Colorado's Water Supply Future

IBCC Meeting

Denver, CO

March 5, 2010

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Welcome, Introductions and Framing the Day

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Agenda

- Meeting Goals
- Welcome, Introductions, Framing the Day
- Panel Discussion
- Breakout Groups and Lunch
- Report Out from Breakout Groups
- State Demographer Presentation
- "Other" Scenarios
- Water Supply Reserve Account Criteria and Guidelines

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Agenda

Upcoming IBCC Meetings:

- April 22
- June 17
- August 30
- October 14
- December 1

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Meeting Goals

1. Examine common elements of December's mid-demand/mid-supply portfolios.
2. Discussion of the strategies associated with the mid-demand/mid-supply portfolio.
3. Begin examining other scenarios starting with the low-supply scenarios.

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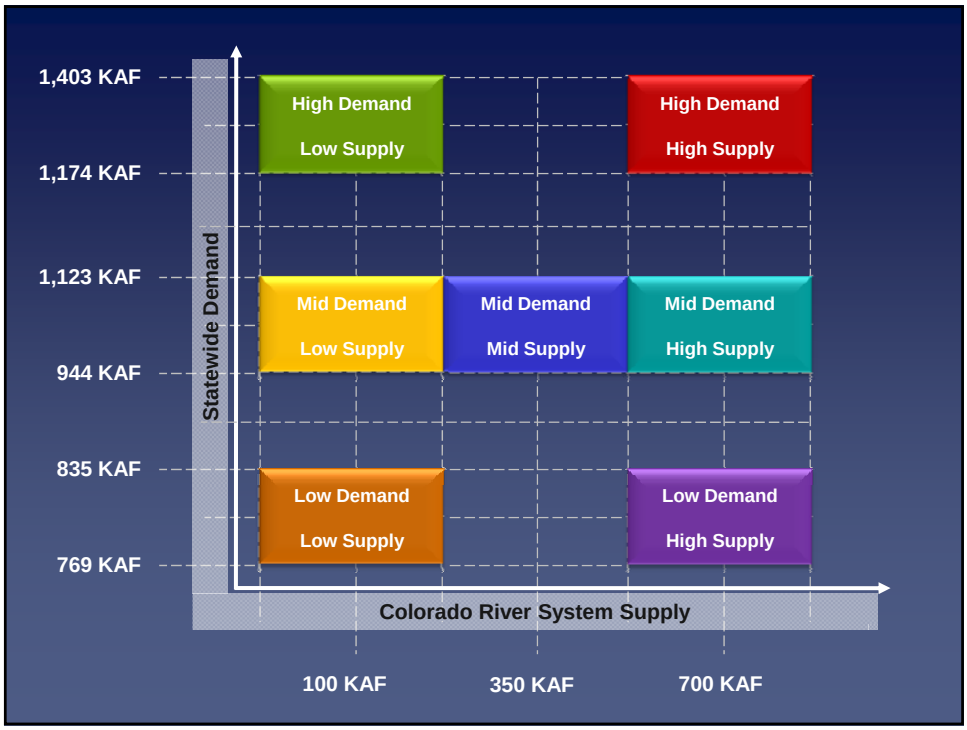

Tool Enhancements

- Updated oil shale water needs from preliminary results of Phase II of Energy Study
- Replacement of nonrenewable groundwater in the South Metro area
- Passive Conservation – using SWSI 1 as placeholder
- Active Conservation – using 2008 as baseline
- Water Use Reductions from Land Use Density for Future Development
- Additional Trade-Offs
  - Size of Alternative Agricultural Transfer Program
  - Cost of Portfolio
  - Nonconsumptive

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Panel Discussion

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During December 2009 meeting the IBCC develop several portfolios for the mid-demand & mid-supply portfolio. Common themes included:

- Promote success of Identified Projects and Processes
- Minimize agricultural transfers to meet future needs on the East Slope and West Slope
- Increase conservation
- Increase reuse of consumable supplies
- Utilize Colorado River System supplies on West Slope and East Slope

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Example Portfolios from December Meeting

Portfolio Element	Group 1	Group 2	Group 3	Group 4
Identified Projects and Processes	322 KAF	382 KAF	367 KAF	410 KAF
Agricultural Transfers	15 KAF (22 KAF W/ Reuse)	60 KAF(88 w/ Reuse)	3 KAF	221 KAF (287 KAF w/ Reuse)
Colorado River System	350 KAF (480 KAF w/ Reuse)	316 KAF (404 KAF w/ Reuse)	350 KAF (461 KAF w/ Reuse)	30 KAF (39 KAF w/ Reuse)
Conservation	227 KAF (40% off 2000 East Slope and 20% for remainder of State)	177 KAF (30% Statewide)	223 KAF (35% Statewide)	315 KAF (30% Statewide)

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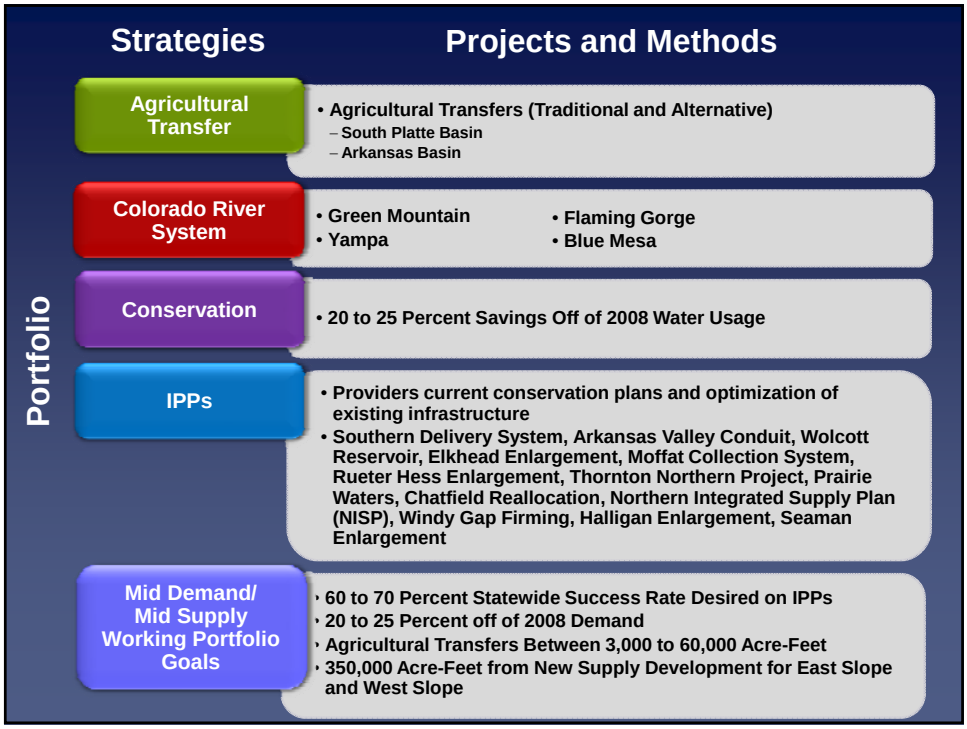
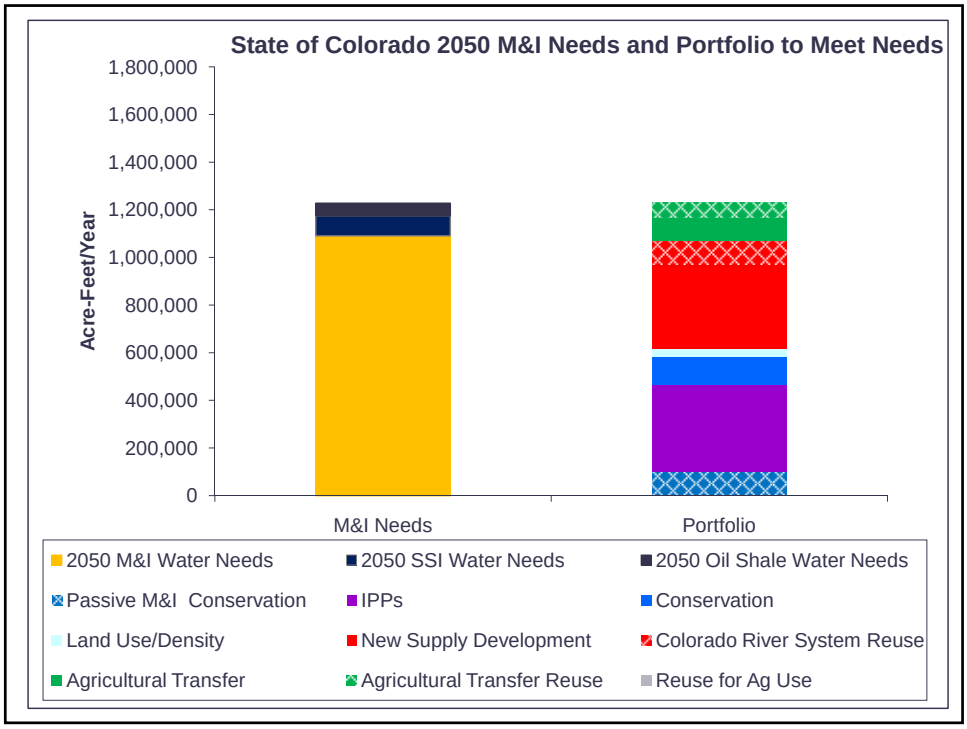
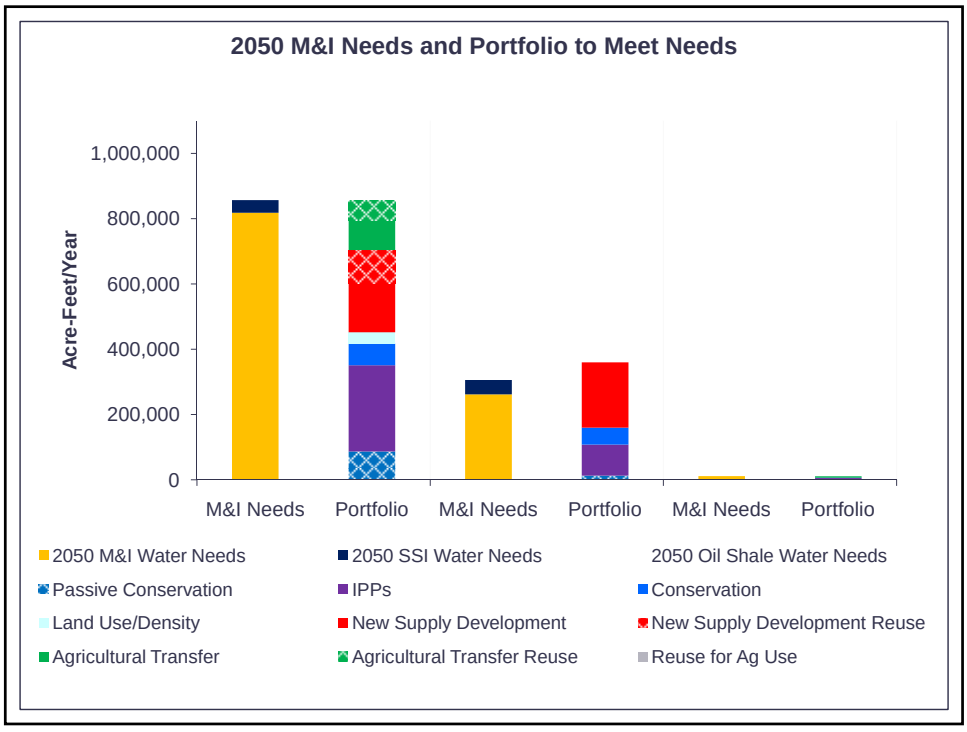


M&I Needs	Statewide	West Slope	East Slope	North Platte/ Rio Grande
M&I Water Needs (AFY)	1,021,000	262,000	748,000	11,100
SSI Water Needs (AFY)	84,000	45,000	39,000	0
Oil Shale Water Needs (AFY)	61,000	61,000	0	0
Total M&I Needs (AFY)	1,166,000	368,000	787,000	11,100
Strategies				
Passive Conservation	102,000	13,000	87,000	1,400
IPPs (AFY)	363,000	95,000	264,000	3,900
Active Conservation (AFY)	119,000	52,000	66,000	1,300
Landuse (AFY)	35,000	0	35,000	0
New Supply Development (AFY)	350,000	208,000	142,000	0
Reuse (AFY)	96,000	0	96,000	0
New Supply Development Sub-Total (AFY)	*446,000*	*208,000*	*238,000*	*0*
Ag Transfer (AFY)	62,000	0	58,000	4,400
Reuse (AFY)	39,000	0	39,000	0
Ag Transfer Sub-Total (AFY)	*101,000*	*0*	*97,000*	*4,400*
Reduction in Irrigated Acres (percent)	8%	7%	16%	1%
			12% Arkansas 17% South Platte	
Reduction in Irrigated Acres (acres)	219,000	31,077	182,300	5,600
			39,400 Arkansas 142,900 South Platte	
Colorado River Depletions (MAF)	0.284 MAF (New)		2.918 MAF (Total)	

NOTE: There may be some discrepancies in totals due to rounding.


State of Colorado 2050 M&I Needs and Portfolio to Meet Needs
Acre-Feet/Year
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
M&I Needs
Portfolio
2050 M&I Water Needs
2050 SSI Water Needs
2050 Oil Shale Water Needs
Passive M&I Conservation
IPPs
Conservation
Land Use/Density
New Supply Development
Colorado River System Reuse
Agricultural Transfer
Agricultural Transfer Reuse
Reuse for Ag Use


2050 M&I Needs and Portfolio to Meet Needs
Acre-Feet/Year
1,000,000
800,000
600,000
400,000
200,000
0
M&I Needs
Portfolio
M&I Needs
Portfolio
M&I Needs
Portfolio
2050 M&I Water Needs
2050 SSI Water Needs
2050 Oil Shale Water Needs
Passive Conservation
IPPs
Conservation
Land Use/Density
New Supply Development
New Supply Development Reuse
Agricultural Transfer
Agricultural Transfer Reuse
Reuse for Ag Use

Breakout Groups and Lunch

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Report out from Breakout Groups

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State Demographer Presentation

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CRWAS Phase I

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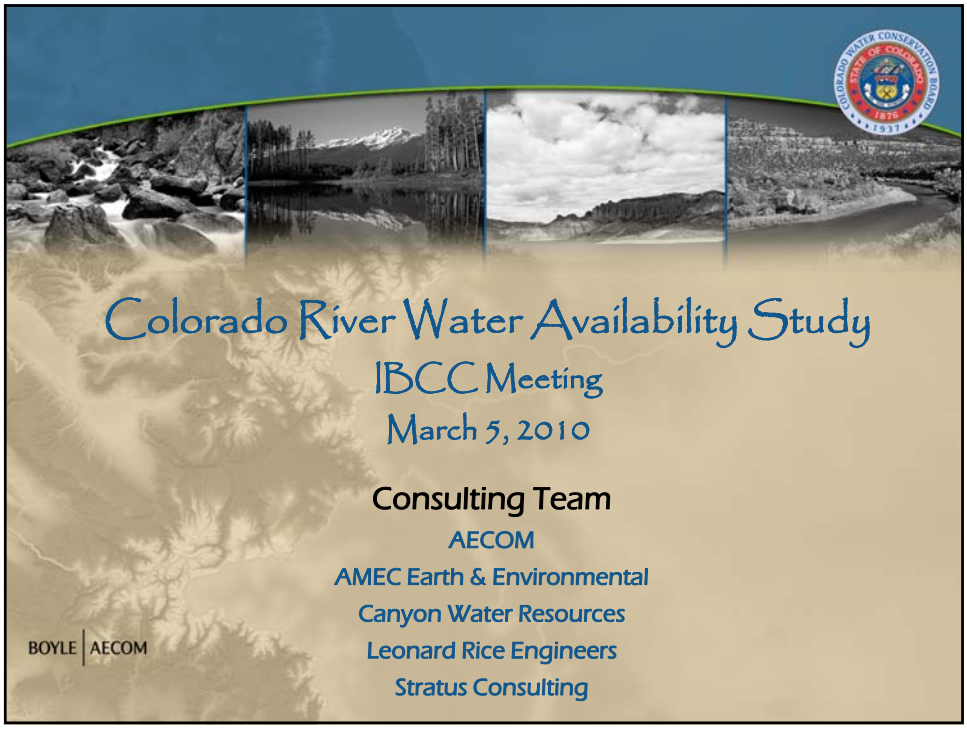
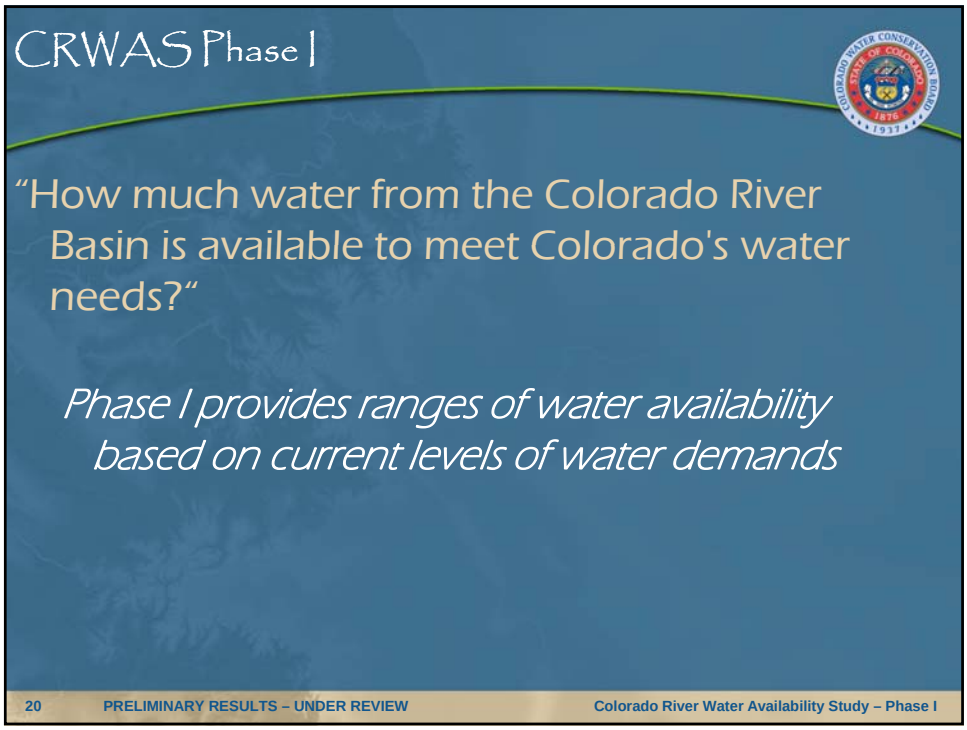

Colorado River Water Availability Study
IBCC Meeting
March 5, 2010
Consulting Team
AECOM
AMEC Earth & Environmental
Canyon Water Resources
Leonard Rice Engineers
Stratus Consulting
BOYLE | AECOM


CRWAS Phase I
"How much water from the Colorado River Basin is available to meet Colorado's water needs?"
Phase I provides ranges of water availability based on current levels of water demands
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PRELIMINARY RESULTS – UNDER REVIEW
Colorado River Water Availability Study – Phase I

How much water is available for future use based on current demand levels?

Approach

- Simulated full-development water use requests in upper basin
- Calculated 10-year cumulative flow at Lee Ferry.
- Calculated upper basin consumptive use that could be maintained considering Compact provisions.

Phase I Compact Assumptions

Upper Colorado River Compact Apportionment

State	% of Apportionment	% of 7.5 MAF(*)
Colorado	51.75	3,855,375
New Mexico	11.25	838,125
Utah	23.00	1,713,000
Wyoming	14.00	1,043,000

* Arizona is apportioned 50,000 af from the Upper Basin

Phase I Approach

- Hydrology adjusted for climate change
- CO current consumptive uses = 2.7 maf
- NM, UT, WY fully developed
- All Upper Basin storage capacity fully used

Phase I Approach

- CRSS
  - Bureau of Reclamation model used for federal planning and recent negotiations.
- Hydrologic Determination
  - Implementation of mass balance analysis used in the 2007 Hydrologic Determination

Compact Assumptions and Uncertainties

- Both approaches have limitations
  - Spatial and temporal scale
  - Don't represent in-state storage
- The bottom line:
  - CRSS may understate physical water use and legal water availability.
  - Mass balance analysis may overstate physical water use but not legal availability
- Estimates of in-state water use by CDSS models are more reliable

Selected Phase I Approach

- Mass Balance Analysis
  - Based on 2007 Hydrologic Determination
  - Added computation of 10-year cumulative flow provision of the Colorado River Compact
- Initial Conditions
  - Reservoir contents
  - Starting conditions set equal to ending conditions
  - No water added or taken away by this assumption

Selected Phase I Approach, continued

- Reservoirs
  - Simulated major federal reservoirs
  - Capacity as of 2060 per Hydrologic Determination
  - Allowed use of CRSP minimum power pools
- Evaporation per Hydrologic Determination
  - Includes Powell, Flaming Gorge and Aspinall
  - Other evaporation chargeable to states

Phase I Scenarios

- Potential Lee Ferry Obligations
  - 75 MAF
  - 82.5 MAF
- Inflow Assumption
  - Mass balance analysis is conducted at Lee Ferry
  - Hydrologic Determination used total inflow above Lees Ferry (does not include Paria River inflow).
  - CRWAS Phase I uses total inflow above Lee Ferry (includes Paria River inflow).

Phase I Scenarios

- Depletions
  - Applied Upper Basin water use requests used in 2007 Hydrologic Determination:

Potential Lee Ferry Obligation	Upper Basin Water Use
75 MAF	6.76 MAF
82.5 MAF	5.98 MAF

  - Assumed that other Upper Basin states may physically use their full apportionments.

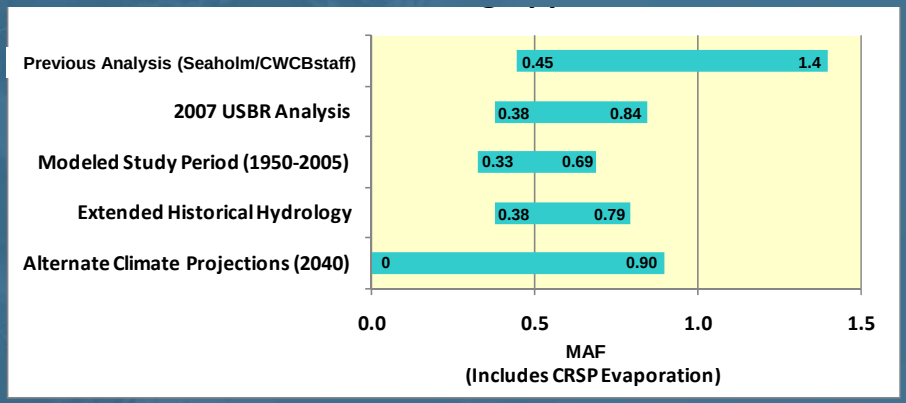
Phase I Hydrologic Cases

- 1906 – 2000 (Hydrologic Determination)
- 1950 – 2005 Study Period
- Extended Historical Hydrology
  - 100 traces of re-sequenced study-period flows
  - Demonstrates more extreme wet and dry traces
- Climate Impacted Hydrology
  - Focus on 2040 time frame
  - Five projections for the time frame
  - 100 traces of re-sequenced flows for each projection

Phase I Assumptions on Current Consumptive Use

- Estimated by StateMod
  - 1950-2005 natural flows
  - 1950-2005 weather
  - Current irrigated acreage
  - Current M&I demands
  - Simulates diversions, crop CU, evaporation
  - Excludes evaporation from Aspinall Unit and Navajo evaporation chargeable to New Mexico
  - Excludes exports to New Mexico
- Estimated CU = 2.7 MAF

Colorado Water Availability for Future Consumptive Use



"Other" Scenarios
3 Potential Options

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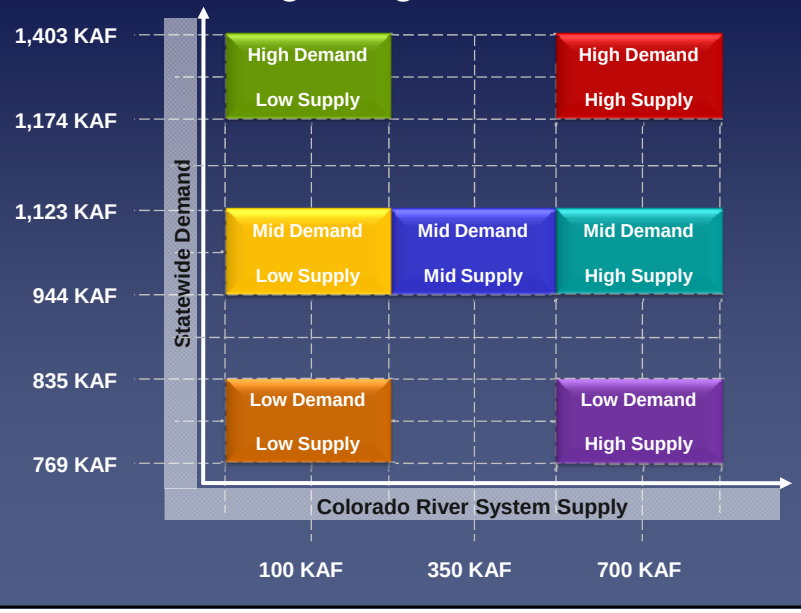
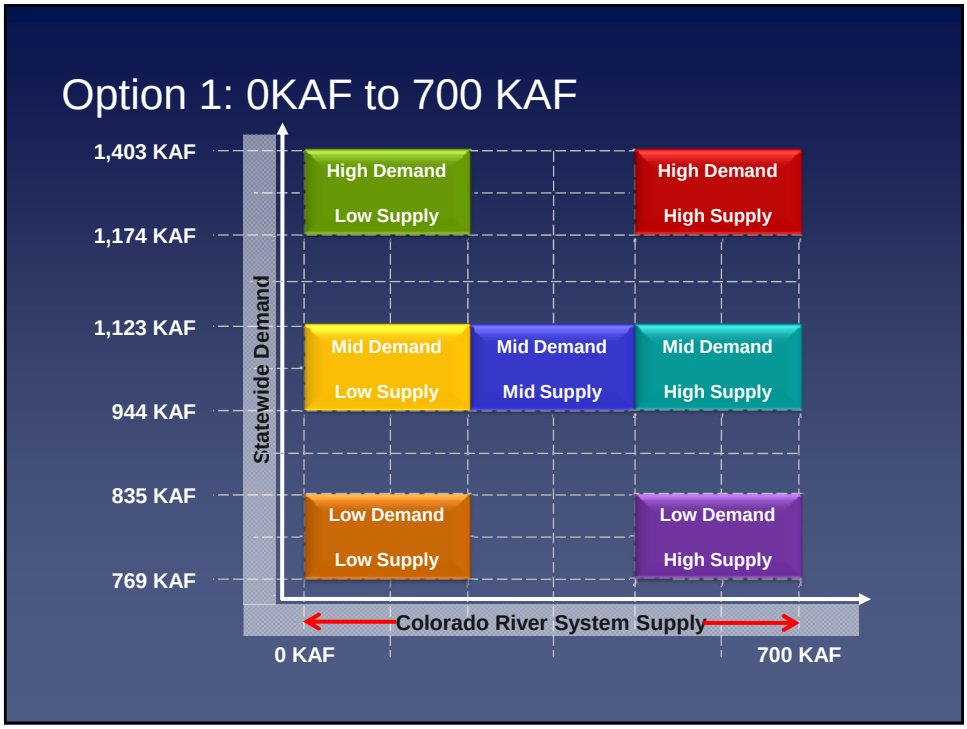
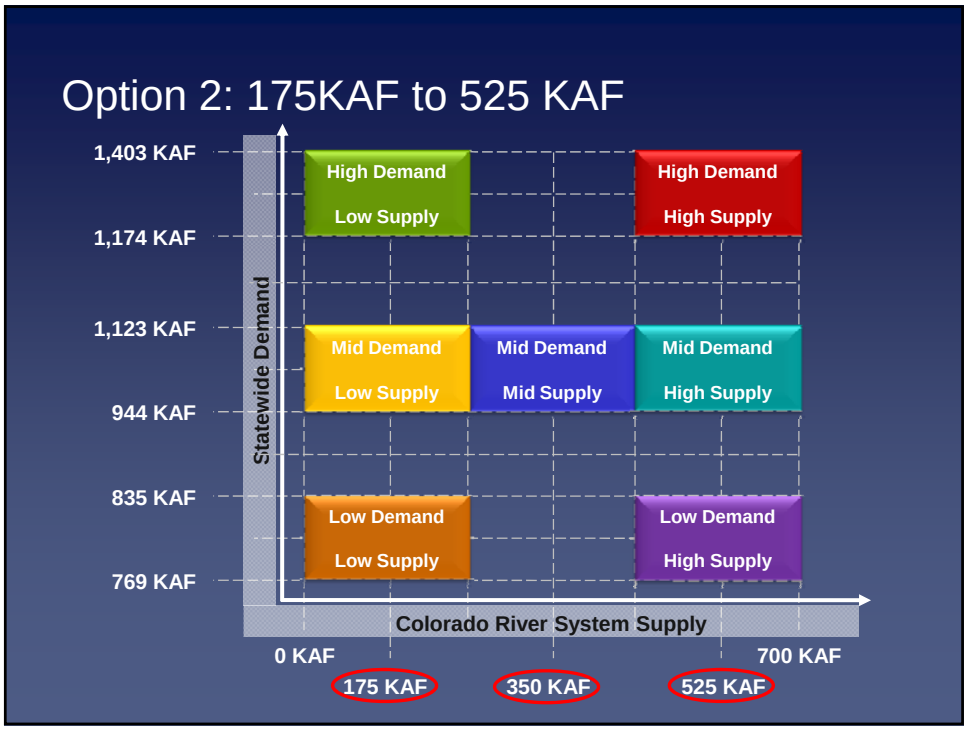
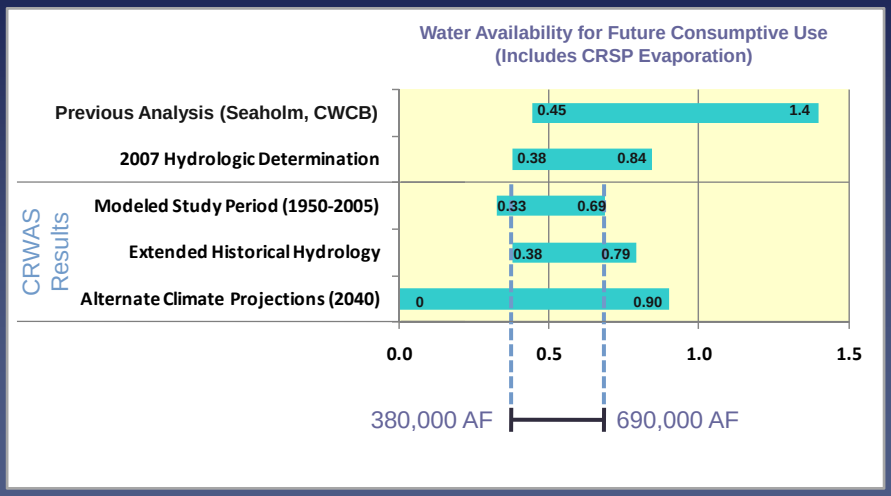
Current Planning Range: 100KAF to 700KAF




Option 1: 0KAF to 700 KAF
1,403 KAF
1,174 KAF
1,123 KAF
944 KAF
835 KAF
769 KAF
Statewide Demand
High Demand
Low Supply
High Demand
High Supply
Mid Demand
Low Supply
Mid Demand
Mid Supply
Mid Demand
High Supply
Low Demand
Low Supply
Low Demand
High Supply
Colorado River System Supply
0 KAF
700 KAF


Option 2: 175KAF to 525 KAF
1,403 KAF
1,174 KAF
1,123 KAF
944 KAF
835 KAF
769 KAF
Statewide Demand
High Demand
Low Supply
High Demand
High Supply
Mid Demand
Low Supply
Mid Demand
Mid Supply
Mid Demand
High Supply
Low Demand
Low Supply
Low Demand
High Supply
Colorado River System Supply
0 KAF
700 KAF
175 KAF
350 KAF
525 KAF

Option 3: CRWAS Hydrological Overlaps (380KAF to 690KAF)



Portfolio Tool Enhancements

Tool Enhancements – M&I Demands

- Updated oil shale water needs from preliminary results of Phase II of Energy Study
- Replacement of nonrenewable groundwater in the South Metro area

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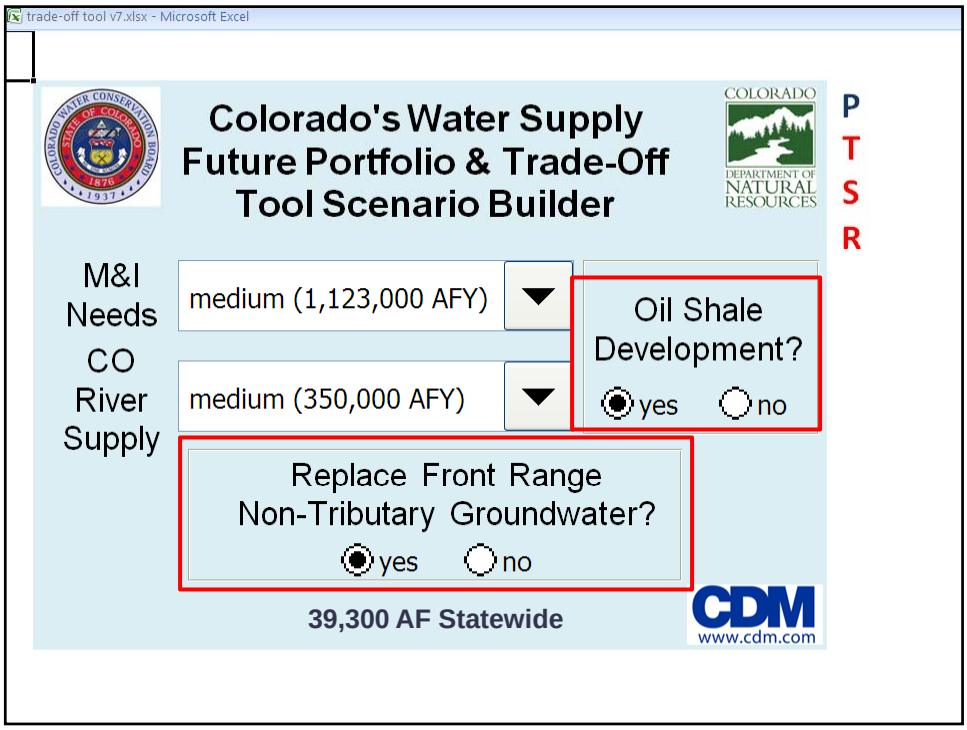

Oil Shale Scenarios

Scenario	Colorado Basin		Yampa-White Basin		Total (AFY)
	SSI (AFY)	M&I (AFY)	SSI (AFY)	M&I (AFY)	
Low	0	2,000	0	31,000	33,000
Medium	3,000	3,000	58,000	56,000	120,000
High	5,000	3,000	106,000	56,000	170,000

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Tool Enhancements – Portfolio Development

- Passive Conservation – using SWSI 1 as placeholder
- Active Conservation – using 2008 as baseline
- Water Use Reductions from Land Use Density for Future Development

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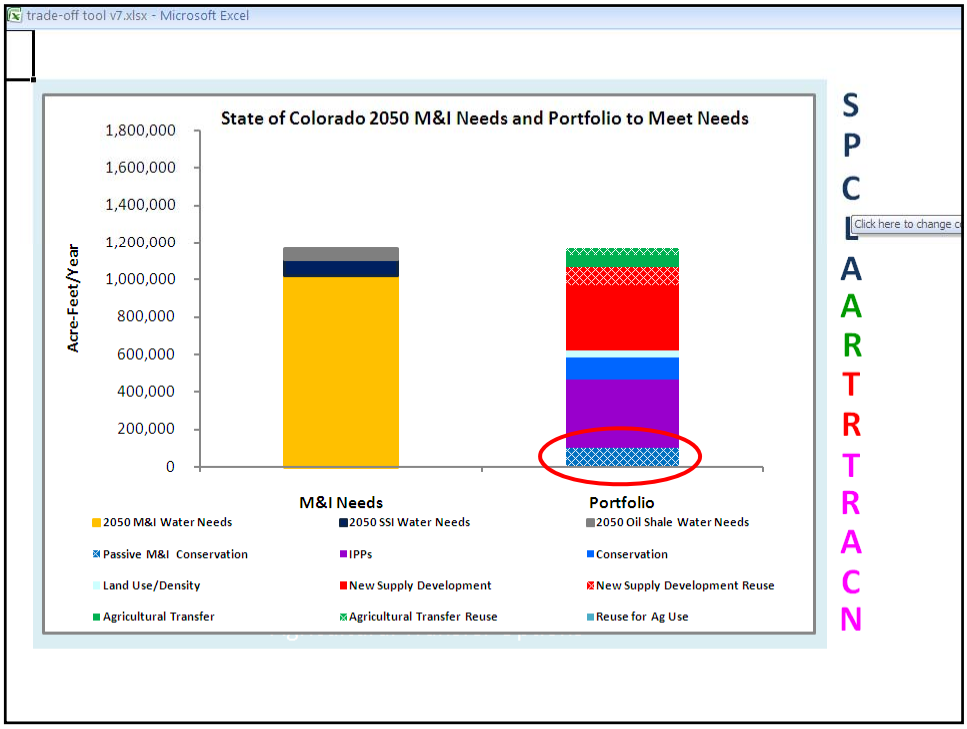
trade-off tool v7.xlsx - Microsoft Excel
State of Colorado 2050 M&I Needs and Portfolio to Meet Needs
Acre-Feet/Year
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1,600,000
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0
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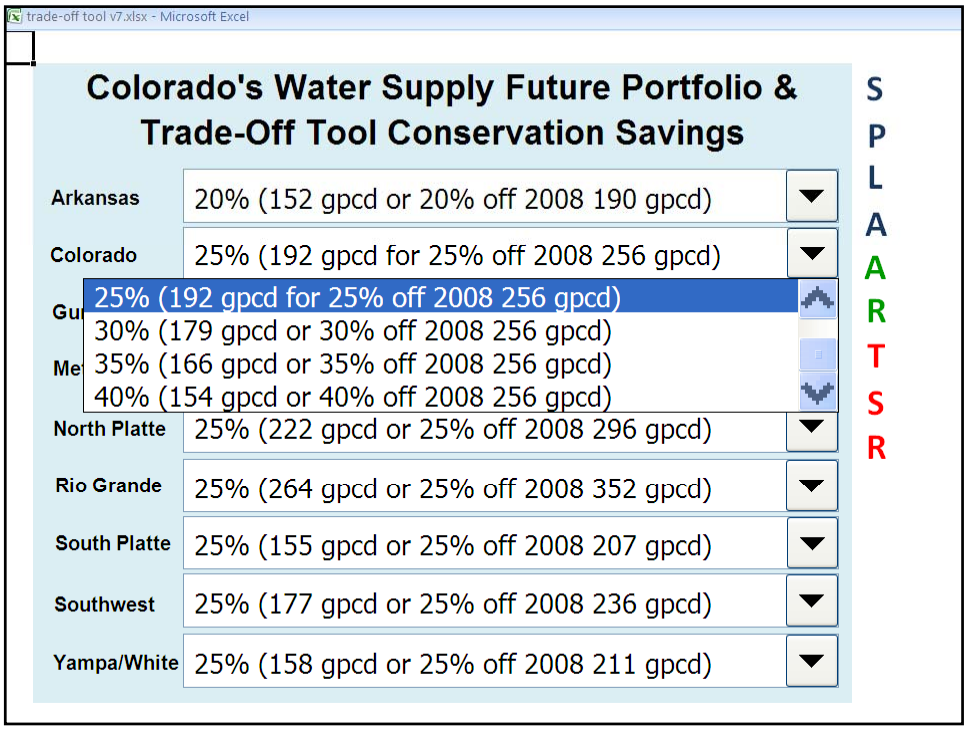
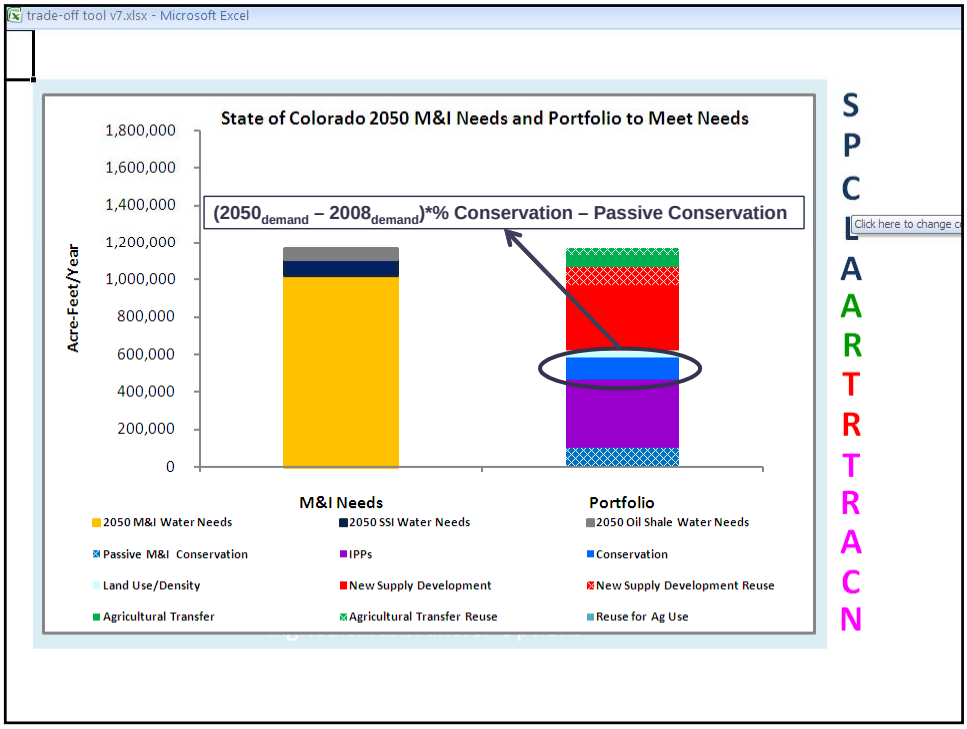
SPCLAARTRTRACN


trade-off tool v7.xlsx - Microsoft Excel
Colorado's Water Supply Future Portfolio & Trade-Off Tool Conservation Savings
Arkansas
20% (152 gpcd or 20% off 2008 190 gpcd)
Colorado
25% (192 gpcd for 25% off 2008 256 gpcd)
25% (192 gpcd for 25% off 2008 256 gpcd)
30% (179 gpcd or 30% off 2008 256 gpcd)
35% (166 gpcd or 35% off 2008 256 gpcd)
40% (154 gpcd or 40% off 2008 256 gpcd)
North Platte
25% (222 gpcd or 25% off 2008 296 gpcd)
Rio Grande
25% (264 gpcd or 25% off 2008 352 gpcd)
South Platte
25% (155 gpcd or 25% off 2008 207 gpcd)
Southwest
25% (177 gpcd or 25% off 2008 236 gpcd)
Yampa/White
25% (158 gpcd or 25% off 2008 211 gpcd)
SPLAARTSR


trade-off tool v7.xlsx - Microsoft Excel
State of Colorado 2050 M&I Needs and Portfolio to Meet Needs
(2050demand – 2008demand)*% Conservation – Passive Conservation
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1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
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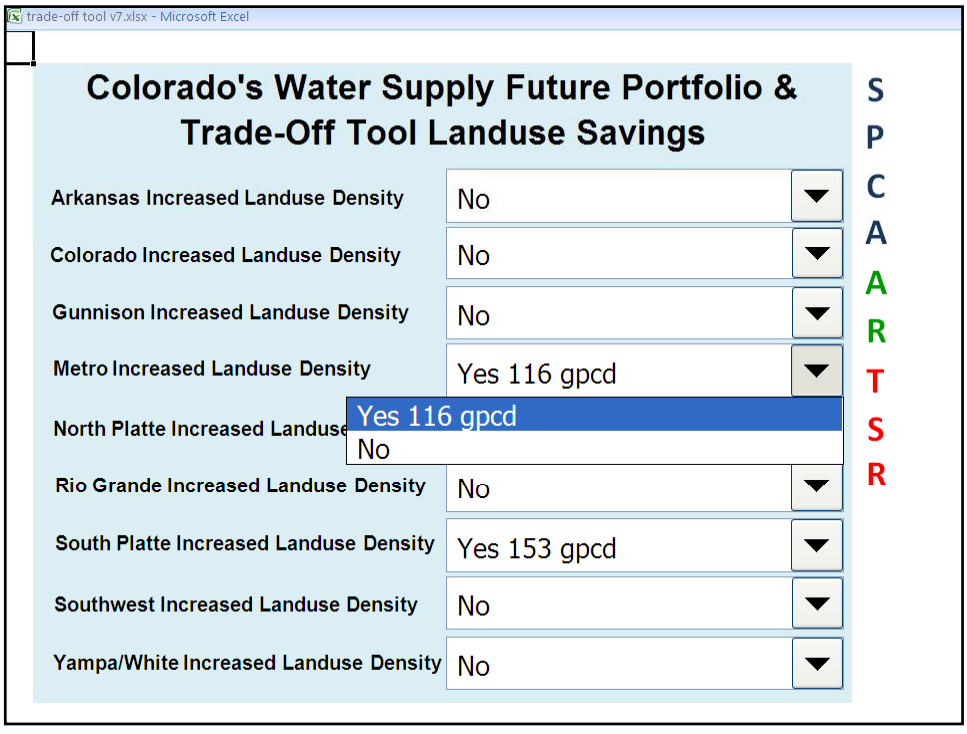
SPCL AARTRTRACN


trade-off tool v7.xlsx - Microsoft Excel
Colorado's Water Supply Future Portfolio & Trade-Off Tool Landuse Savings
Arkansas Increased Landuse Density
No
Colorado Increased Landuse Density
No
Gunnison Increased Landuse Density
No
Metro Increased Landuse Density
Yes 116 gpcd
North Platte Increased Landuse
Yes 116 gpcd
No
Rio Grande Increased Landuse Density
No
South Platte Increased Landuse Density
Yes 153 gpcd
Southwest Increased Landuse Density
No
Yampa/White Increased Landuse Density
No
SPCAARTSR

Tool Enhancements – Trade-Offs

- Size of Alternative Agricultural Transfer Program
- Cost of Portfolio
- Nonconsumptive

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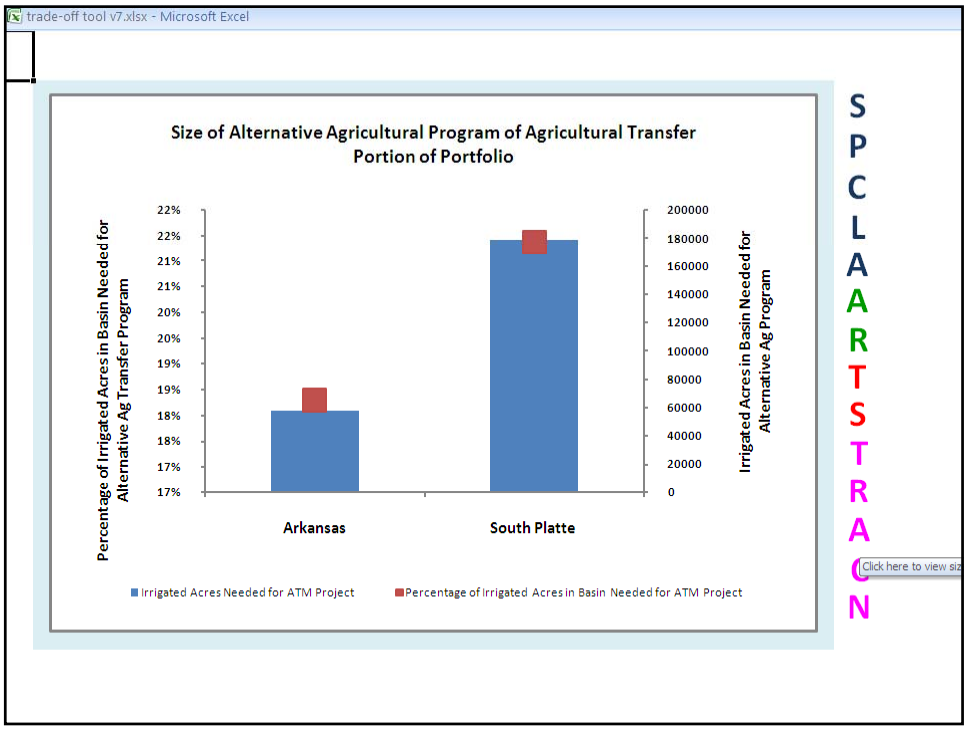

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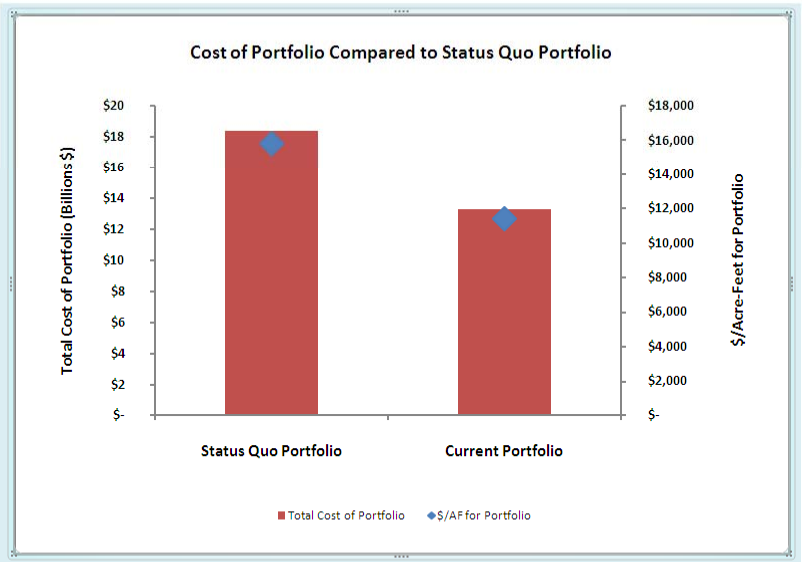

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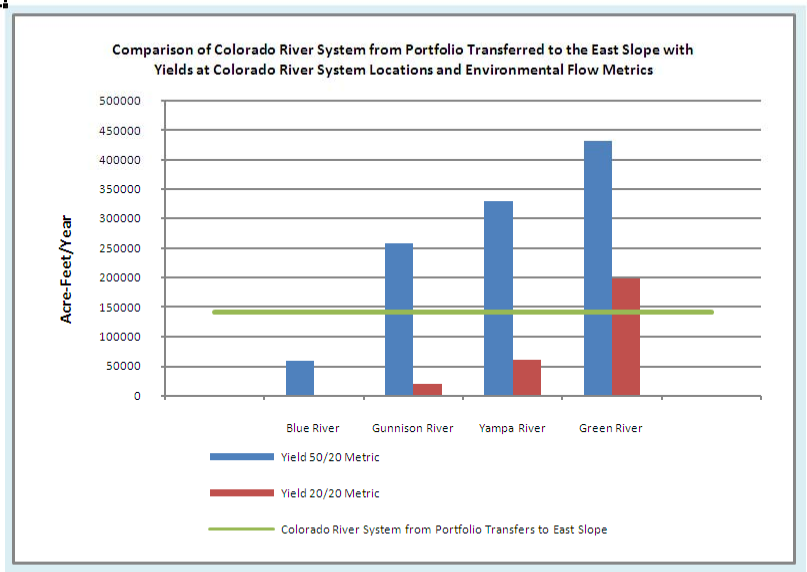

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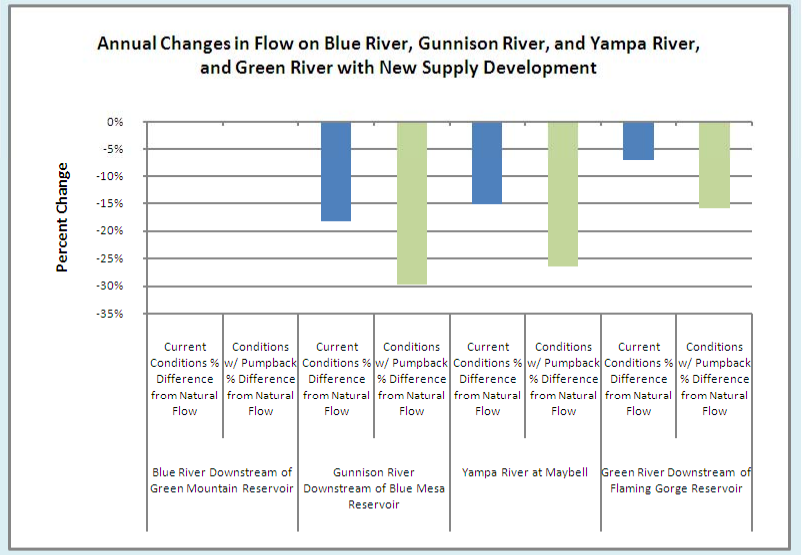

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WSRA Criteria & Guidelines

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WSRA Criteria and Guidelines Sub-Committee Recommendations

- Statewide Account Applications Once per Year – September CWCB Meeting
- Statewide Account Evaluation Criteria – Three Tiers
  - Promoting Collaboration/Cooperation and Meeting Identified Water Needs
  - Facilitating Water Activity Implementation
  - Water Activity Addresses Issues of Statewide Value
- Statewide Account Applications – Support from 2 BRTS or Implement an IPP
- Basin Accounts – Stronger relationship to Consumptive or Nonconsumptive Needs Assessments

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