

The Yakima Basin Integrated Water Resources Management Plan

Steven M. Thurin, P.E., *HDR Engineering*



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Acknowledgements

- Integrated Plan being developed by Washington Department of Ecology and Bureau of Reclamation
- Consulting Team includes HDR Engineering, Anchor QEA, ESA Adolfson, Golder Associates, ECONorthwest, & others
- Stakeholders Group:
 - Local, State, and Federal agencies
 - Yakama Nation
 - American Rivers
- Climate Change Hydrology by RMJOC and UW CIG

Basin Issues

- Declines in populations of anadromous fish
- Loss of critical bull trout habitat and connectivity
- Irrigation water supply shortages
- Inadequate water supply for municipal growth
- Climate change predicted to make things worse

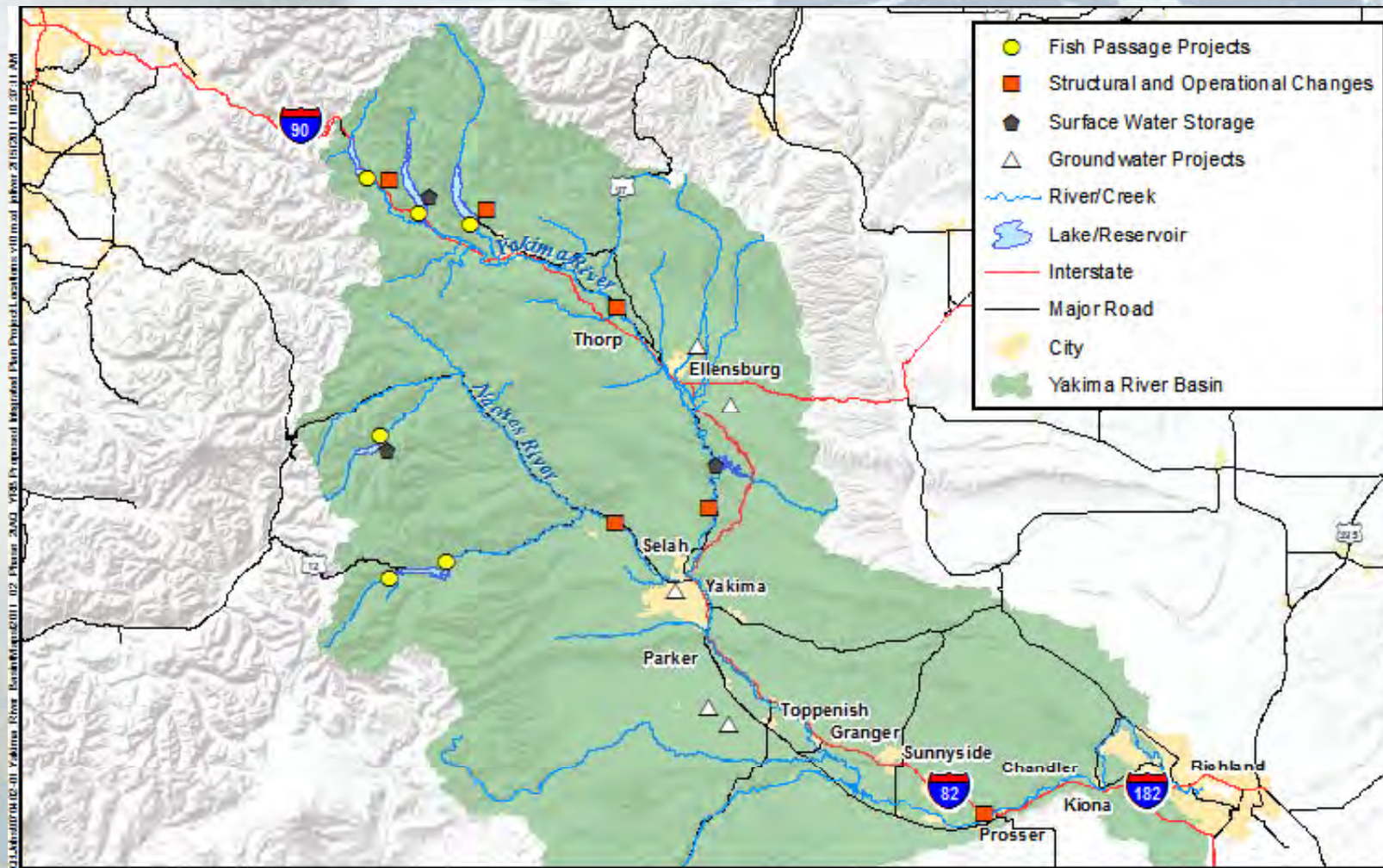
Plan Objectives

- Improve water management
- Protect fish and wildlife habitat
- Increase flexibility and provide better instream flows
- Improve water supply reliability

Integrated Plan Elements

- Structural and operational changes
- Surface water storage
- Groundwater storage
- Fish passage
- Habitat protection and enhancement
- Enhanced water conservation
- Market-based reallocation

Yakima Basin



0 25 Miles

**Yakima River Basin
Proposed Integrated Plan Project Locations**

Yakima Basin Study

Yakima Basin Plan – Proposed New Facilities

- Keechelus to Kachees Pipeline – 400 cfs capacity, reduces high summer flows
- Kachess Inactive Storage – New outlet, pump station/tunnel – 200,000 acre-ft additional capacity
- Wymer Offstream Storage – 162,500 acre-ft capacity
- Enlarged Bumping Reservoir – 150,000 acre-ft additional capacity
- Enhanced Aquifer Storage and Recovery – 100,000 acre-ft capacity
- Plus Fish Passage at six reservoirs, canal improvements, etc.

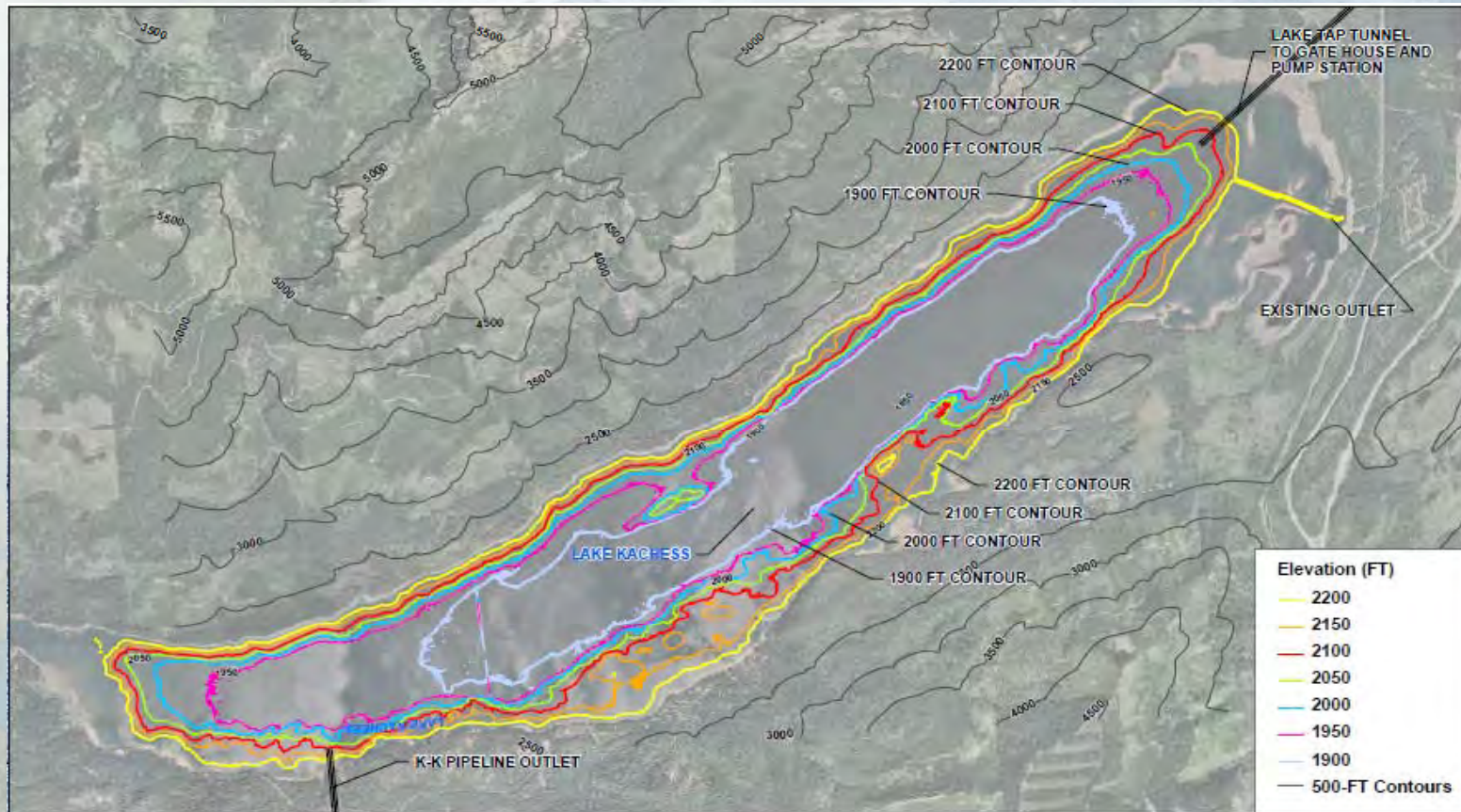
Yakima Basin Plan – Proposed New Facilities

- **Keechelus to Kachees Pipeline** – 400 cfs capacity, reduces high summer flows, improves yield slightly



Yakima Basin Plan – Proposed New Facilities

- **Kachess Inactive Storage** – New outlet, pump station/tunnel – 200,000 acre-ft additional capacity

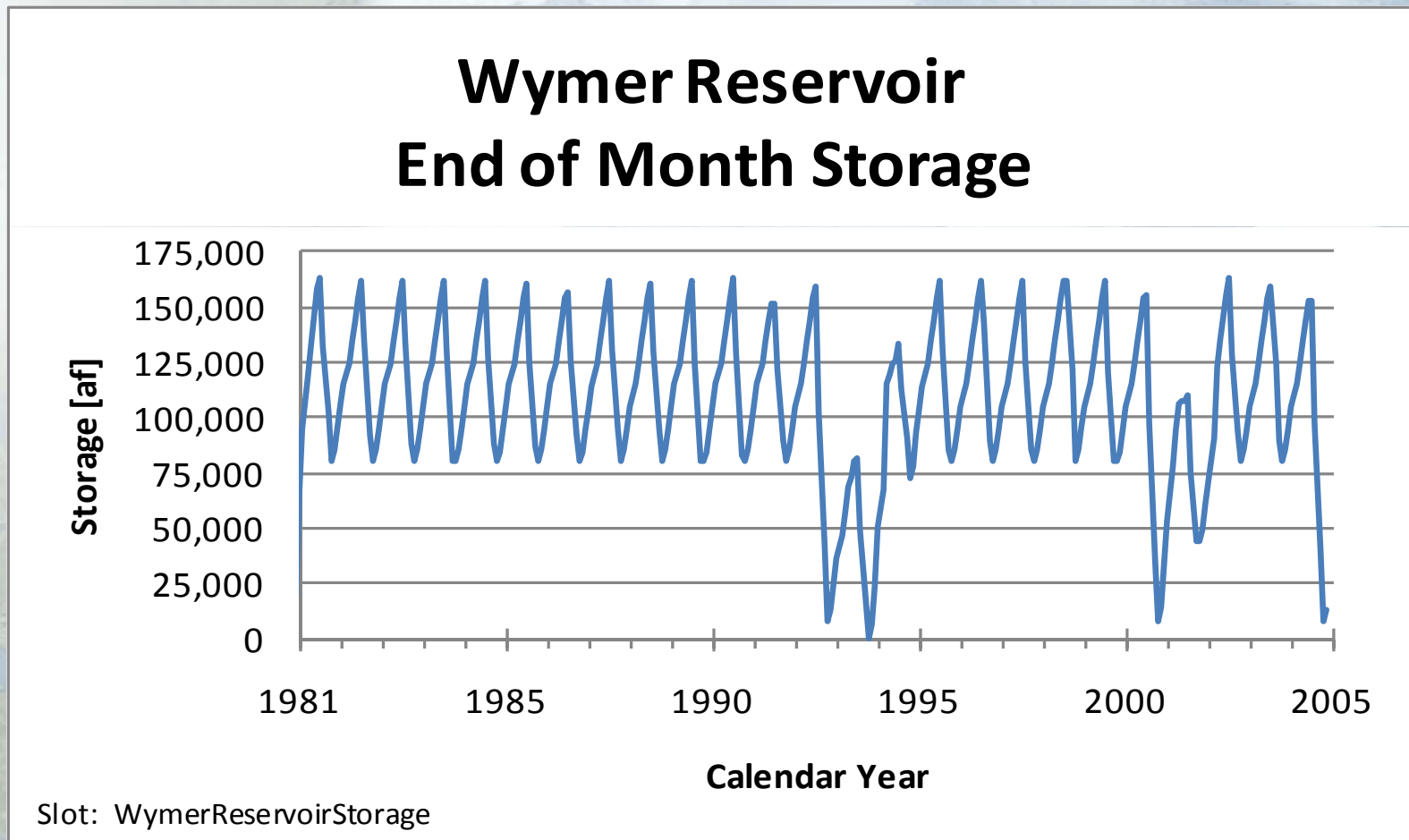


Lake Kachess Contours Bathometric and Aerial Map
FIGURE 3

Kachess Inactive Storage Project, Yakima Basin Study

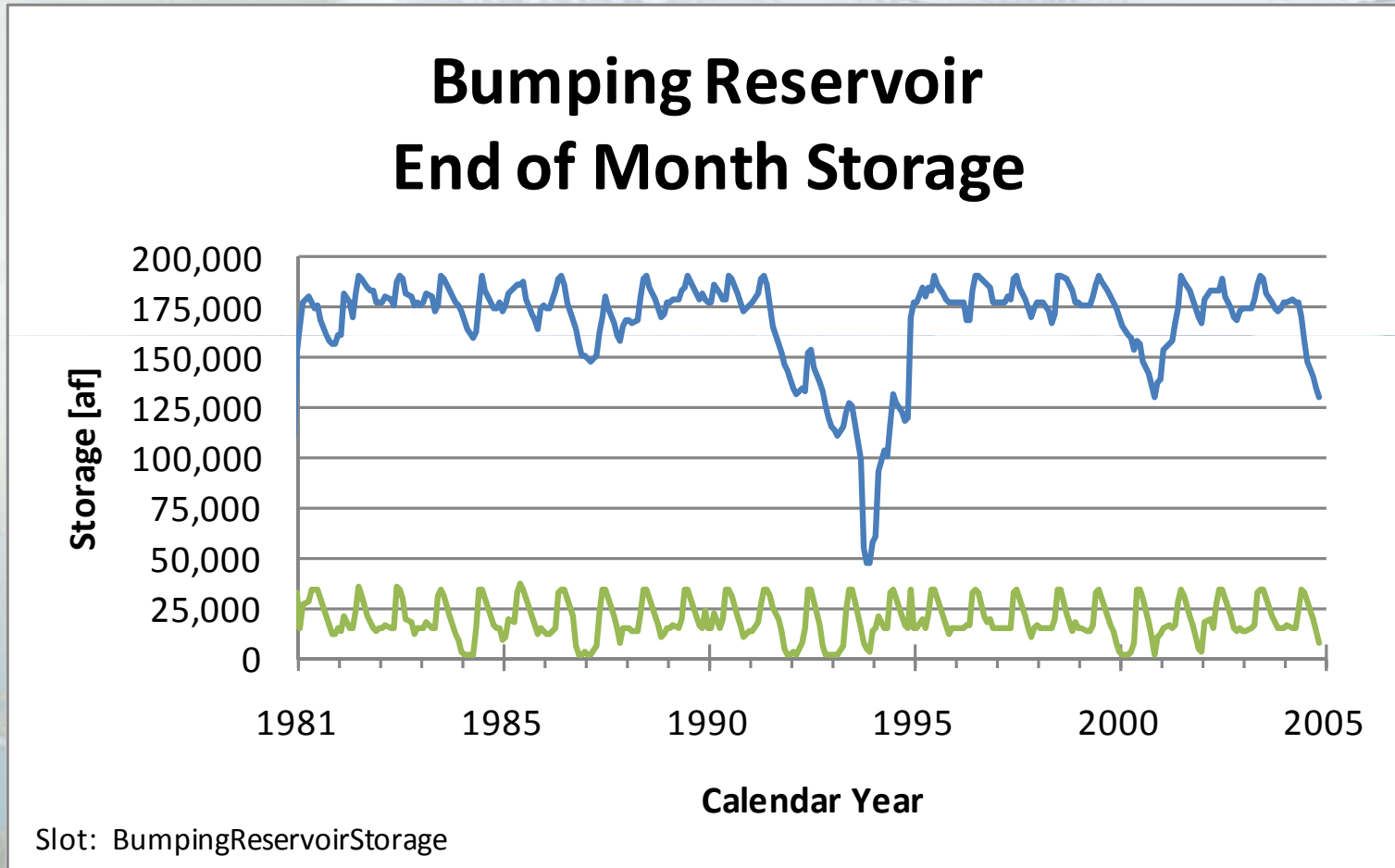
Yakima Basin Plan – Proposed New Facilities

- **Wymer Offstream Storage** – 162,500 acre-ft capacity, instream flow enhancement and additional supply



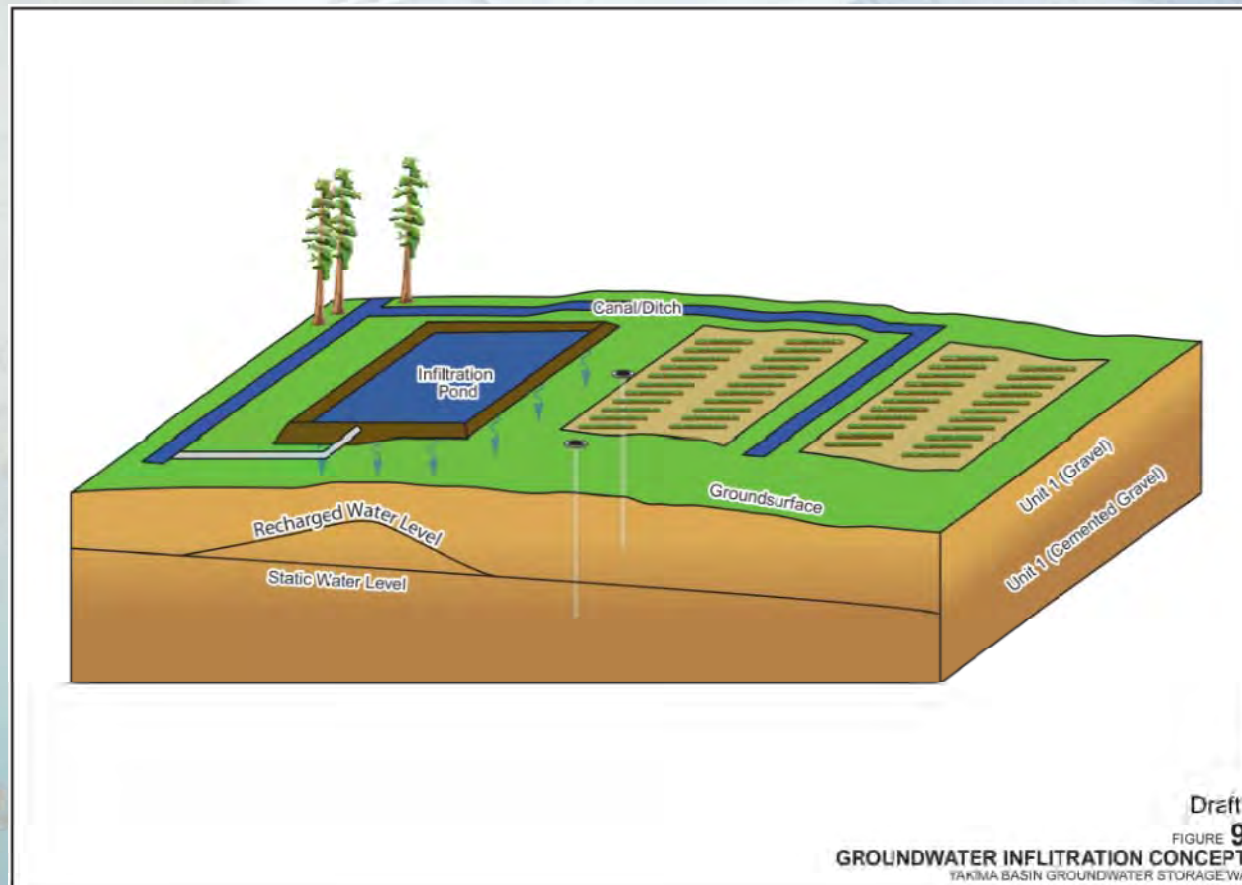
Yakima Basin Plan – Proposed New Facilities

Enlarged Bumping Reservoir – Increase storage from 37,000 to 198,000 acre-feet

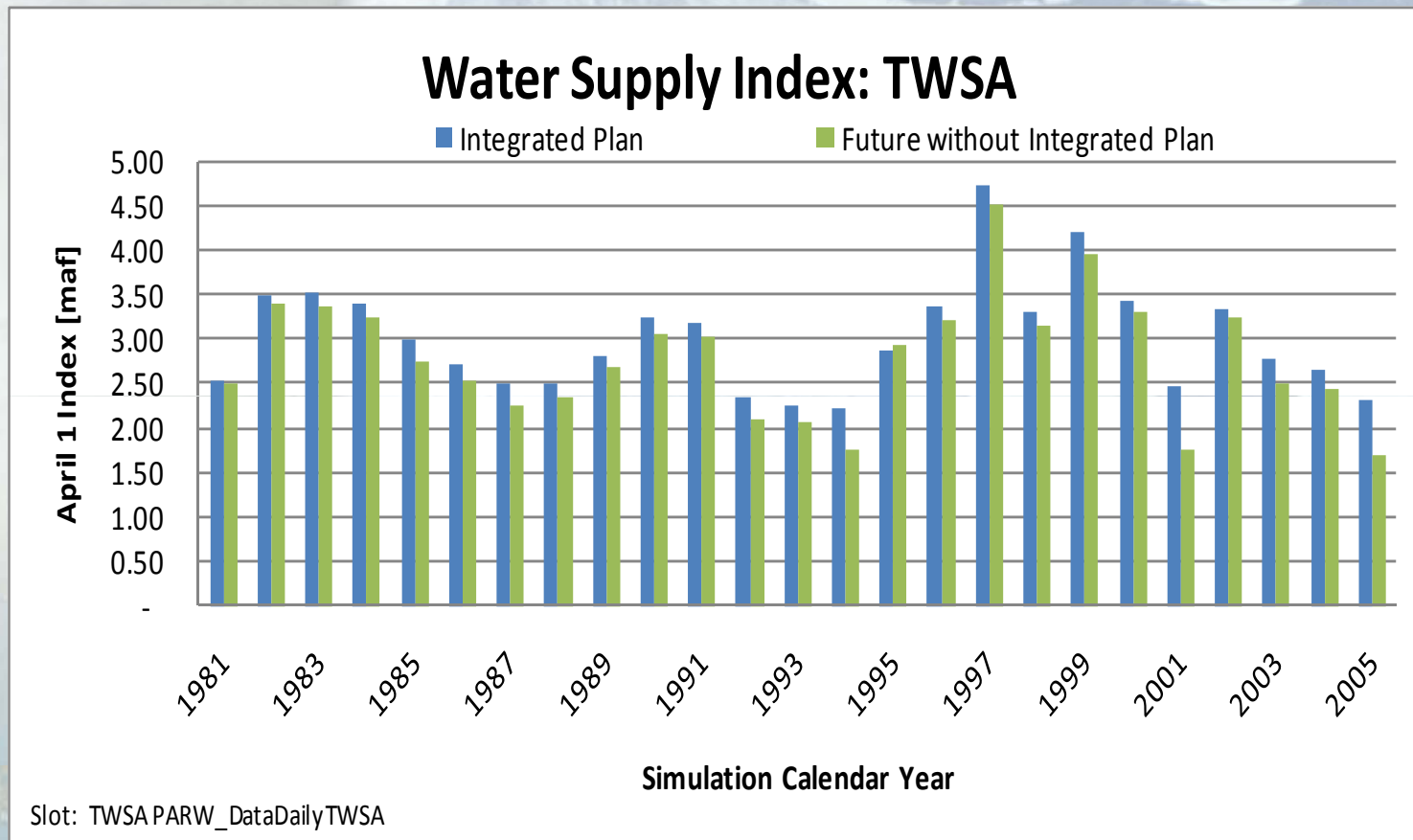


Yakima Basin Plan – Proposed New Facilities

- Enhanced Aquifer Storage and Recovery – 100,000 acre-ft capacity, increased instream flow and supply

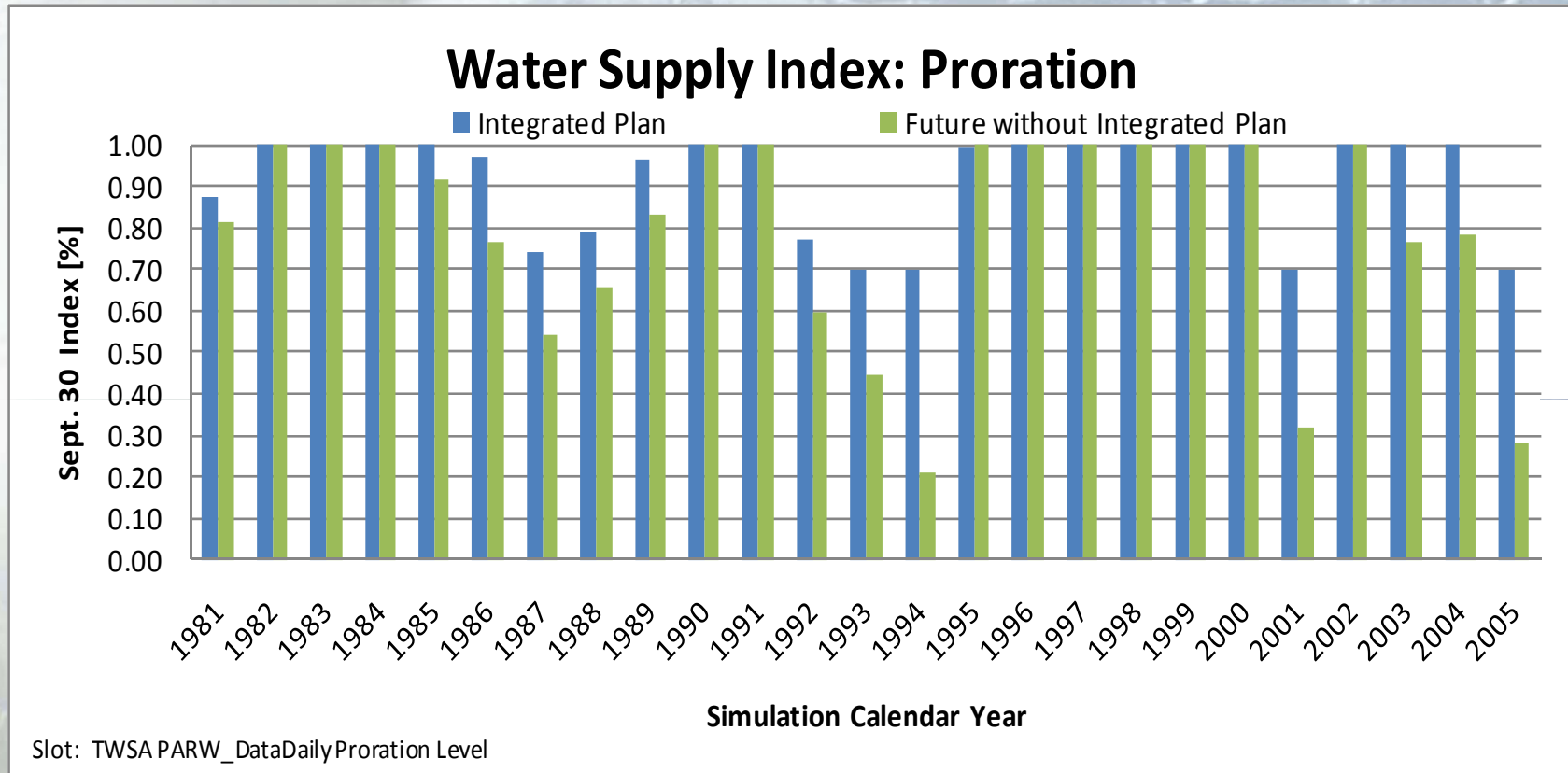


Integrated Plan – Simulated Results



TWSA is a measure of reservoir storage and expected return flow and gains available for water supply. Full supply requires about 3 MAF

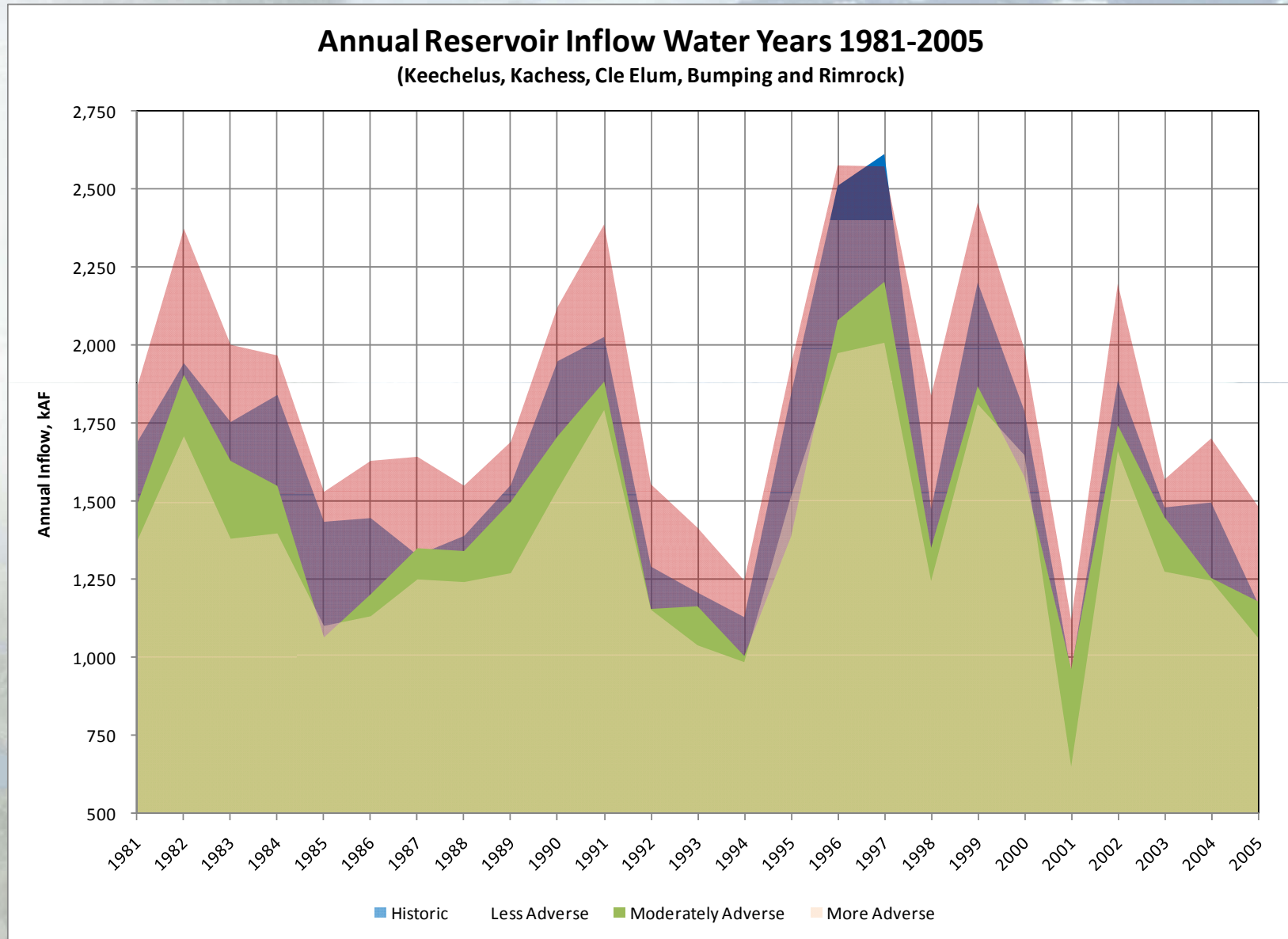
Integrated Plan – Simulated Results



Climate Change Scenarios

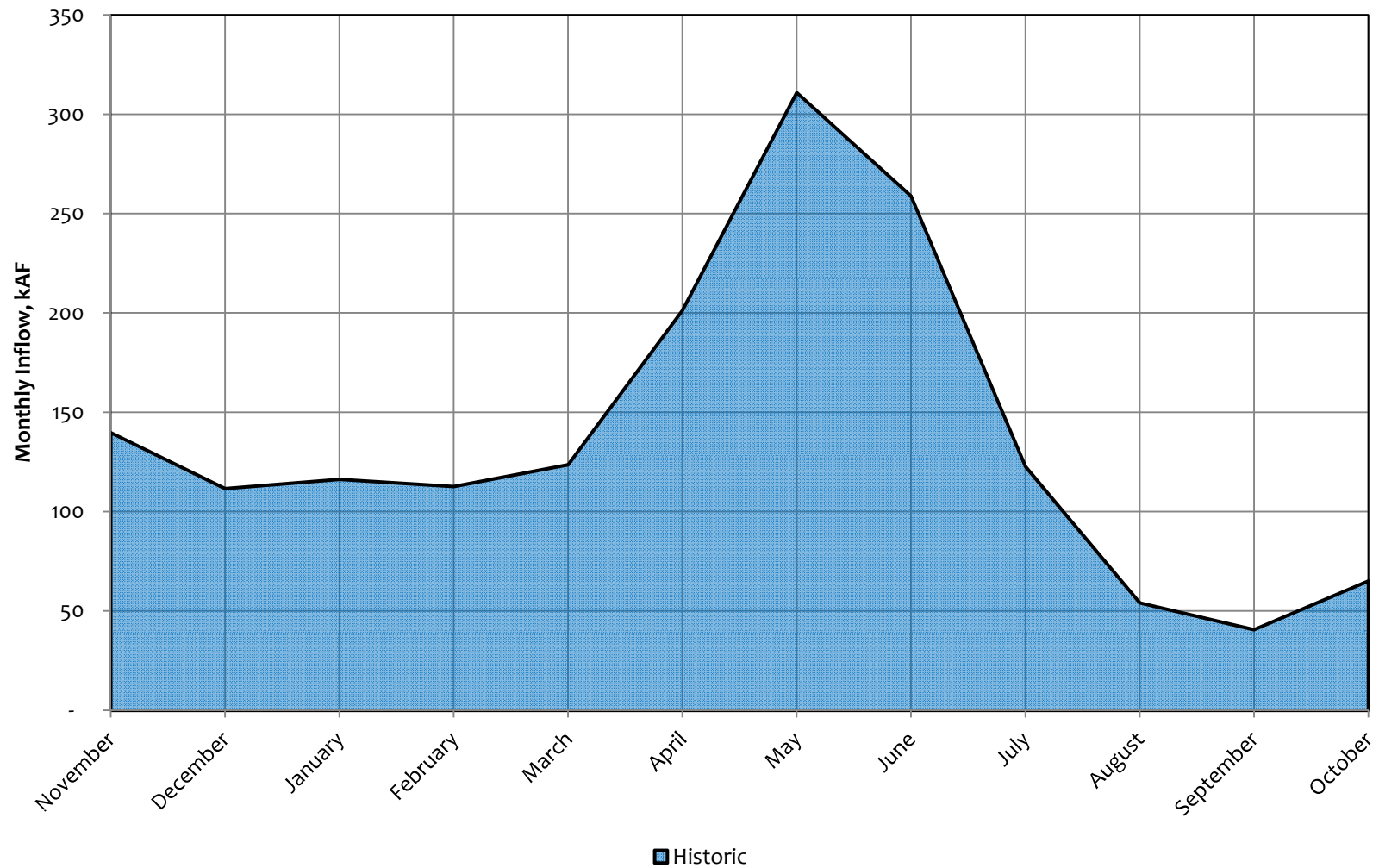
Scenario	Average Temperature Change from Existing Conditions	Average Precipitation Change from Existing Conditions	Average Annual Reservoir Inflow (million acre-feet)
Existing Conditions (historically-based)	Not applicable	Not applicable	1.66
Less Adverse Climate Change	1.8 °C average increase	13.4% increase	1.86
Moderately Adverse Climate Change	1.7 °C average increase	3.7% increase	1.48
More Adverse Climate Change	2.8 °C average increase	2.5% decrease	1.38

Reservoir Inflows – Annual Totals



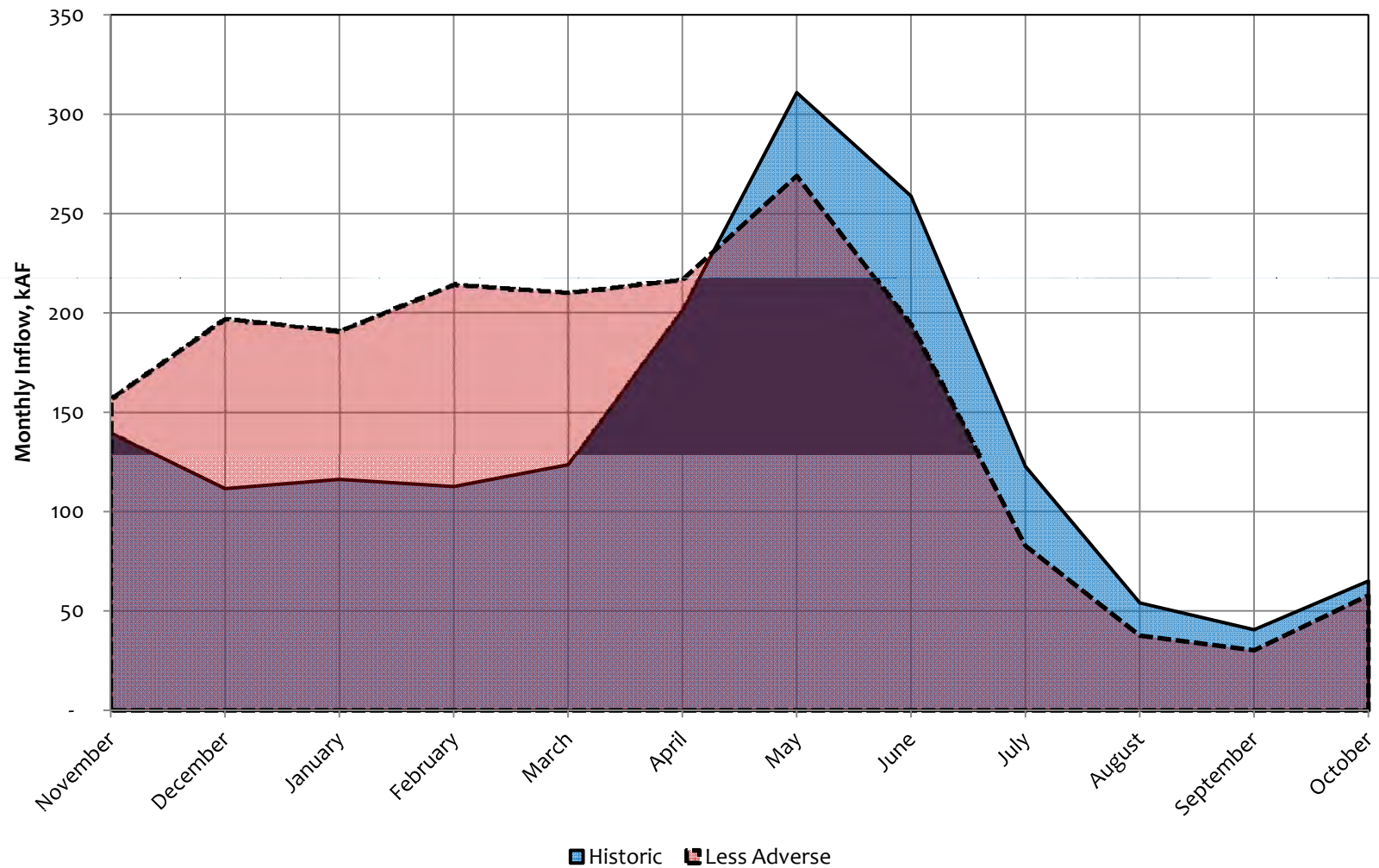
Reservoir Inflows

Average Reservoir Inflow Water Years 1981-2005
(Keechelus, Kachess, Cle Elum, Bumping and Rimrock)



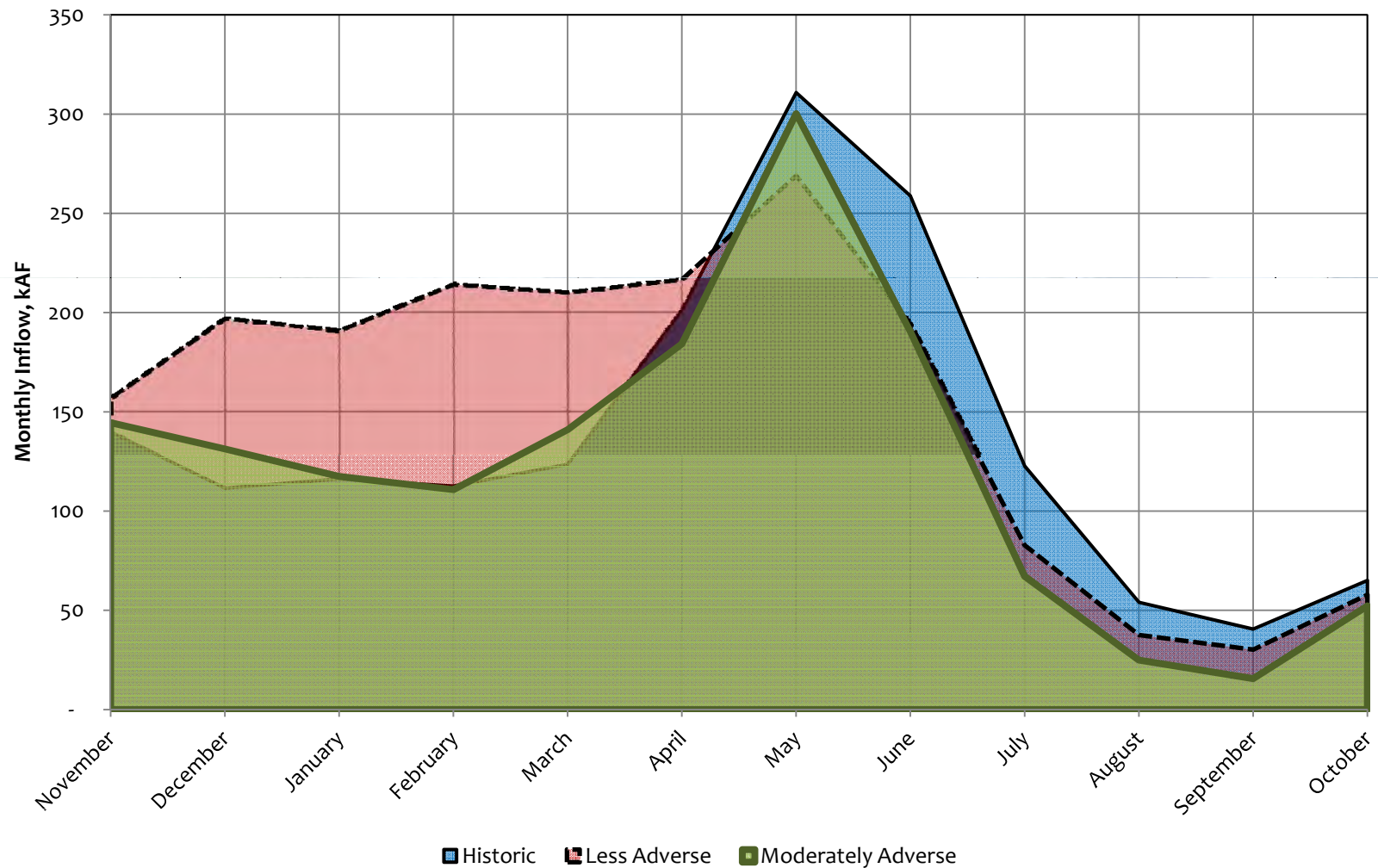
Reservoir Inflows - Effect of Climate Change

Average Reservoir Inflow Water Years 1981-2005
(Keechelus, Kachess, Cle Elum, Bumping and Rimrock)



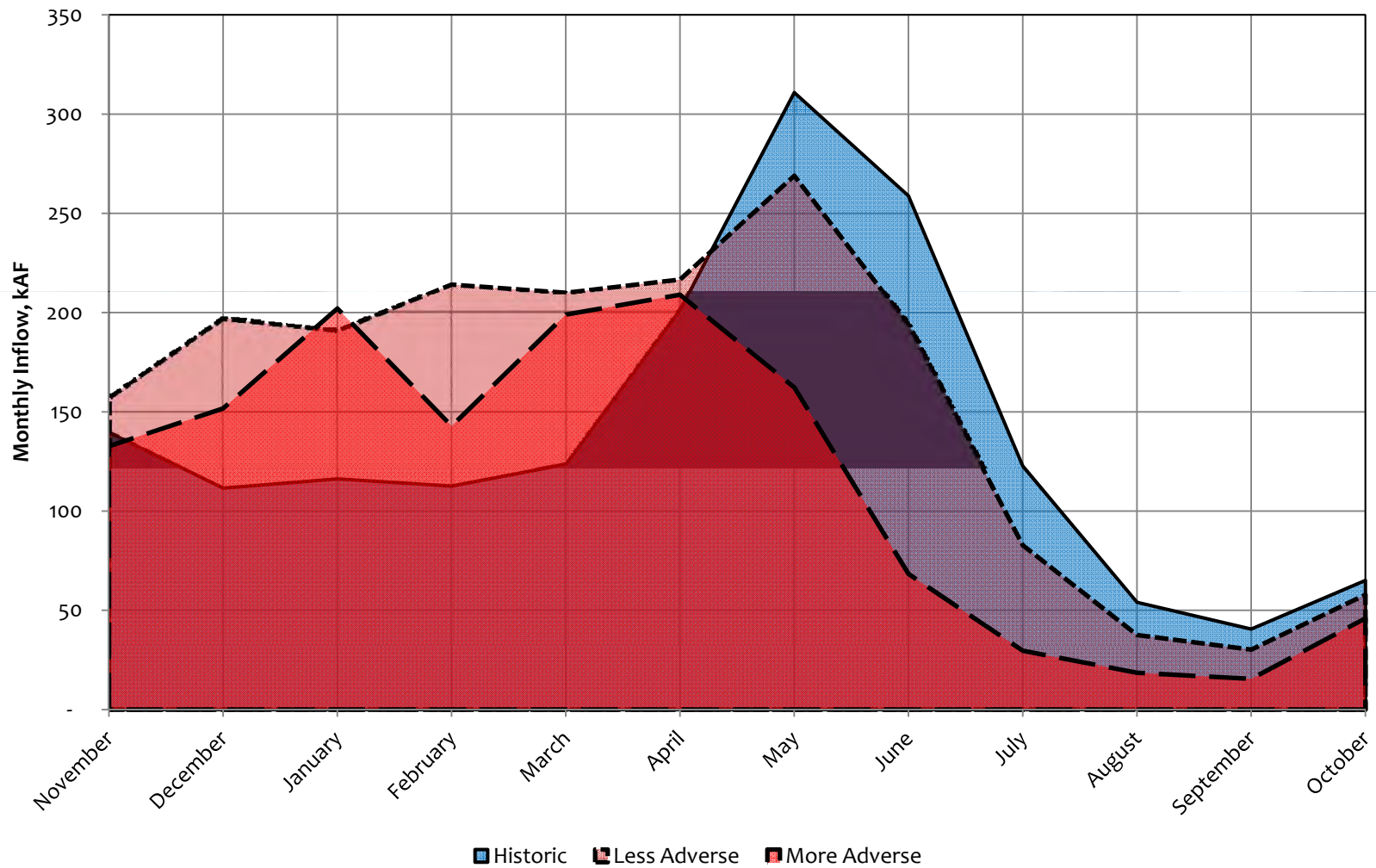
Reservoir Inflows - Effect of Climate Change

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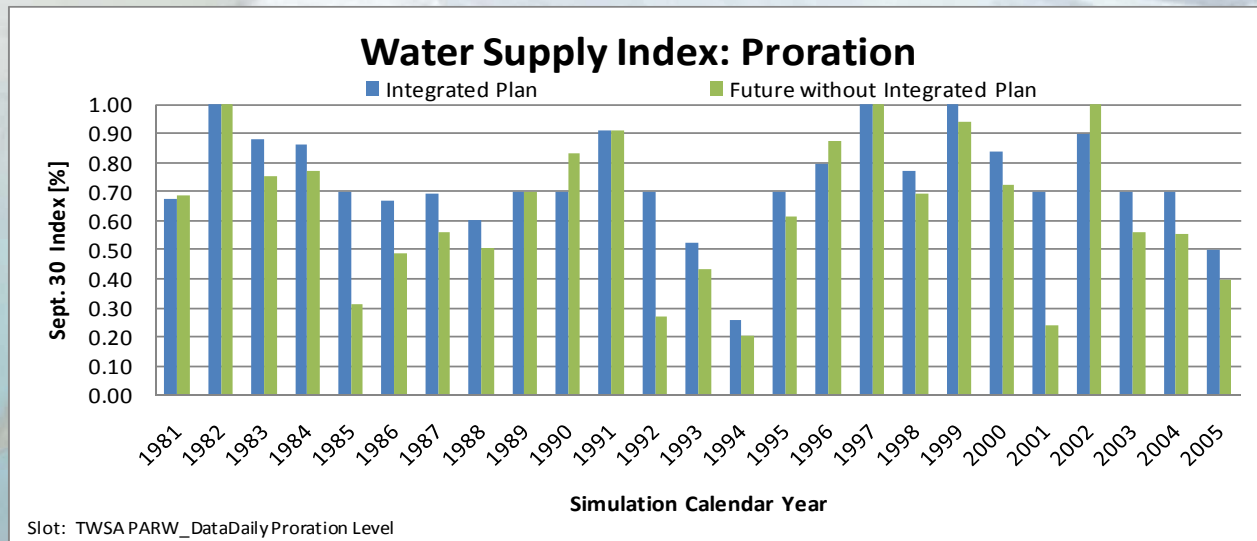
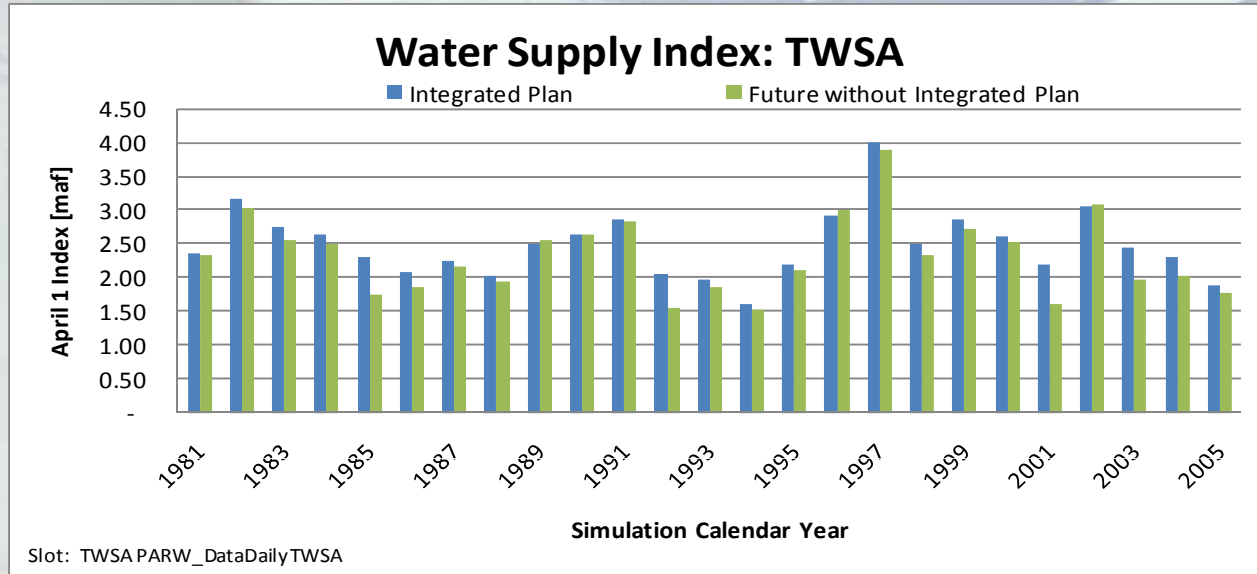


Reservoir Inflows - Effect of Climate Change

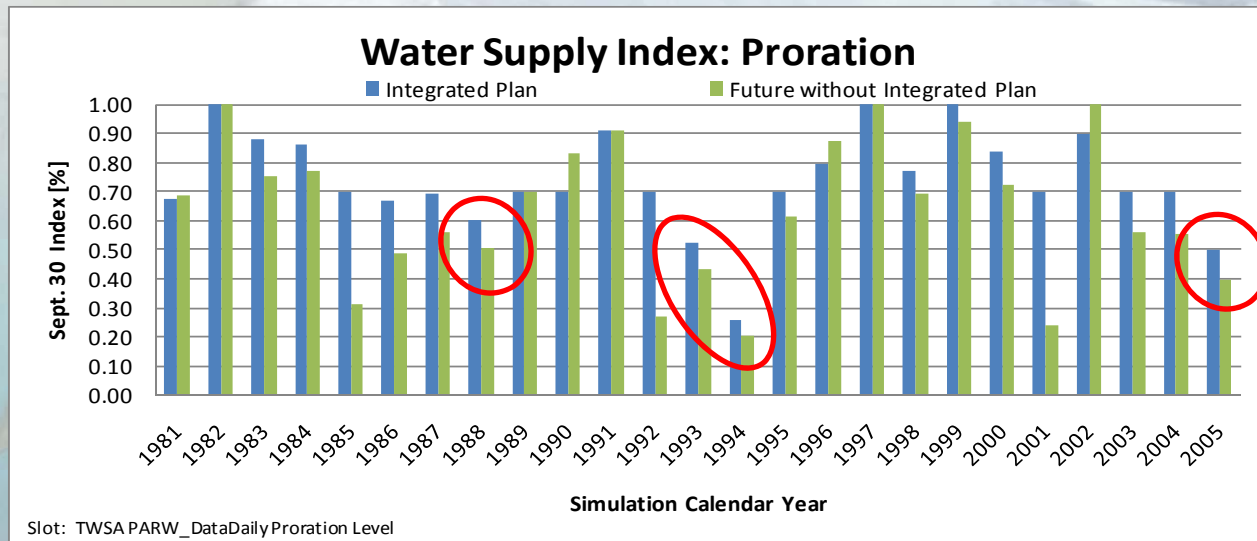
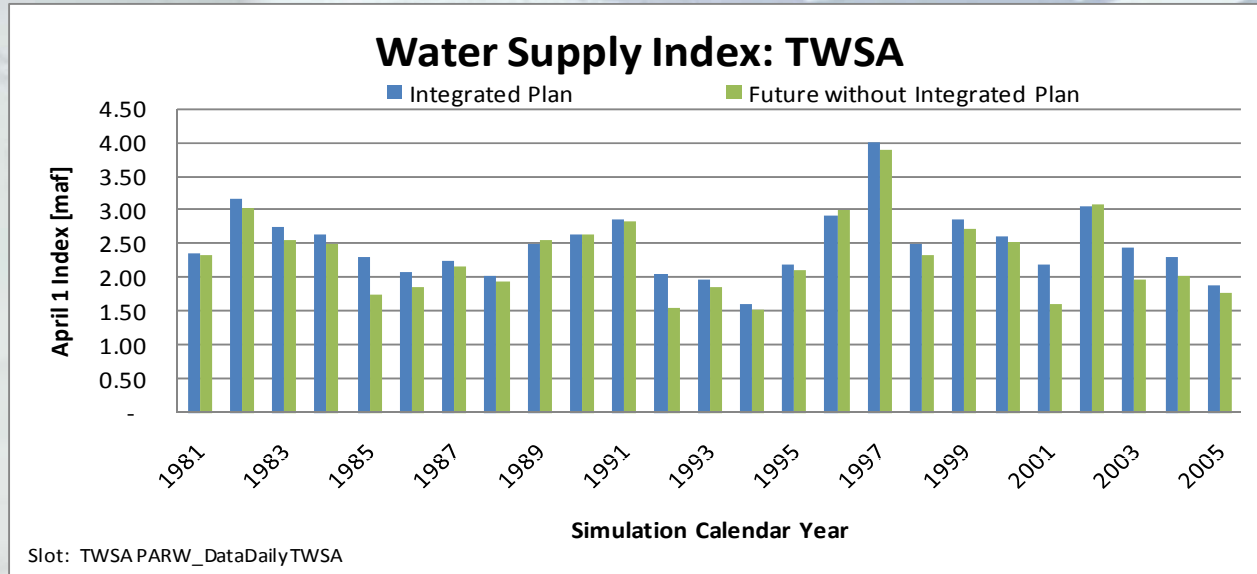
Average Reservoir Inflow Water Years 1981-2005
(Keechelus, Kachess, Cle Elum, Bumping and Rimrock)



Simulated Results Moderately Adverse



Simulated Results Moderately Adverse



Climate Change Conclusions

- The Integrated Plan still works under predicted Climate Change conditions.
- Moderately and More Adverse Climate Change Scenarios will reduce the ability of the Integrated Plan to meet water supply goals.
- To the extent these changes occur, adjusted system operations and water use responses will need to occur as well.

Project Costs - \$3 billion (present value)

- Fish Passage - \$324 million
- Habitat - \$460 million
- K to K Pipeline - \$191 million
- Kachess Inactive Storage - \$226 million
- Wymer Reservoir – 1,310 million
- Bumping Enlargement - \$402 million
- Canal improvements and other projects - \$112 million
- Enhanced Water Conservation - \$423 million

Project Benefits - \$2.2 - \$3.8 billion (present value)

- Increased farm earnings in severe droughts – \$400 million
- Increased supply of 50,000 acre-feet for M&I – \$100 million
- Increases in salmon & steelhead – \$1.7 to \$3.3 billion.
- Other benefits from higher fish populations, recreational opportunities and increased farm earnings in non-severe droughts – not quantified

QUESTIONS ?



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THANK YOU!



The Yakima Basin Integrated Water Resources Management Plan

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MORE INFORMATION:

Bureau of Reclamation

<http://www.usbr.gov/pn/programs/yrbwep/2011integratedplan>

Department of Ecology

http://www.ecy.wa.gov/programs/wr/cwp/cr_yak_storage.html

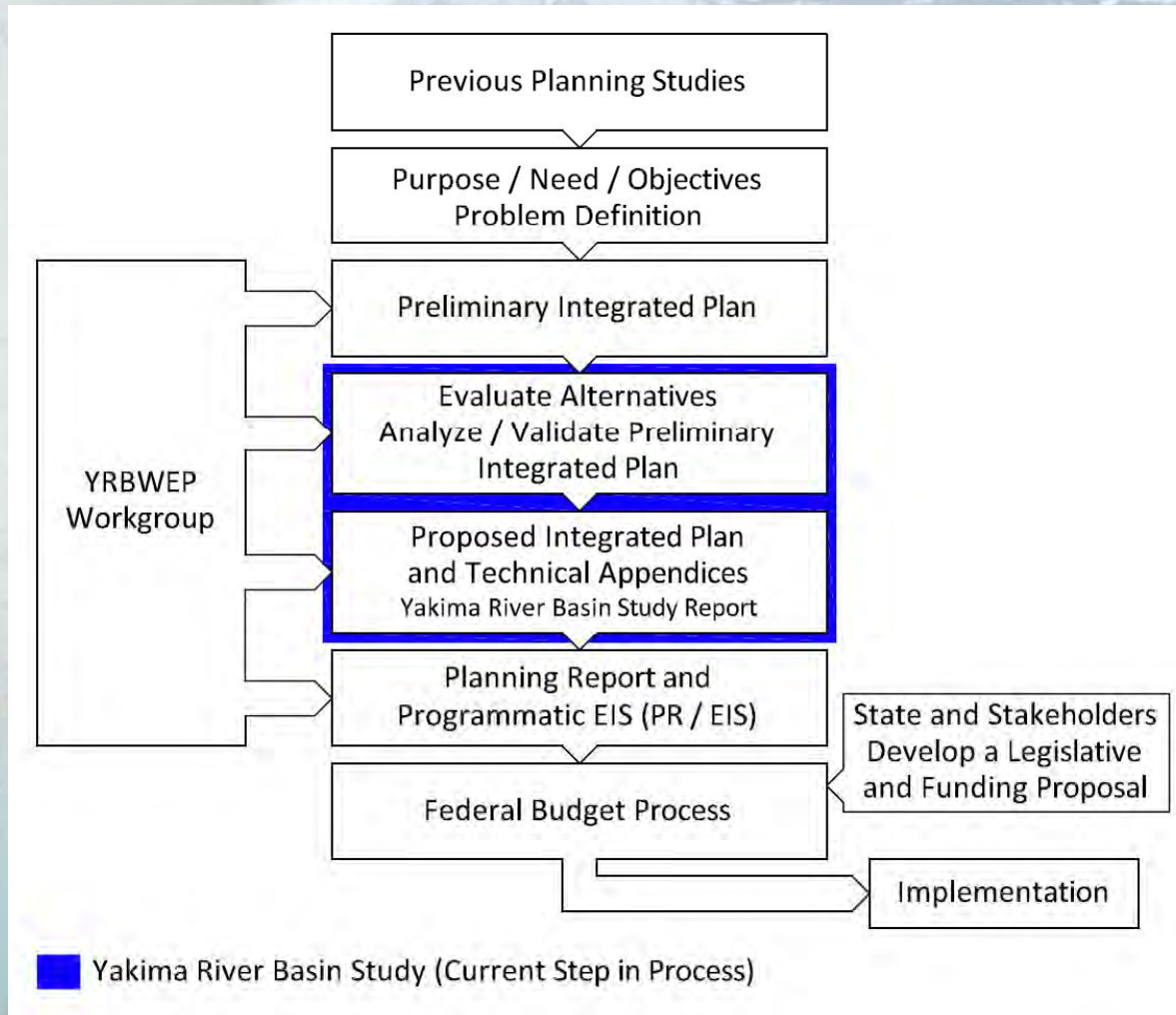
Or just search for Yakima Basin Integrated Plan



RMJOC Climate Scenarios - 2040

Climate Projections			"Climate Change"		
Number	Climate Model	Emissions Scenario	2040s		
			Change in P (in) ^[2]	Change in T (°C) ^[2]	
1	ccsm3	B1	-0.8	1.8	Moderately Adverse
2	cgcm3.1 t47	B1	11.5	1.3	
3	cnrm cm3	B1	5.3	1.2	
4	echam5	B1	5.9	1.2	
5	echo g	B1	-7.9	1.8	
6	hadcm	B1	3.7	1.7	
7	ipsl cm4	B1	6.9	2.1	
8	miroc 3.2	B1	10.4	2.3	
9	pcm1	B1	3.6	0.8	
10	ccsm3	A1b	2.0	2.4	Less Adverse
11	cgcm3.1 t47	A1b	13.4	1.8	
12	cnrm cm3	A1b	4.1	1.6	
13	echam5	A1b	3.7	1.5	
14	echo g	A1b	0.9	1.9	
15	hadcm	A1b	6.7	2.2	
16	ipsl cm4	A1b	11.2	2.6	
17	miroc 3.2	A1b	14.2	2.7	
18	pcm1	A1b	-0.2	1.8	
19	hadgem1	A1b	-2.5	2.8	More Adverse

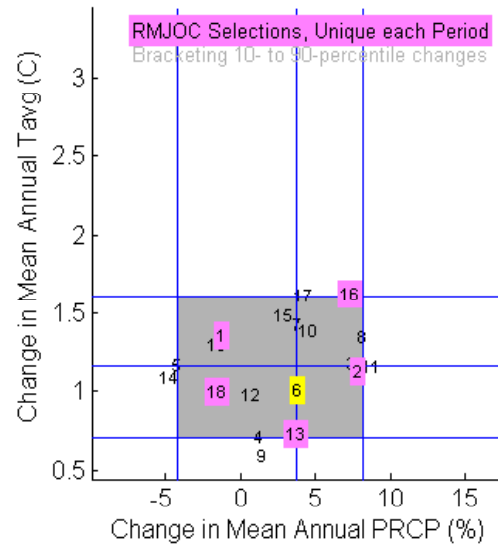
Status of Overall Efforts and Future Steps



RMJOC Scenarios

Climate Projections		
Number	Climate Model	Emissions Scenario
1	ccsm3	B1
2	cgcm3.1 t47	B1
3	cnrm cm3	B1
4	echam5	B1
5	echo g	B1
6	hadcm	B1
7	ipsi cm4	B1
8	miroc 3.2	B1
9	pcm1	B1
10	ccsm3	A1b
11	cgcm3.1 t47	A1b
12	cnrm cm3	A1b
13	echam5	A1b
14	echo g	A1b
15	hadcm	A1b
16	ipsi cm4	A1b
17	miroc 3.2	A1b
18	pcm1	A1b
19	hadgem1	A1b

Columbia-Snake Basin, Area-Average Condition
2010-2039 from 1970-1999



2030-2059 from 1970-1999

