

REACH: YAKIMA RIVER, KEECHELUS DAM TO LAKE EASTON

REACH FLOW PROBLEM:

Flow is too high in July, August and 1st week of September. Winter flow is lower than desired, pulses are absent.

REACH FLOW OBJECTIVE:

The objective is to improve rearing during July-early September by reducing flows down to 450-550 cfs and increasing winter flow to 120 cfs. Periodic pulses are desired to mimic natural flow conditions.

SPECIES AND LIFE STAGES BENEFITTED:

Adult Migration: Steelhead, spring Chinook, Coho and sockeye

Spawning: Steelhead, spring Chinook, Coho

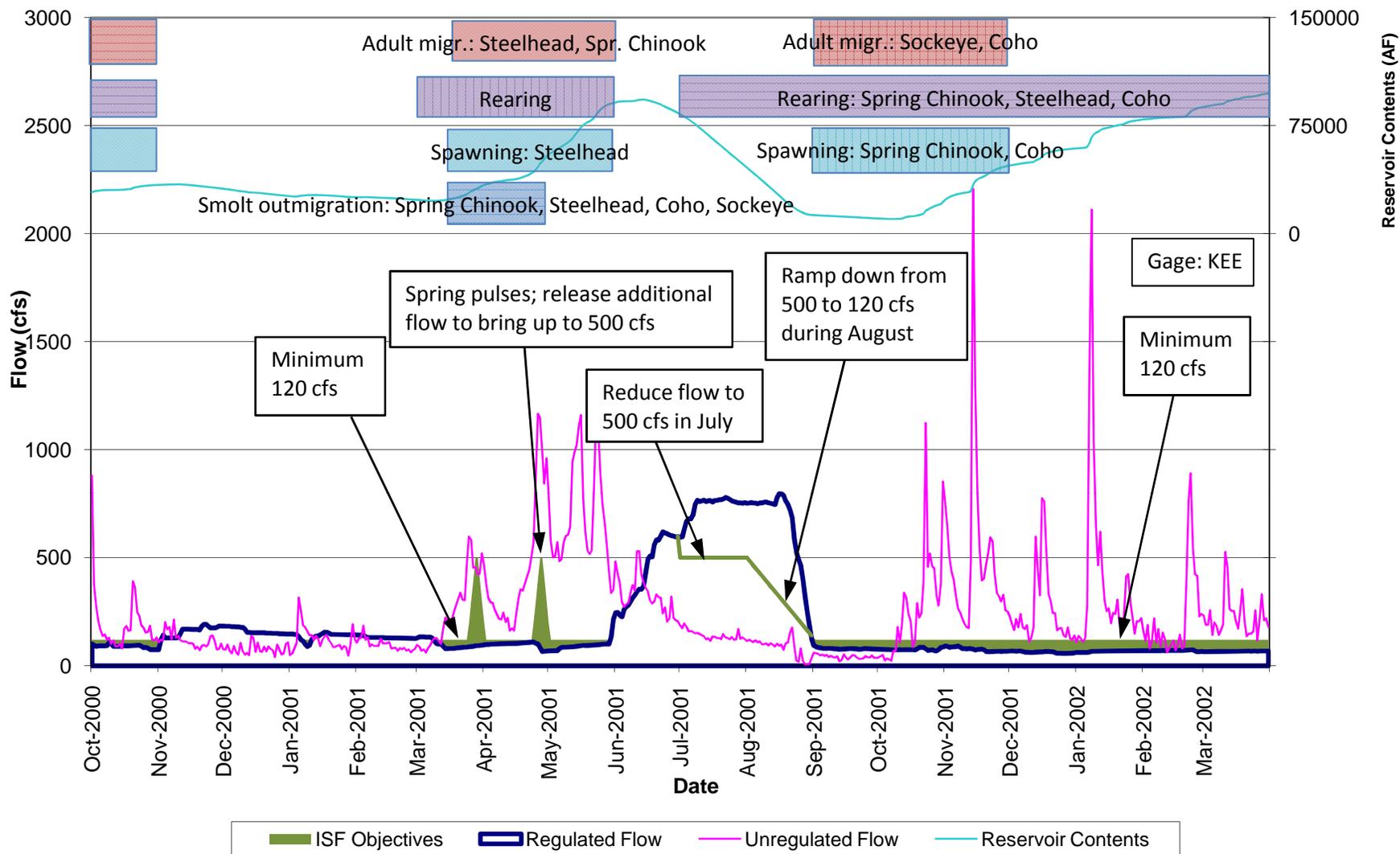
Rearing: Steelhead, spring Chinook, Coho

Smolt Outmigration: Steelhead, spring Chinook, Coho and sockeye

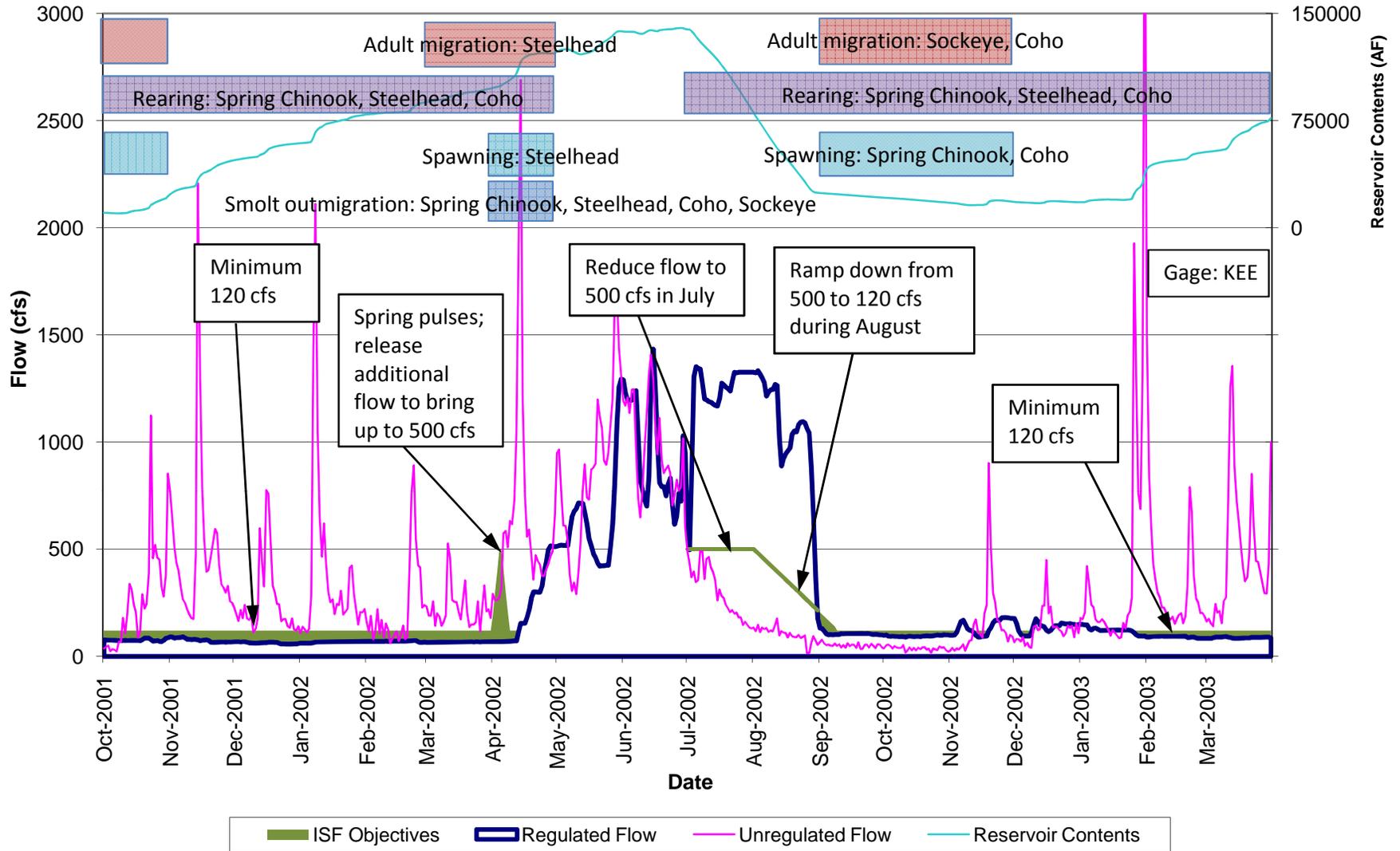
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are the K-K Pipeline, Wymer Reservoir and other possible storage proposals (Kachess Inactive Storage, Bumping, Cle Elum pool raise, etc). The hydrologic model will test the capability of these elements to meet the reach flow objectives. In general, water will be released from Keechelus Dam during winter to provide an average of 120 cfs flow and flow pulses. The water released during wet years may not need to be stored downstream as there would be sufficient runoff to meet entitlements during the irrigation season. During spring operations, additional water would be released to provide a strong pulse in April (up to channel shaping flows perhaps). In summer water would be released through both the K-K pipeline (up to 400 cfs) and the Yakima River but the flow in the Yakima River would be curtailed as much as possible to meet the 450-550 cfs flow objective in July-early September. To accomplish that, water will be conserved in Keechelus Reservoir during summer and that flow demand met through additional storage in Wymer, Cle Elum or Bumping reservoirs (and possibly Kachess). The water can be released the following winter to refill Wymer or Kachess.

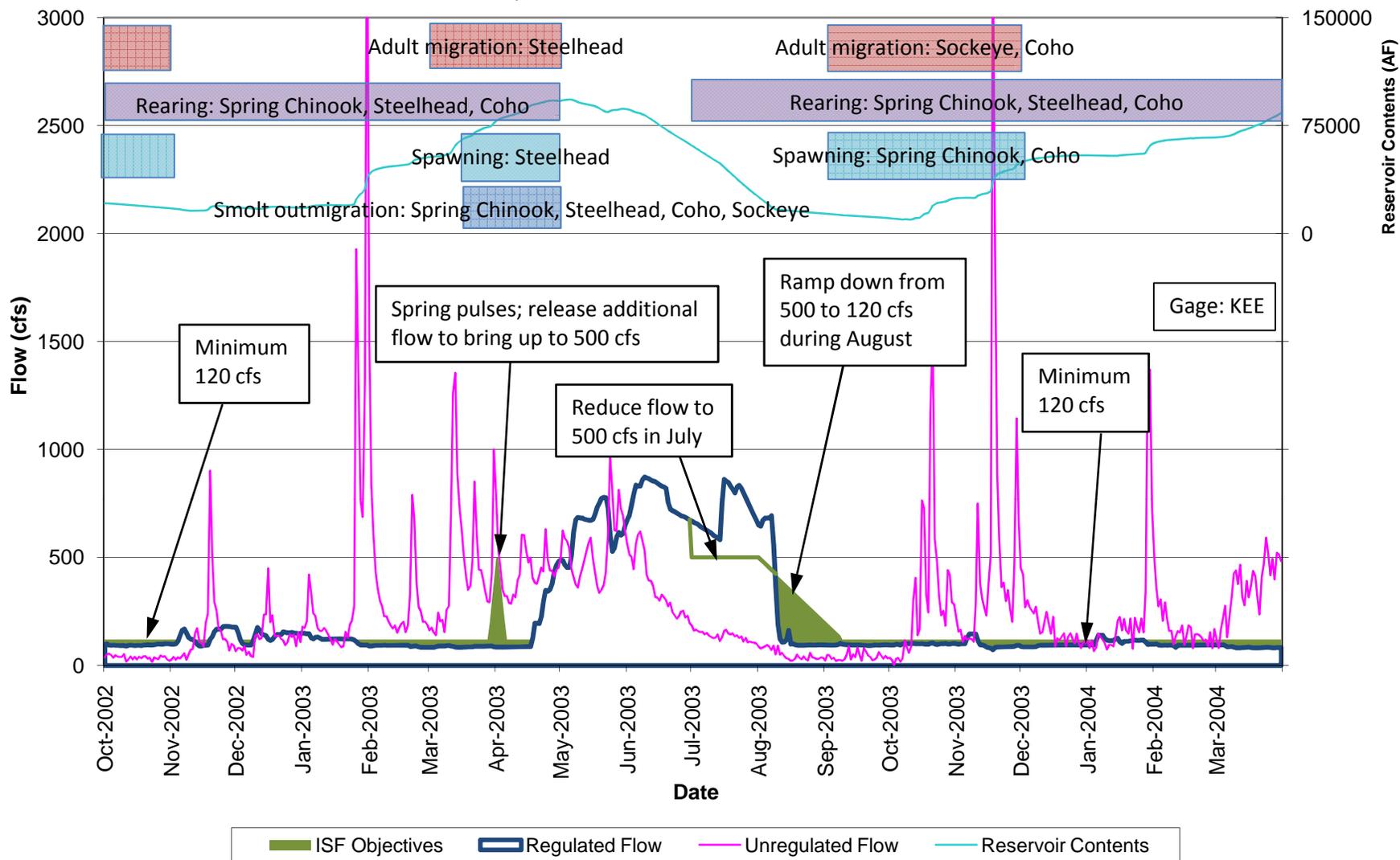
Comparison of 2001 Flow Data (Drought Year) with Unregulated Flow and Instream Flow Improvement Objectives Yakima River, Keechelus Reservoir to Lake Easton Reach



Comparison of 2002 Flow Data (Wet Year) with Unregulated Flow and Instream Flow Improvement Objectives Yakima River, Keechelus Reservoir to Lake Easton Reach



Comparison of 2003 Flow Data (Average Year) with Unregulated Flow and Instream Flow Improvement Objectives Yakima River, Keechelus Reservoir to Lake Easton Reach



REACH: YAKIMA RIVER, EASTON REACH

REACH FLOW PROBLEM:

Need additional flow for spawning and rearing in the fall and winter to increase habitat area, including connecting side channels.

REACH FLOW OBJECTIVE:

The objective is to increase spawning flows to around 220 cfs and then increase flows for rearing to 250-300 cfs in winter. This will provide connection to additional side channels. Periodic pulses are desired to mimic natural flow conditions.

SPECIES AND LIFE STAGES BENEFITTED:

Spawning: Steelhead, spring Chinook, Coho

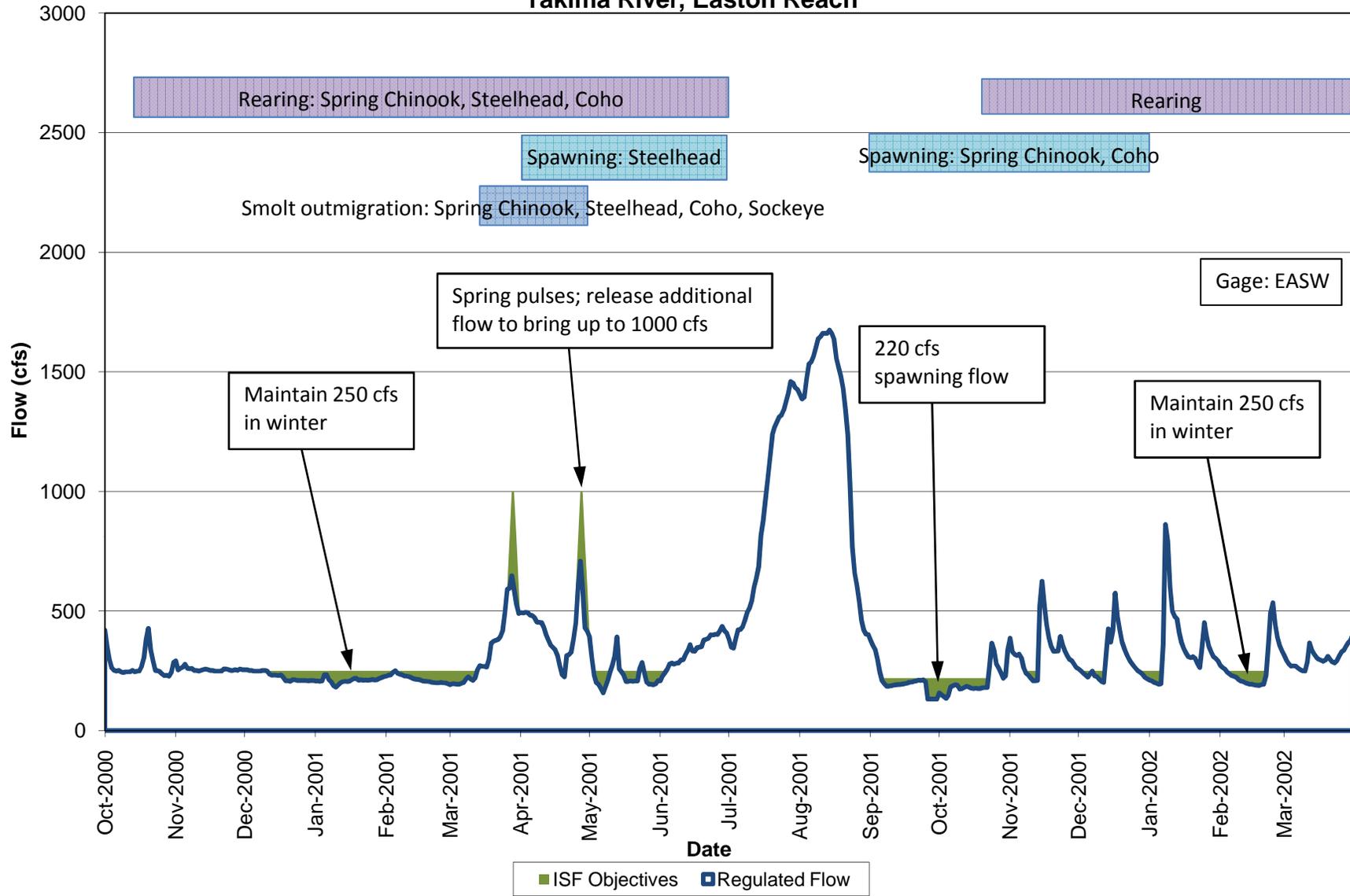
Rearing: Steelhead, spring Chinook, Coho

Smolt Outmigration: Steelhead, spring Chinook, Coho and sockeye

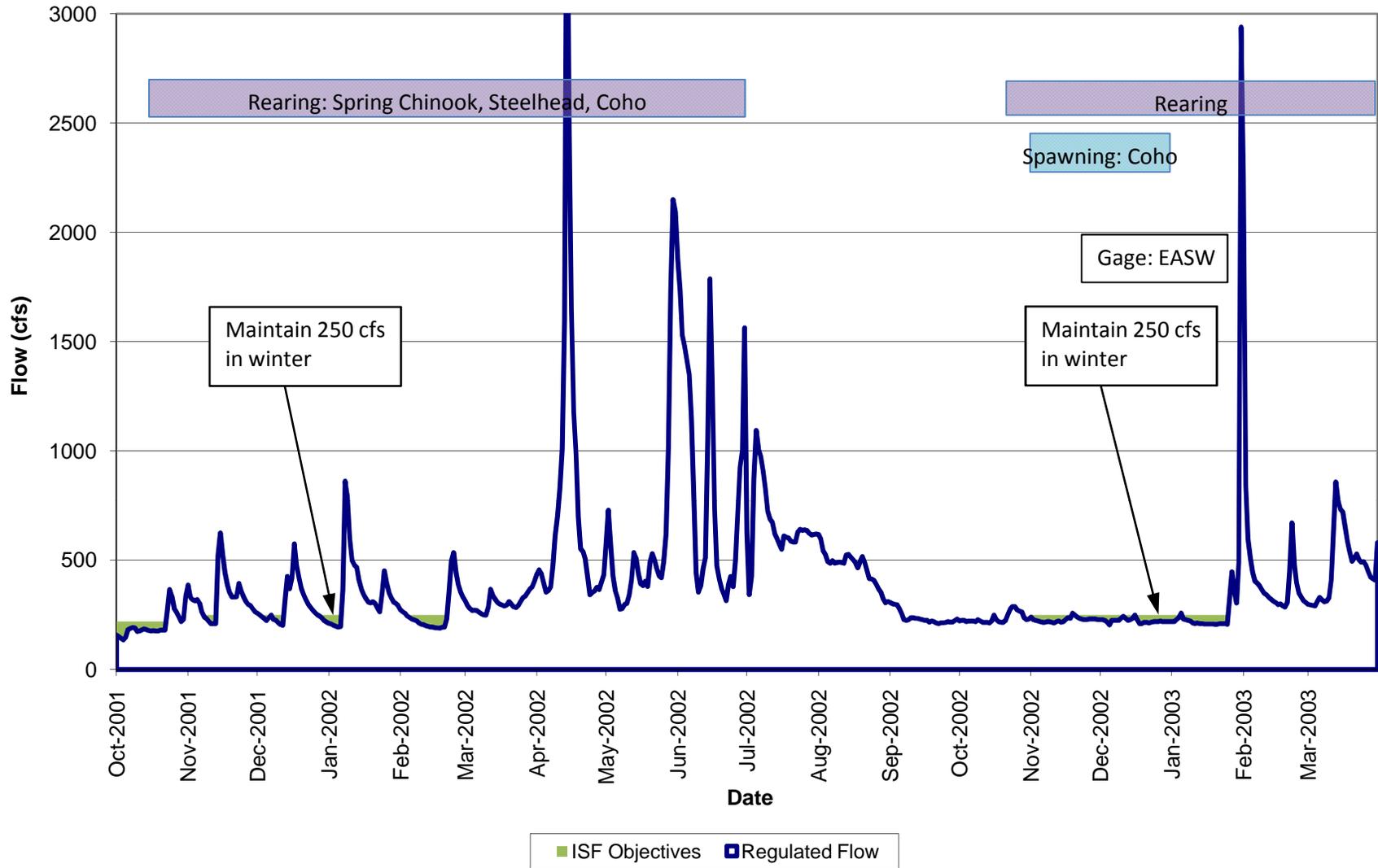
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are Wymer Reservoir and other possible storage proposals (Kachess Inactive Storage, Bumping, Cle Elum pool raise, etc). The hydrologic model will test the capability of these elements meeting the reach flow objectives. In general, water will be released from Keechelus (120 cfs) and Kachess (130 cfs) reservoirs during winter to provide an average of 250 cfs flow and flow pulses. The water released during wet years may not need to be stored downstream as there would be sufficient runoff to meet entitlements during the irrigation season. During spring operations, additional water would be released to provide a strong pulse in April (up to channel shaping flows perhaps). That water would be released to build upon unregulated tributary peaks. The flow in late summer will not be limited for these first hydrologic model runs. Additional water released from Keechelus and Kachess will be picked up in Wymer Reservoir or conserved in Cle Elum reservoir.

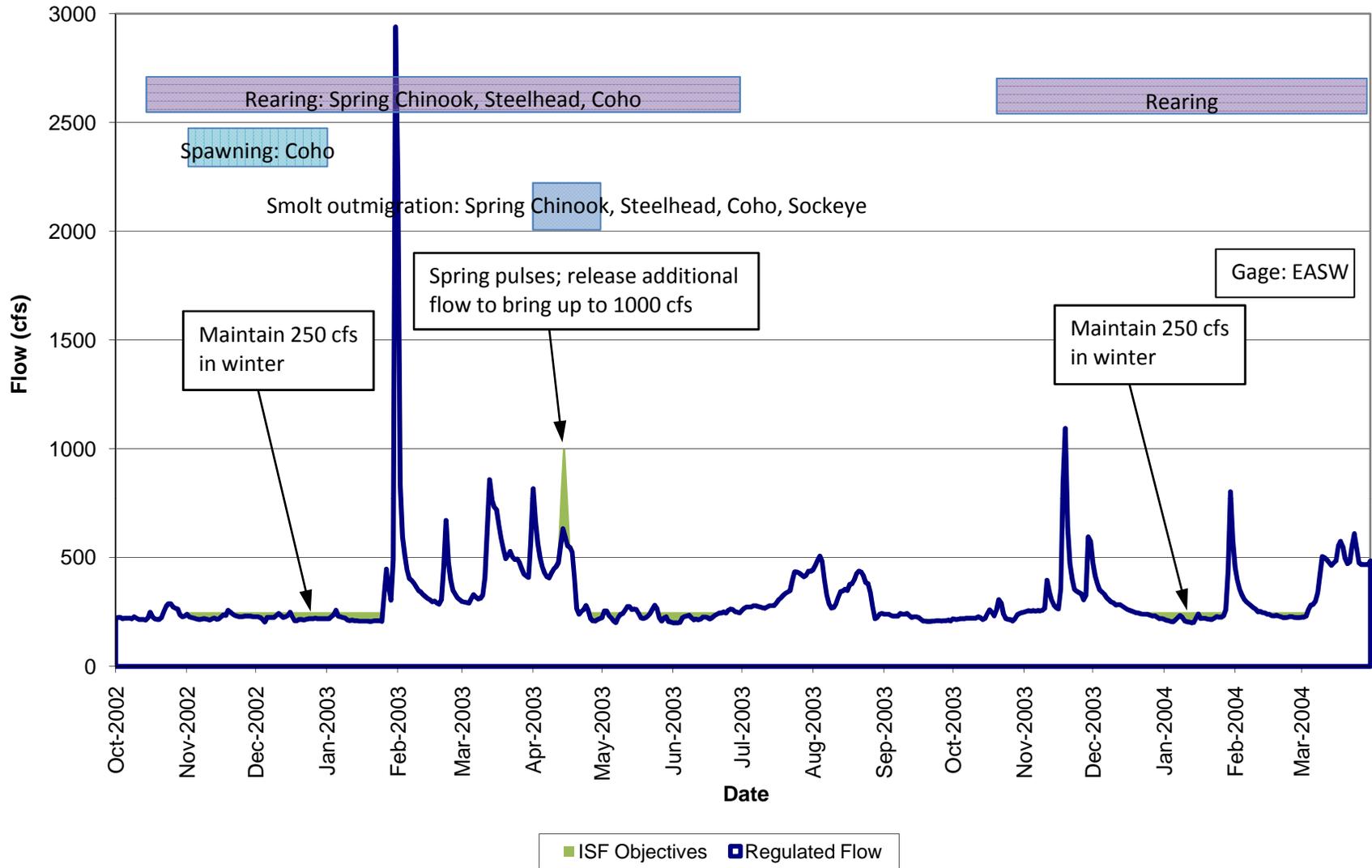
2001 Flow Data (Drought Year) with Instream Flow Improvement Objectives Yakima River, Easton Reach



2002 Flow Data (Wet Year) with Instream Flow Improvement Objectives Yakima River, Easton Reach



2003 Flow Data (Average Year) with Instream Flow Improvement Objectives Yakima River, Easton Reach



REACH: CLE ELUM RIVER

REACH FLOW PROBLEM:

Summer flows are too high in July and August. Lack of flow variation from September 10 through March limits access to side channels. Additional flow is needed from September to March for rearing and access to side channels.

REACH FLOW OBJECTIVE:

The summer objective is to hold water in storage to reduce flows by up to 1000 cfs to give a more gentle change in hydrograph. The fall/winter flows objective is to increase flows starting September 10 through March to as much as 500 cfs. Preliminary modeling performed for the State's EIS indicates that too much storage would be exhausted at this level, so flows in the range of 300 cfs are more achievable. This will provide connection to additional side channels, where recent efforts are connecting side channels at 200 cfs. Periodic pulses are desired to mimic natural flow conditions. Integrate with floodplain restoration efforts.

SPECIES AND LIFE STAGES BENEFITTED:

Spawning: Steelhead, spring Chinook

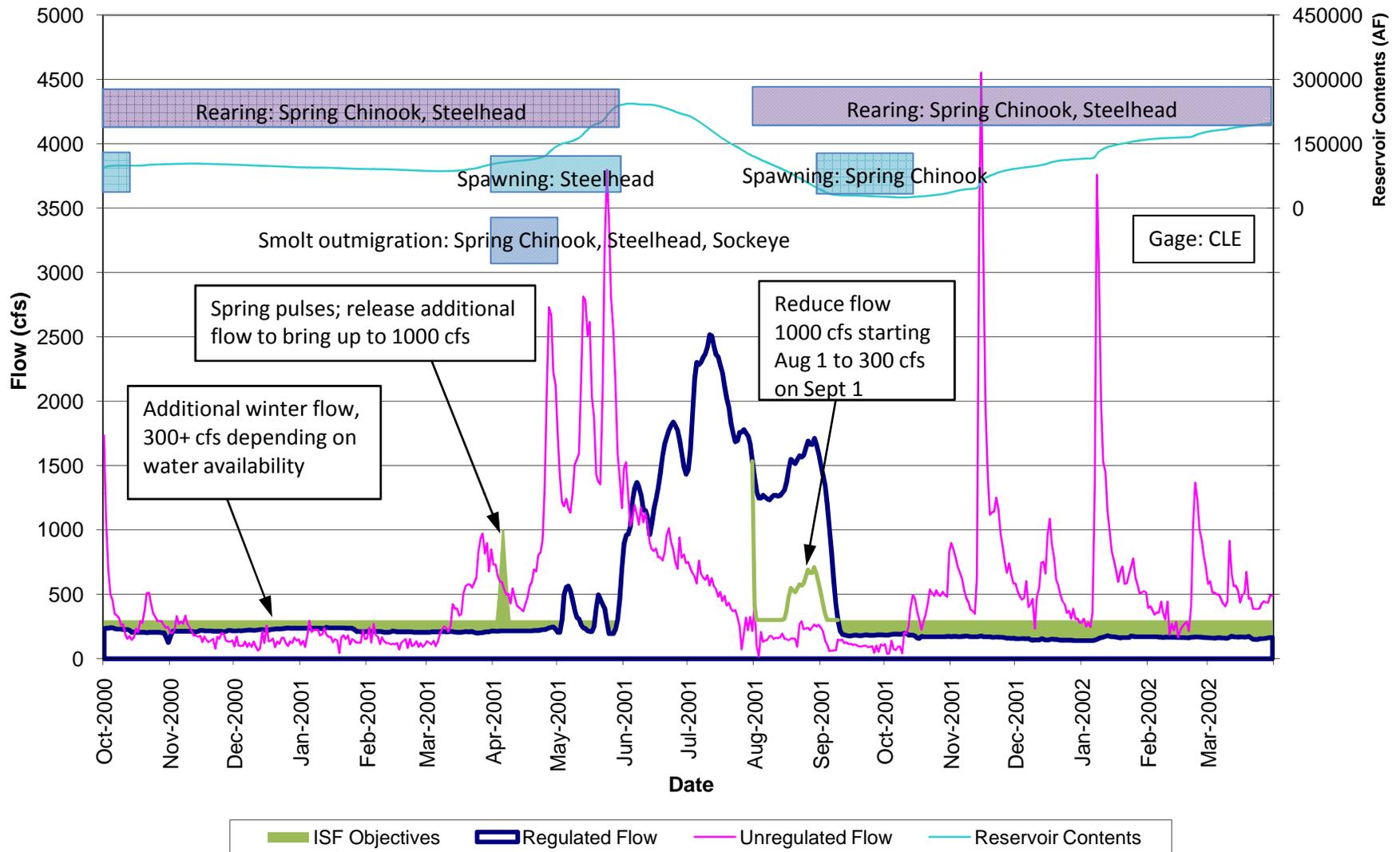
Rearing: Steelhead, spring Chinook

Smolt Outmigration: Steelhead, spring Chinook, sockeye

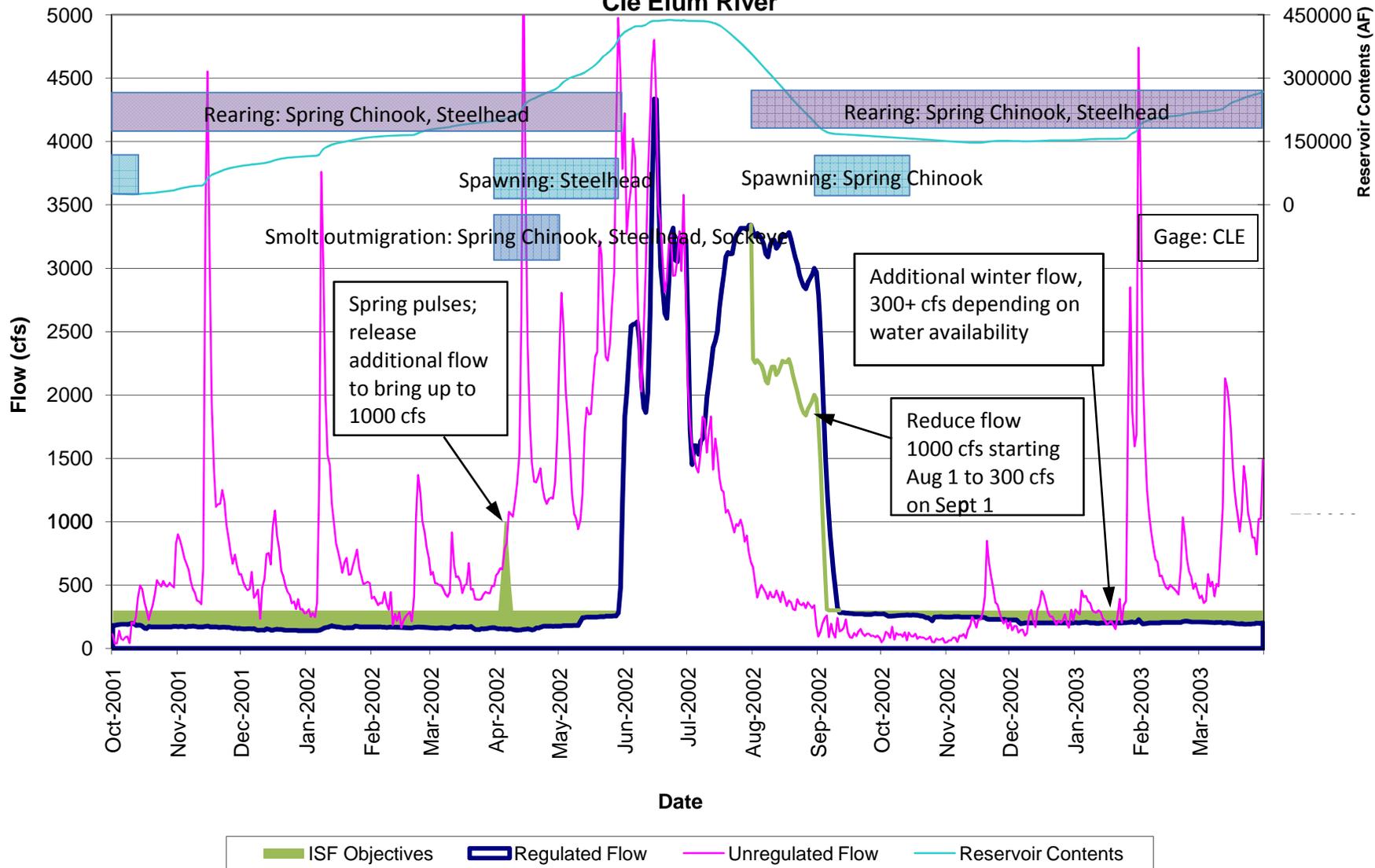
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are the Wymer Reservoir and other possible storage proposals (Kachess Inactive Storage, Bumping, Cle Elum pool raise, etc). The hydrologic model will test the capability of these elements to meet the reach flow objectives. In general, water will be released from Cle Elum Dam during fall and winter to provide additional instream flow. A flow objective of 500 cfs was stated; however the storage volume required to meet that objective is probably greater than available. The modeling will test a flow objective of 300 cfs at first. The released flow will need to be pumped back into Wymer Reservoir. During summer, storage will need to be conserved in Cle Elum reservoir to reduce flow by 1000 cfs in August. That flow will need to be released in fall and winter and stored in Wymer as described above. Pulse flows and flow variability are also desired. At least one pulse with a peak of 1000 cfs will be provided in April and the winter flow should be viewed as an average with variability around the mean flow.

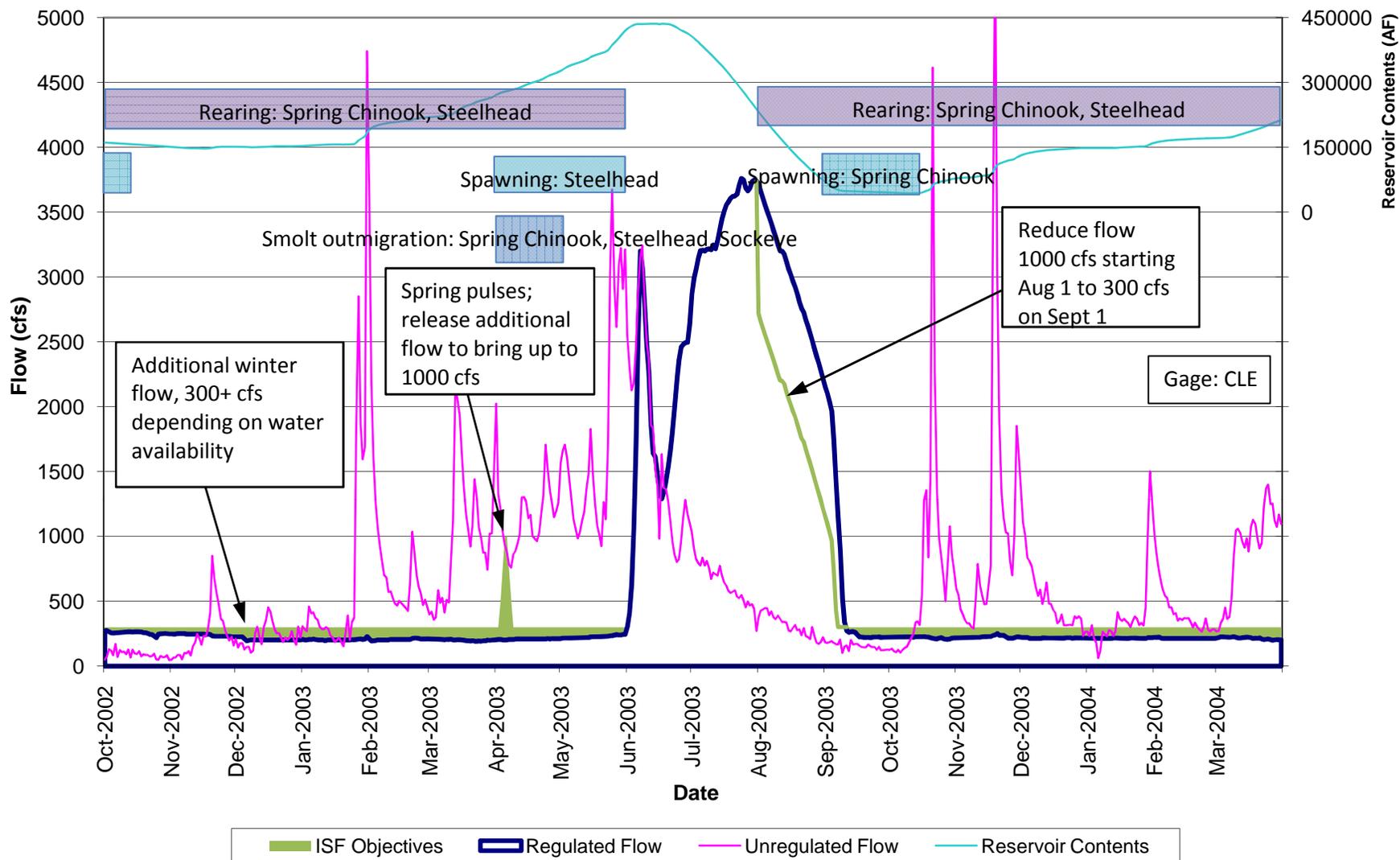
Comparison of 2001 Flow Data (Drought Year) with Unregulated Flow and Instream Flow Improvement Objectives Cle Elum River



Comparison of 2002 Flow Data (Wet Year) with Unregulated Flow and Instream Flow Improvement Objectives Cle Elum River



Comparison of 2003 Flow Data (Average Year) with Unregulated Flow and Instream Flow Improvement Objectives Cle Elum River



REACH: YAKIMA RIVER, TEANAWAY RIVER TO ROZA DAM

REACH FLOW PROBLEM:

Summer flows are too high in July and August. Tributary inflows help with flow variation and channel shaping flows but additional improvement is desired.

REACH FLOW OBJECTIVE:

The summer objective and highest priority is to reduce flows to more closely mimic the unregulated hydrograph. Periodic pulses in winter are desired to mimic natural flow conditions, along with channel shaping flows.

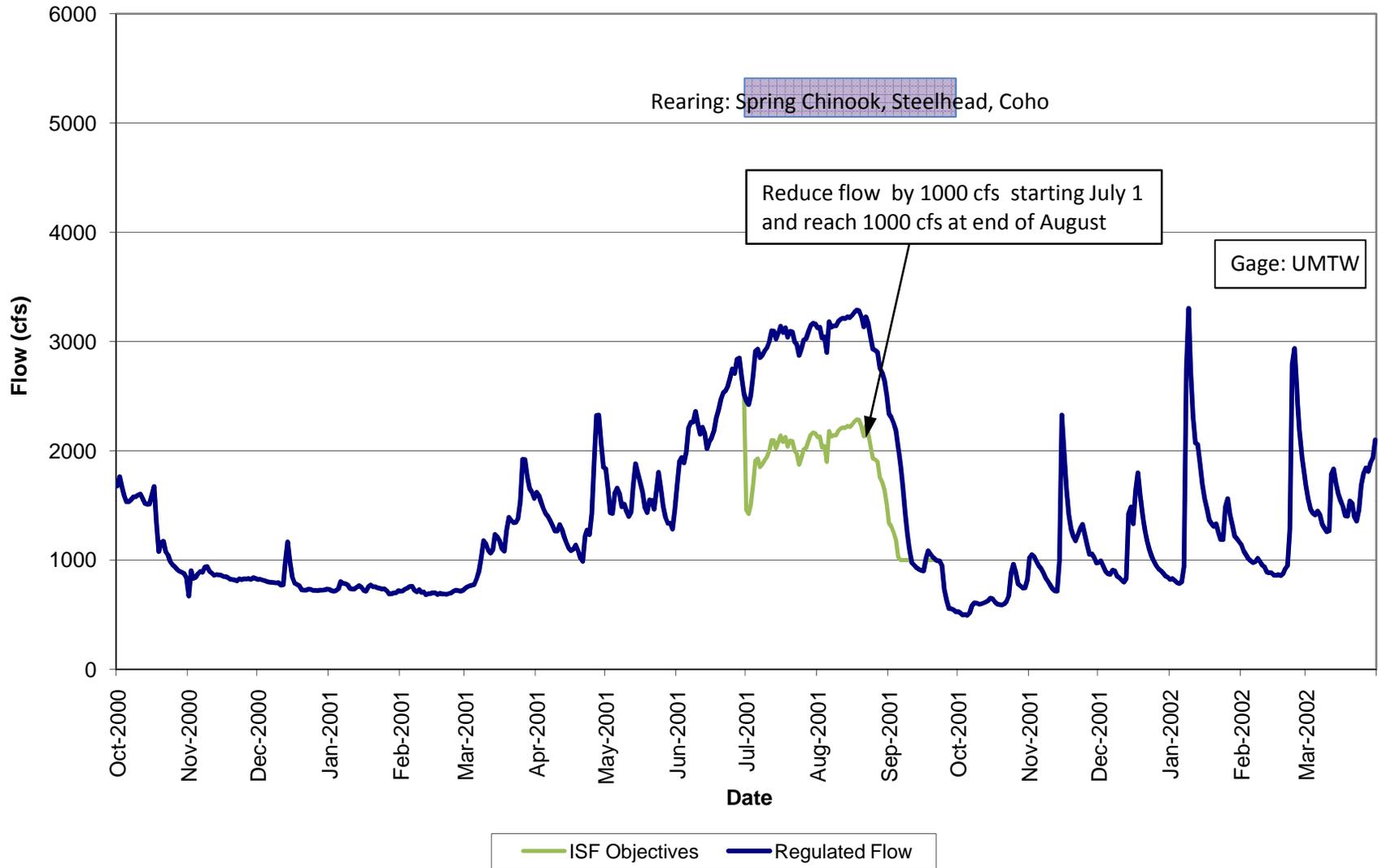
SPECIES AND LIFE STAGES BENEFITTED:

Rearing: Steelhead, spring Chinook, Coho

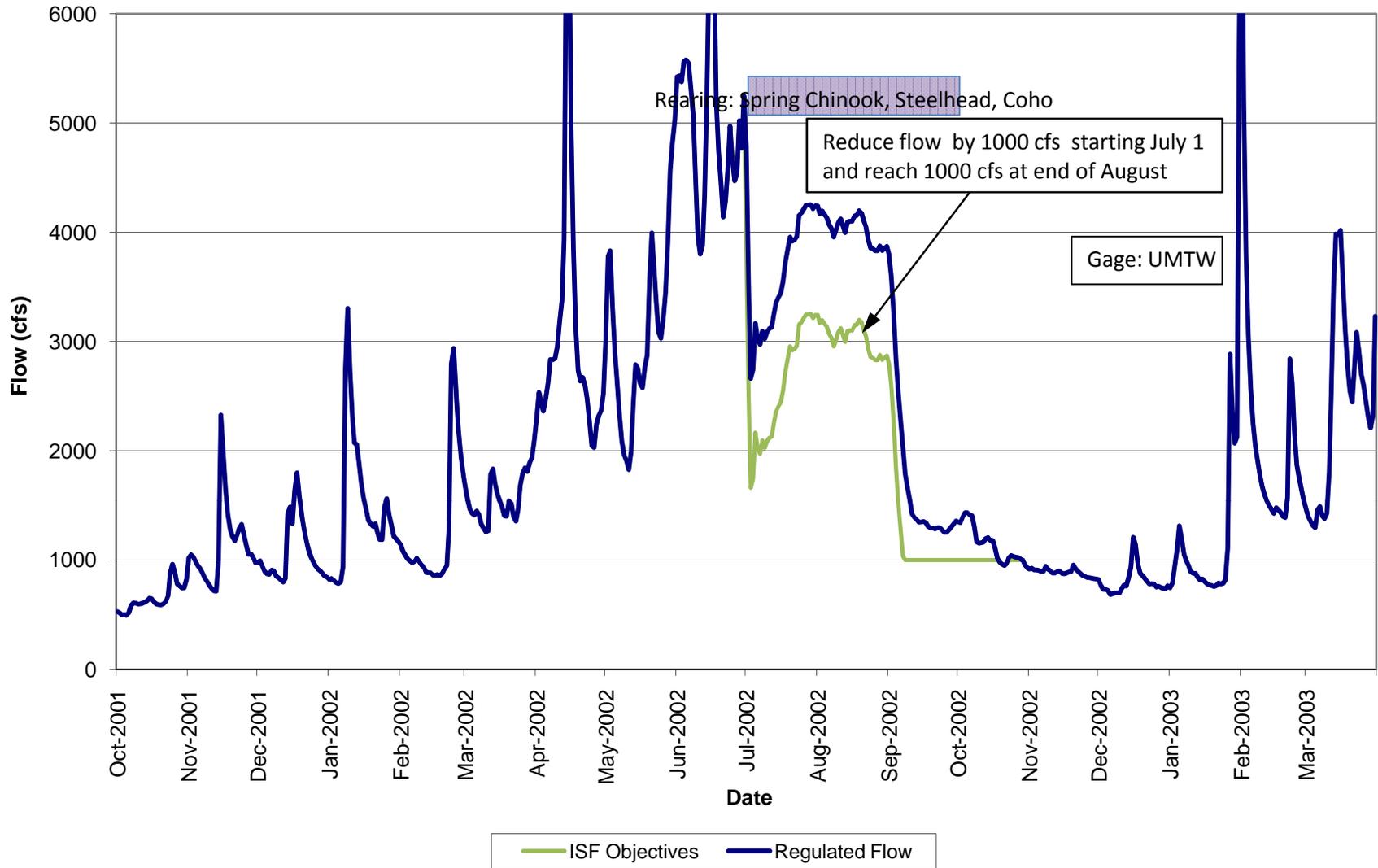
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are the Thorp Pump Station and feed to Wymer Reservoir, and other possible storage proposals downstream of this reach (Bumping, etc). Downstream reservoirs can release water to make up for desired flow reductions in August. New upstream reservoir projects such as Kachess Inactive Storage are important to allow earlier release of water and balance releases from the reservoir system. The hydrologic model will test the capability of these elements meeting the reach flow objectives. In summer water releases would be reduced as much as possible during August to meet lower flow objectives. A flow reduction will be obtained by other August flow reduction efforts performed for upstream reaches combined with pumping 1000 cfs at Thorp into the KRD North Branch Canal and Wymer Reservoir. The August flow in this reach will be decreased as much as possible (given the limits of storage and releases and the capacity of the Thorp Pump Station). To accomplish that, water will be conserved in Keechelus, Kachess and Cle Elum reservoirs during summer and that flow demand met through additional storage in Wymer or Bumping reservoirs. The water can be released the following winter to refill Wymer or Kachess.

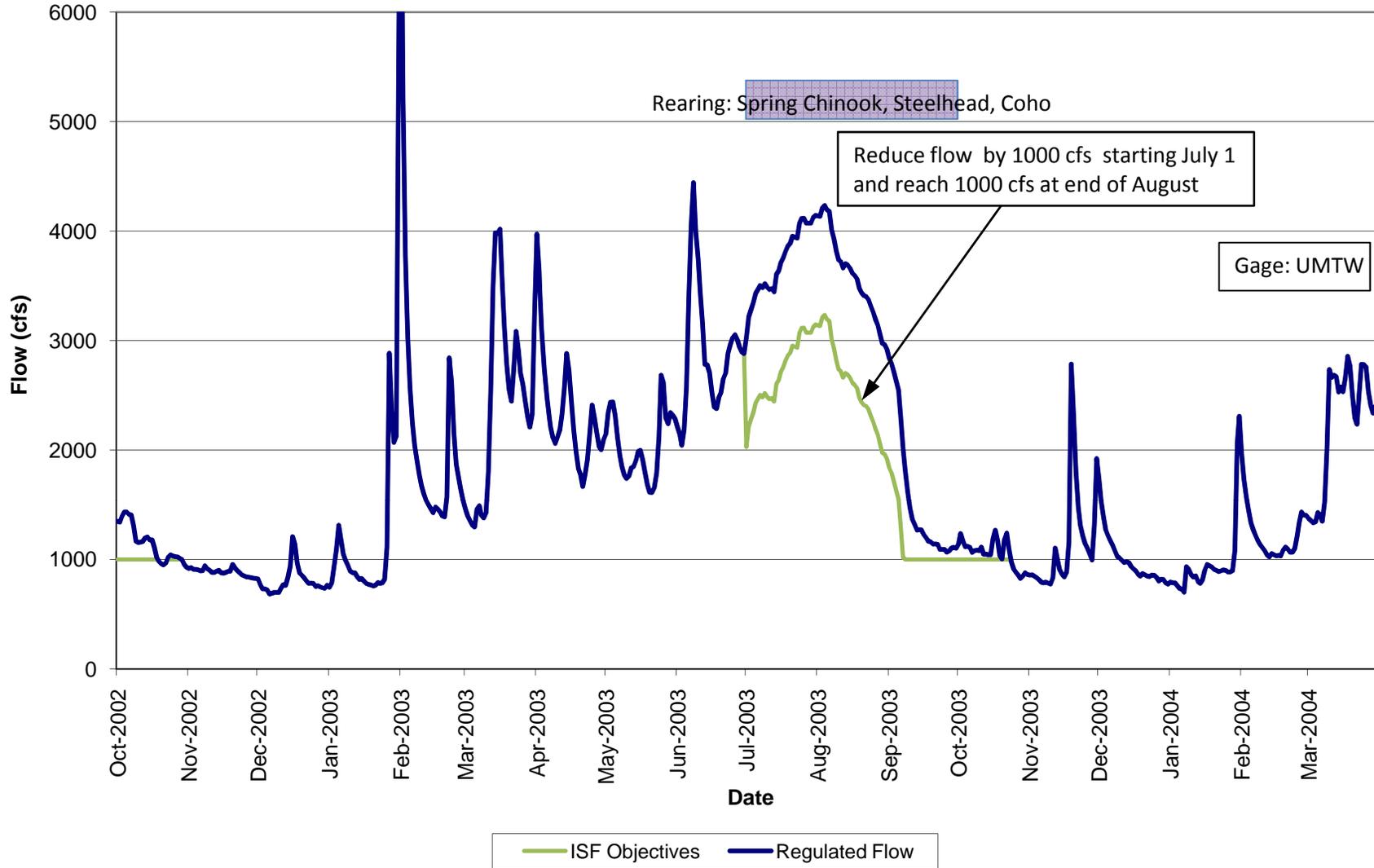
2001 Flow Data (Drought Year) with Instream Flow Improvement Objectives Yakima River, Teanaway to Roza (Ellensburg) Reach



2002 Flow Data (Wet Year) with Instream Flow Improvement Objectives Yakima River, Teanaway to Roza (Ellensburg) Reach



2003 Flow Data (Average Year) with Instream Flow Improvement Objectives Yakima River, Teanaway to Roza (Ellensburg) Reach



REACH: TIETON RIVER

REACH FLOW PROBLEM:

Low winter flows (75 – 120 cfs) and limited variation November to March. Also have high flows in September due to flip-flop operations

REACH FLOW OBJECTIVE:

The winter objective, and high priority, is to increase flows to approximately 125 cfs. In September at the beginning and end of flip-flop operations, reduce flows as much as possible.

SPECIES AND LIFE STAGES BENEFITTED:

Adult Migration: Steelhead, Coho

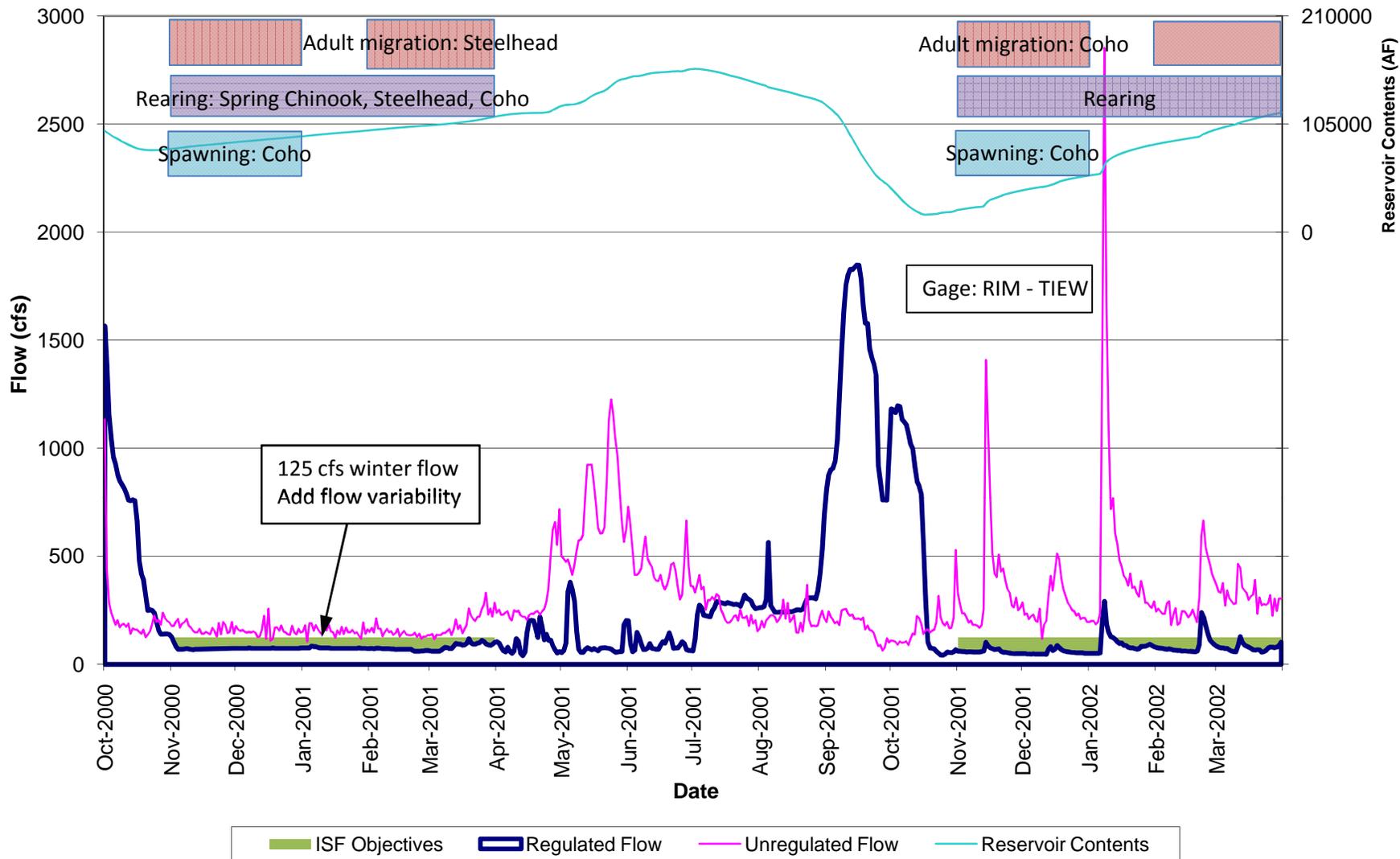
Spawning: Coho

Rearing: Steelhead, spring Chinook, Coho

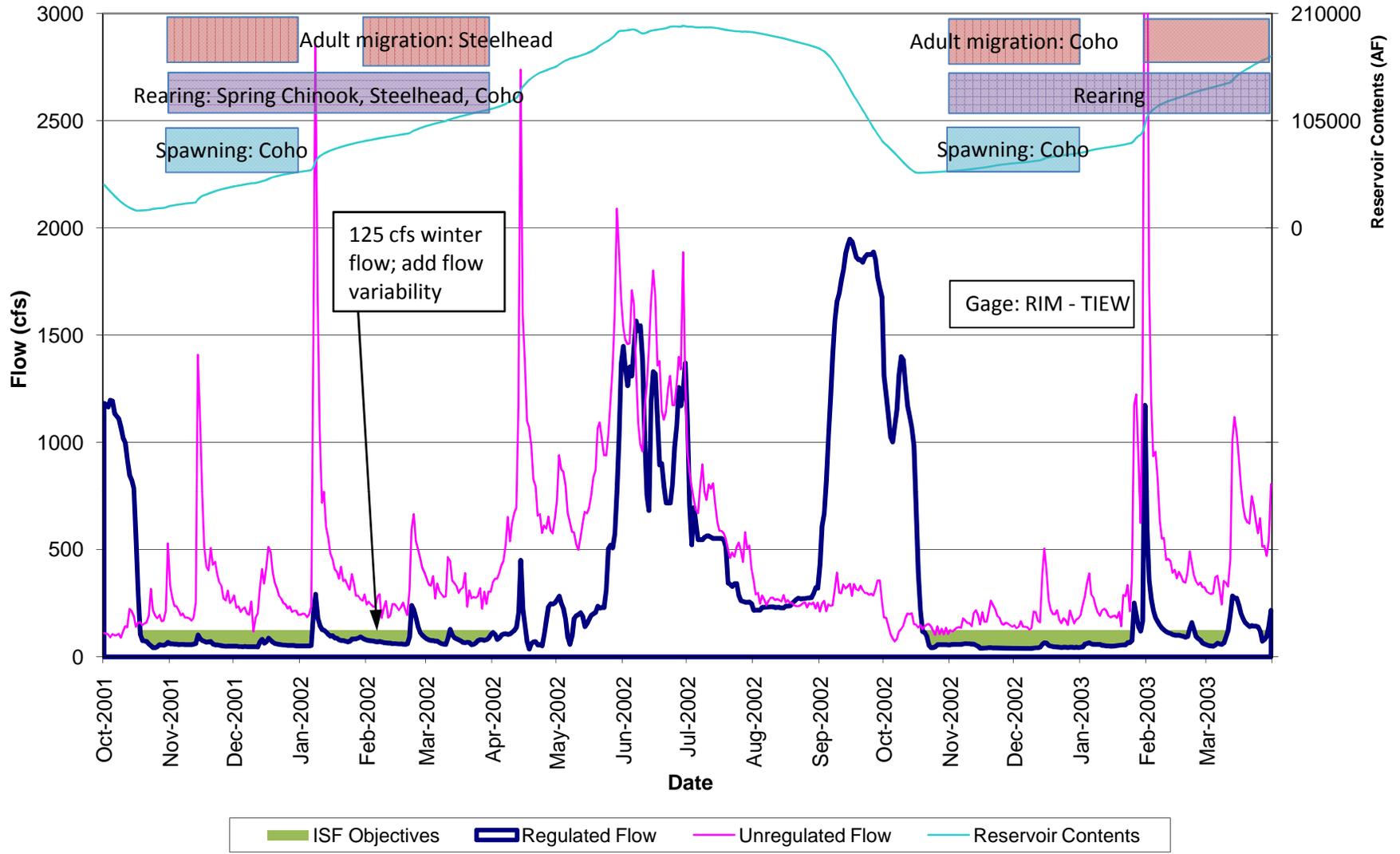
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are additional storage at Bumping Dam to allow additional flow to be released from Rimrock Reservoir in winter and operational improvements to adjust the rate of flow change. The South Fork fish passage project is also needed to allow flexibility in Rimrock reservoir operations.

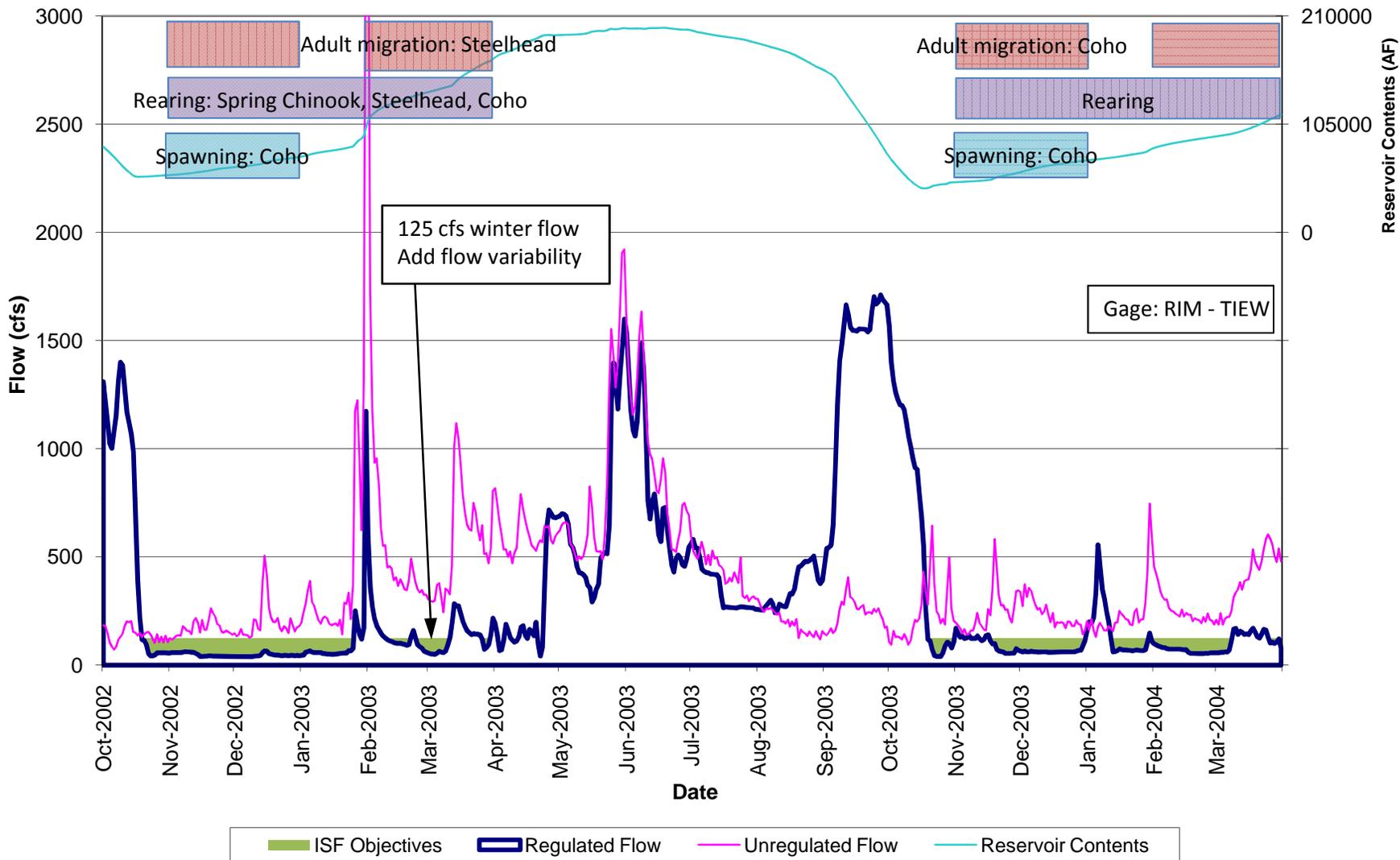
Comparison of 2001 Flow Data (Drought Year) with Unregulated Flow and Instream Flow Improvement Objectives Tieton River Reach



Comparison of 2002 Flow Data (Wet Year) with Unregulated Flow and Instream Flow Improvement Objectives Tieton River Reach



Comparison of 2003 Flow Data (Average Year) with Unregulated Flow and Instream Flow Improvement Objectives Tieton River Reach



REACH: LOWER NACHES RIVER

REACH FLOW PROBLEM:

Summer flows are low. Ramping rate from high spring flows to summer flows is abrupt, affecting rearing for steelhead, coho and spring Chinook. Up to 50% of flow in river is lost to groundwater in lower parts of this reach.

REACH FLOW OBJECTIVE:

Change to more graduated ramping rate from spring to summer. Increase summer low flow to 550 cfs. Reduce fall flows as much as possible, look at releasing more in summer and reducing flip flop. Integrate habitat needs with flow management regime. All those flow objectives are high priority.

SPECIES AND LIFE STAGES BENEFITTED:

Adult Migration: Spring Chinook

Spawning: Steelhead, Coho

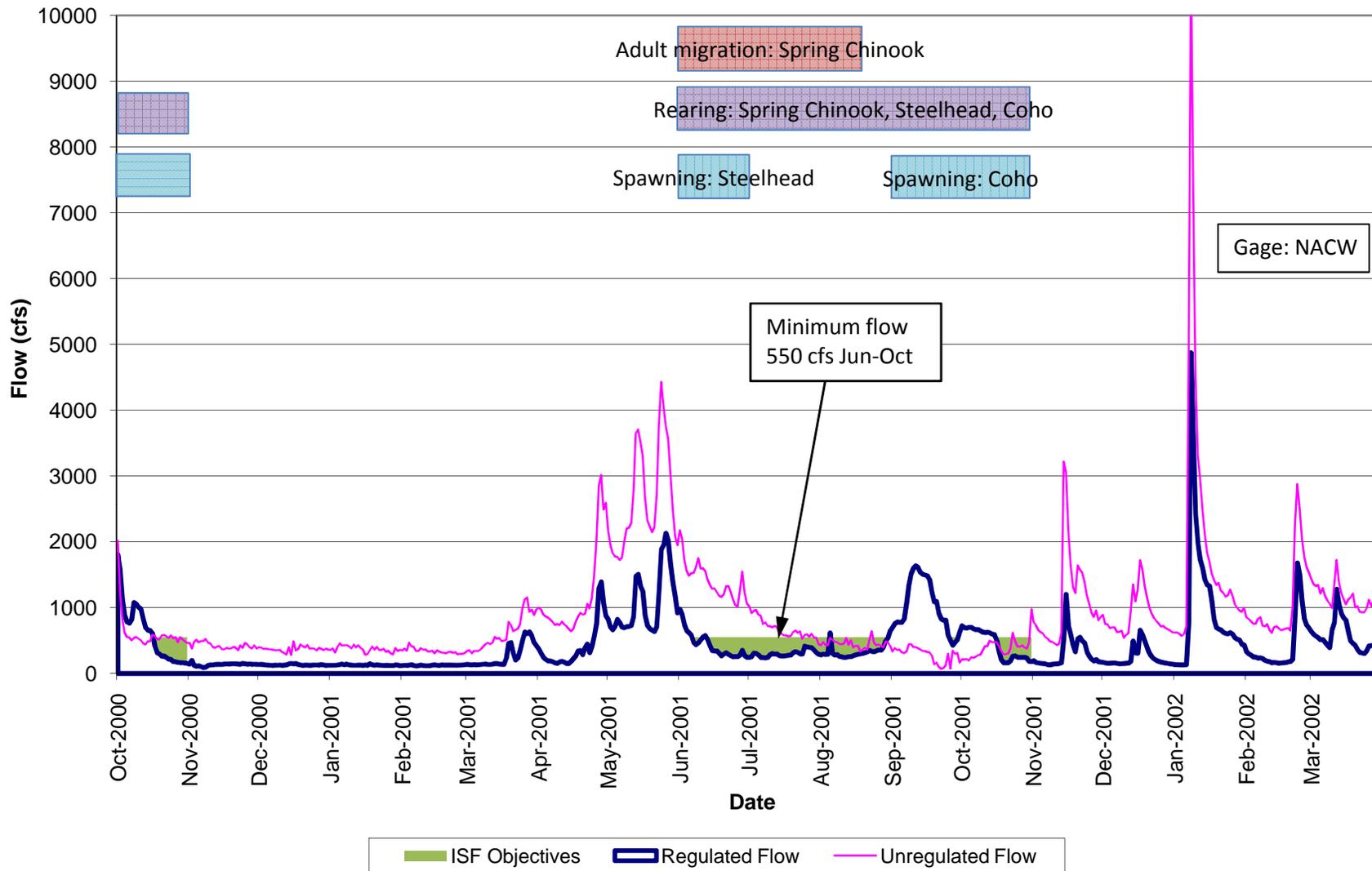
Rearing: Steelhead, spring Chinook, Coho

HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

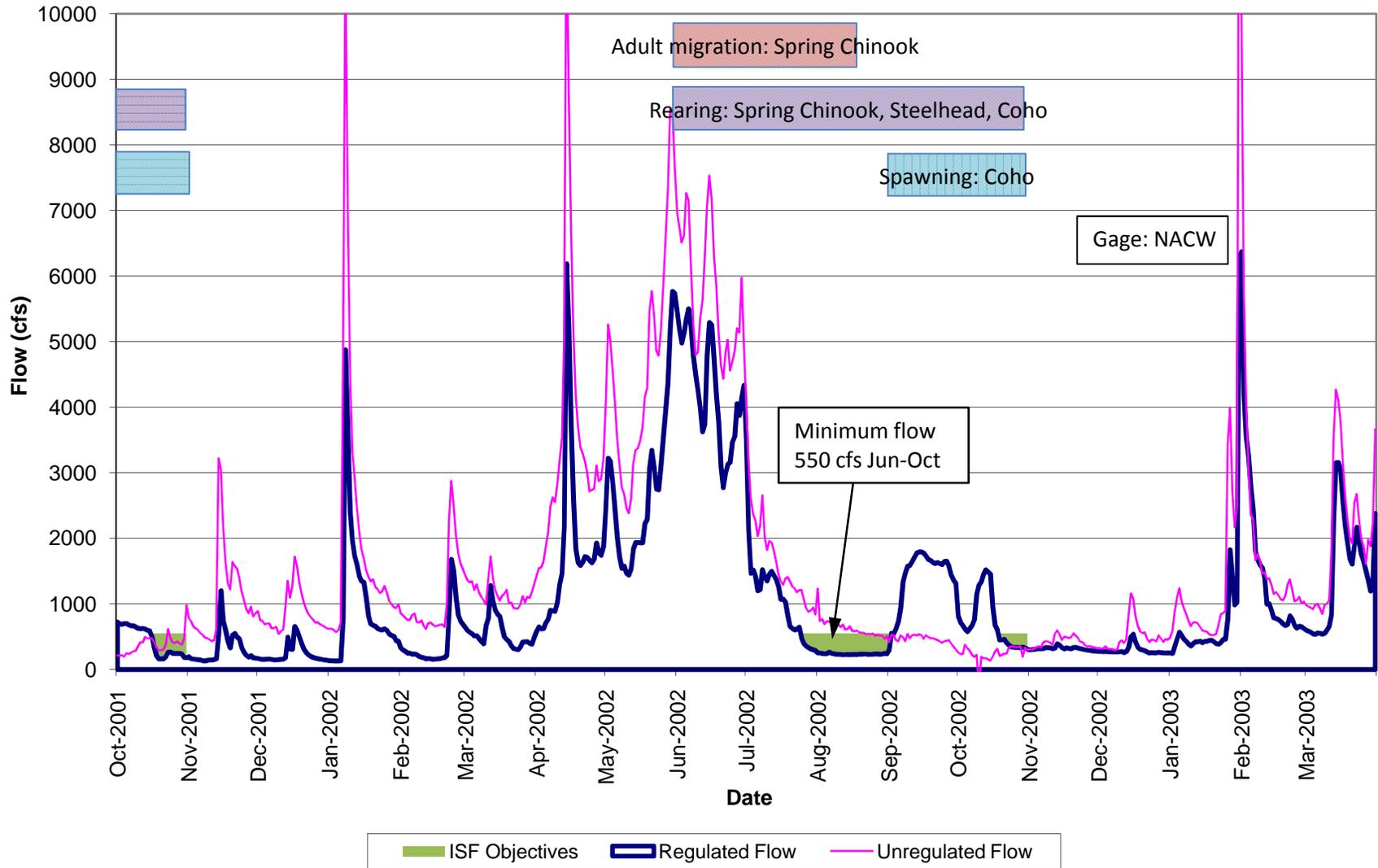
With the Integrated Plan, the projects that would help achieve the reach flow objectives are additional storage in Bumping Reservoir, water conservation and operational improvements.

At the same time summer flows are being reduced in the Upper Yakima River reaches, summer flows will be increased in the Naches River through releases from Bumping Reservoir. Wymer Reservoir releases will need to make up the difference in flow between reductions in upper Yakima River reaches and increased flow in the Naches River. Water conservation projects in the Naches River basin and in the Yakima River basin below Parker will also increase instream flow.

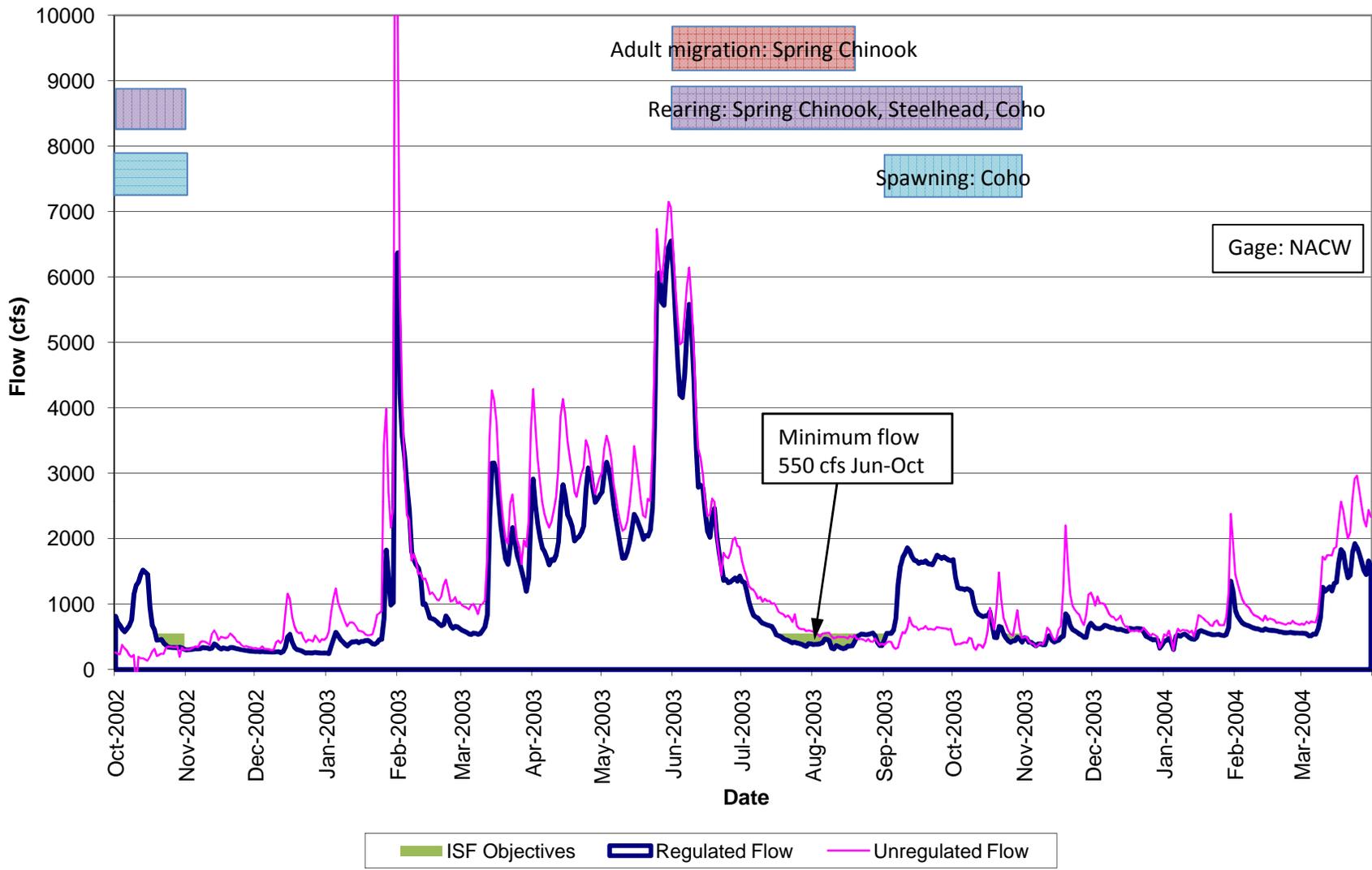
**Comparison of 2001 Flow Data (Drought Year) with Unregulated Flow and Instream Flow Improvement Objectives
Lower Naches River Reach**



Comparison of 2002 Flow Data (Wet Year) with Unregulated Flow and Instream Flow Improvement Objectives Lower Naches River Reach



**Comparison of 2003 Flow Data (Average Year) with Unregulated Flow and Instream Flow Improvement Objectives
Lower Naches River Reach**



REACH: YAKIMA RIVER, FROM PARKER TO TOPPENISH CREEK (WAPATO REACH)

REACH FLOW PROBLEM:

Need additional spring outmigration flow, particularly during dry years.

REACH FLOW OBJECTIVE:

The spring objective is to increase available water to support outmigration (15,000 – 20,000 acre-feet). A pulse flow with a 2-day peak of 1,200 cfs additional flow in the Yakima River would use about 15,000 acre-feet, including the flow required to ramp up and ramp down from the peak.

SPECIES AND LIFE STAGES BENEFITTED:

Adult Migration: Coho

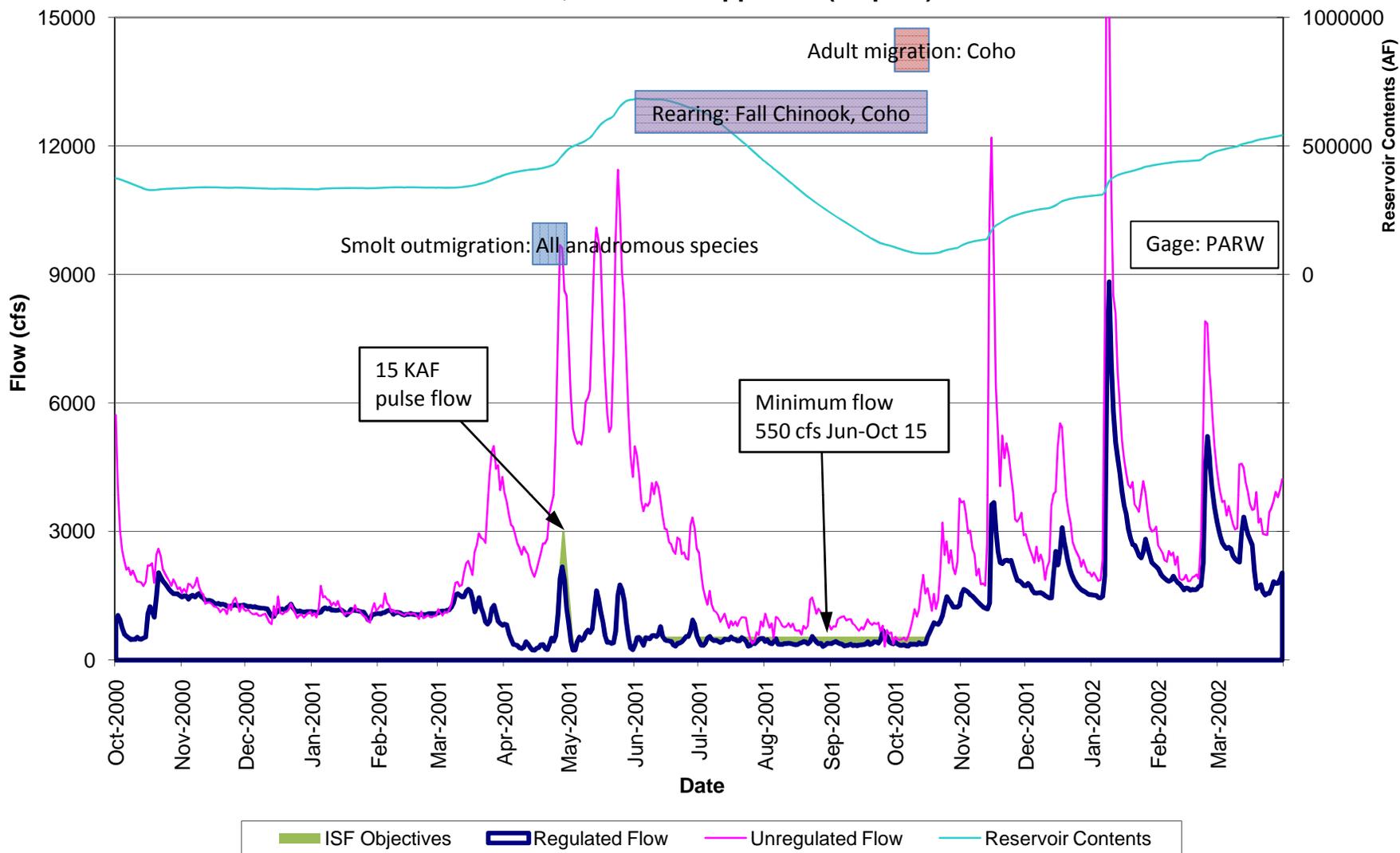
Rearing: Fall Chinook, Coho

Smolt Outmigration: Steelhead, spring Chinook, Coho and sockeye

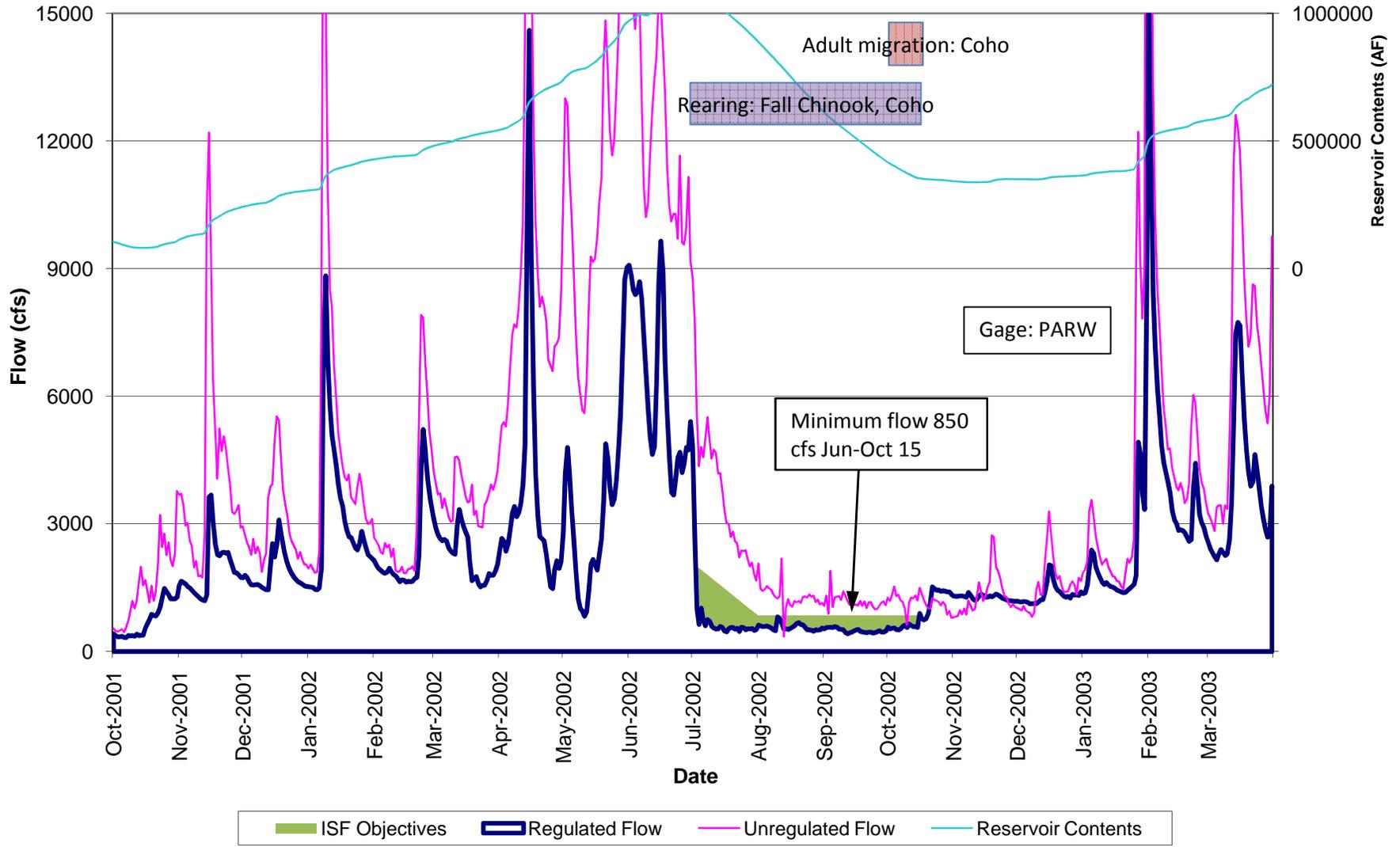
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are primarily water conservation, with Wymer Reservoir, Kachess Inactive Storage, Bumping Reservoir and Cle Elum pool raise also possibly providing flow.

Comparison of 2001 Flow Data (Drought Year) with Unregulated Flow and Instream Flow Improvement Objectives Yakima River, Parker to Toppenish (Wapato) Reach



Comparison of 2002 Flow Data (Wet Year) with Unregulated Flow and Instream Flow Improvement Objectives Yakima River, Parker to Toppenish (Wapato) Reach



**Comparison of 2003 Flow Data (Average Year) with Unregulated Flow and Instream Flow Improvement Objectives
Yakima River, Parker to Toppenish (Wapato) Reach**

