Yakima River Basin Integrated Water Resource Management Alternative

- Package of elements designed to improve water supply and fish habitat
  - Fish passage
  - Structural and operational changes
  - New or expanded storage reservoirs
  - Ground water storage
  - Fish habitat enhancements
  - Enhanced water conservation
  - Market-based reallocation

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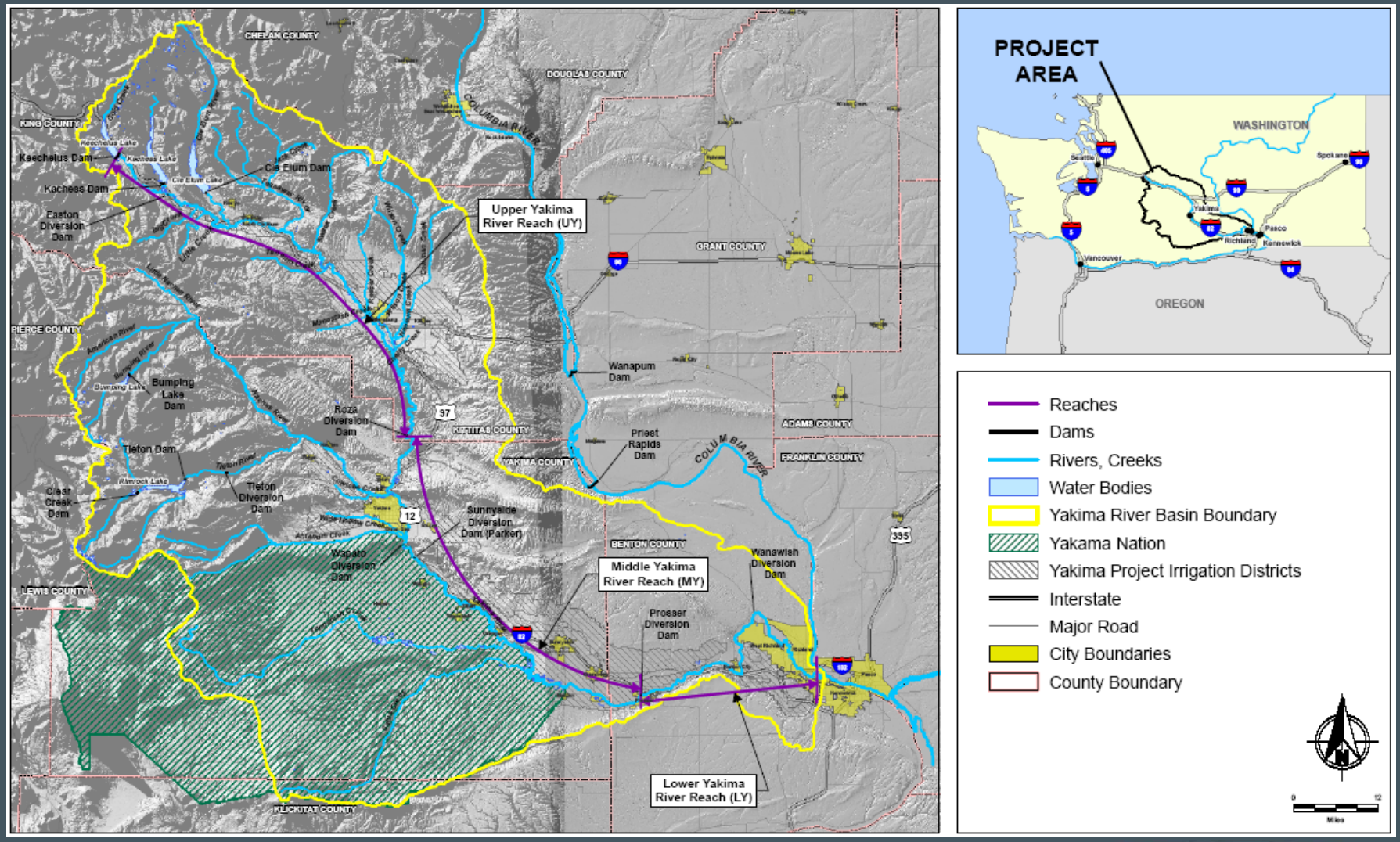
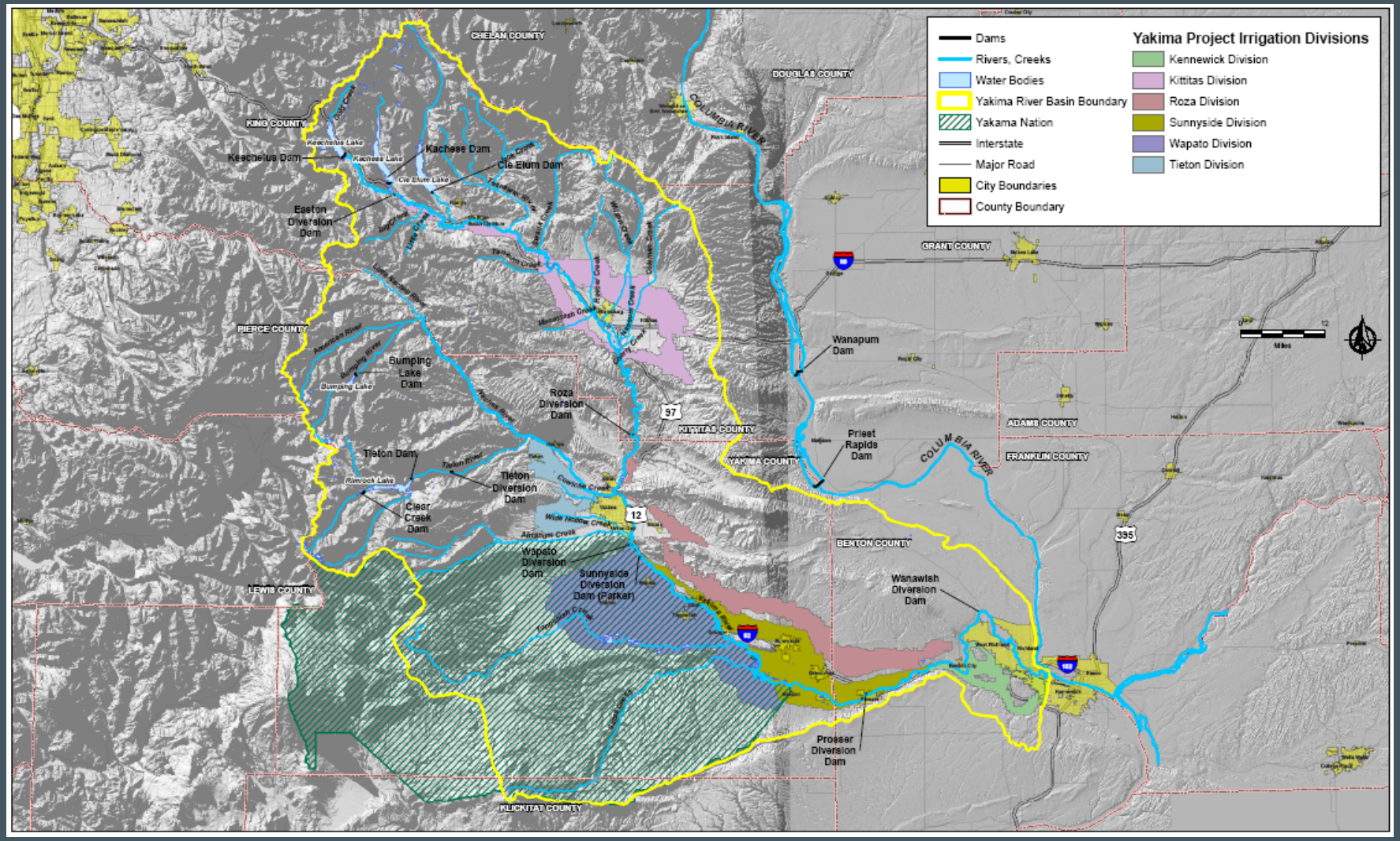
Yakima River Basin



Yakima River Basin



Surface Water Storage

- Alternatives
  - Naches River storage reservoirs
    - Bumping Lake Expansion
  - Wymer Reservoir
  - Tributary storage
    - Pine Hollow Reservoir

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Surface Water Storage

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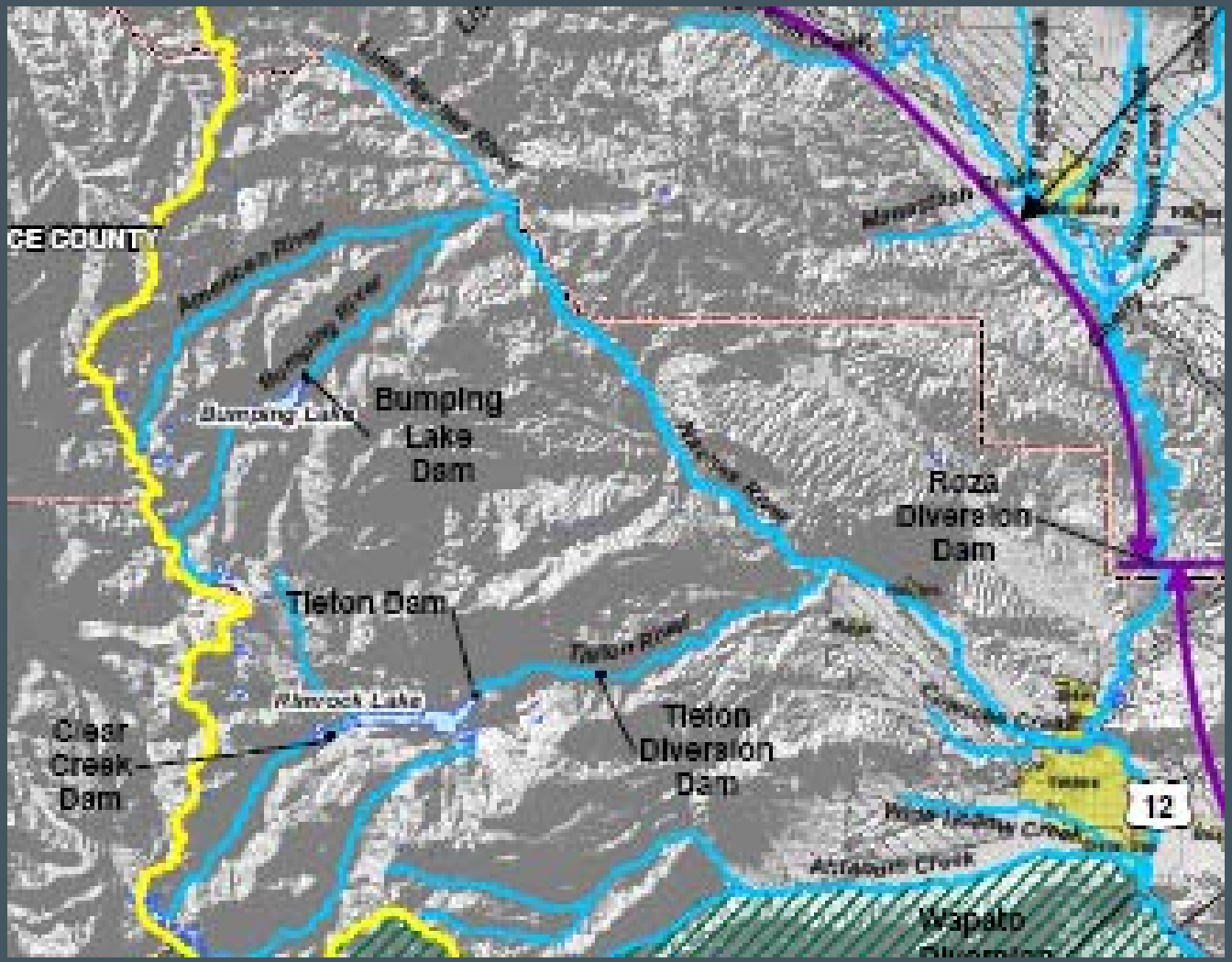
Water Storage – Naches River



Surface Water Storage – Naches River

- Bumping Lake Expansion
  - Proxy for Naches River storage reservoirs
  - Most developed proposal
  - Storage volume = 458,000 acre-feet
  - Modeled to determine water availability
    - Yakima Project RiverWare model
    - 25-year period (November 1980-October 2005) used in model

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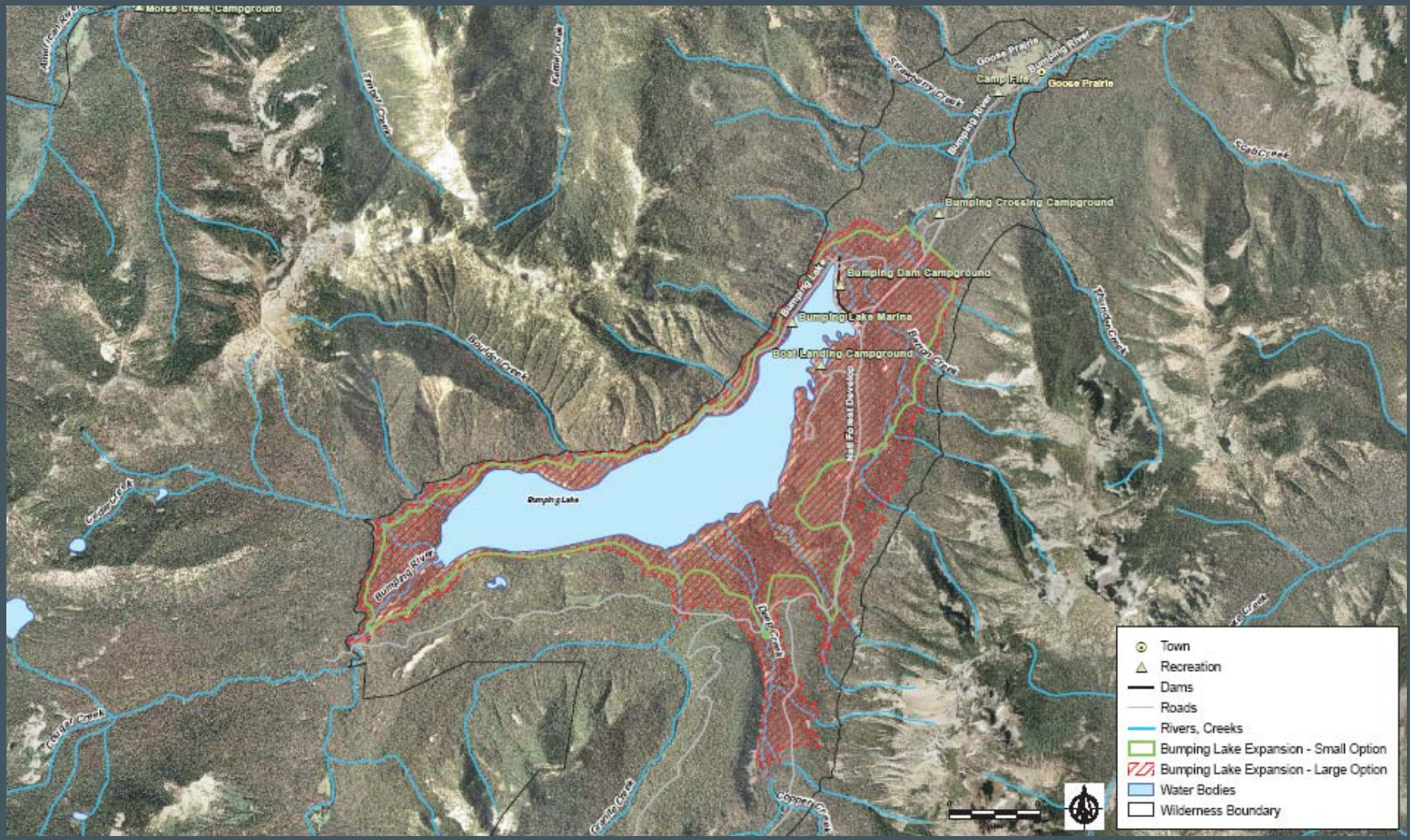
Water Storage – Naches River



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Bumping Lake Expansion

- RiverWare model assumptions
  - 458,000 acre-foot storage capacity
    - 33,700 acre-feet storage for TWSA
      - Same as current operation
    - 100,000 acre-feet storage for irrigation
      - Drought years only (proration less than 70%)
      - Used by proratable irrigation district
        - » Roza Irrigation District assumed in RiverWare
    - 324,300 acre-feet storage for flow enhancement

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Bumping Lake Expansion

- Modeling assumptions
  - Revised minimum flow releases to be met in all years
    - Improve flow for spring out-migration
      - November 1-March 31: 130 cfs (same as current)
      - April 1-April 15: 365 cfs
      - April 16-June 15: 600 cfs
      - June 16-June 30: 365 cfs
      - July 1-October 31: 130 cfs (same as current)
  - 42,000 acre-feet water released during drought years
    - 1,000 cfs pulse flows for Parker gage for 3 weeks

Bumping Lake Expansion

- Modeling assumptions
  - Reservoir fills during:
    - Winter flows (November-March) above 130 cfs
    - Spring flows (April-June) during high flow events
      - When Bumping River and Yakima River at Parker flow targets are met
        - » Targets yet to be decided
        - » Should be very infrequent occurrence

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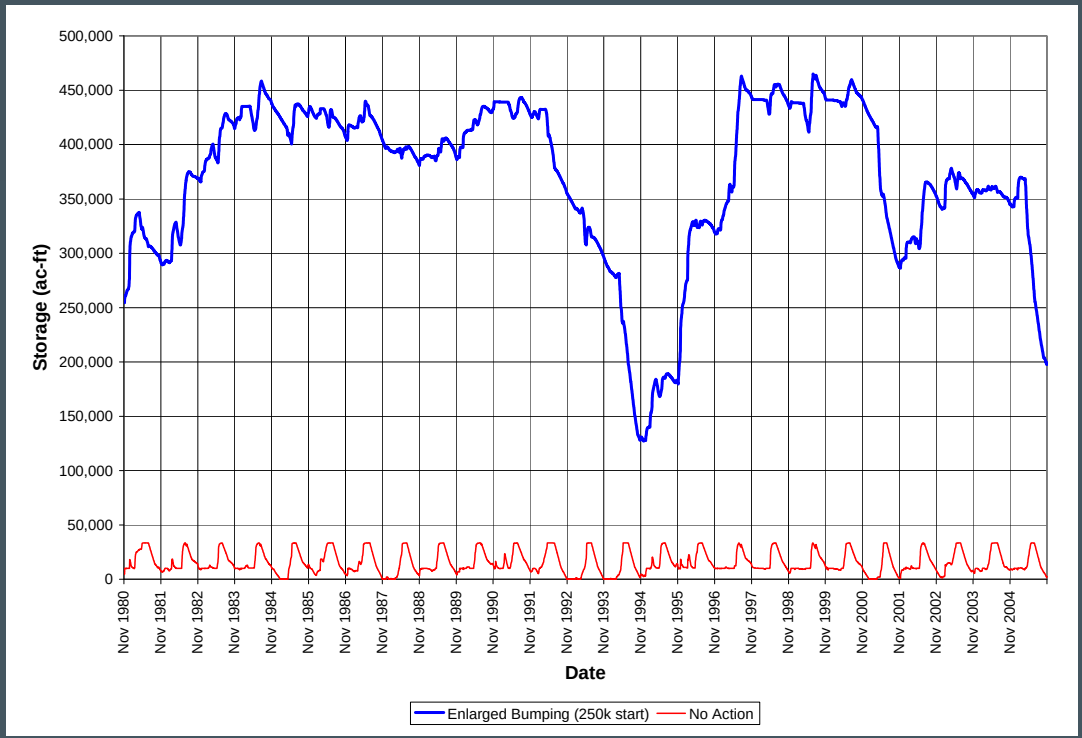
Bumping Lake Expansion

- Modeling results for Bumping Lake Expansion as stand-alone element
  - Bumping Lake storage volume



Bumping Lake Expansion

- Modeling results for Bumping Lake Expansion as stand-alone element
  - Roza Irrigation District drought year water supply

Year	Roza Irrigation Volume (ac-ft)		Proration Percentage Based on Entitlement (375,000 ac-ft)		
	Current Operations	Bumping Lake Expansion – Large Option	Current Operations	Bumping Lake Expansion – Large Option	Difference
1992	252,686	230,285	67%	61%	-6%
1993	229,523	249,169	61%	66%	5%
1994	143,055	208,829	38%	56%	18%
2001	159,252	205,541	42%	55%	12%
2005	148,304	204,106	40%	54%	15%
Average (non-prorated years)	349,844	349,844			

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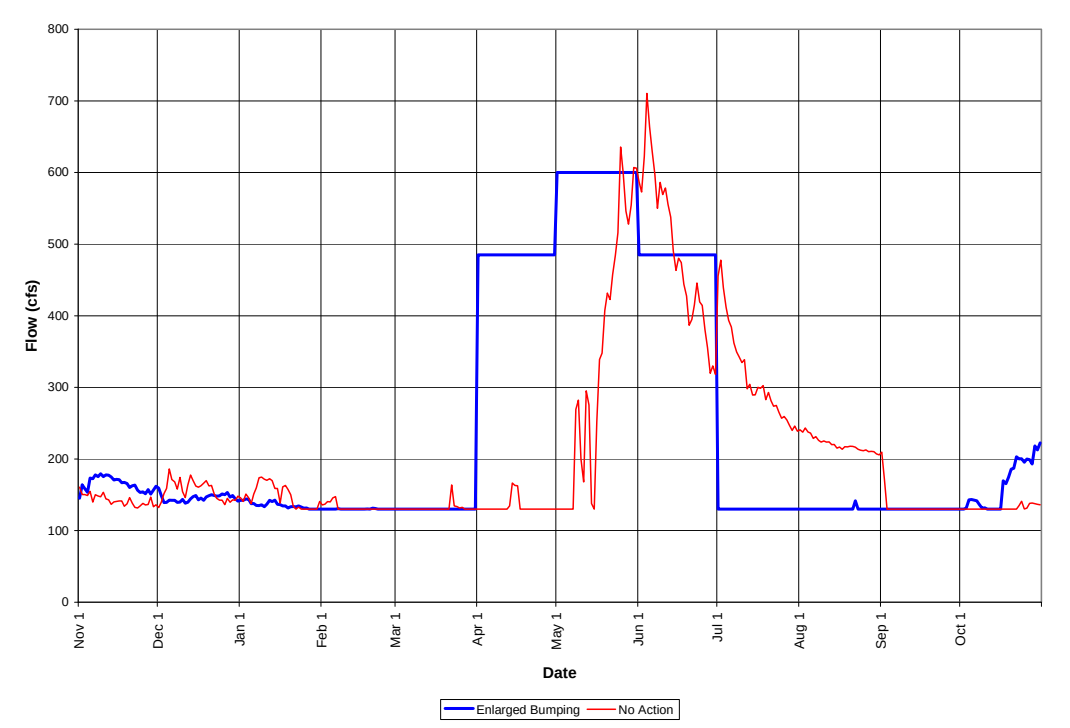
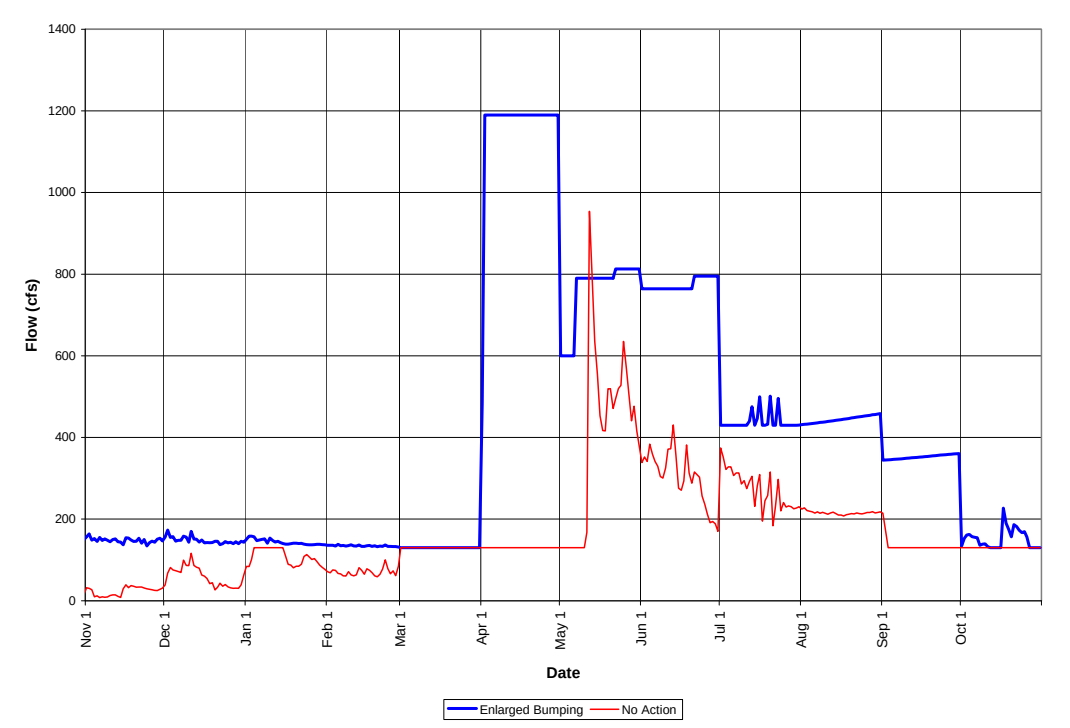
Bumping Lake Expansion

- Modeling results for Bumping Lake Expansion as stand-alone element
  - Bumping River median flow



Bumping Lake Expansion

- Modeling results for Bumping Lake Expansion as stand-alone element
  - Bumping River drought flow – 1994



Bumping Lake Expansion

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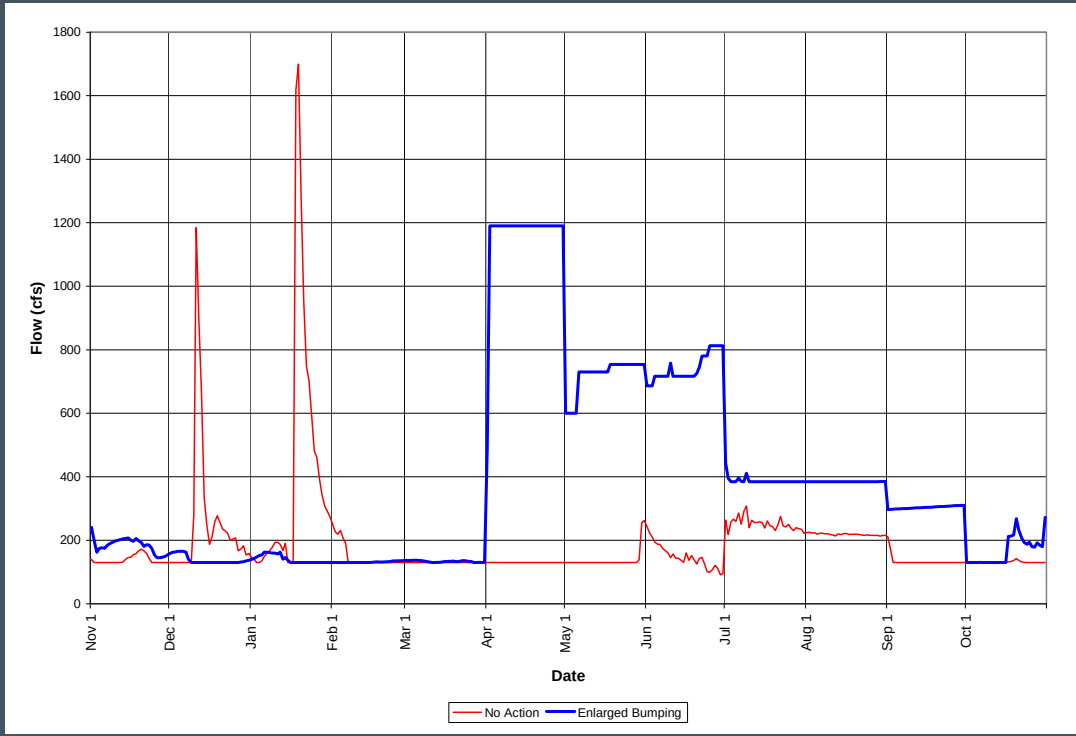
  - Bumping River drought flow – 2005



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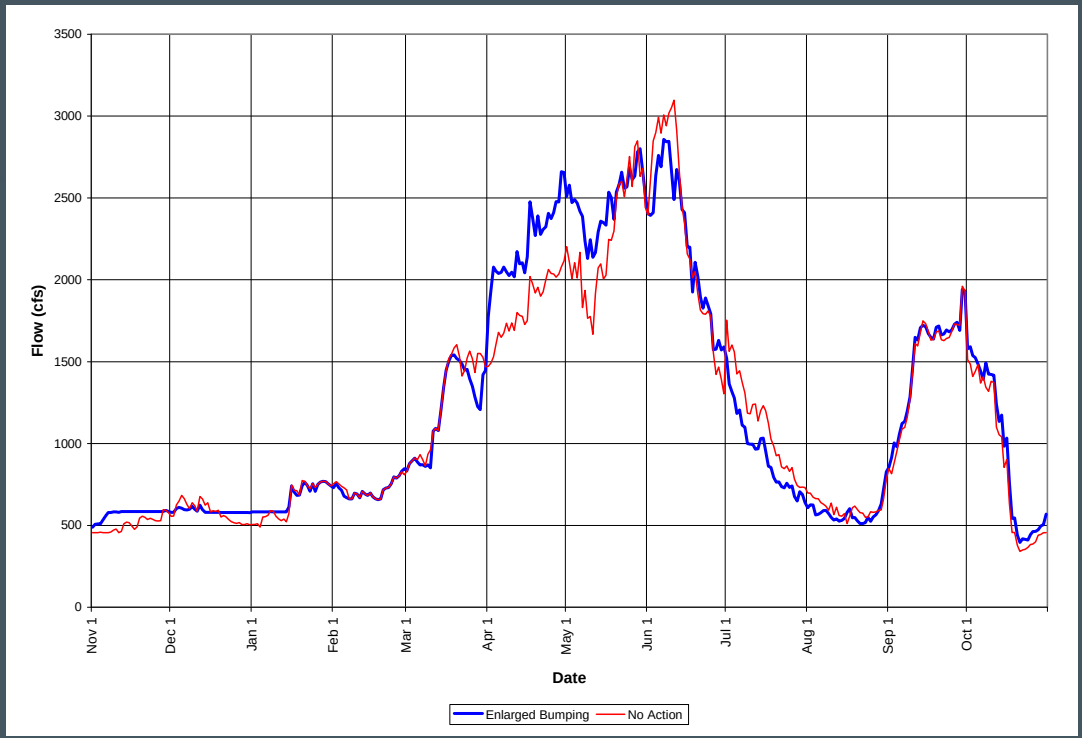
Bumping Lake Expansion

- Modeling results for Bumping Lake Expansion as stand-alone element
  - Naches River near Naches median flow



Bumping Lake Expansion

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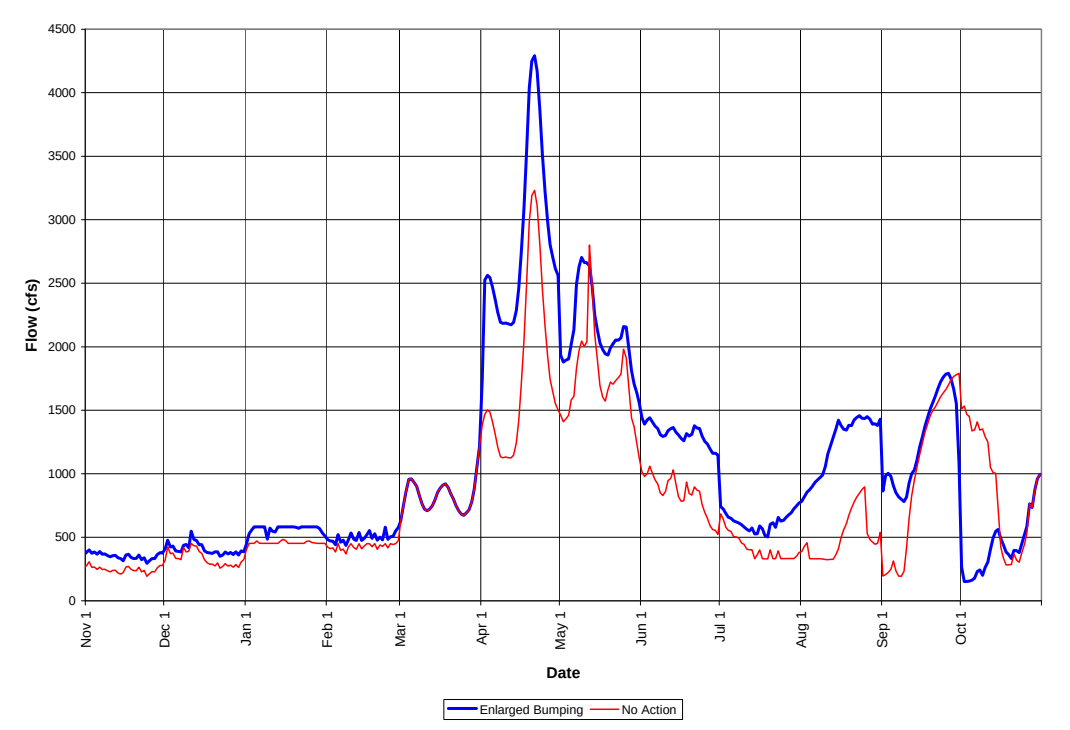

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Bumping Lake Expansion

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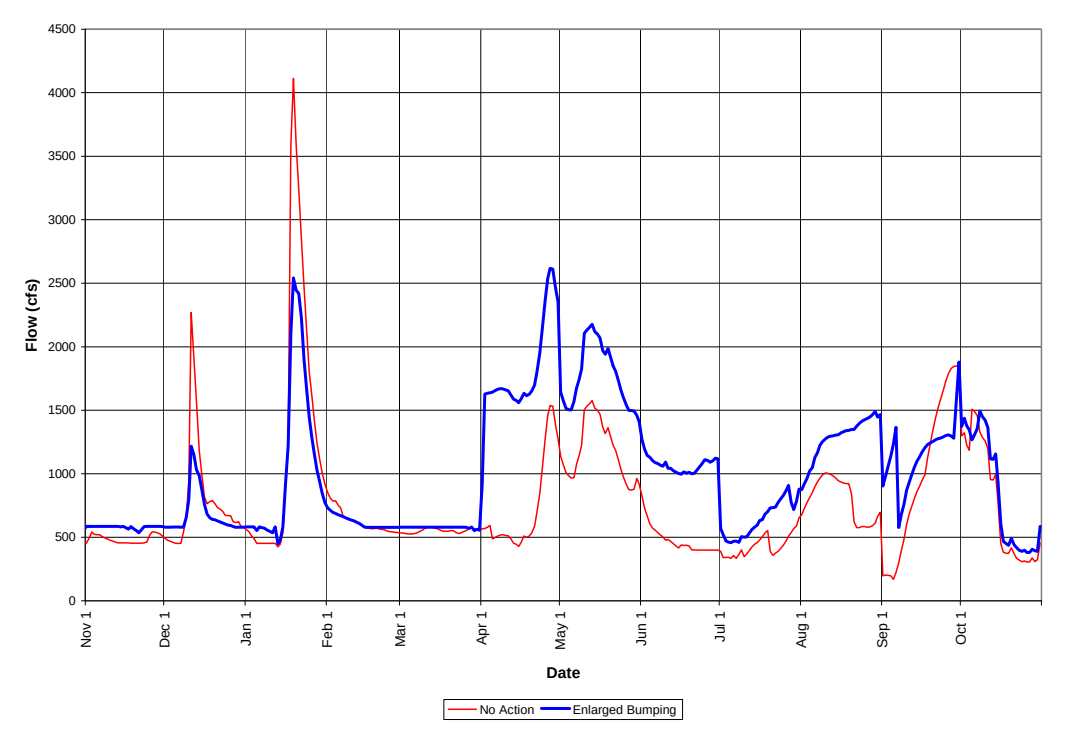

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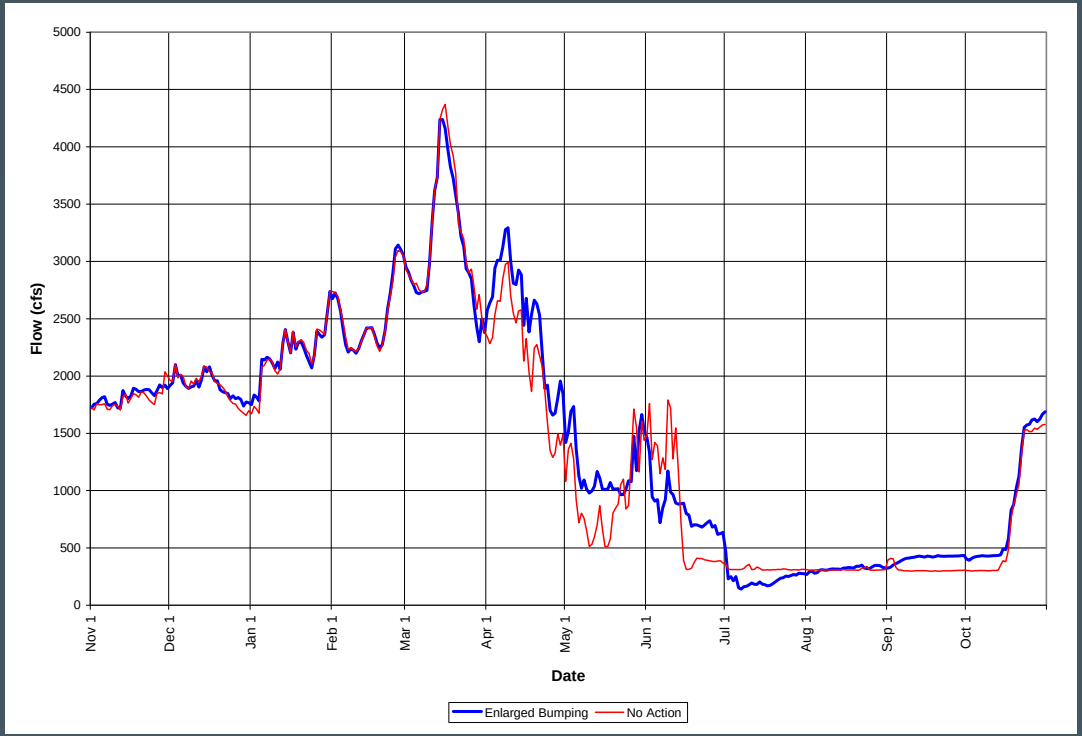
Bumping Lake Expansion

- Modeling results for Bumping Lake Expansion as stand-alone element
  - Yakima River at Parker median flow



Bumping Lake Expansion

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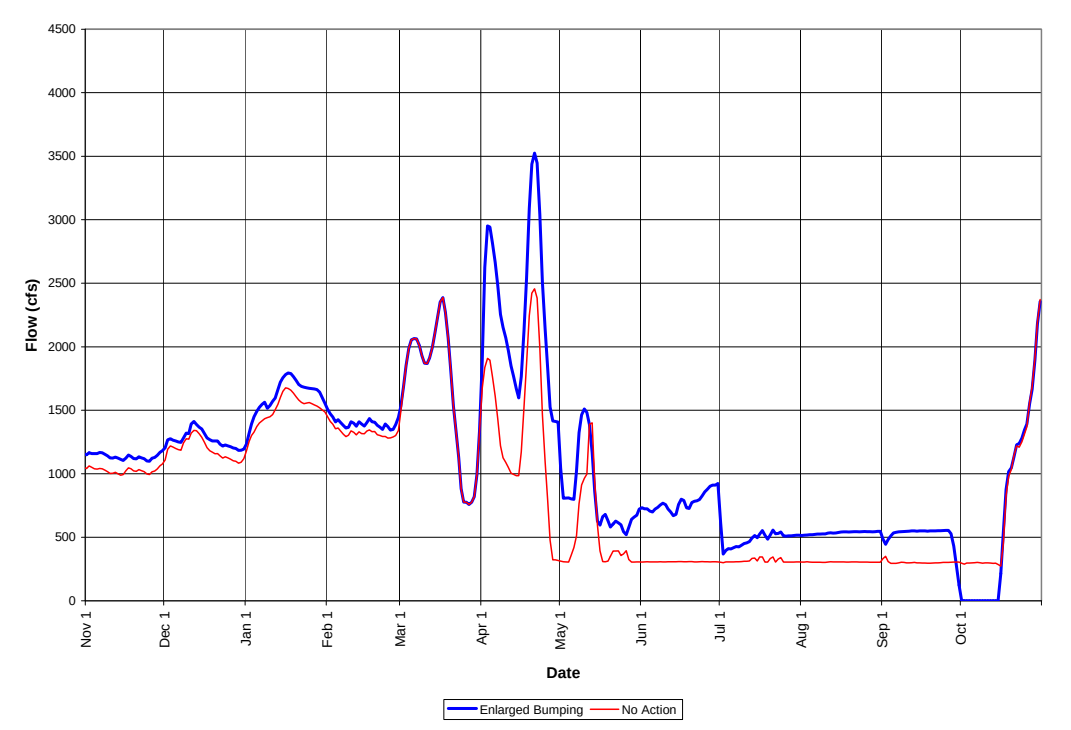

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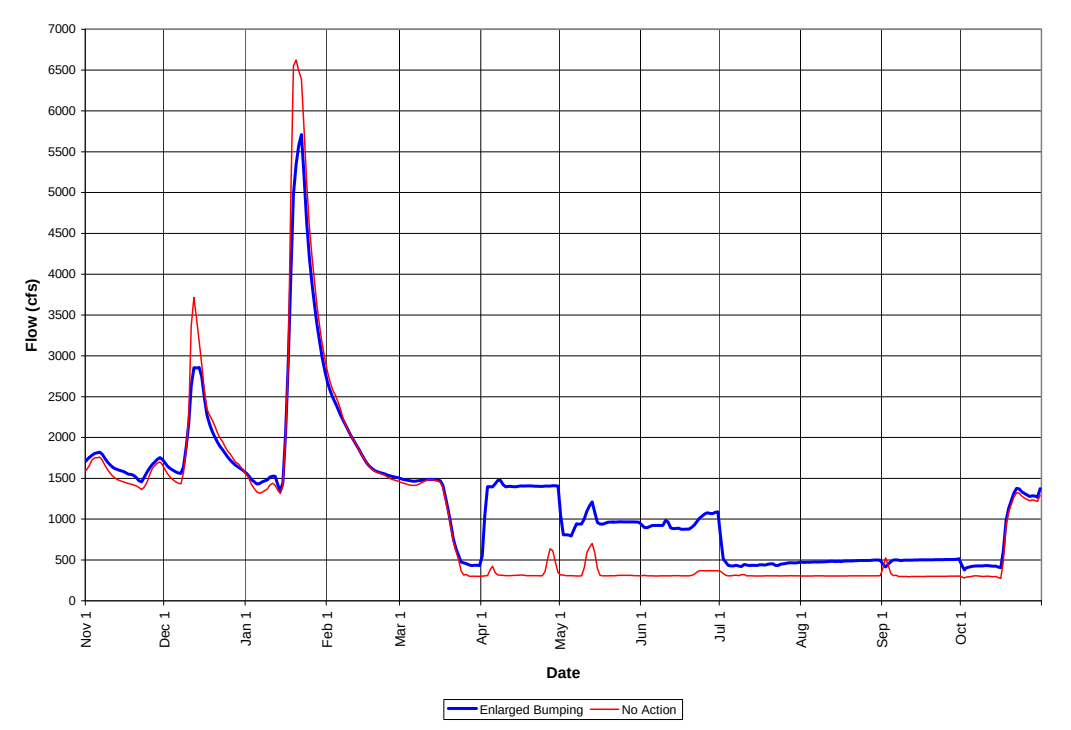

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Bumping Lake Expansion

- Summary of benefits for Bumping Lake Expansion as stand-alone element
  - Improved Bumping River flow for spring out-migration
  - 1,000 cfs increase in spring for pulse flows in Naches River and Yakima River below Parker
  - Additional irrigation storage water available during drought years for proratable irrigation district(s)

Surface Water Storage

- Alternatives
  - Naches River storage reservoirs
    - Bumping Lake Expansion
  - Wymer Reservoir
  - Tributary storage
    - Pine Hollow Reservoir

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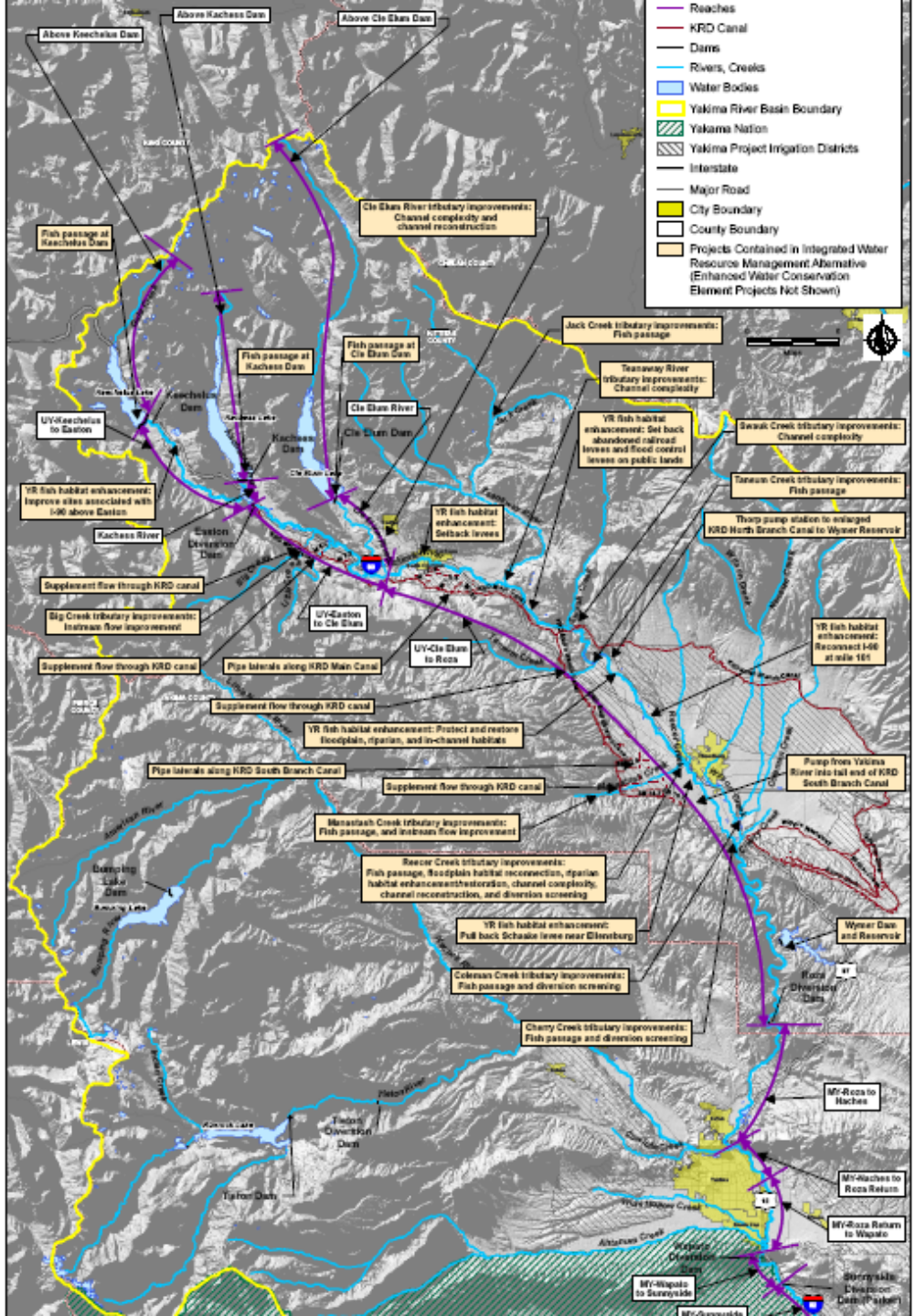
Wymer Reservoir



Wymer Reservoir

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Wymer Reservoir

- Similarities to Reclamation's proposal
  - 162,500 acre-foot capacity reservoir
    - 82,500 acre-feet storage for fish enhancement
      - Released in July and August to meet irrigation demands and YRBWEP target flows
    - 80,000 acre-feet storage for irrigation
      - Storage is part of TWSA, is released when proration level is less than 70%

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Wymer Reservoir

- Differences from Reclamation's proposal
  - Thorp to Wymer pump station
    - Pump 500-1000 cfs into enlarged North Branch Canal of Kittitas Reclamation District or separate pipeline
      - Cle Elum Lake can be used to supply pump station, flow from unregulated tributaries can be captured
    - Convey flow around Yakima River between Thorp and Wymer, approximately 44 miles of canal and 4 miles of tunnels
      - Reduces high summer flow by pumping amount
    - Can recover energy through hydroelectric plant at outlet of Wymer Dam

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Wymer Reservoir

- Modeling results for Thorp to Wymer option as stand-alone element
  - April 1 TWSA
    - 3.2% increase on average
    - 8% increase in drought year 1994
    - 3.4% increase in drought year 2005
  - April-September diversion volume upstream of Parker
    - 5.9% increase on average
    - 15.5% increase in drought year 1994
    - 7.7% increase in drought year 2005

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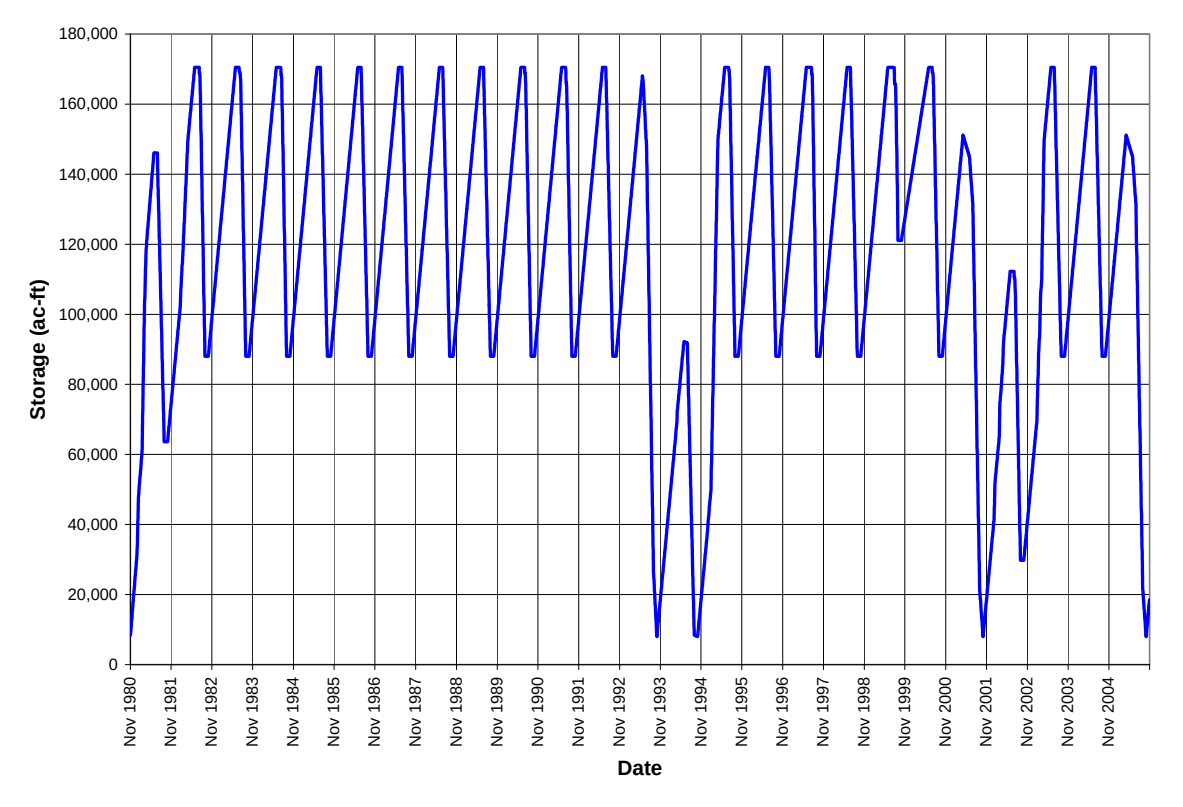
Wymer Reservoir

- Modeling results for Thorp to Wymer option as stand-alone element
  - Irrigation proration level
    - 5% increase on average
    - 14% increase in drought year 1994
    - 5% increase in drought year 2005
  - September 30 storage
    - 49.6% increase on average
    - 23.9% increase in drought year 1994
    - 99.0% increase in drought year 2005

Wymer Reservoir

- Modeling results for Thorp to Wymer option as stand-alone element
  - Wymer Reservoir storage volume



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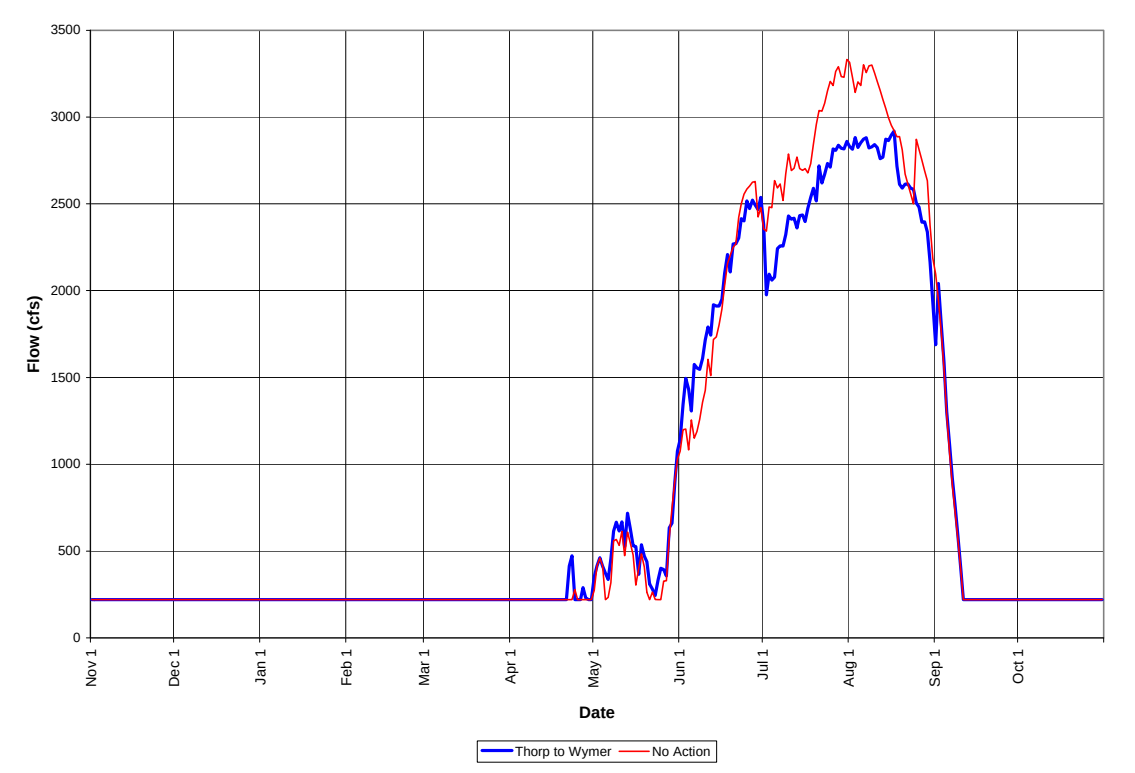
Wymer Reservoir

- Modeling results for Thorp to Wymer option as stand-alone element
  - Cle Elum River below dam median flow



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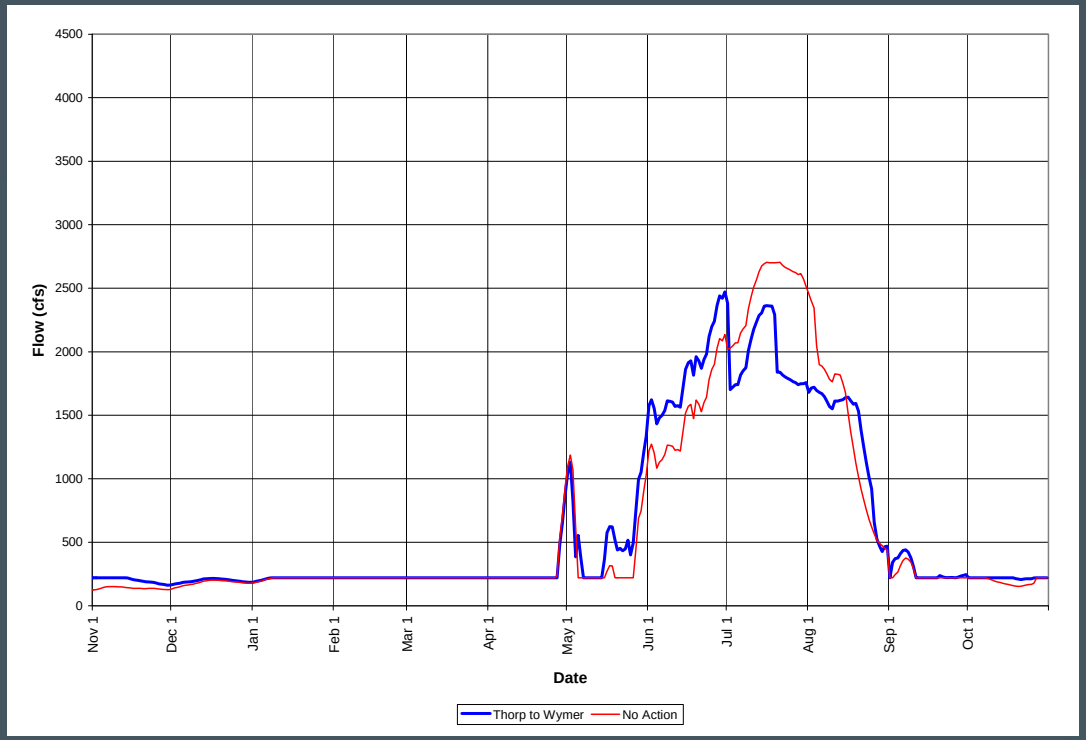

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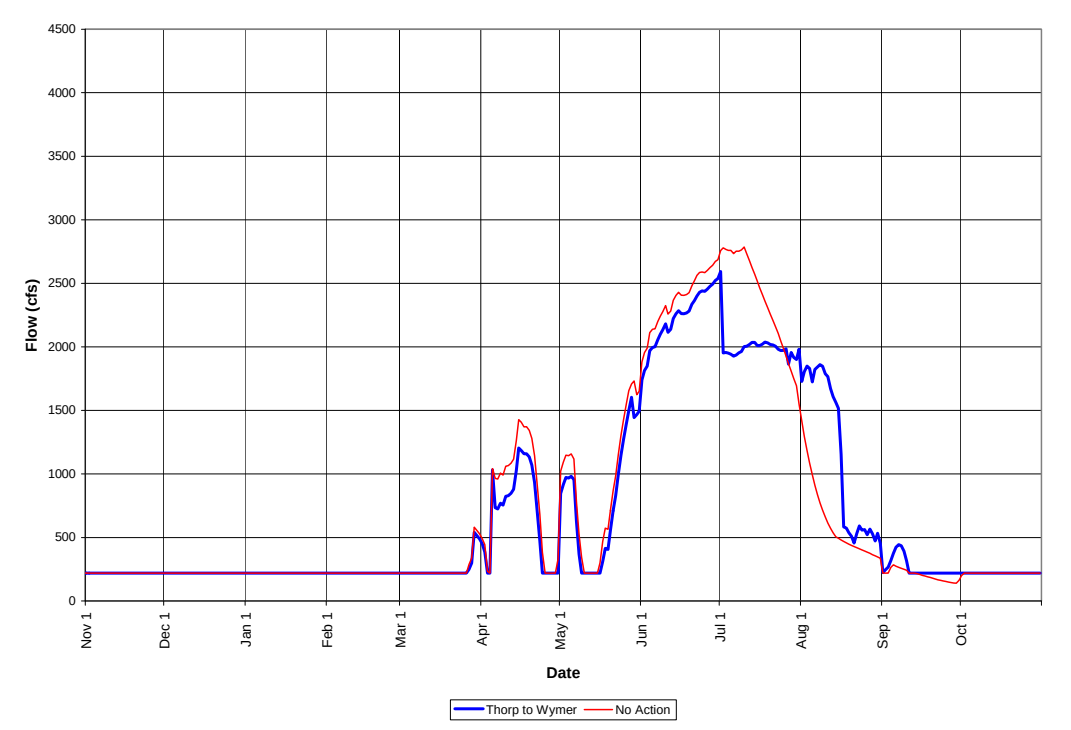

Wymer Reservoir

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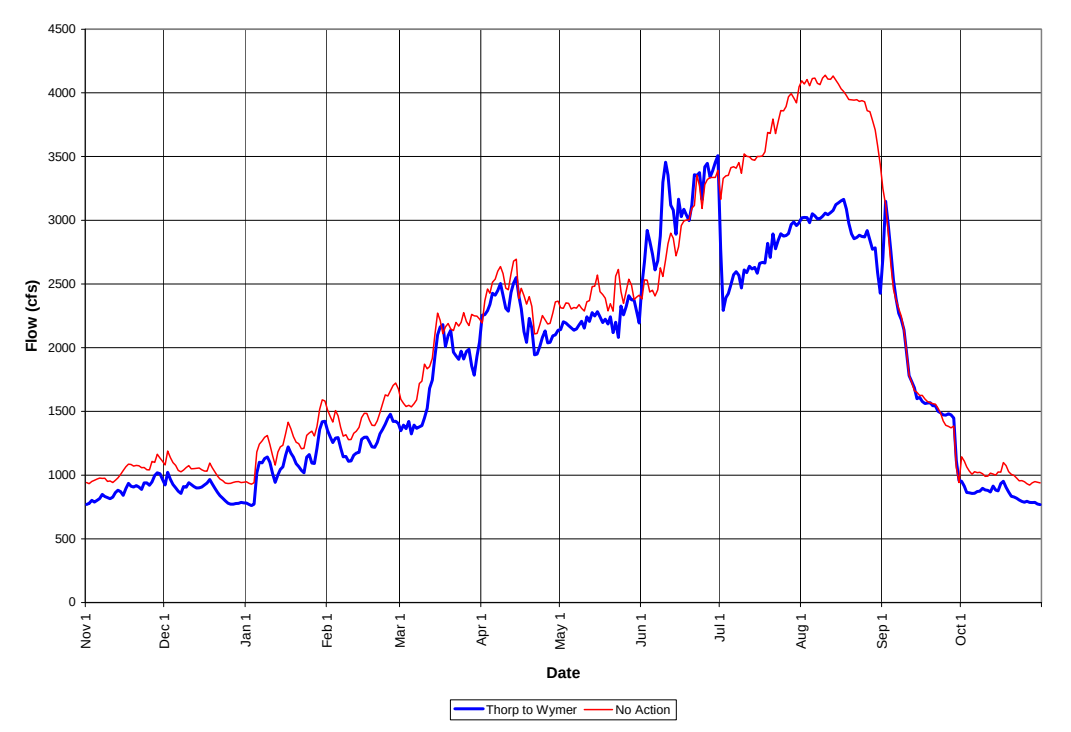
  - Yakima River at Umtanum median flow



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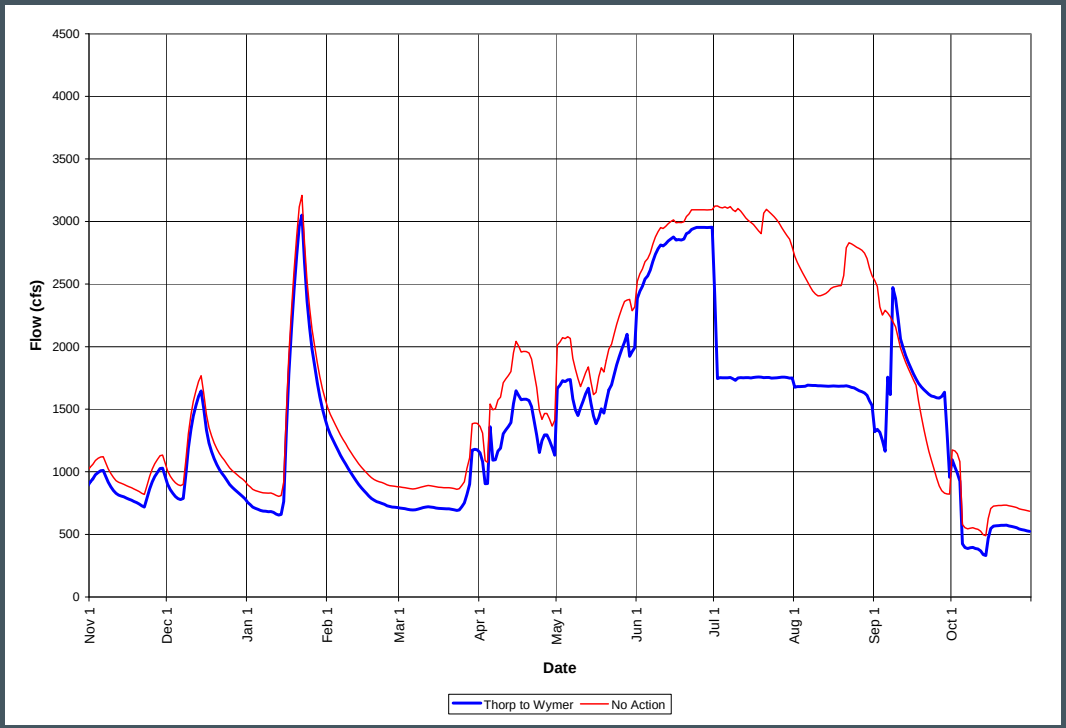

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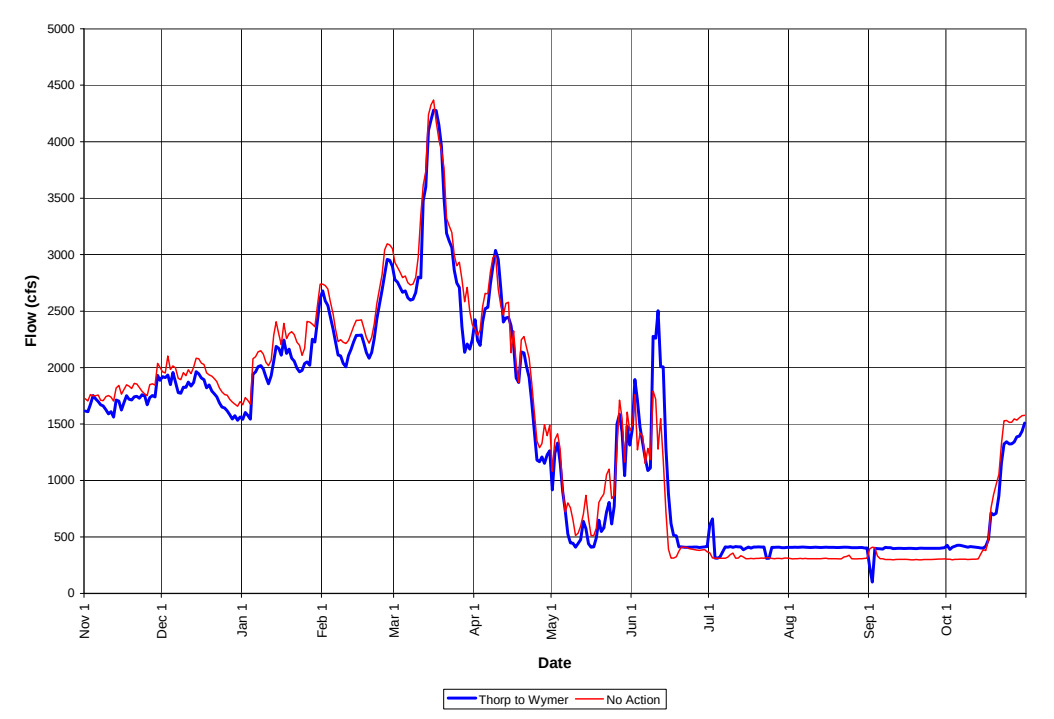

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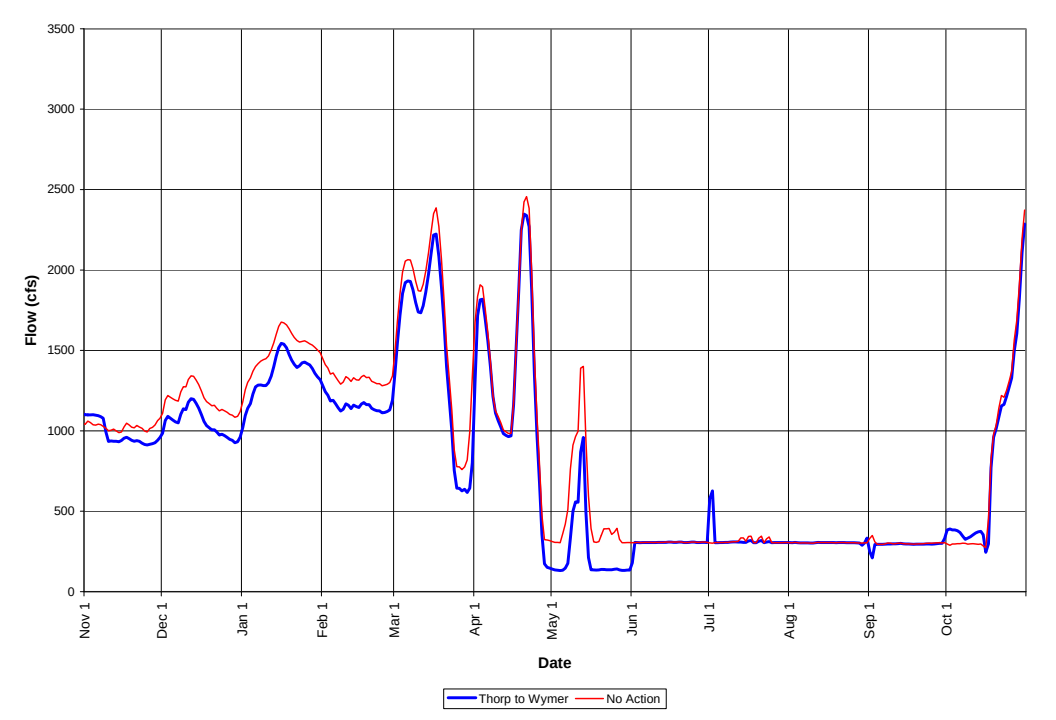

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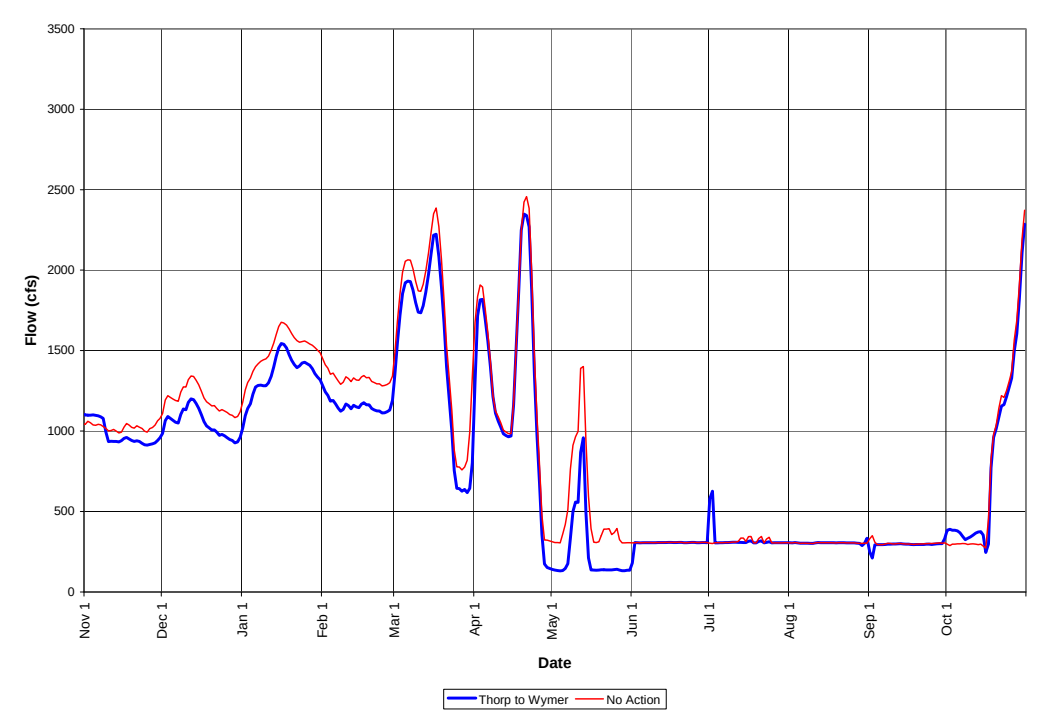

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Wymer Reservoir

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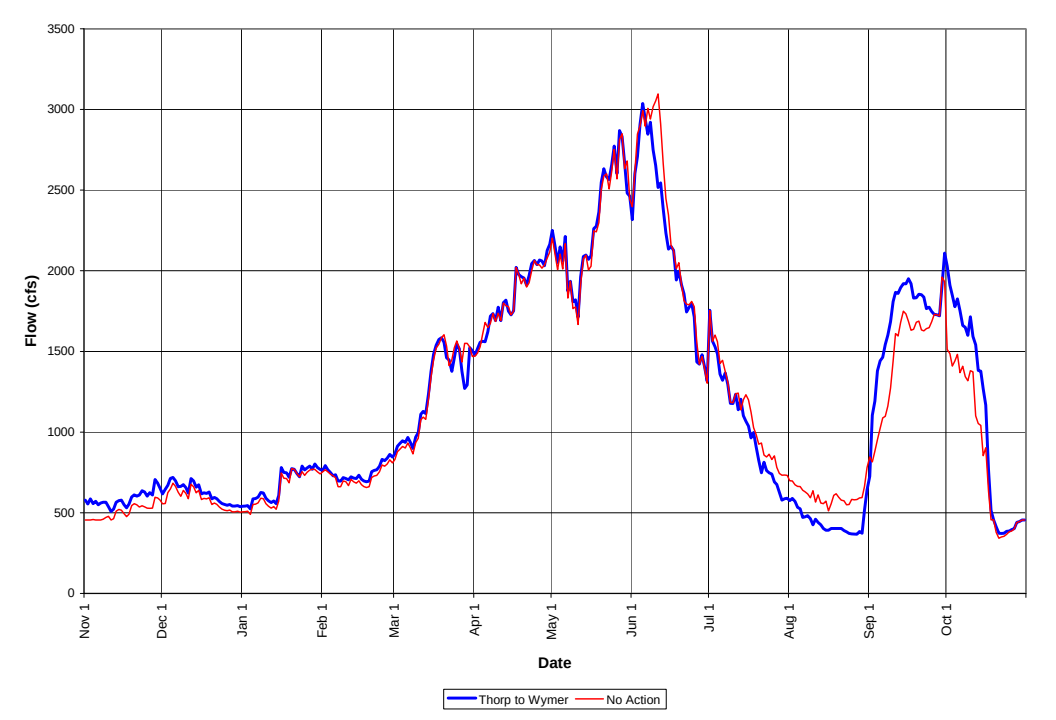

Wymer Reservoir

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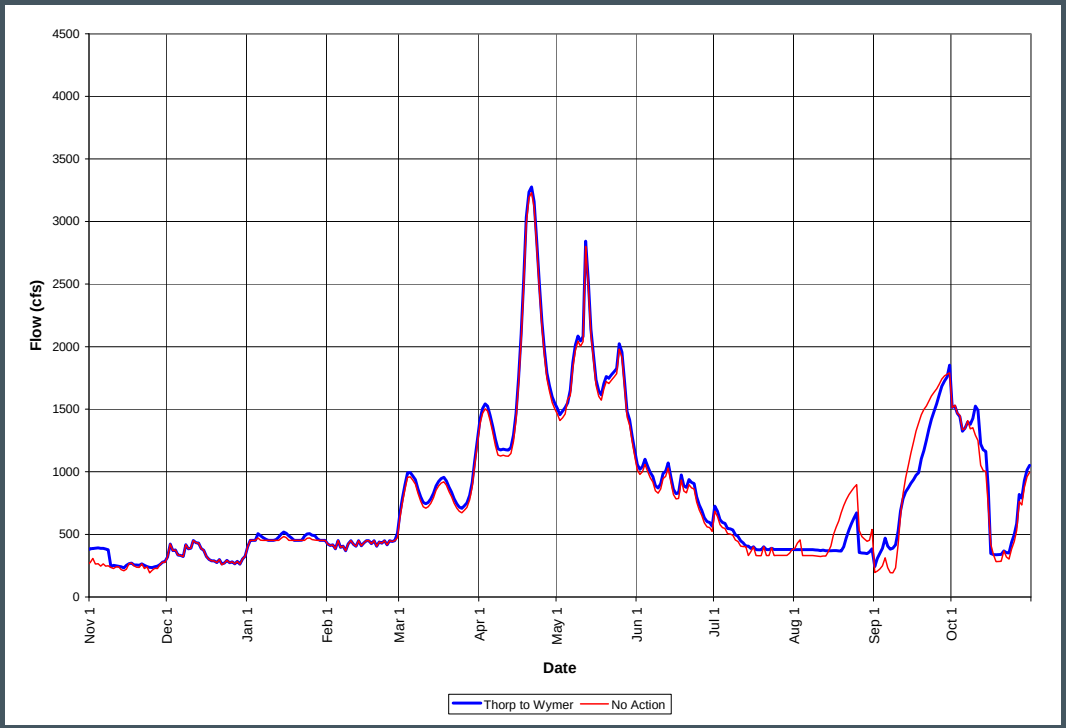

Wymer Reservoir

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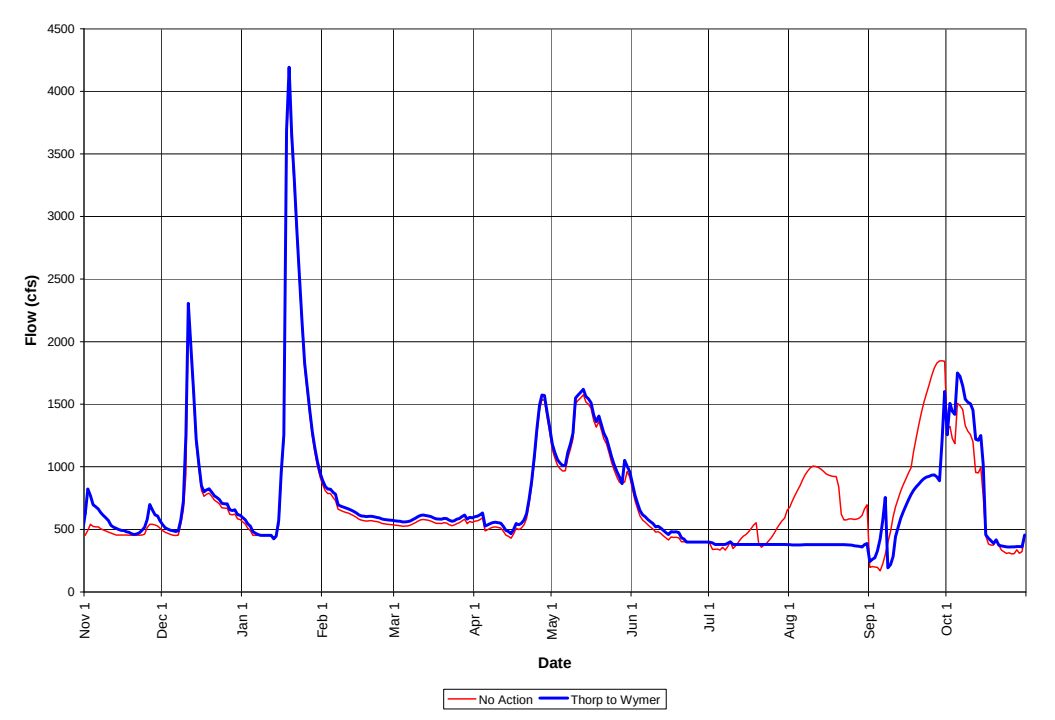

Wymer Reservoir

- Summary of benefits for Thorp to Wymer option as stand-alone element
  - 500 cfs reduction in summer flows in Cle Elum River
  - 500-1,000 cfs reduction in summer flows between Thorp and Wymer
  - Increase in winter flows in Cle Elum River
  - Increase in April 1 TWSA
  - Increase in proration level
  - Increase in September 30 storage
  - If KRD North Branch Canal is expanded and used, it will help the reliability of the KRD system