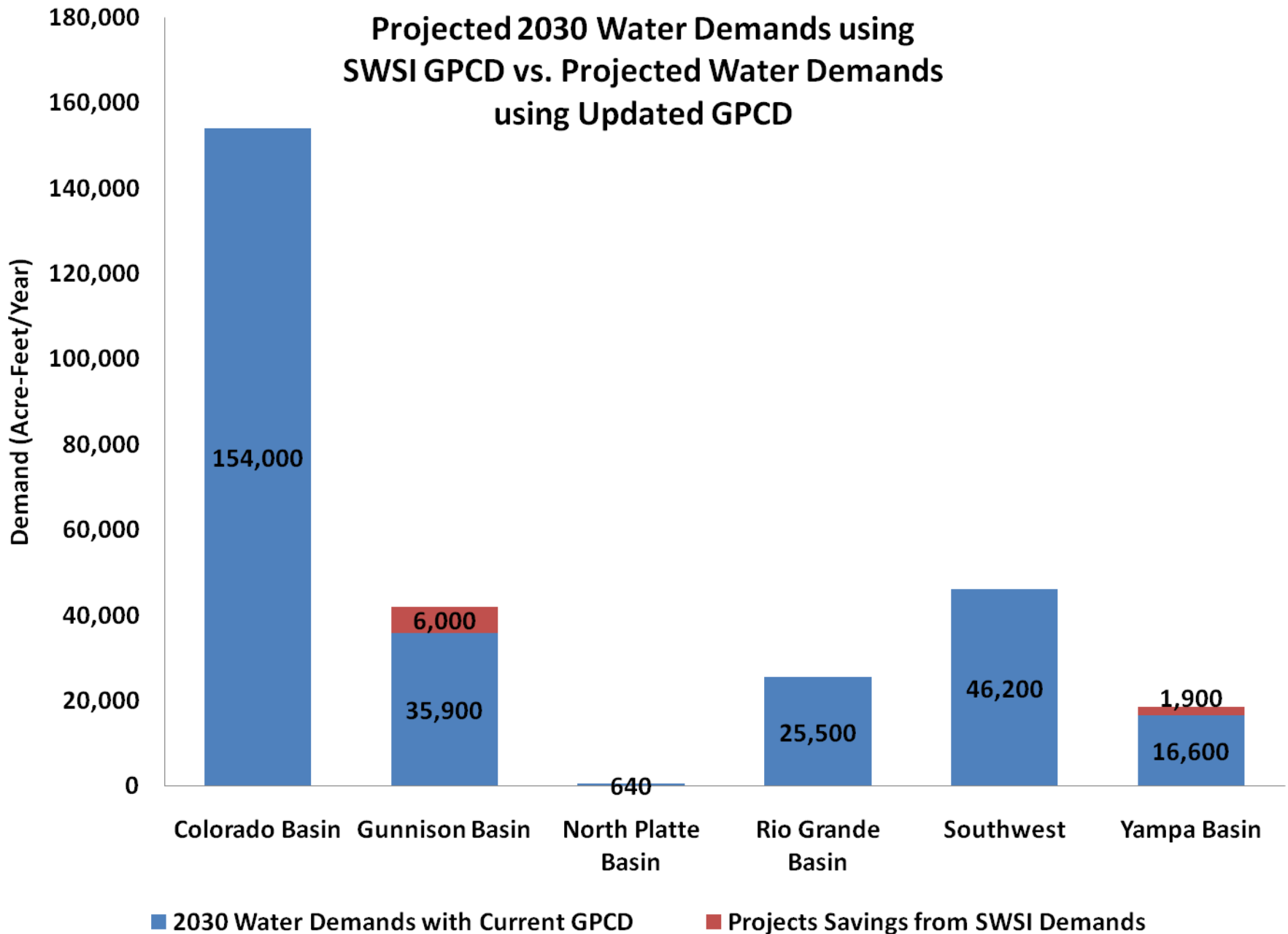
Projected 2030 Water Demands using SWSI GPCD vs. Projected Water Demands using Updated GPCD



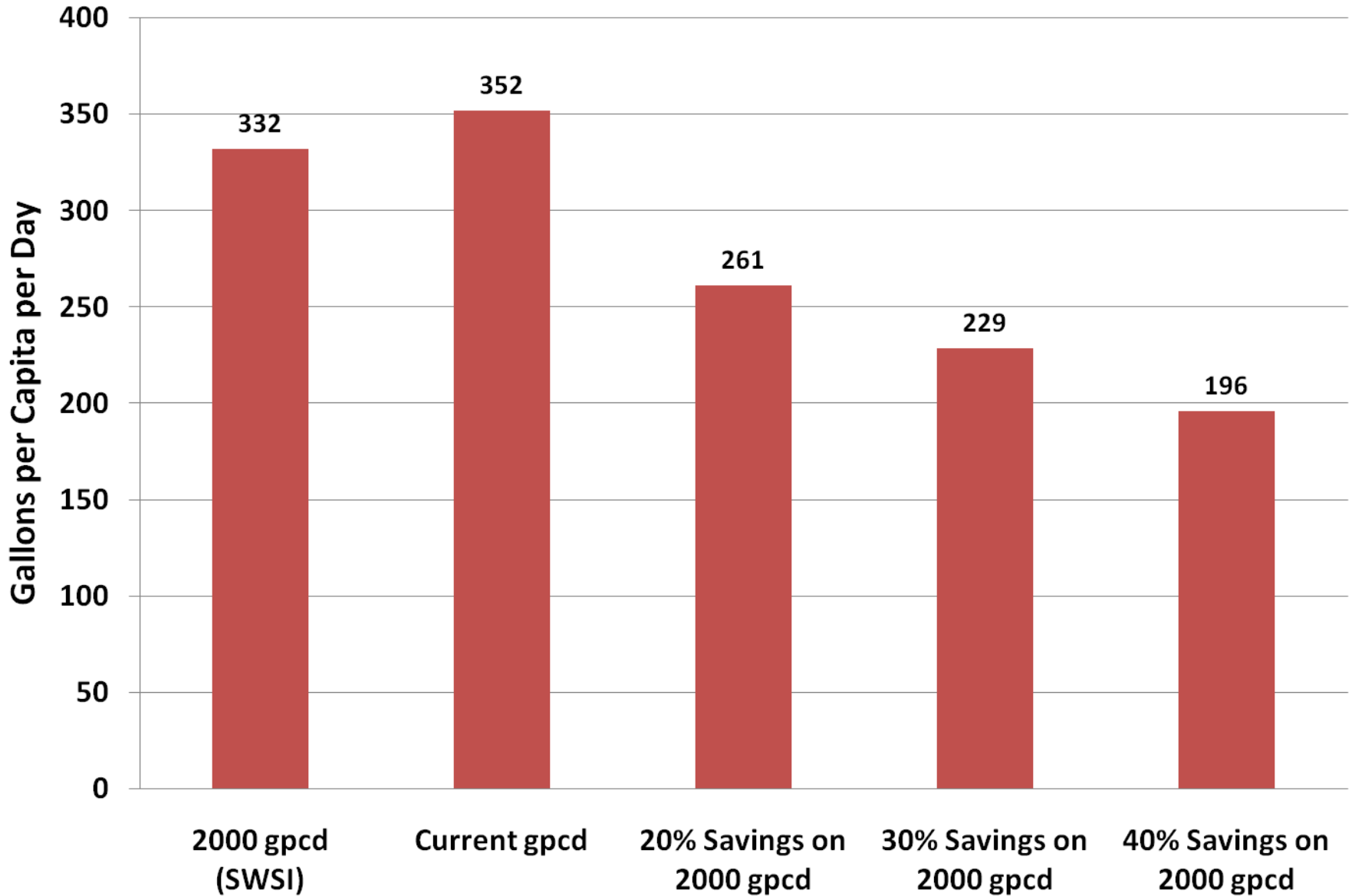
Projected 2030 Water Demands using SWSI GPCD vs. Projected Water Demands using Updated GPCD



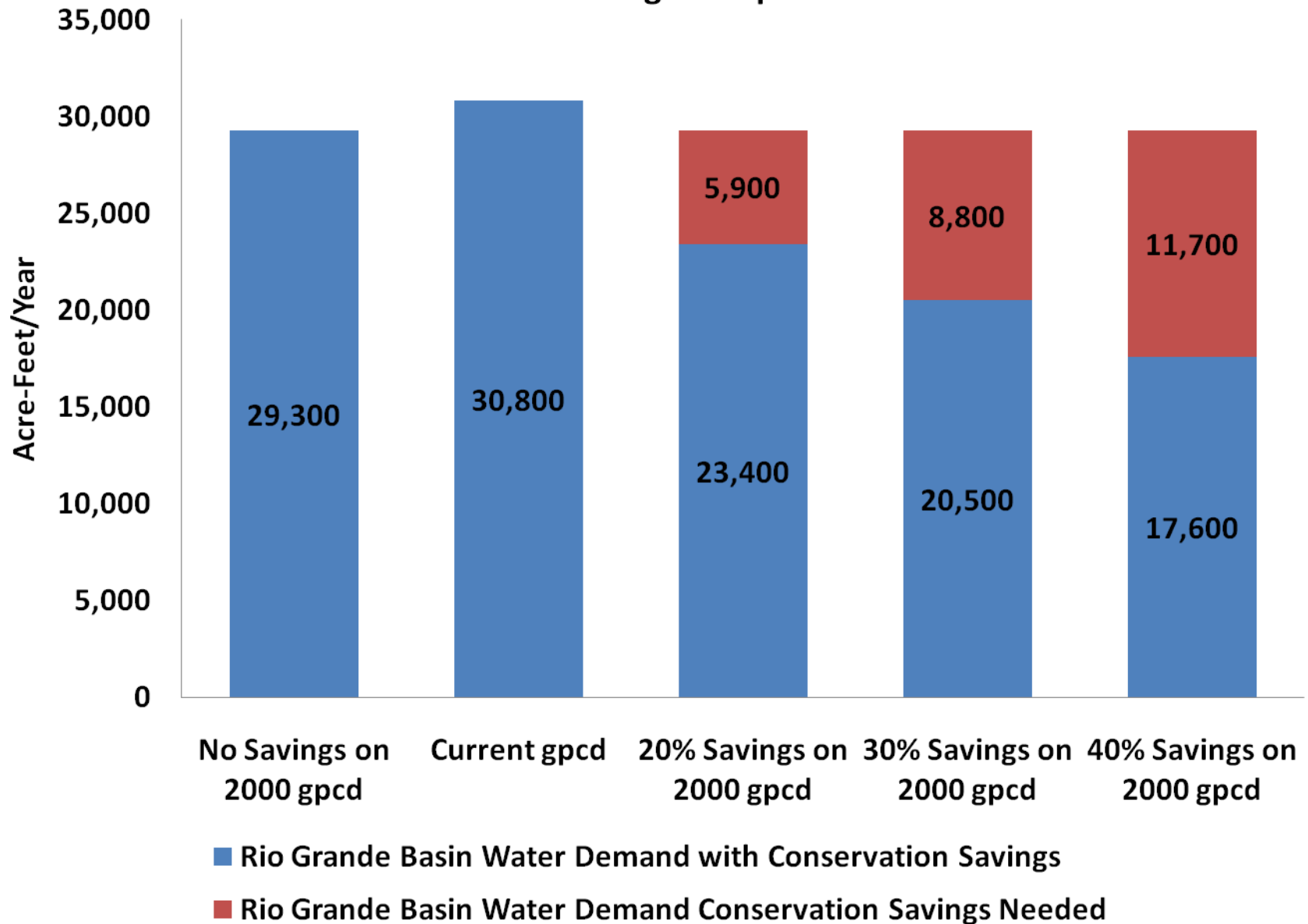
Projected 2030 Water Demands using SWSI GPCD vs. Projected Water Demands using Updated GPCD



Rio Grande Basin Gallons per Capita per Day



Rio Grande Basin 2050 M&I Water Demand Forecast Potential Conservation Savings Compared to Current GPCD



SWSI 2 Conservation Measures

- Turf replacement
- Utility water loss reduction programs
- Toilet rebates
- Conservation oriented water rates
- Washer rebates
- Cooling towers increased cycle concentration
- Rebates for landscape retrofits other than turf replacement
- Residential landscape audits
- Residential indoor audits
- Sub-metering in multi-family housing
- Commercial landscape audits
- Commercial indoor audits
- Metering of all utility customers

Conservation Strategy Next Steps

- Complete basin by basin analysis
- Work with water providers and Basin Roundtables to confirm analysis
 - Confirm where 2000 to current savings is permanent or temporary
 - Confirm conservation measures utilized
- Summarize findings

Conservation Strategy Next Steps

- Identify benefits, implementation issues, potential attributes and acceptability
- Refine Cost Estimates
- Analyze other conservation elements such as sharing of conserved water and the infrastructure and institutional arrangements required
- Analyze municipal use of ditch water
- Analyze impacts of conservation measures
- Additional Refinements
 - Consumptive use vs. diversion demand
 - System wide use vs. residential use
 - Current uses vs. new customers

M&I Conservation Strategy

Example of Benefits, Impacts and Attributes

Benefits	Impacts	Potential Attributes
Cost effective water supply strategy	Potential reliability concerns	Environmental or recreational flows
Reduces need for future transbasin diversion	Consideration of utilities financial model	
Reduces need for future agricultural transfers	For higher levels of conservation, potentially severe landscape impacts	

*Overview of Agricultural Transfer
Strategy and New Supply
Development Strategy*

Today – Examine the Engineering Evaluation Elements for Strategies

- Description of strategy or project elements – water source, conveyance and storage, water quality

Purpose

Ability to begin to compare tradeoffs between strategies

Further Evaluation of Strategies will Include:

- Identification of:
 - Project benefits
 - Implementation issues
 - Mitigation
 - Potential attributes/additional options
 - Acceptability
- Other evaluation elements:
 - Capital costs – permitting, mitigation, land acquisition, pumps, pipe, treatment
 - Annual O&M costs – energy, equipment maintenance and replacement
 - Additional cost elements (water rights or storage)
 - Discuss potential attributes/additional options for ag transfer and new supply development options with Basin Roundtables
 - Incorporate other conservation elements such as sharing of conserved water and the infrastructure and institutional arrangements required
- Qualitative description of how each strategy meets the Vision Statement and Vision Goals

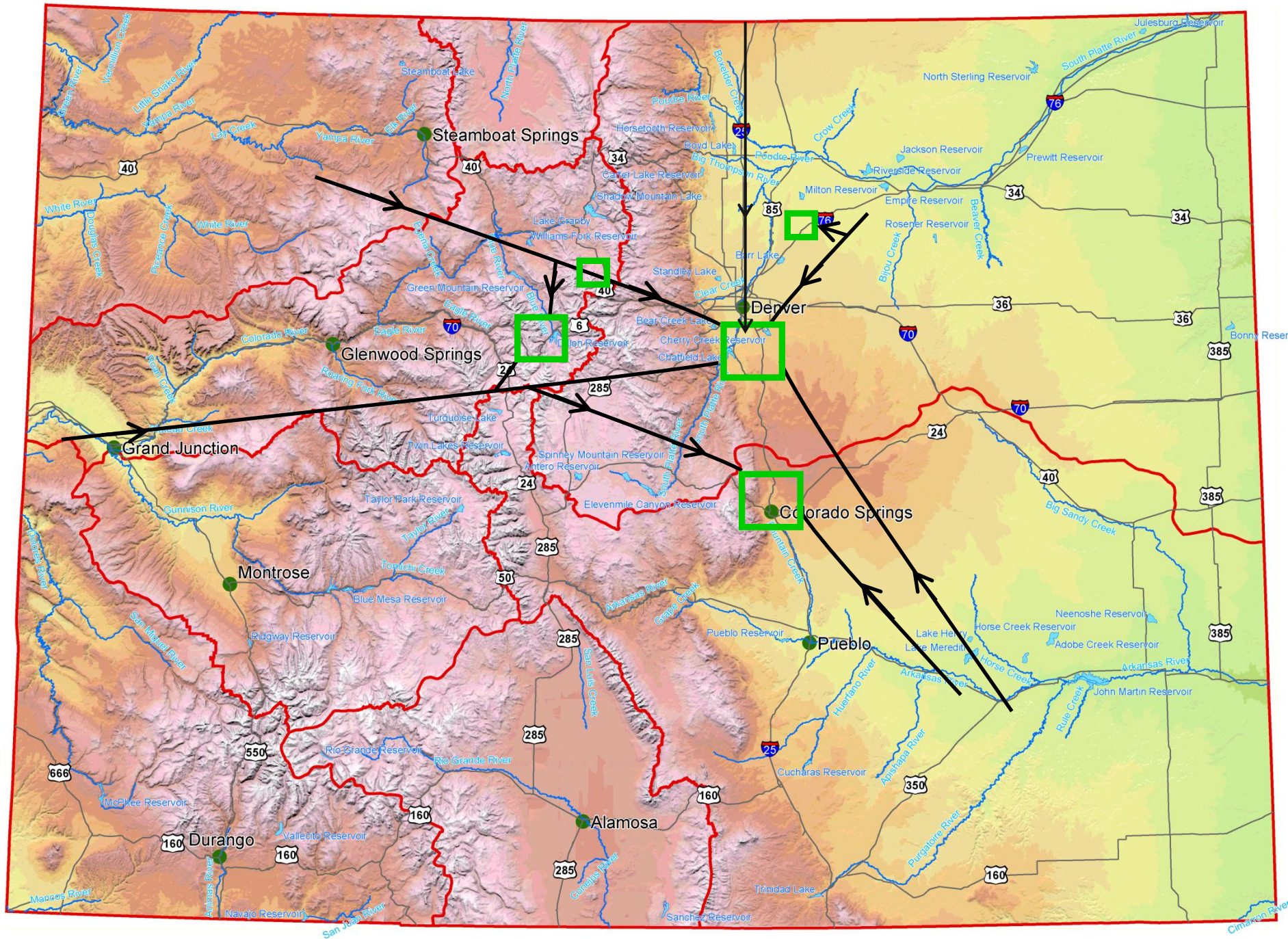
Assumptions for Today's Analysis for the Agricultural Transfer Strategy and New Supply Development Strategy

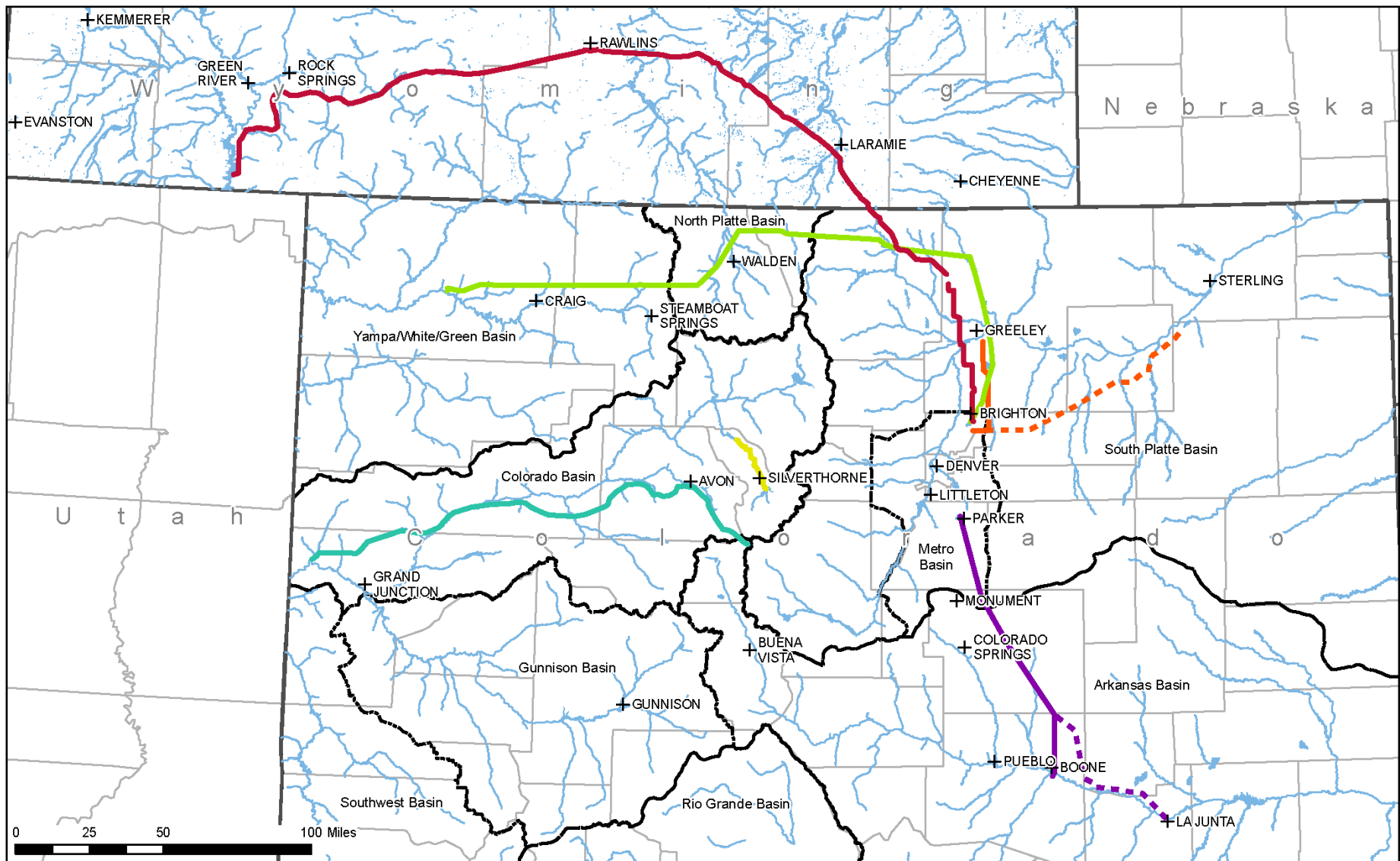
- Delivery of similar water quality
- With exception of Green Mountain concept, strategies will deliver water in the range of 100KAF to 250KAF

Water Supply Concepts

- 2 Lower South Platte concepts
- 2 Lower Arkansas concepts
- Green Mountain concept
- Yampa concept
- Flaming Gorge concept
- Colorado River Return Reconnaissance concept

Asked by the IBCC to evaluate additional small-to-medium sized new water supply projects





Legend

- | | | |
|--|-----------------------------|--------------------------|
| Colorado River Return Reconnaissance Study Concept | Middle South Platte Concept | Lower Arkansas Concept 2 |
| Flaming Gorge Concept | Lower South Platte Concept | Green Mountain Concept |
| Yampa River Concept | Lower Arkansas Concept 1 | Colorado Basins |



DRAFT

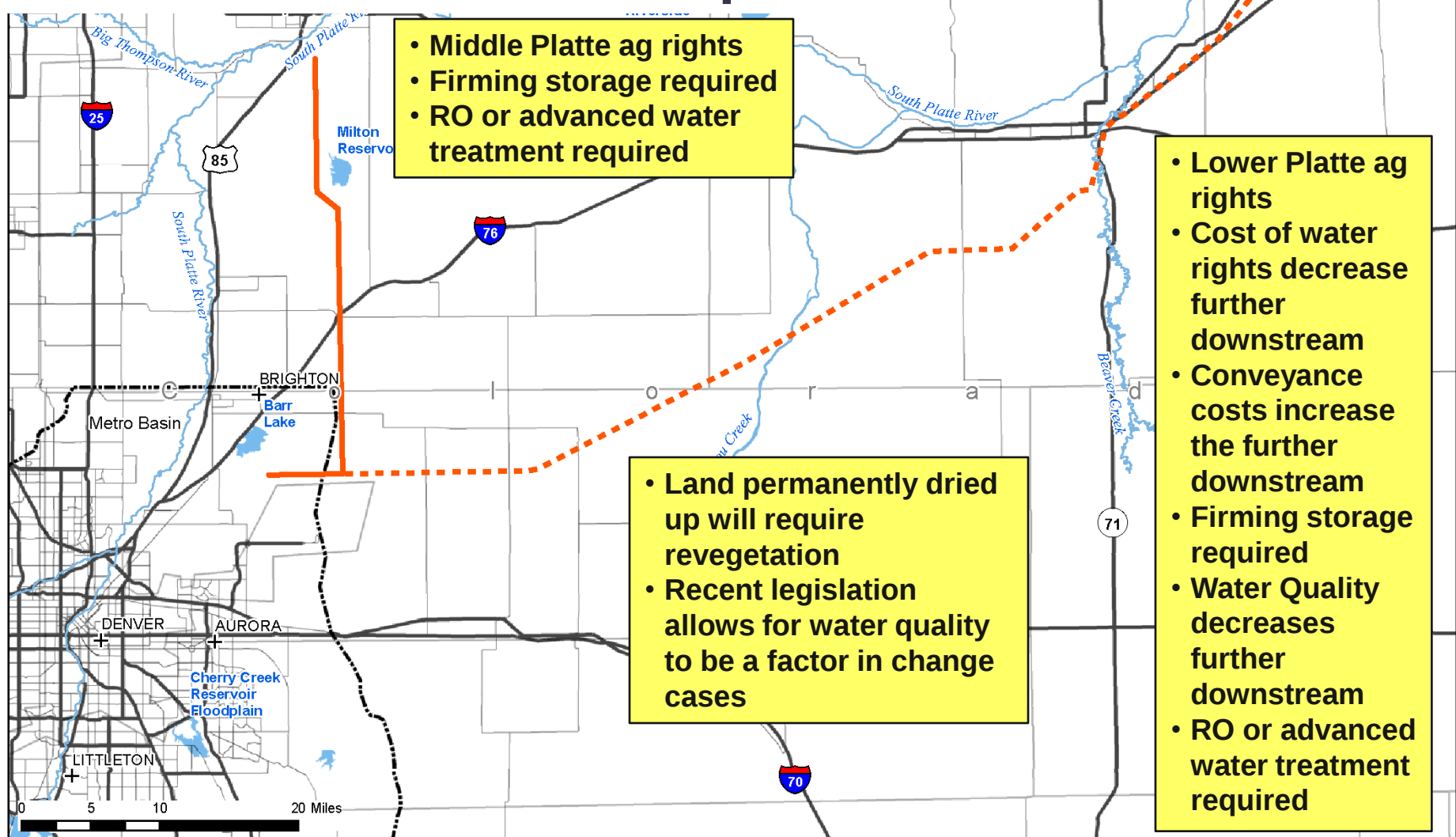
3/6/2009

Agricultural Transfer Strategy

Agricultural Transfer Strategy Overview

- Overview of projects and methods to meet needs matrix for roundtables
- Engineering Evaluation Elements
 - Lower South Platte concept 100,000-250,000 acre-feet
 - Lower Arkansas concept 100,000-250,000 acre-feet
- Example benefits and issues with each project

Lower South Platte Concept



Legend

- + Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Middle South Platte Concept
- Lower South Platte Concept



DRAFT

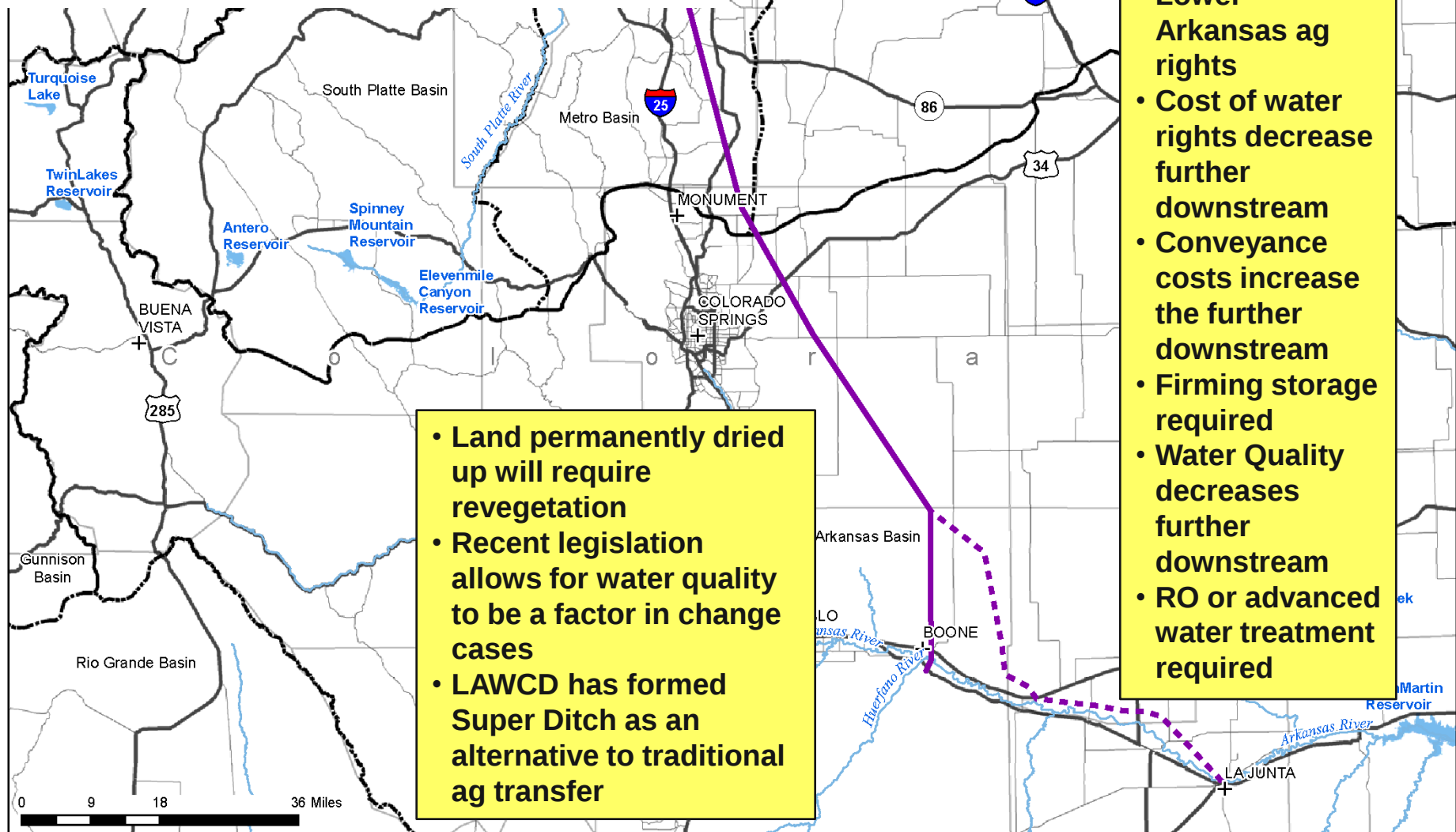
3/6/2009

Lower South Platte Concept

Example of Benefits, Impacts, and Attributes

Benefits	Impacts	Potential Attributes
Less reliance on additional deliveries from headwaters areas, thus minimizing streamflow impacts in environmentally sensitive areas	Water quality is poor and treatment costs (capital and O&M) are high	Potential to collaborate with remaining agricultural users to construct lower basin storage or recharge facilities to improve agricultural yields or provide for well augmentation
Decreases the need for additional transbasin diversions	Disposal of treatment waste stream concentrate is a challenge and very costly	Shared infrastructure among water providers, resulting in economies of scale for capital and O&M
No net increase in depletions to the river system	Loss of irrigated acreage in production annually regardless of the type of agricultural transfer	Can provide for coordinated acquisition of agricultural rights for either a traditional or alternative transfer preserving higher quality/value agricultural production
	Significant energy requirements for pumping and water treatment	Conjunctive use with non-tributary groundwater can potentially improve the overall project operation

Lower Arkansas Concept



- Land permanently dried up will require revegetation
- Recent legislation allows for water quality to be a factor in change cases
- LAWCD has formed Super Ditch as an alternative to traditional ag transfer

- Lower Arkansas ag rights
- Cost of water rights decrease further downstream
- Conveyance costs increase the further downstream
- Firming storage required
- Water Quality decreases further downstream
- RO or advanced water treatment required

DRAFT

3/6/2009

Lower Arkansas Concept

Example of Benefits, Impacts, and Attributes

Benefits	Impacts	Potential Attributes
Less reliance on additional deliveries from headwaters areas, thus minimizing streamflow impacts in environmentally sensitive areas	Water quality is poor and treatment costs (capital and O&M) are high	Potential to collaborate with remaining agricultural users to construct lower basin storage or recharge facilities to improve agricultural yields or provide for well augmentation
Decreases the need for additional transbasin diversions	Transfer to South Metro Area may be of concern	Shared infrastructure among water providers, resulting in economies of scale for capital and O&M
No net increase in depletions to the river system	Disposal of treatment waste stream concentrate is a challenge and very costly	Can provide for coordinated acquisition of agricultural rights for either a traditional or alternative transfer preserving higher quality/value agricultural production
	Loss of irrigated acreage in production annually regardless of the type of agricultural transfer	Conjunctive use with non-tributary groundwater can potentially improve the overall project operation
	Significant energy requirements for pumping and water treatment	

Ag Transfer Strategy Next Steps

- Identify benefits, implementation issues, potential attributes and acceptability
- Refine Cost Estimates
- Incorporate alternative ag transfer methods into the strategy
- Work with others (e.g. Dept. of Ag, CSU, Ag Water Alliance) to:
 - Investigate the regional interdependence of agriculture (both within CO and with other western states)
 - Analyze the “tipping point” for agriculture both at the ditch system level and regional level

New Supply Development

New Supply Development Strategy Overview

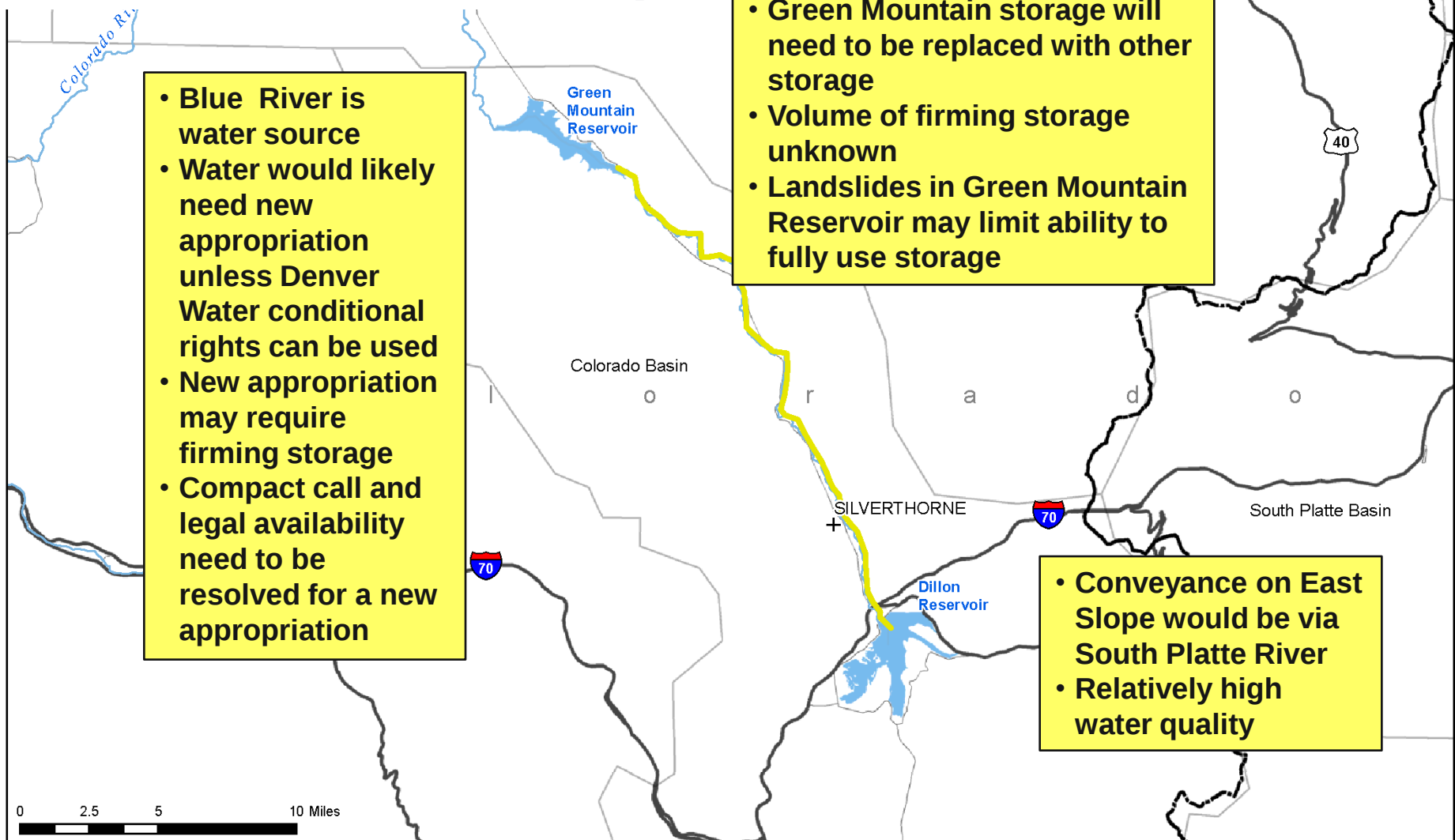
- Overview of projects and methods to meet needs matrix for roundtables
- Engineering Evaluation Elements
 - Green Mountain concept <100,000 acre-ft
 - Yampa concept 100,000 to 250,000 acre-ft
 - Flaming Gorge concept 100,000 to 250,000 acre-ft
 - Colorado River Return Reconnaissance concept 100,000 to 250,000 acre-ft
- Example benefits and issues with each project
- Additional small-to-medium sized projects

Green Mountain Concept

- Blue River is water source
- Water would likely need new appropriation unless Denver Water conditional rights can be used
- New appropriation may require firming storage
- Compact call and legal availability need to be resolved for a new appropriation

- Green Mountain storage will need to be replaced with other storage
- Volume of firming storage unknown
- Landslides in Green Mountain Reservoir may limit ability to fully use storage

- Conveyance on East Slope would be via South Platte River
- Relatively high water quality



Legend

- + Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Green Mountain Concept



DRAFT

3/6/2009

Green Mountain Concept

Example of Benefits, Impacts, and Attributes

Benefits	Impacts	Potential Attributes
Minimize loss of irrigated acres in South Platte and Arkansas Basins	Potential for increased compact call	Delivery to North Fork of South Platte upstream of Denver Metro area for gravity delivery to Denver Water customers and other water providers
Maximize Colorado's Colorado River compact entitlement	Additional in-basin storage	
Additional flows in Upper South Platte	Diminished flows in rivers below proposed diversions with potential increases in TDS and other water quality impacts	Protect or enhance Blue River flows
Grand County streamflow management	Phosphorus levels in Dillion Reservoir	Exchanges for additional flows in Colorado headwaters
Additional Grand Valley water supplies	Green Mountain Reservoir levels	Multi-purpose storage for endangered species and other Colorado Basin needs

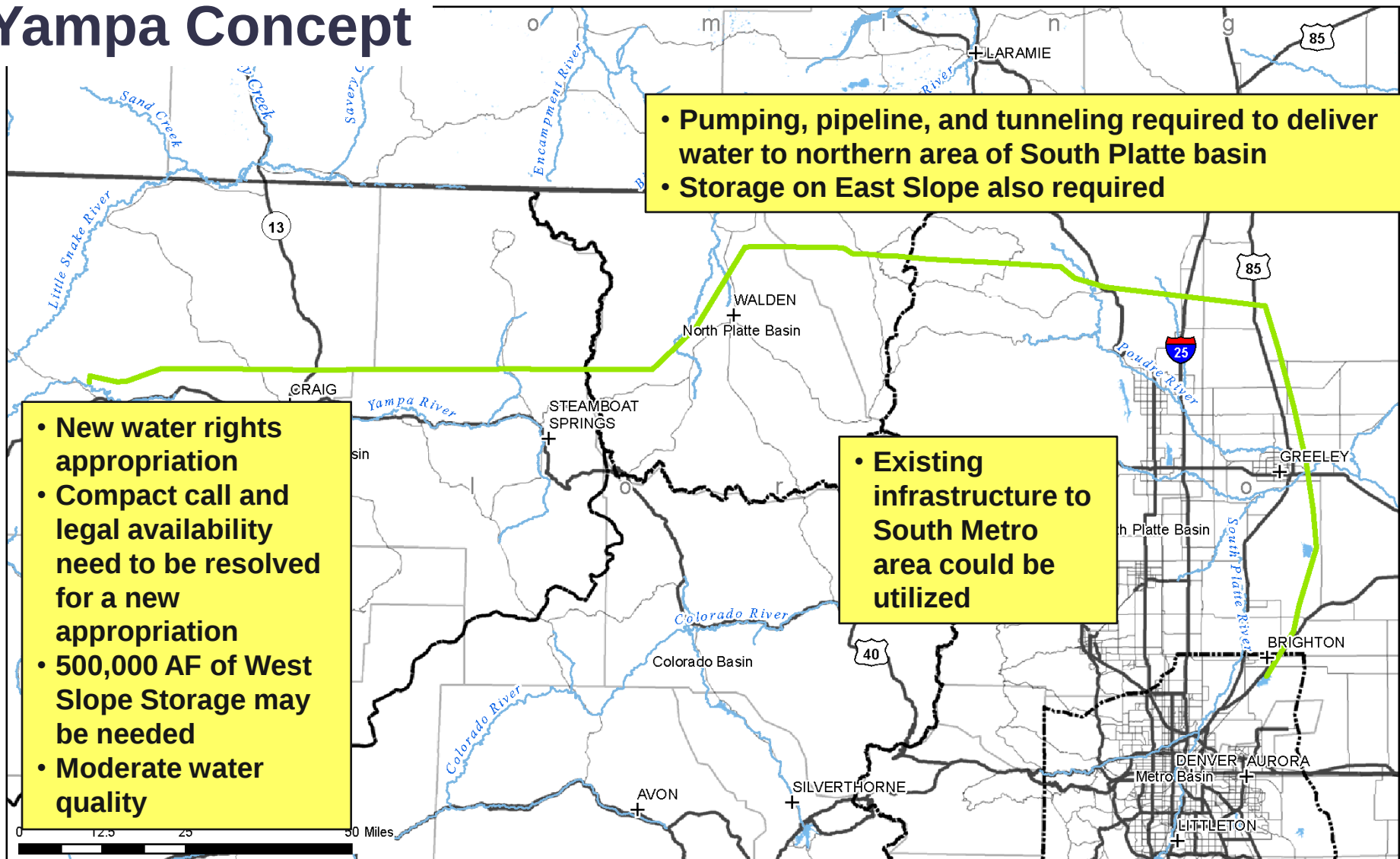
Green Mountain Concept

Example of Benefits, Impacts, and Attributes

(cont.)

Benefits	Impacts	Potential Attributes
Dillon Reservoir Levels	Green Mountain Reservoir/ Wolcott Reservoir Swap	Ability to exchange water for Summit County Municipal and Industrial purposes
Additional water supplies for the upper Blue River		
Additional yield for Clinton Reservoir		
Blue River flow enhancement		
Additional west slope supplies		Recreation component for Wolcott Reservoir
Abandonment of some Eagle River rights		

Yampa Concept



Legend

- + Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Yampa River Concept



DRAFT

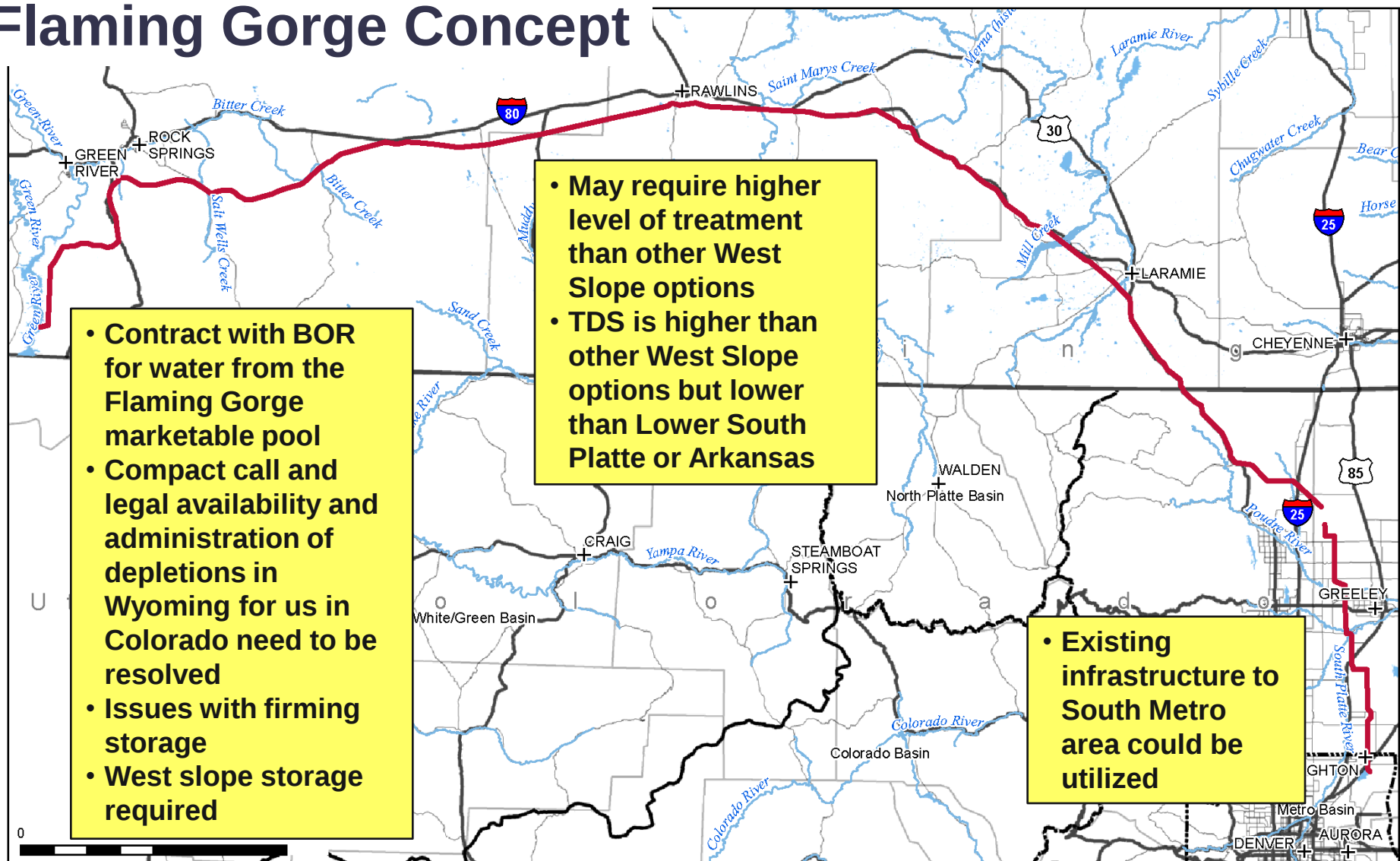
3/6/2009

Yampa Concept

Example of Benefits, Impacts, and Attributes

Benefits	Impacts	Potential Attributes
Minimize loss of irrigated acres in South Platte and Arkansas Basins	Potential for increased compact call	Multiple Front Range delivery locations
Maximize Colorado's Colorado River Compact entitlement	Large energy requirements	West Slope and East Slope storage
	Endangered species on Yampa and Green Rivers	East Slope hydropower facilities
	Dinosaur National Monument located downstream of proposed diversion	

Flaming Gorge Concept



Legend

- + Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Flaming Gorge Concept



DRAFT

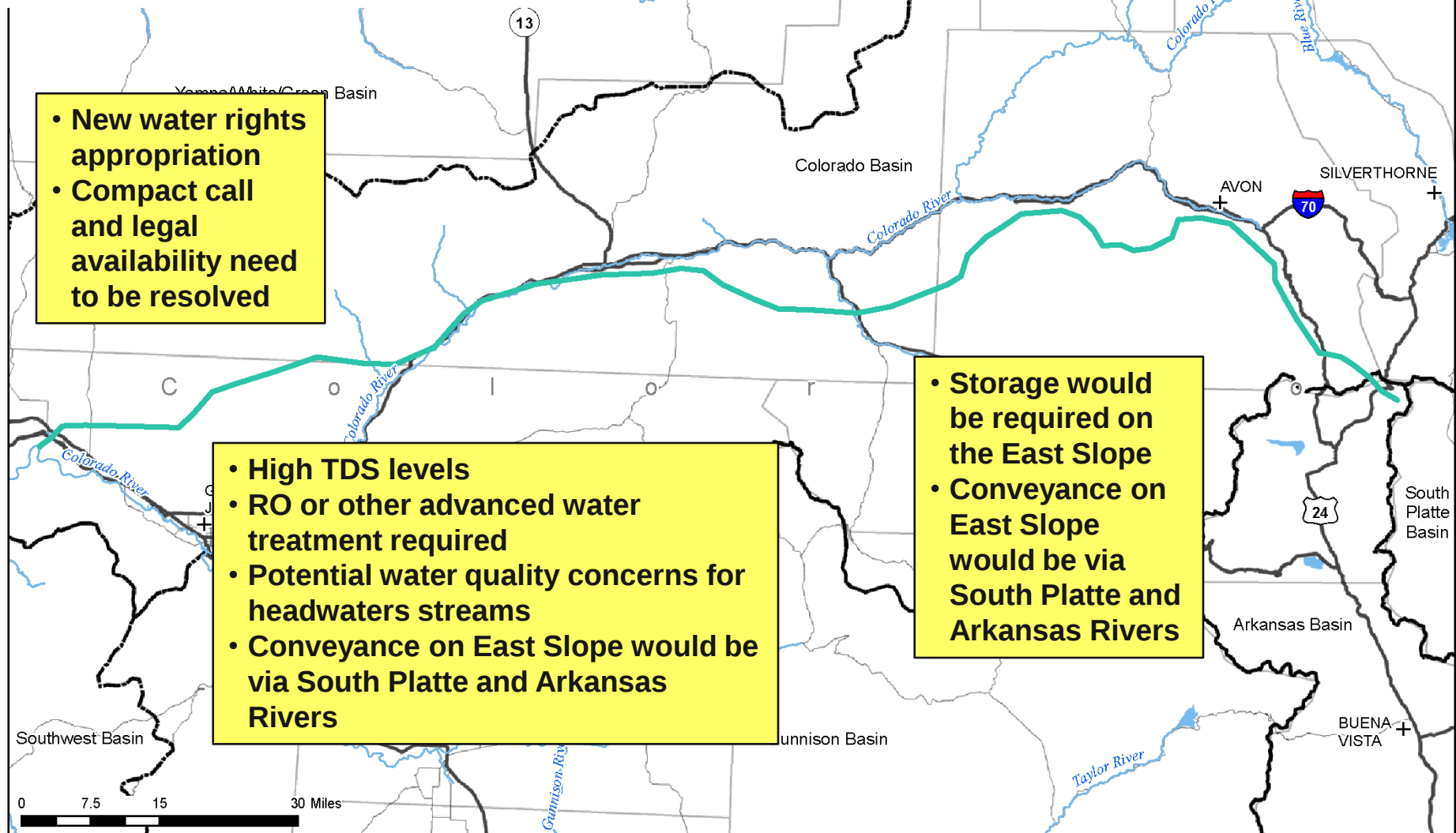
3/6/2009

Flaming Gorge Concept

Example of Benefits, Impacts, and Attributes

Benefits	Impacts	Potential Attributes
Minimize loss of irrigated acres in South Platte and Arkansas Basins	Potential downstream endangered fishes and depletion issues	Delivery to in-basin users for agricultural domestic augmentation and instream flows
Acceptable quality water source that may not require advanced water treatment processes	Enlargement or construction of additional storage in South Platte or Arkansas	Exchanges for additional flows in Colorado headwaters
Maximizes State of Colorado's Colorado River Compact entitlement without impacting streamflows Colorado	Large energy requirements	Allows water development while protecting recreational and environmental flows in Colorado River Basin
	Potential for increased compact call	
	Coordinated administration of water rights in the event of a compact call	

Colorado River Return



Legend

- + Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Colorado River Return Reconnaissance Study Concept



DRAFT

3/6/2009

Colorado River Return Reconnaissance

Example of Benefits, Impacts, and Attributes

Benefits	Impacts	Potential Attributes
Minimize loss of irrigated acres in South Platte and Arkansas	Water quality is poor and treatment costs (capital and O&M) are high	Delivery to in-basin users for ag, domestic augmentation, and instream flows
Diverts below all major users in Colorado	Disposal of treatment waste stream concentrate is a challenge and very costly	Exchanges for additional flows in Colorado headwaters
Maximize Colorado's compact entitlement	Potential for increased compact call	Allows water development while protecting recreational and environmental flows in Colorado basin
Less reliance on additional deliveries from headwaters areas, thus minimizing streamflow impacts	Stream temperature, nutrients, and TDS in water after treatment will be different than streams receiving discharge from project	
Additional flows in upper South Platte, Arkansas, and Colorado Rivers, providing for additional environmental and recreational enhancement	Reduction of flows in the main stem Colorado River and the presence of federally listed fish species below the diversion	
Multiple basin delivery	Significant energy requirements	

Integration of Nonconsumptive Needs

- Statewide map of priorities
- CWCB in process of identifying existing protections
- Priority areas addressed during strategy development
 - Qualitative need
 - Quantitative need
 - Non-flow related needs

New Supply Development Strategy Next Steps

- Identify benefits, implementation issues, potential attributes and acceptability
- Refine Cost Estimates
- Analyze additional projects in the small to medium range
- Develop details on risk management strategies (risk of additional development of Colorado River water and risk of not developing)

Risk Management Strategies

Risk Management and Planning

- Timing and phased development
- Incremental development
- No regrets planning

Risk Management and Implementation

- West Slope Water Bank
- Compact Delivery via Blue Mesa
- Conjunctive Use of Denver Basin Aquifer
- System Wide Augmentation

Next Steps in Strategy Analysis

- Evaluation processes
- Tradeoffs
- Risk and uncertainty

Next Steps in Strategy Analysis

- Feedback on Benefits and Impacts Tables
- Development of Water Supply Portfolios (there is no “silver bullet”)
- Evaluation of Trade-offs
- Evaluation of Risk and uncertainty
- Tie strategies and portfolios back to the IBCC’s Vision Statement and Goals

Elements of the Visioning Process



**Colorado's
Water Supply
Future Vision
Goals**

Meet M&I Demands

Meet Agricultural Demands

**Meet Colorado's Environment and
Recreation Demands**

**Promote Cooperation Between Water Supply
Planners and Land Use Planners**

**Promote More Cooperation Among All
Colorado Water Users**

Optimize Existing and Future Water Supplies

Promote Cost-Effectiveness

Minimize the Net Energy Used to Supply Water

**Protect Cultural Values Linked to
Water Resources**

**Provide Operational Flexibility
and Coordinated Infrastructure**

**Promote Increased Fairness When
Water is Moved Between Areas**

**Comply With all Applicable
Laws and Regulations**

**Educate all Coloradoans on the
Importance of Water**

Roundtable Work

Benefits	Impacts	Mitigation	Potential Attributes