URGWOM Updates

Planning and Water Operations Model Updates

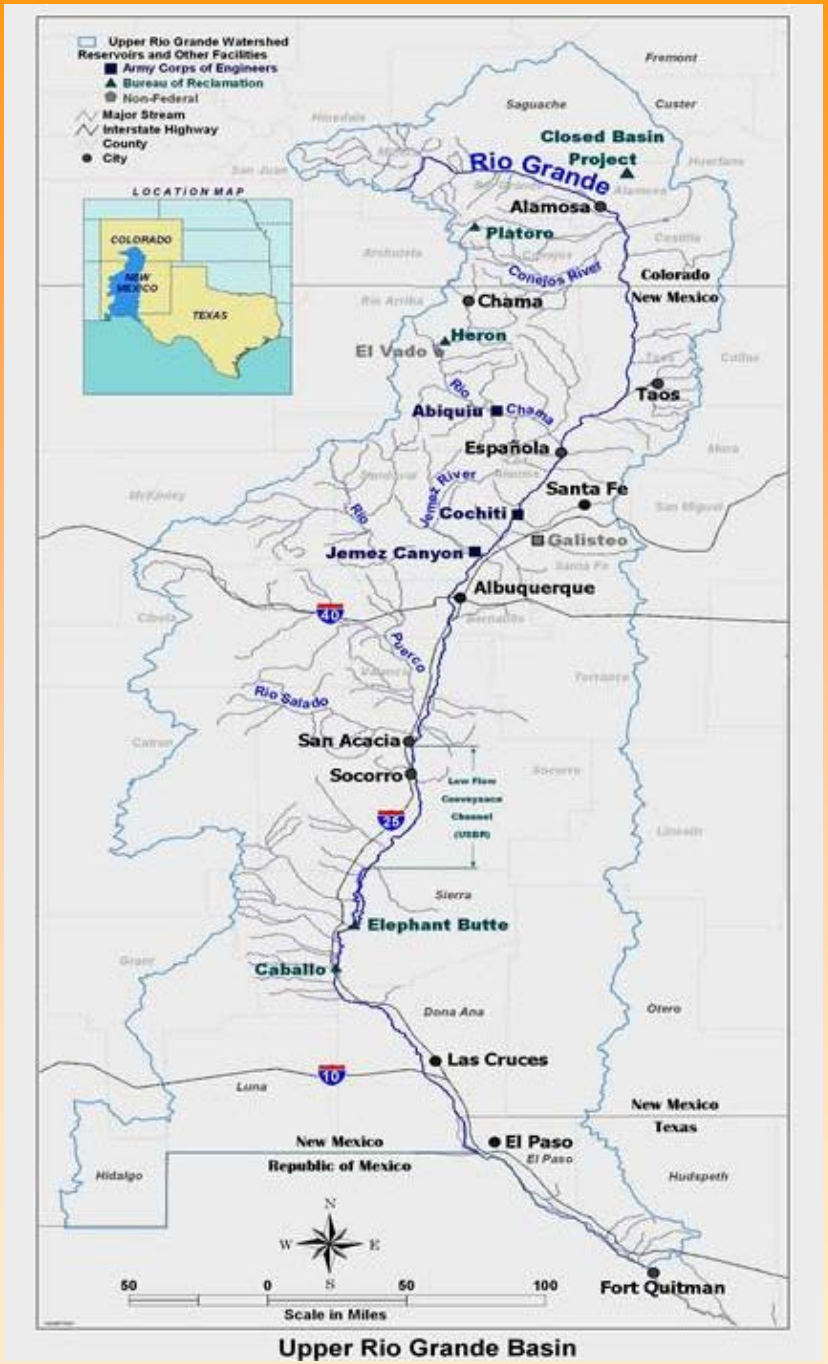
URGWOM Technical Review

October 14, 2010

Upper Rio Grande Basin

System from Colorado state-line to Texas state-line modeled with URGWOM

including the Rio Chama and San Juan-Chama Project diversions



Upper Rio Grande Basin

Planning Model versus Water Ops Model

- Planning Model used for long-term planning studies.
- Primary difference from the Water Operations Model is the single Combined account used for all contractors for San Juan-Chama Project water other than MRGCD, Albuquerque, and the Cochiti Rec Pool.
  - Reduced number of accounts allows for longer runs to be completed more efficiently.
- Single URGWOM ruleset used with both the Water Operations and Planning models.

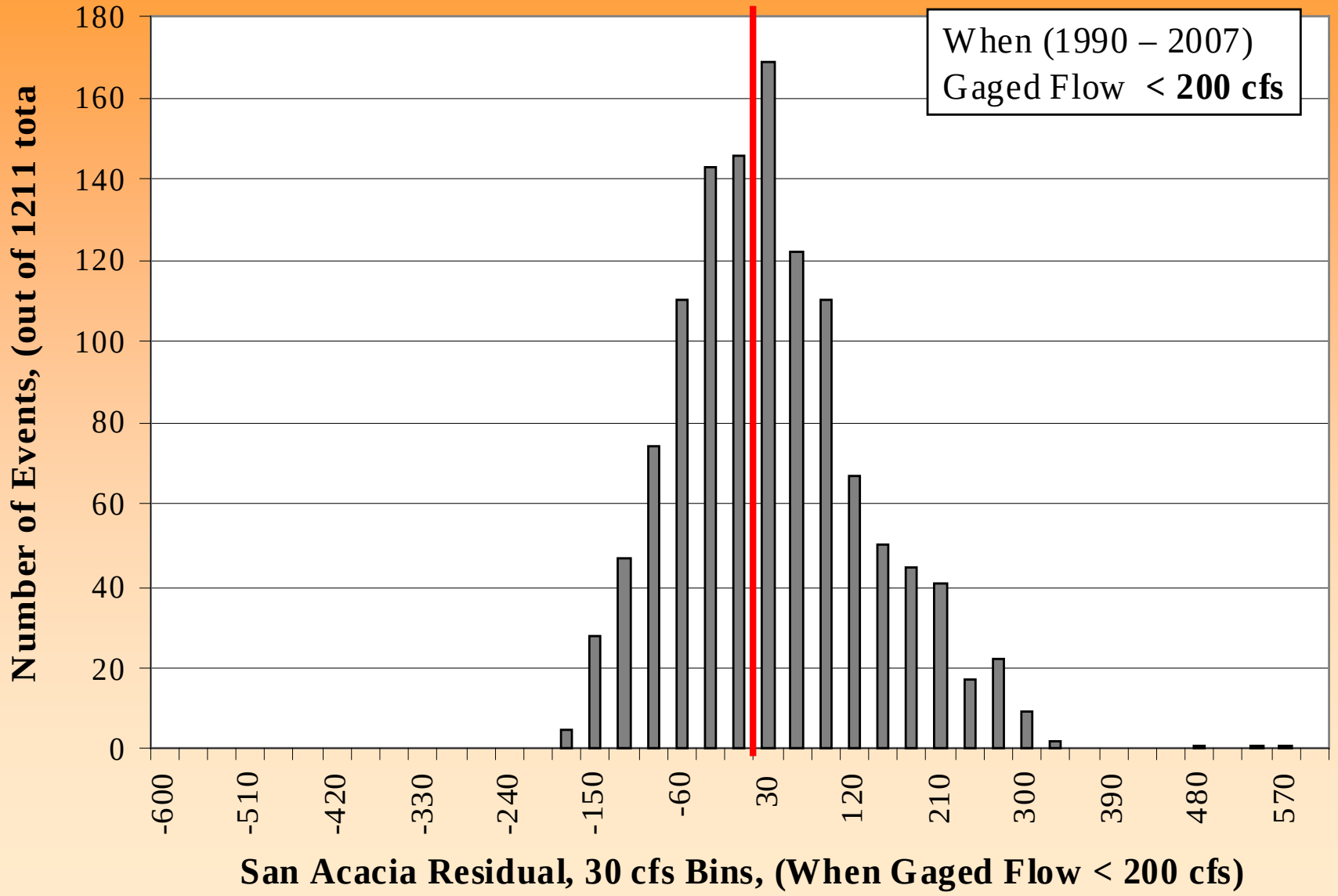
Planning Model Use

- Planning Model used by the Collaborative Program:
  - Population and Habitat Viability Assessment (PHVA) Hydrology ad hoc Work Group
    - for the Biological Assessment (BA) effects analysis.
  - Species Water Management (SWM) Work Group
    - for analyzing potential solutions to water needs.
- Much of the latest model development driven by needs for the Collaborative Program to simulate
  - water needs for all users,
    - Companion “unlimited supply” runs
  - specific flow tools, and
  - resulting river conditions under modeled operations
    - River Drying and
    - Recruitment and Overbank Flows.

Calibration Review

- New configuration for the Middle Valley incorporated.
  - *Will be discussed separately after lunch.*
- Calibration reviewed by the PHVA work group.
  - Residuals from a (1990-2007) calibration run were reviewed to evaluate the distribution of the residuals between modeled flows for historical operations and historical gaged flows.
  - Modeled flow volumes compared to historical gaged flow volumes.
  - Simulated river drying evaluated against the historical occurrence of river drying
    - with focus on 2007 RiverEyes data and
    - low flow triggers defined for when drying would be expected.

Calibration Review



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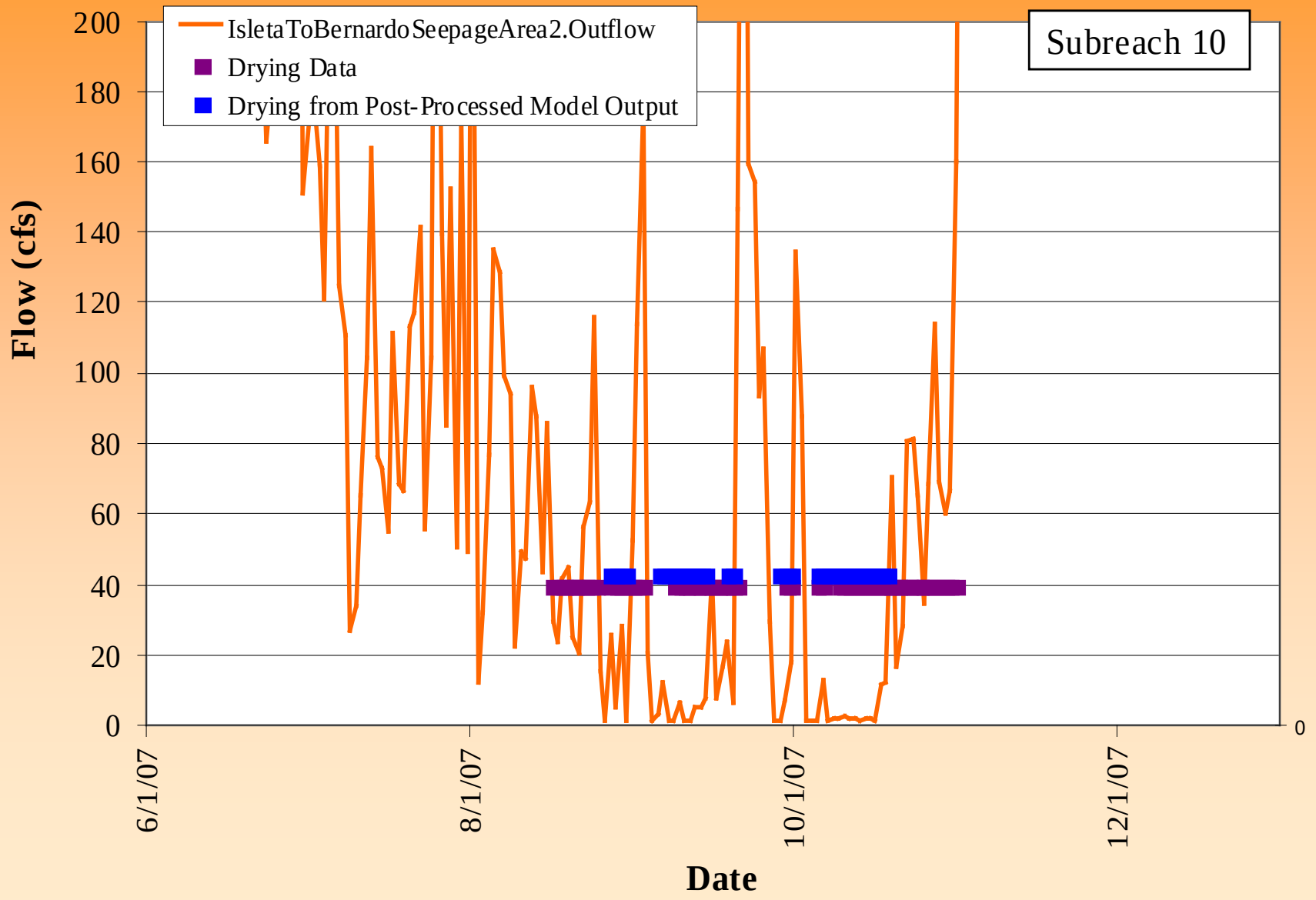

Model Development

- Model development has included work on the following to better represent *current operations*:
  - ABCWUA Diversions,
    - Preemptive cutoff;
  - Projected Letter Water Deliveries;
  - MRGCD Diversions,
    - Increased Angostura Diversions during P&P Operations;
  - Operations under the 2003 Biological Opinion,
    - use of supplemental water for targets,
    - operations to manage recession and control the rate of drying, and
    - LFCC pumping;
  - Storage at El Vado, when Article VII not in effect;
  - Releases per Article VIII of the Compact; and
  - Waivers for Storage of San Juan-Chama Water at Heron.

Model Development

- Development to represent potential *flow tools*:
  - Reclamation leases of San Juan-Chama Project water,
  - Relinquished Compact credits and storage of Emergency Drought water at El Vado Reservoir,
  - Cochiti deviations, and
  - Alternate Timing for Letter Water Deliveries.

Model Set Up

- The following must be set up for a Planning Model run:
  - Hydrology
    - Historical or a predefined synthetic sequence,
  - Initial Conditions,
    - Current conditions or projected conditions for a future date,

Model Set Up

- The following must be set up for a Planning Model run:
  - Hydrology
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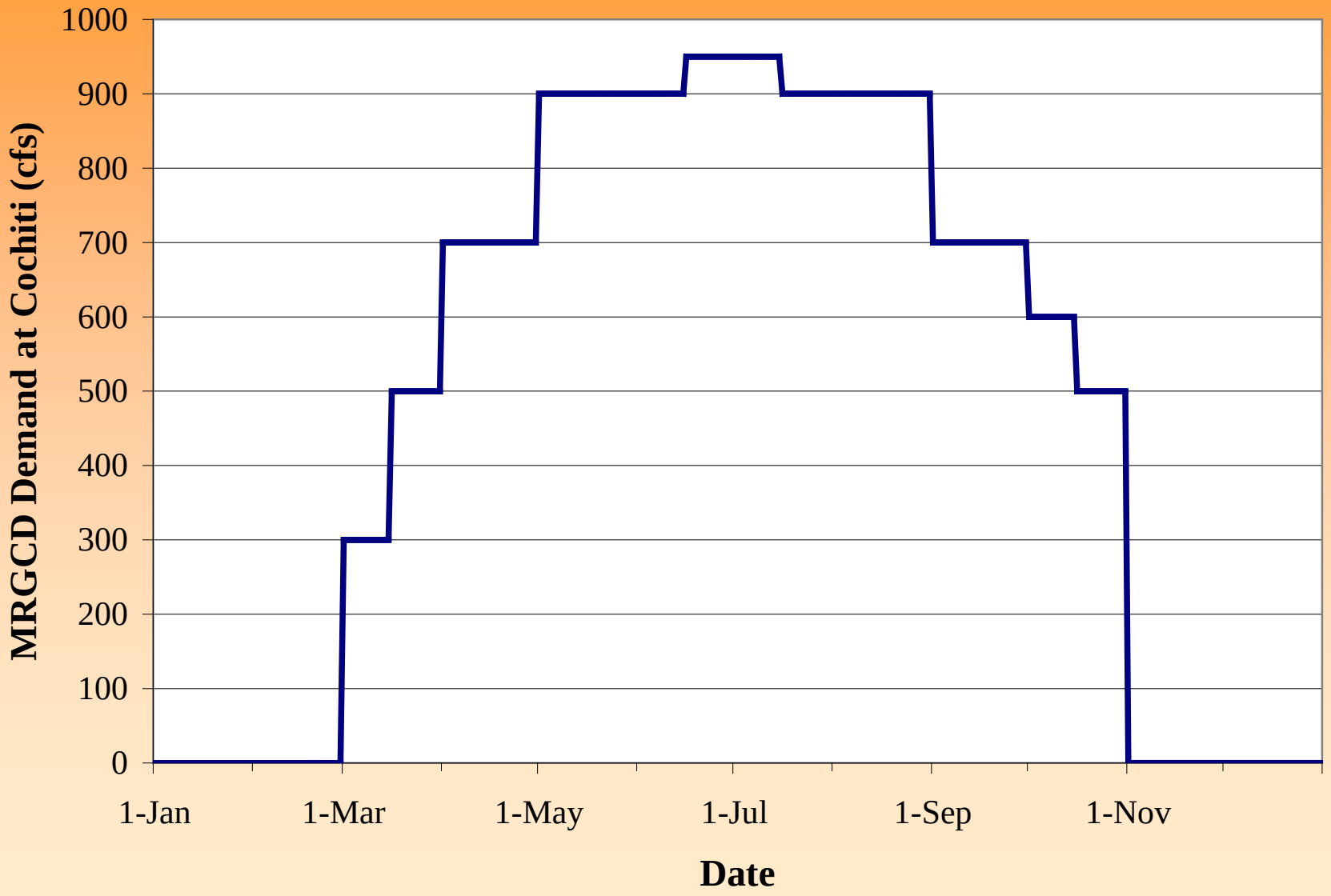
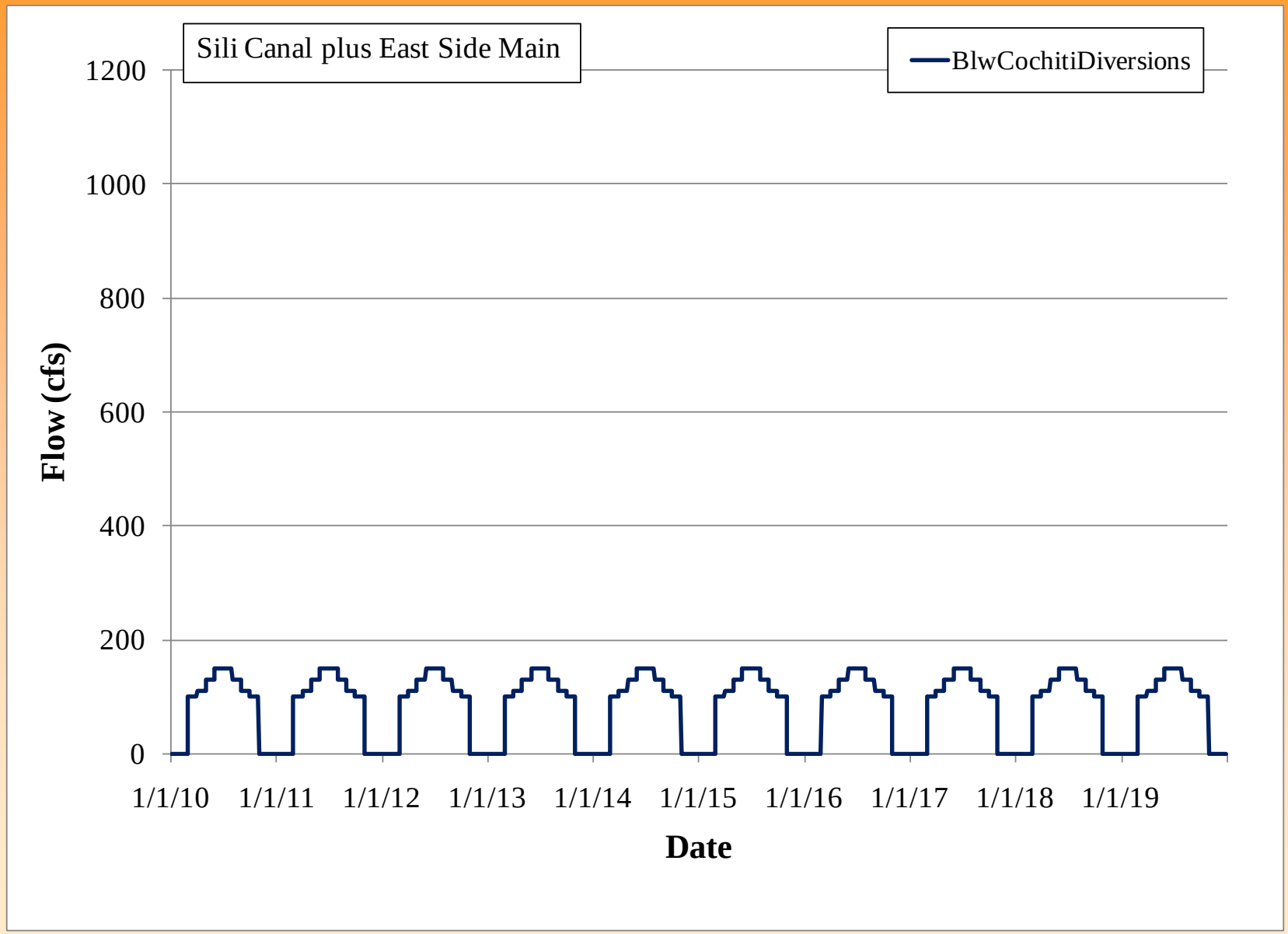
  - Standard Operation Assumptions
    - Waiver date of September 30th,
    - MRGCD demand at Cochiti and diversion schedules,

MRGCD Demand



MRGCD Diversions



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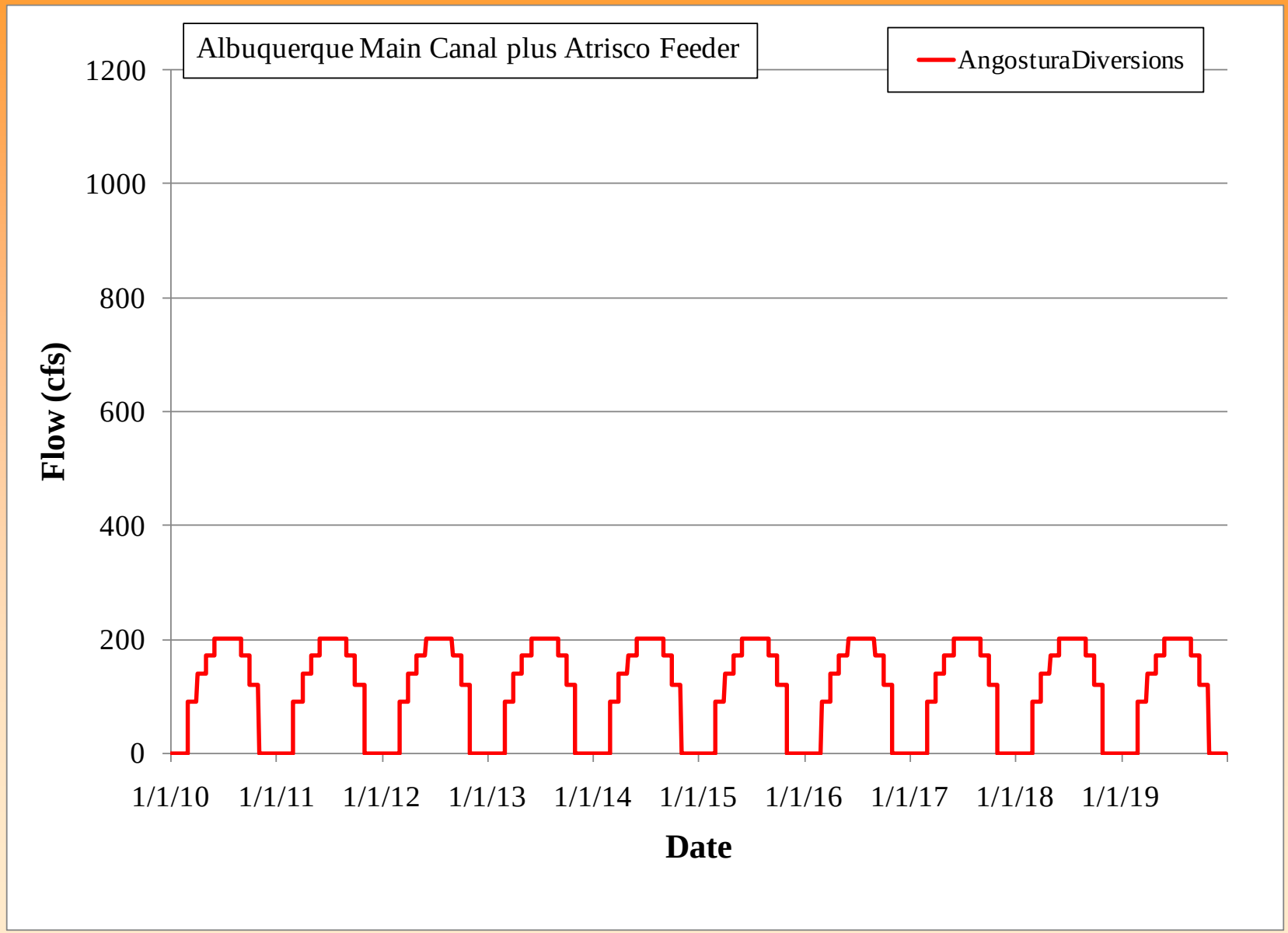

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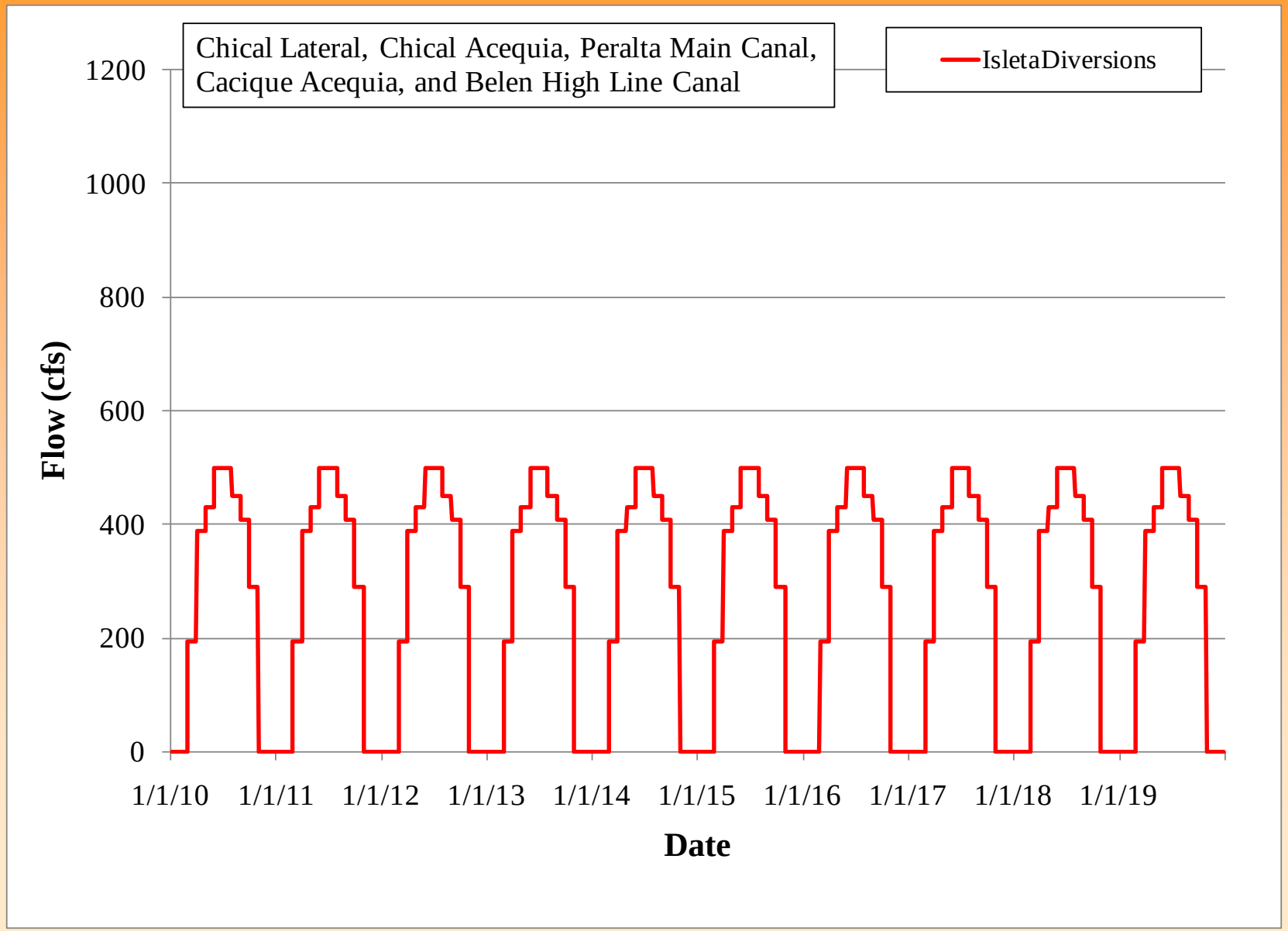

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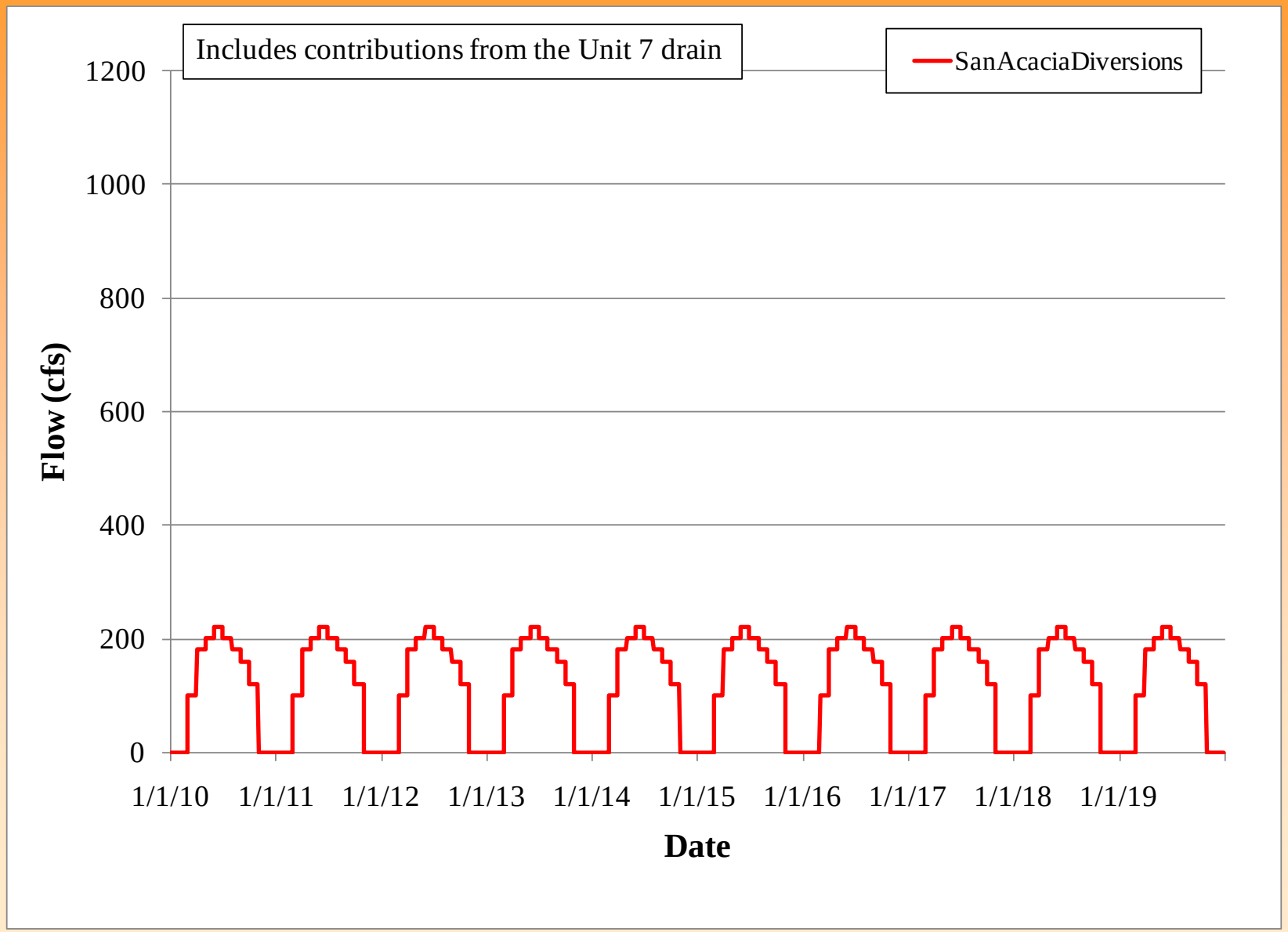

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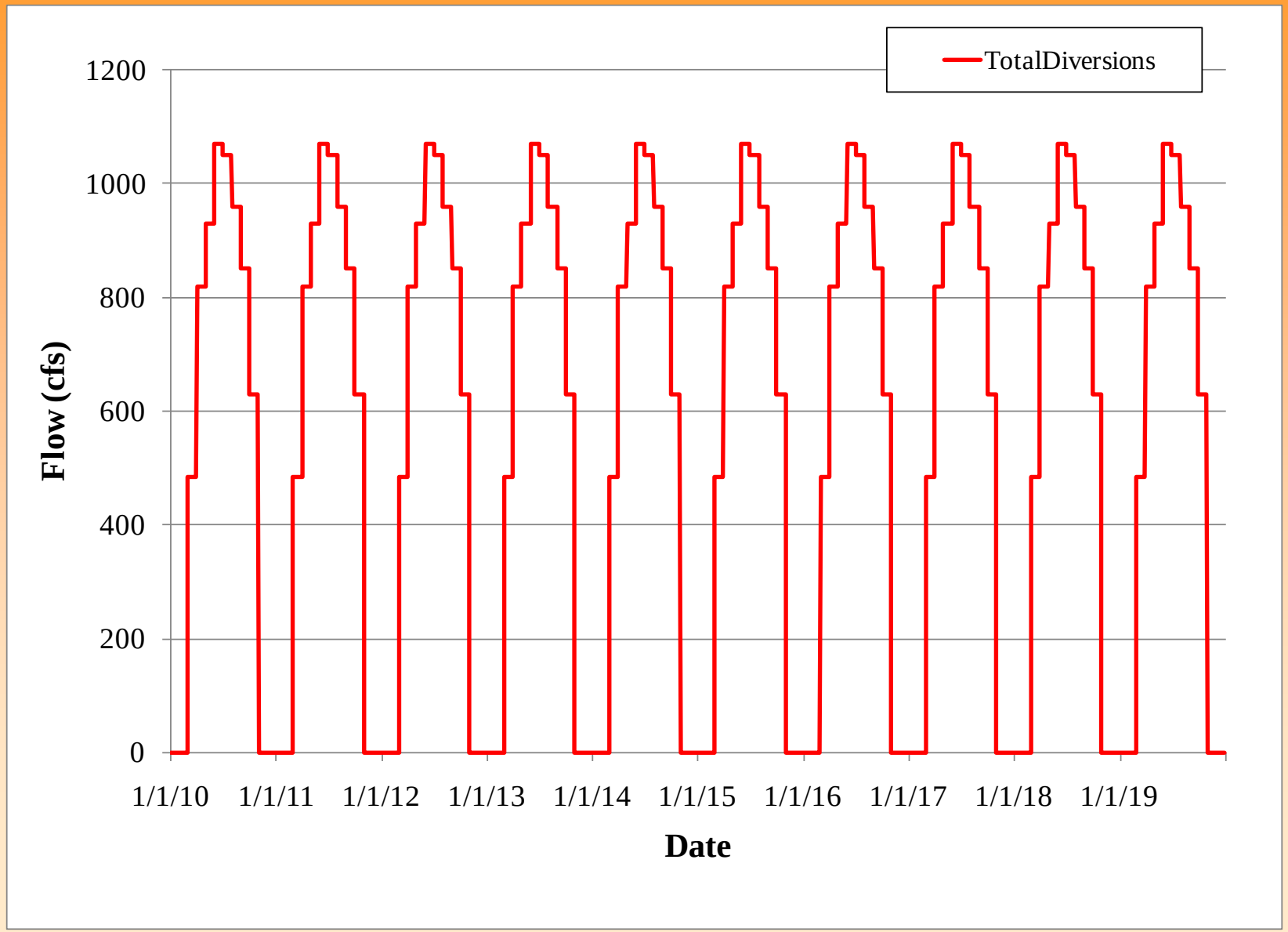
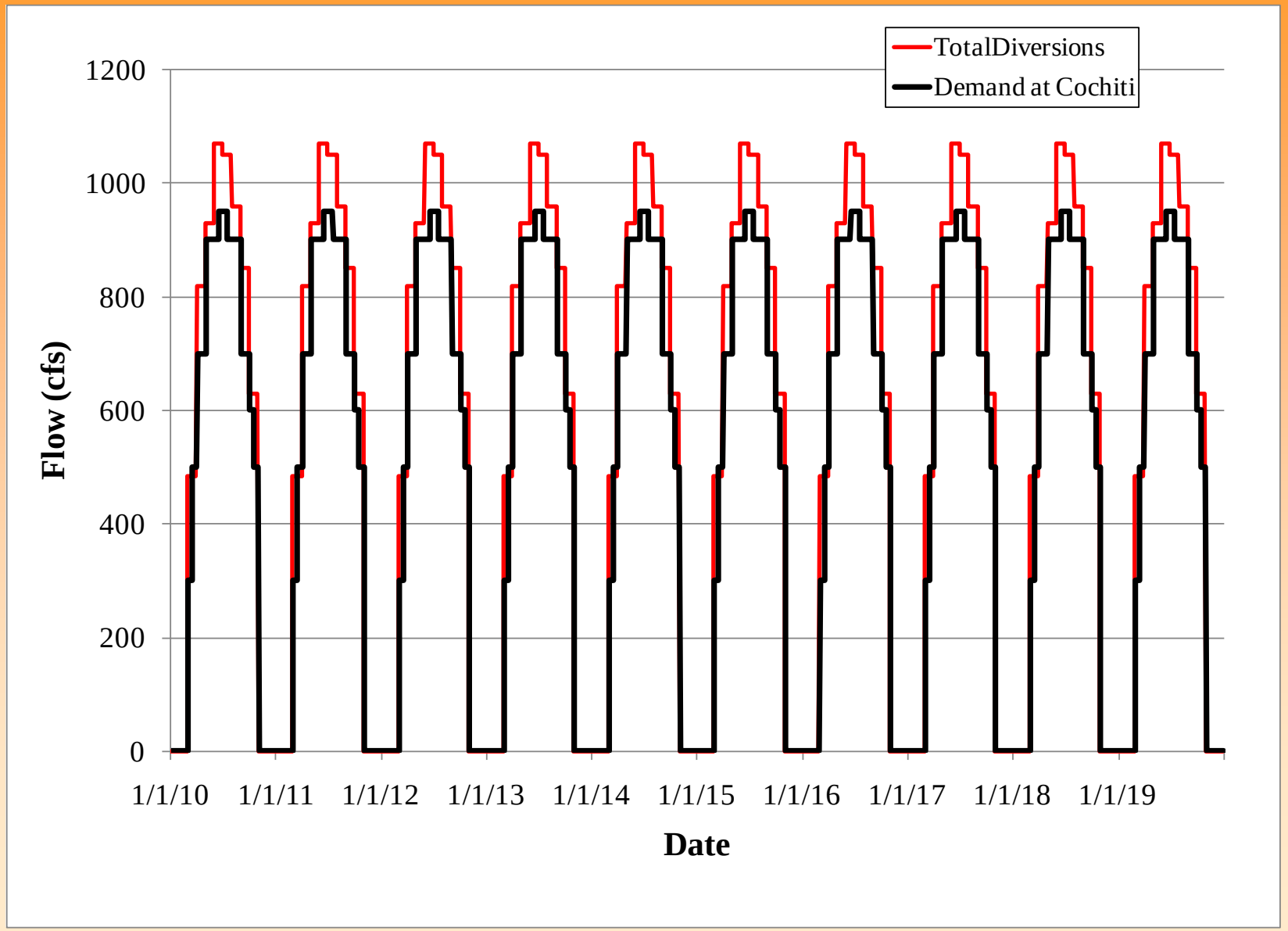


MRGCD Diversions and Demand



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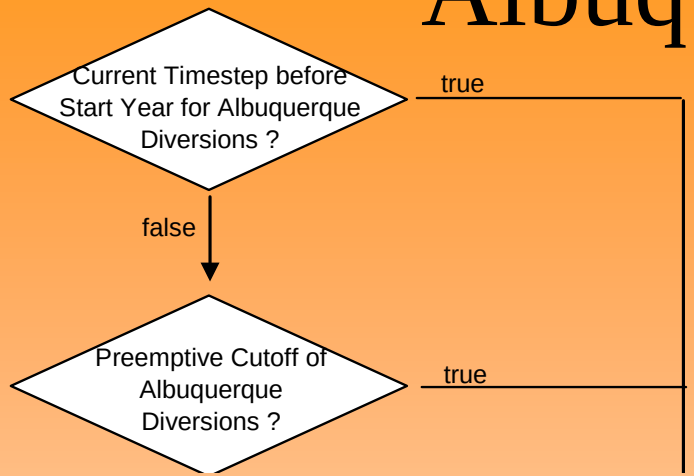
      - Check preemptive cutoff criteria,

Albuquerque Diversions



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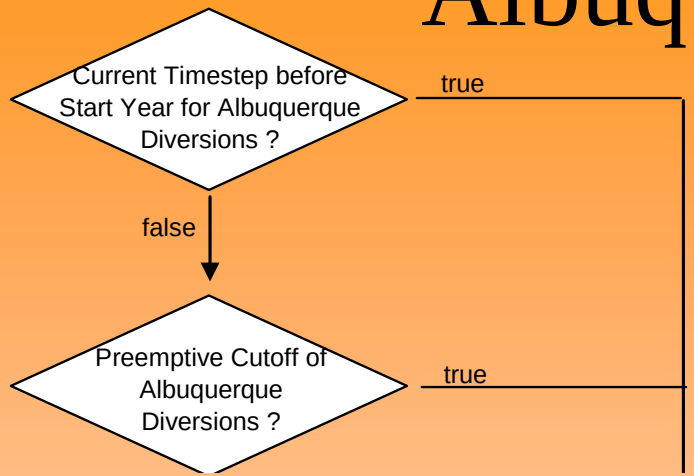

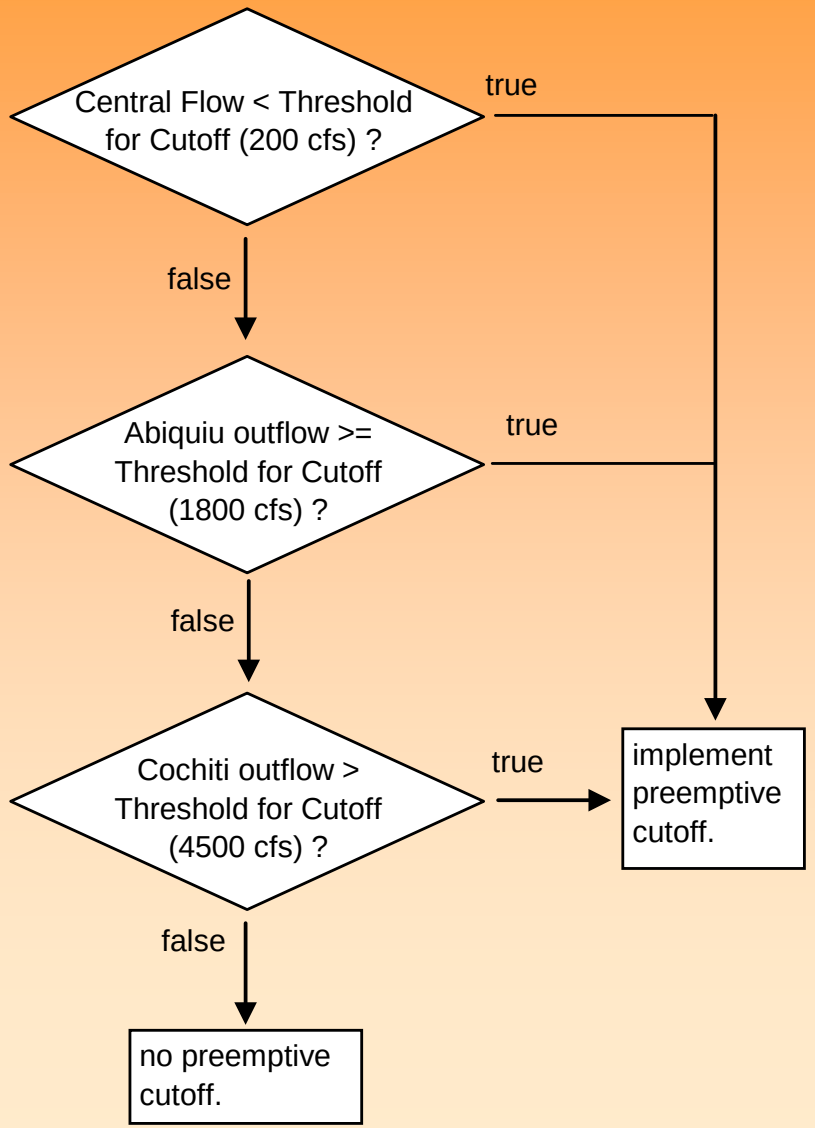

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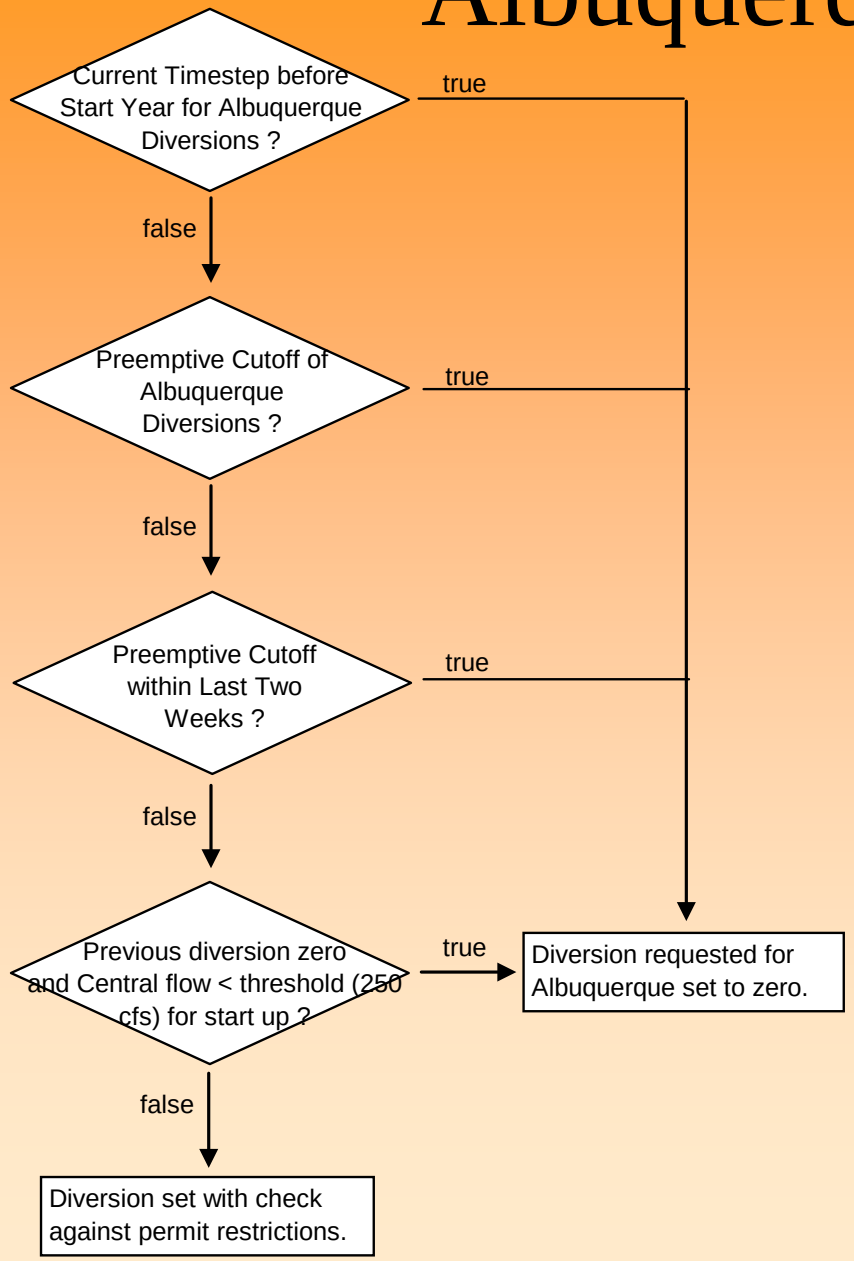

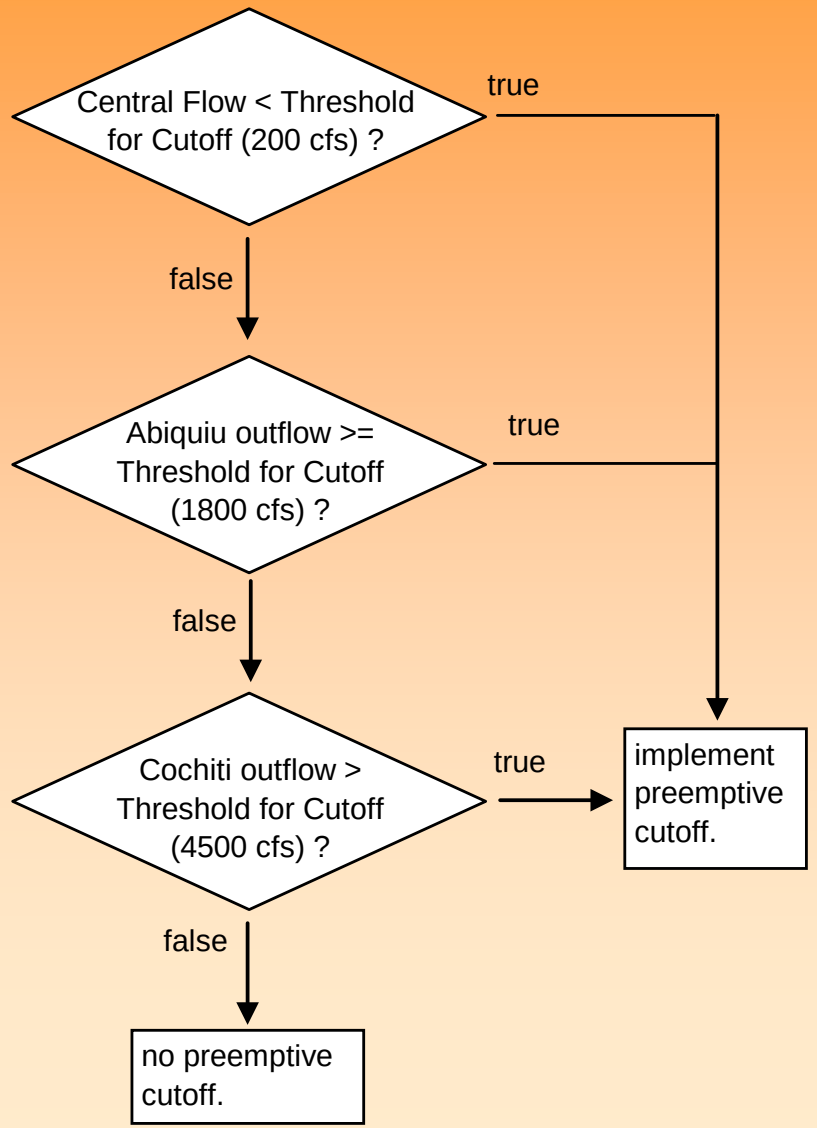

Permitted Albuquerque Diversion

- The permitted diversion is 130 cfs if curtailment or cutoff operations are not in effect.
  - using 65 cfs delivered San Juan-Chama Project water and 65 cfs native Rio Grande water.
    - assumes native Rio Grande water returned to the river (50% return).
    - return flows input (actually higher than 50% - 58,500 acre-ft).
- Curtailment
  - If the flow at the Alameda gage < 195 cfs and > 130 cfs, the permitted diversion is 130 cfs – (195 cfs – the Alameda gaged flow).
- Cutoff
  - If the flow at the Alameda gage < 130 cfs, the permitted diversion is 0 cfs.
- Diversion would be set to twice the available supply if the supply of Albuquerque SJC water is less than the permitted diversion.

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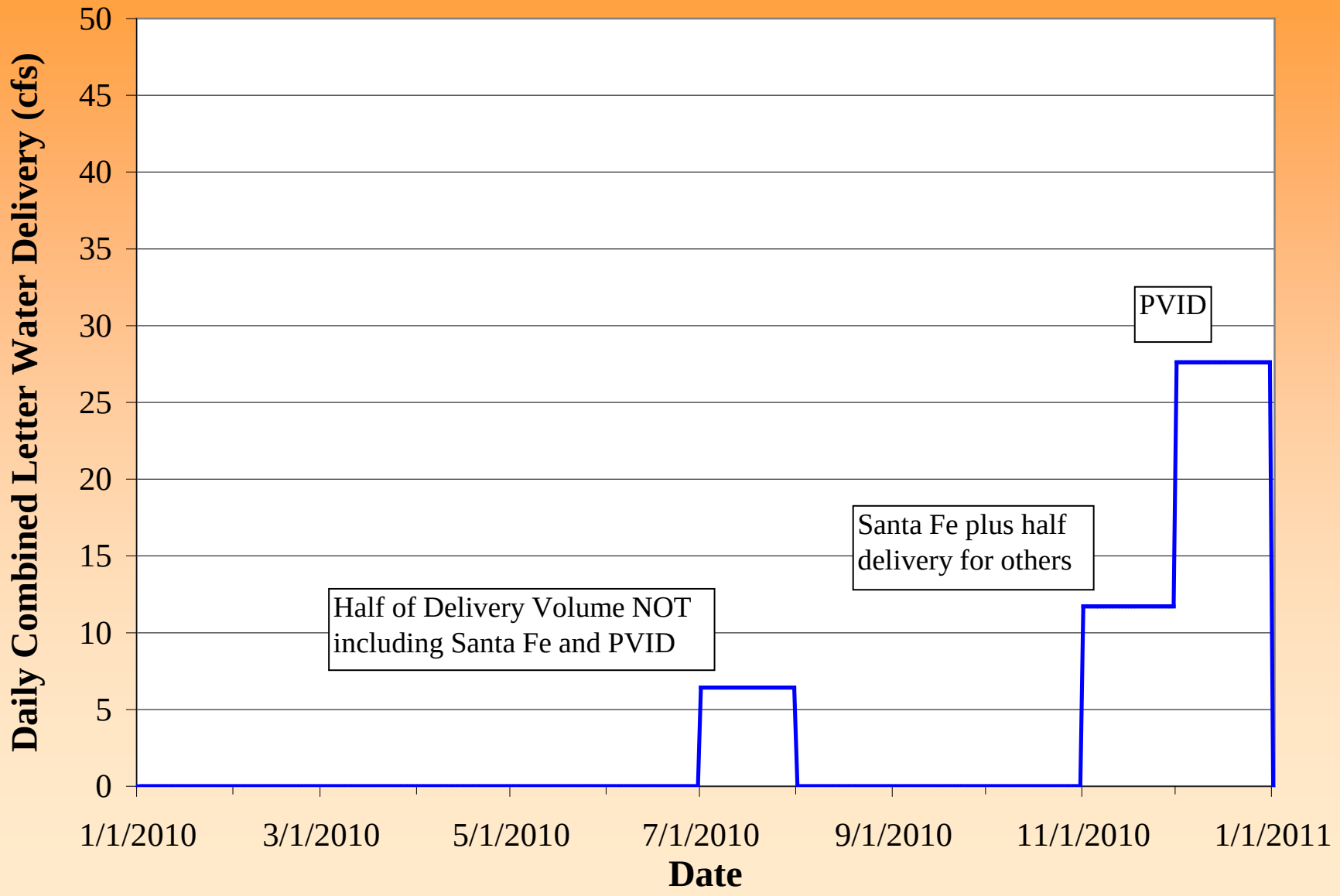
    - Albuquerque demand for San Juan-Chama Project water for diversions,
      - Check preemptive cutoff criteria,
    - Daily letter water delivery schedules for Albuquerque and other contractors (i.e. the Combined account),

Combined Account Letter Water Delivery Volume

Contractor	Annual Delivery Volume	Annual Allocation
COMBINED	**2790**	22,100
Santa Fe	1000	5605
Nambe/PVID	1000	1030
Bernalillo	380	400
Espanola	200	1000
Los Lunas	130	400
Belen	50	500
Taos	30	400
Jicarilla	0	6500
Los Alamos/DOE	0	1200
Red River	0	60
Twining	0	15
San Juan Pueblo	0	2000
NMISC	0	through exchanges
Uncontracted	0	2990

Standard Letter Water Delivery Schedule

Combined Account



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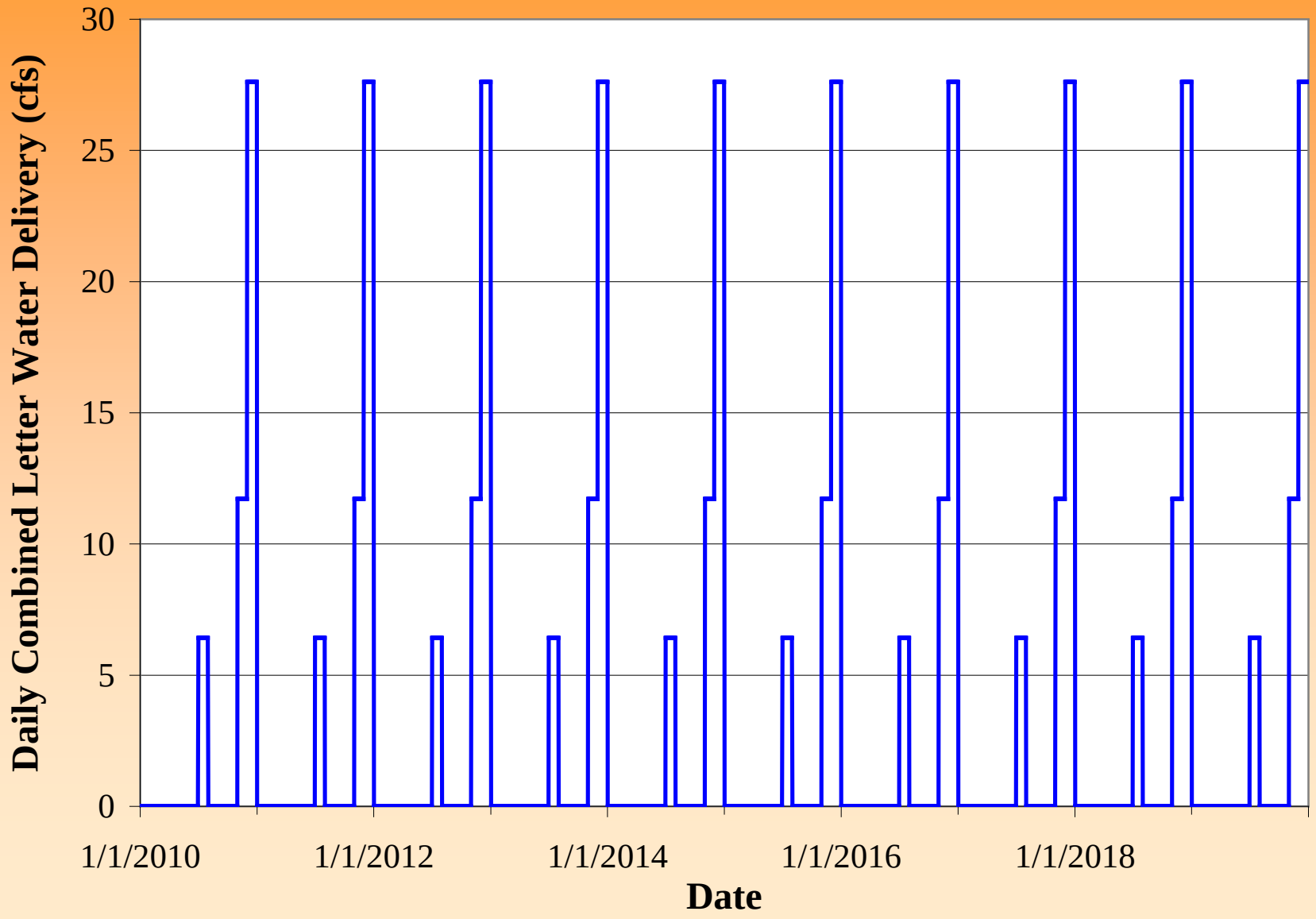
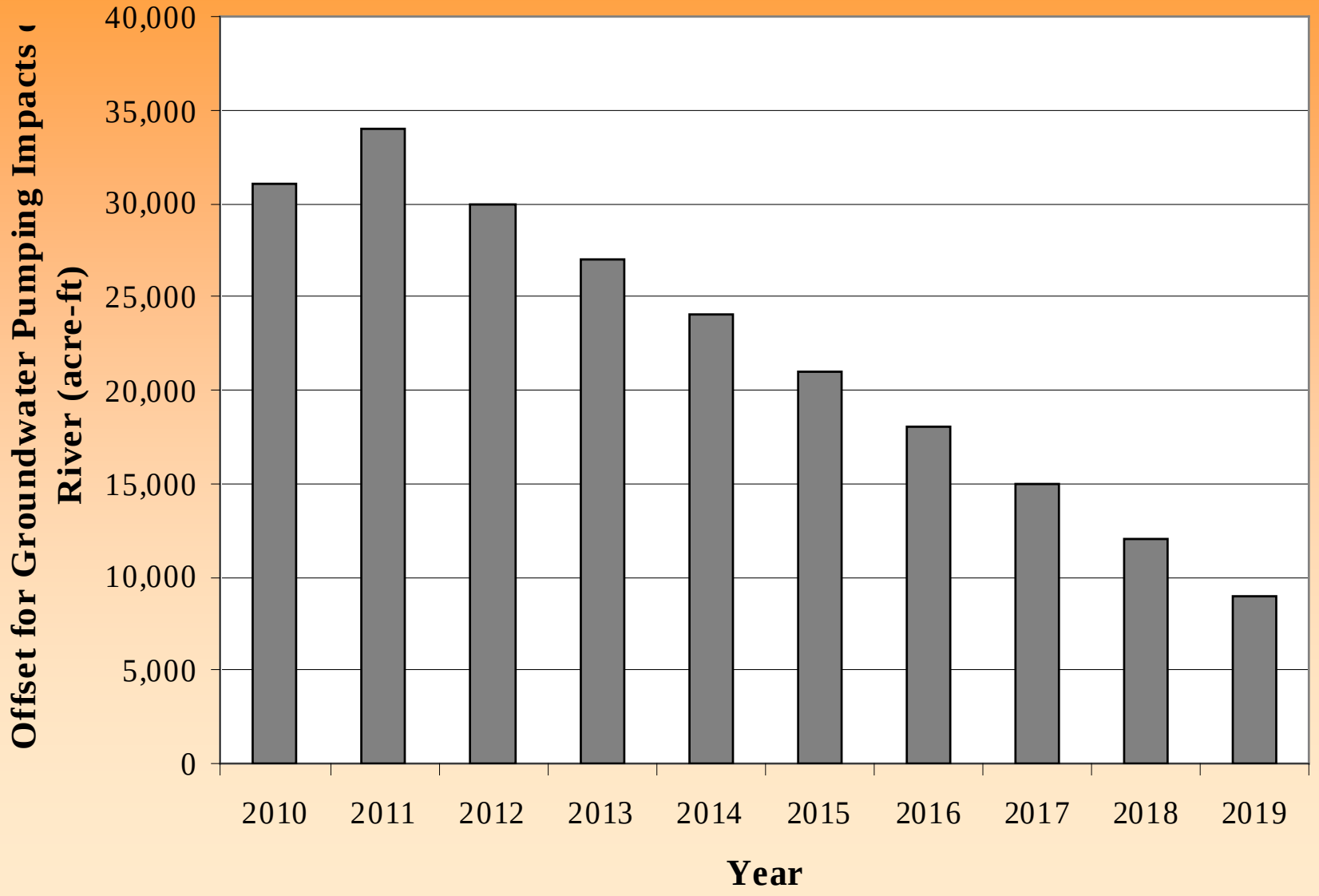


Albuquerque Letter Water Delivery Volumes

Year	Delivery for the Non-Potable Project	Delivery to Offset Groundwater Pumping Impacts on River	Total Delivery
2010	2700	31,000	33,700
2011	2700	34,000	36,700
2012	2700	30,000	32,700
2013	2700	27,000	29,700
2014	2700	24,000	26,700
2015	2700	21,000	23,700
2016	2700	18,000	20,700
2017	2700	15,000	17,700
2018	2700	12,000	14,700
2019	2700	9,000	11,700

Letter Water Delivery Volumes
Albuquerque Account



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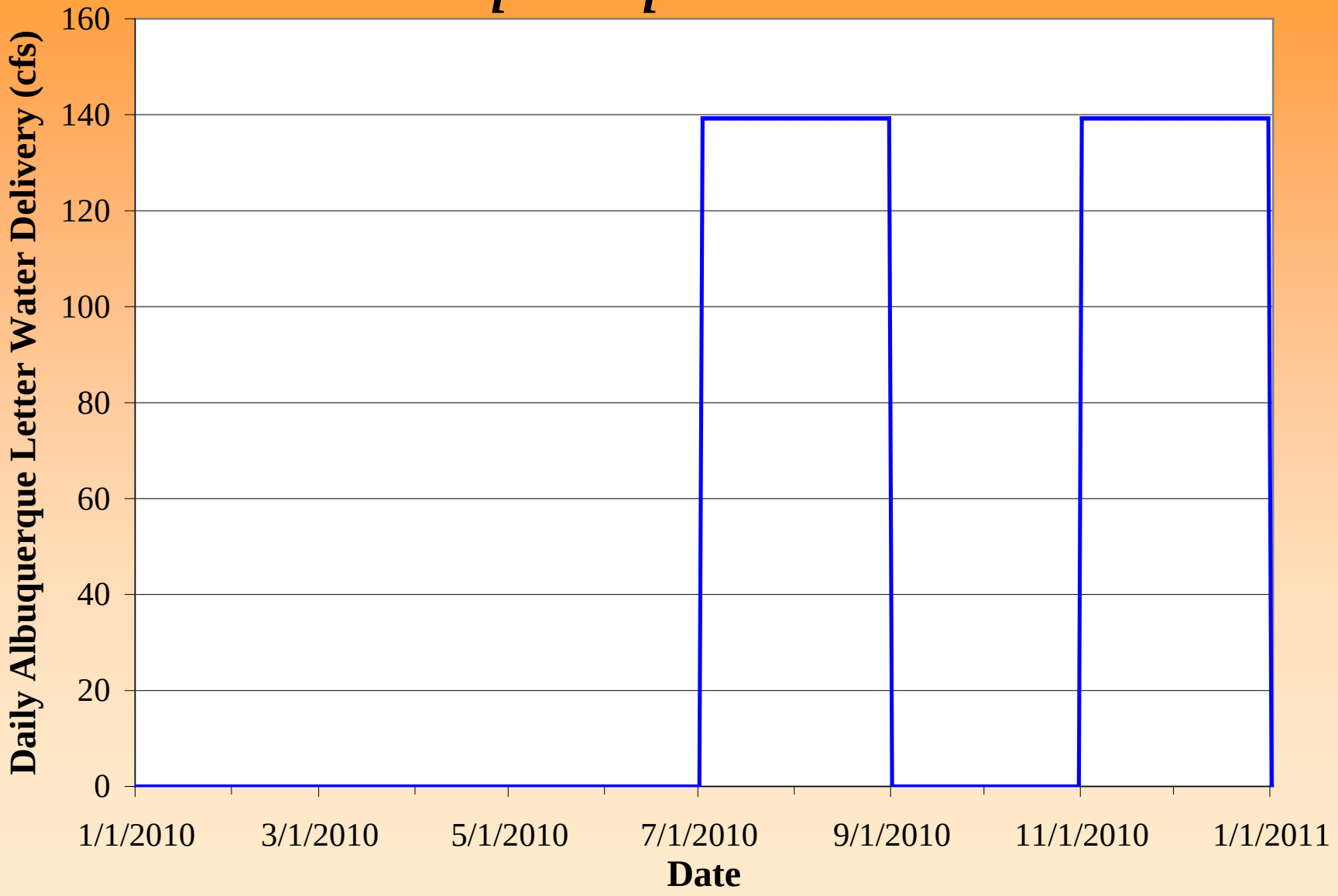

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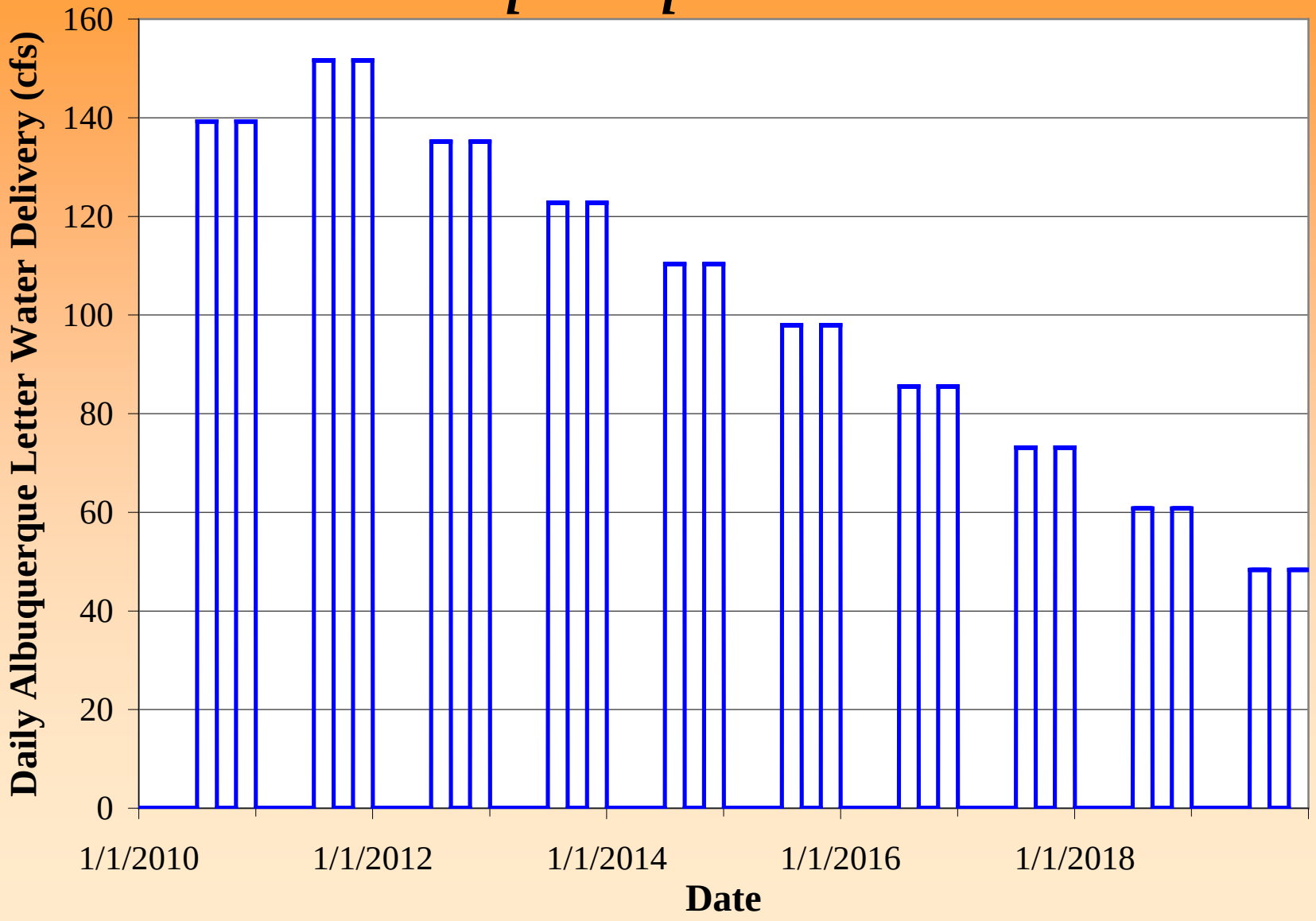

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    - Storage at El Vado when Article VII is not in effect,

Release of Rio Grande Water from El Vado

- El Vado is a post-Compact reservoir and storage and release of native Rio Grande water is dependent on restrictions per Article VII of the Compact.
  - If the usable storage at Elephant Butte and Caballo is less than 400,000 acre-ft, native Rio Grande water cannot be stored.

$$UsableStorage = ElephantButteStorage - NMCreditWater - COCreditWater - AnySJCwater + CaballoStorage$$

  - Usable storage checked daily to identify whether restrictions of Article VII are in effect.
  - Rio Grande water already in storage can be kept in storage.
    - Unless a call is made by Texas for a release per Article VIII.

Release of Rio Grande Water from El Vado

- If Article VII in effect,
  - *initial* calculated Rio Grande release entails bypassing inflows not needed for
    - P&P storage and
    - to fill allocations for Emergency Drought storage
  - and release Rio Grande water from storage
    - as needed to meet P&P needs,
    - to correct for any P&P storage in excess of requirement,
    - as needed to meet the MRGCD demand
      - with consideration for any released P&P water and any letter water delivered to payback MRGCD for impacts of depletions in the basin,
    - Emergency Drought (Supplemental ESA) water to meet targets
      - Emergency Drought water is effectively used first to meet targets by being used to maintain the storage of supplemental leased (Reclamation) SJC water at Abiquiu as water is released from Abiquiu to meet targets.

Release of Rio Grande Water from El Vado

- If Article VII is NOT in effect,
  - *Initial* calculated Rio Grande release set to fill the reservoir to 6901.0 ft (183,035 acre-ft) by a fill date (May 25th).
    - All inflows stored until reservoir is 65% full (reaches elev 6878.35).
    - A portion of inflows are bypassed above 65% of full storage.
      - The percentage is computed daily as the portion of a forecasted inflows up to the fill date that must be bypassed to fill the reservoir on the target date.
        - » Forecasted Rio Grande inflows known exactly in the model.
        - » Inflows of San Juan-Chama Project water estimated.
      - Percentage applied to a 3-day average of forecasted inflows.
  - After target fill date, release set to a computed avg, updated daily, to reach target elev 6879 ft (120,544 acre-ft) by Dec 31.
  - Not to be less than the release needed to meet P&P needs, MRGCD demand, and targets with Emergency Drought water.

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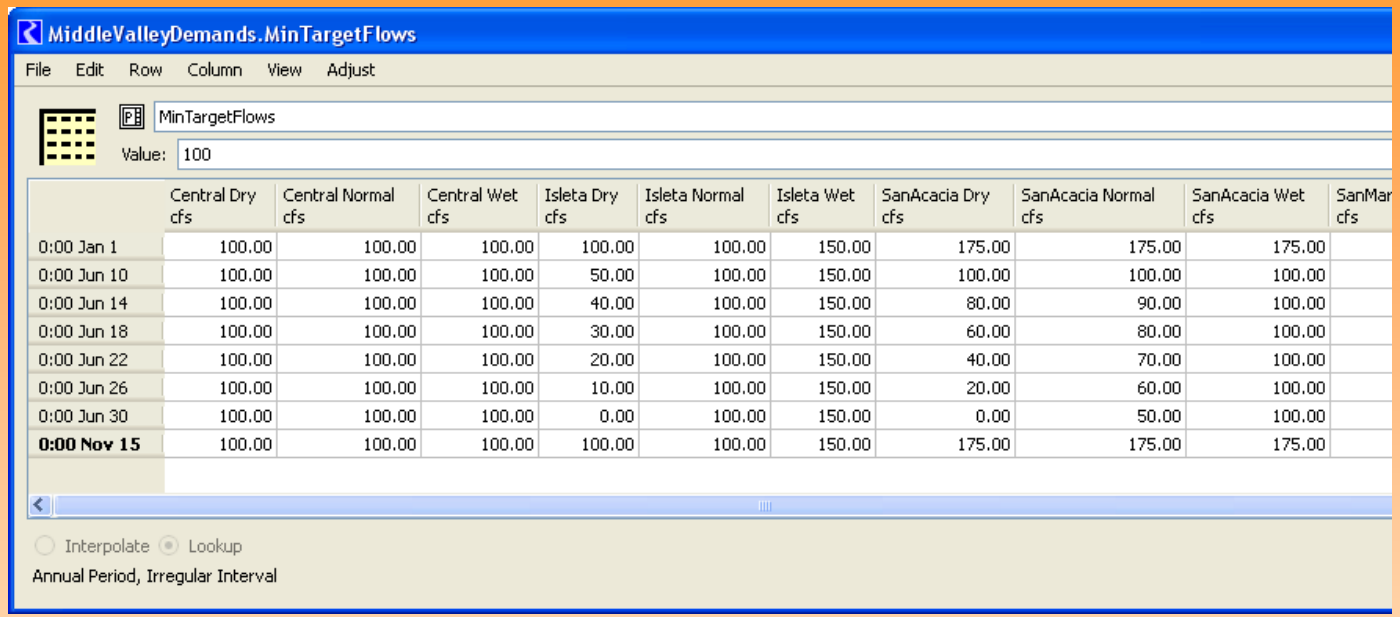
    - Storage at El Vado when Article VII is not in effect,
    - Schedule for the full demand below Elephant Butte, and
    - Channel capacities.

Model Set Up

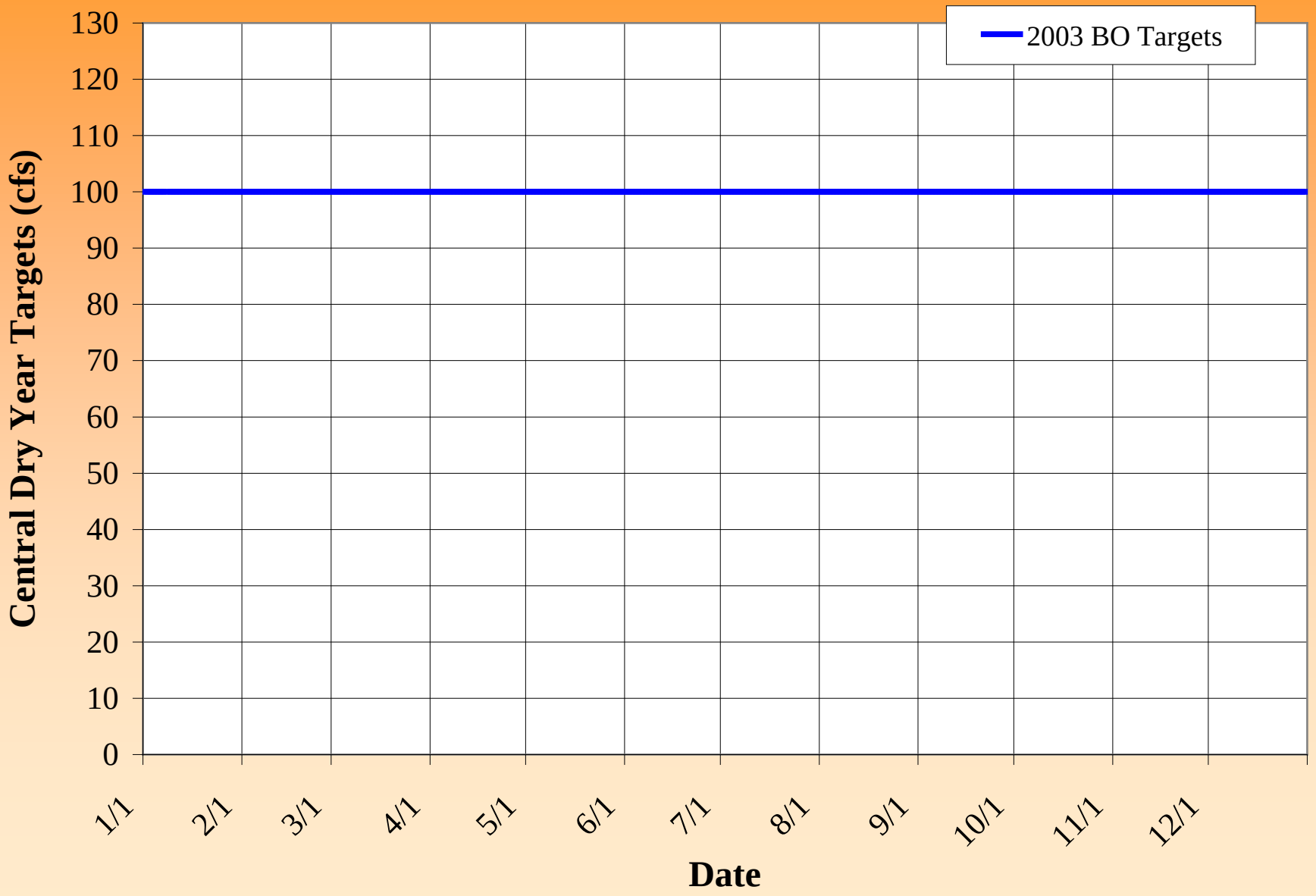
- Scenario Defined Inputs and Potential Flow Tools,
  - Middle Valley targets,

Target Table



	Central Dry cfs	Central Normal cfs	Central Wet cfs	Isleta Dry cfs	Isleta Normal cfs	Isleta Wet cfs	SanAcacia Dry cfs	SanAcacia Normal cfs	SanAcacia Wet cfs	SanMar cfs
0:00 Jan 1	100.00	100.00	100.00	100.00	100.00	150.00	175.00	175.00	175.00	
0:00 Jun 10	100.00	100.00	100.00	50.00	100.00	150.00	100.00	100.00	100.00	
0:00 Jun 14	100.00	100.00	100.00	40.00	100.00	150.00	80.00	90.00	100.00	
0:00 Jun 18	100.00	100.00	100.00	30.00	100.00	150.00	60.00	80.00	100.00	
0:00 Jun 22	100.00	100.00	100.00	20.00	100.00	150.00	40.00	70.00	100.00	
0:00 Jun 26	100.00	100.00	100.00	10.00	100.00	150.00	20.00	60.00	100.00	
0:00 Jun 30	100.00	100.00	100.00	0.00	100.00	150.00	0.00	50.00	100.00	
0:00 Nov 15	100.00	100.00	100.00	100.00	100.00	150.00	175.00	175.00	175.00	

2003 BO Targets



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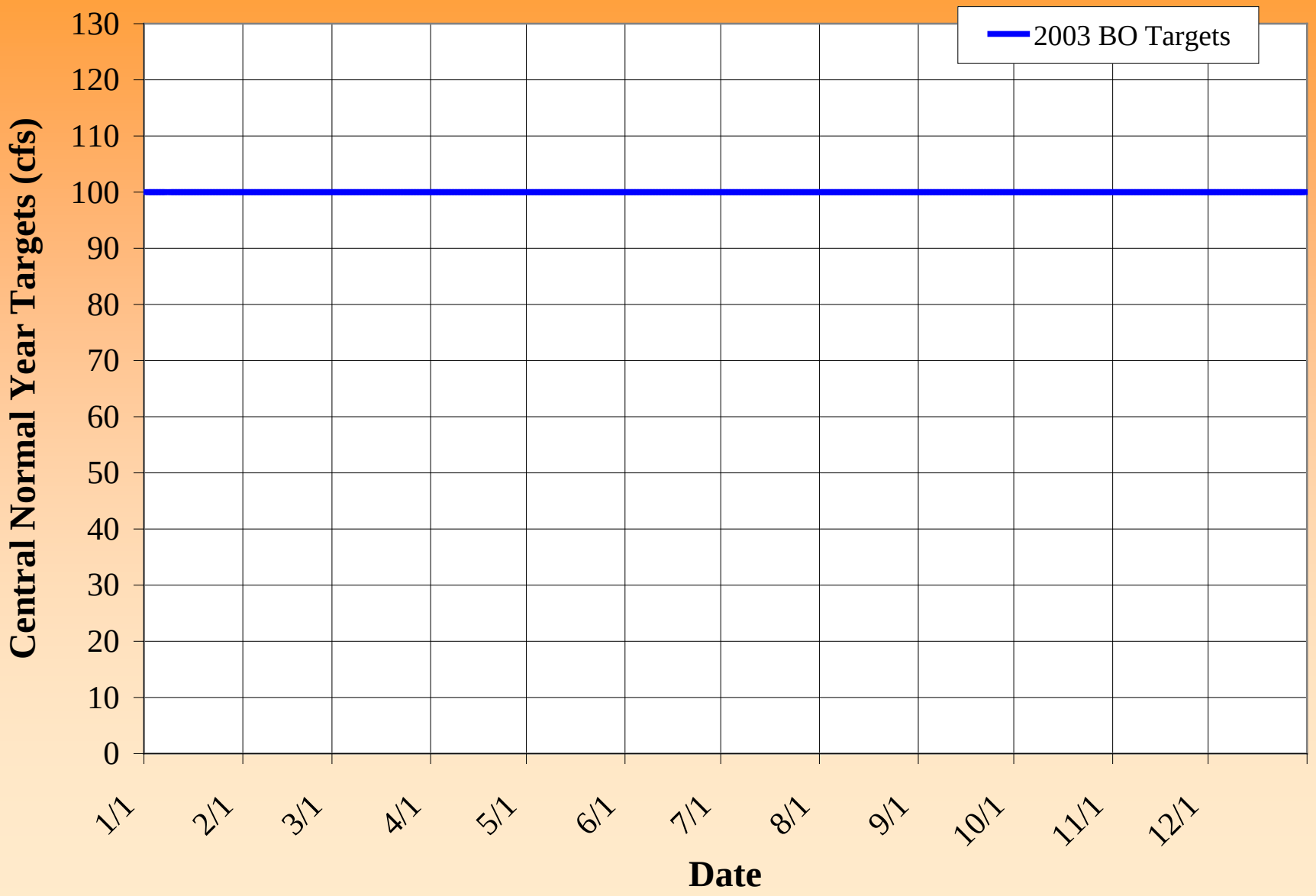

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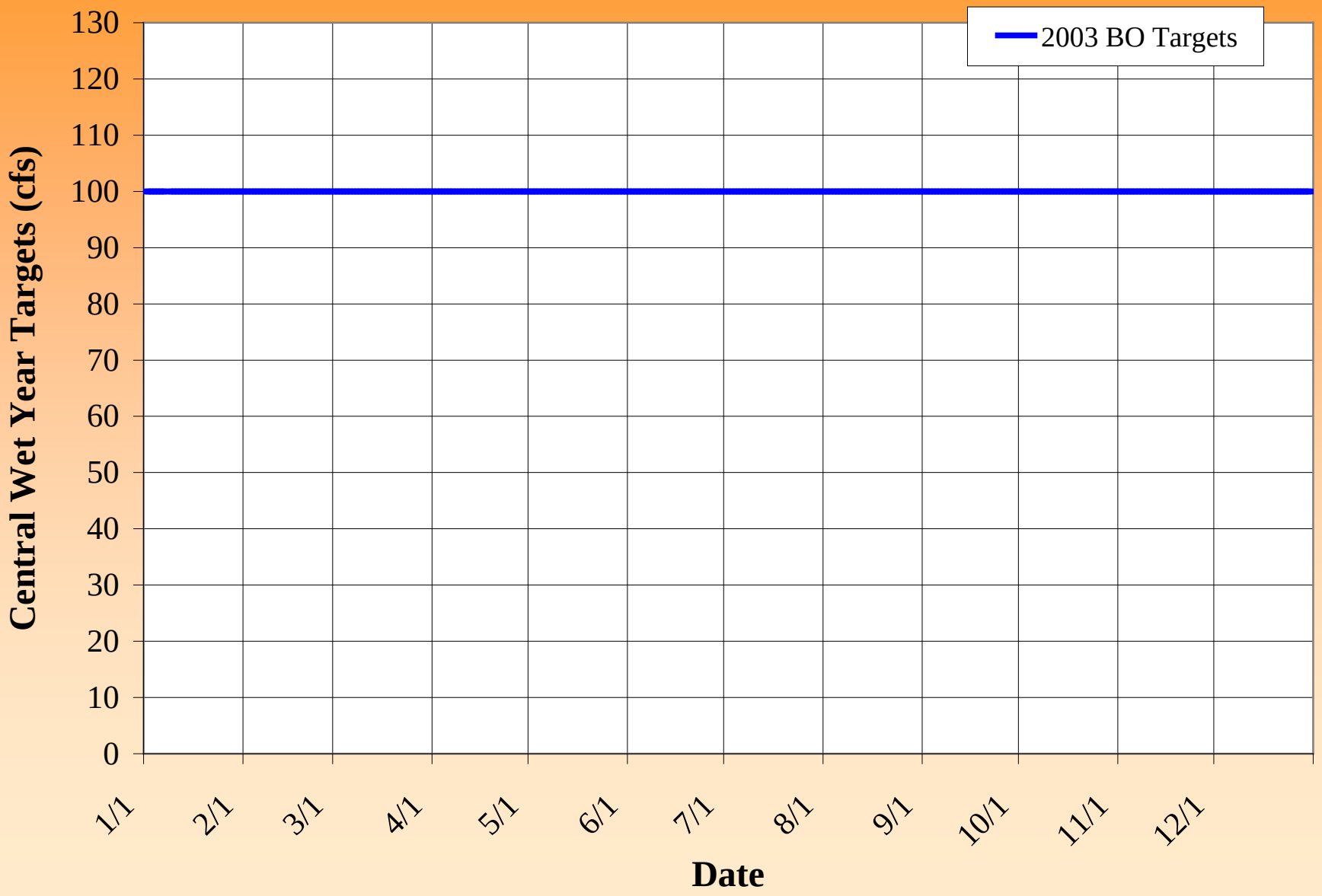

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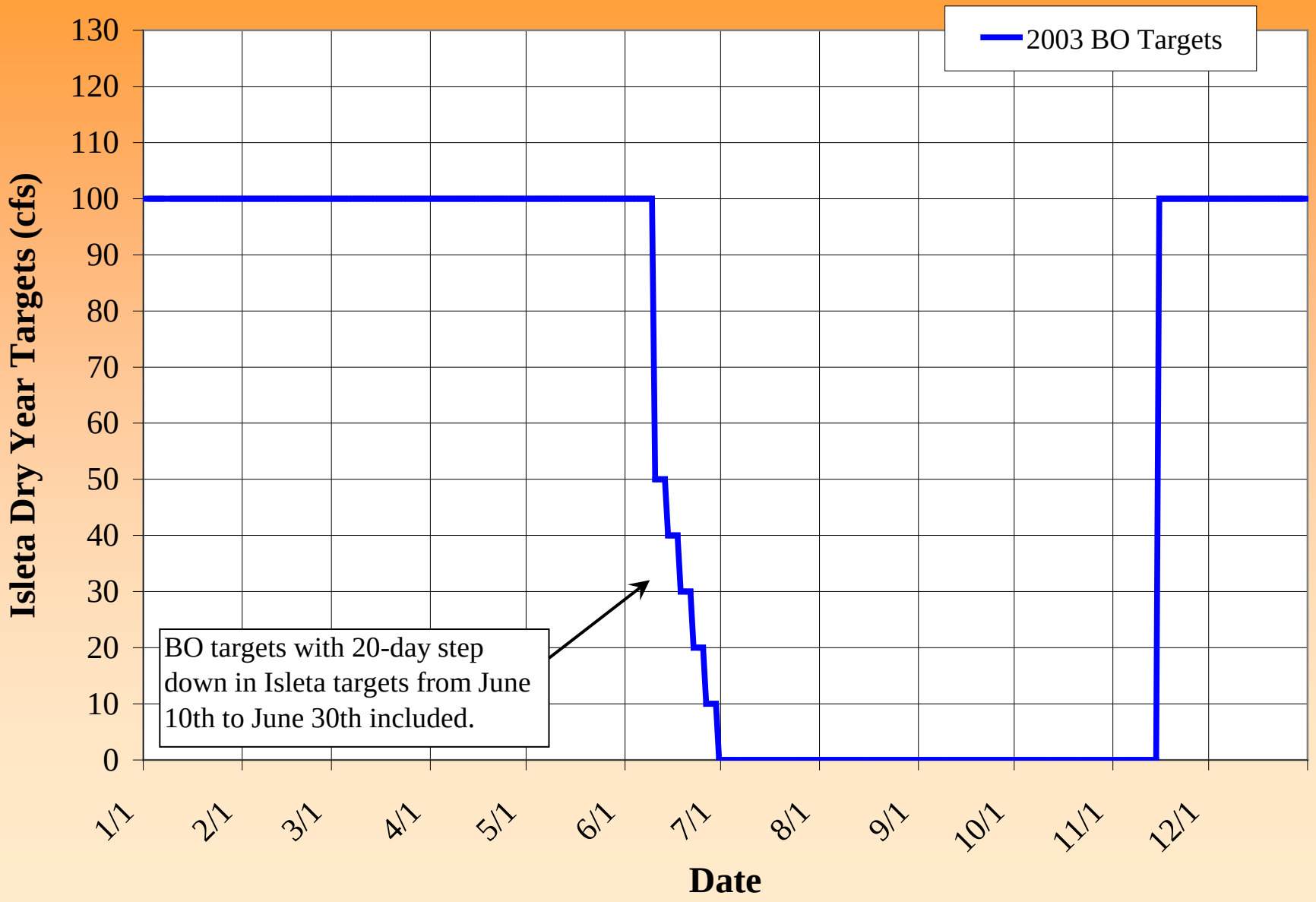

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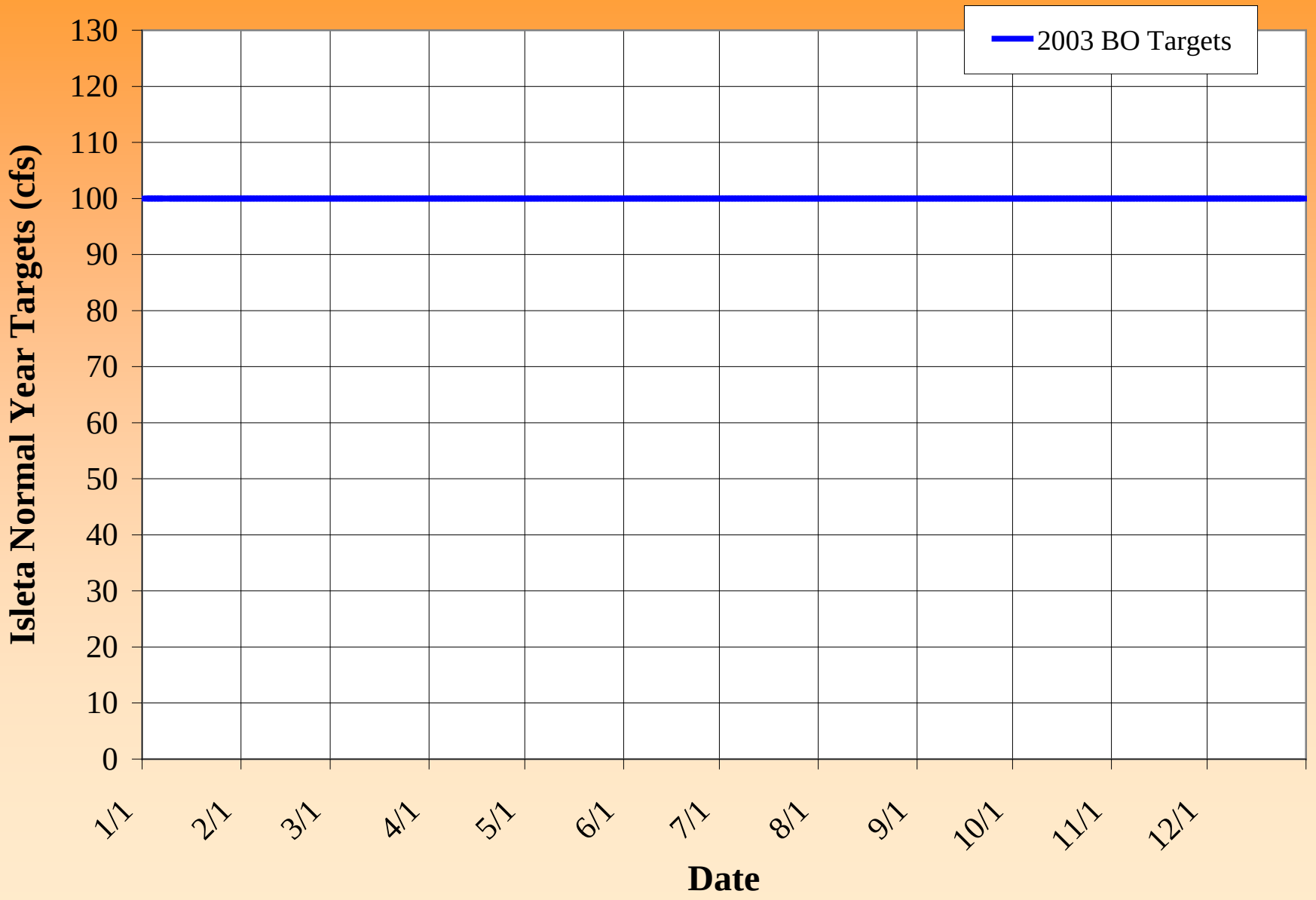

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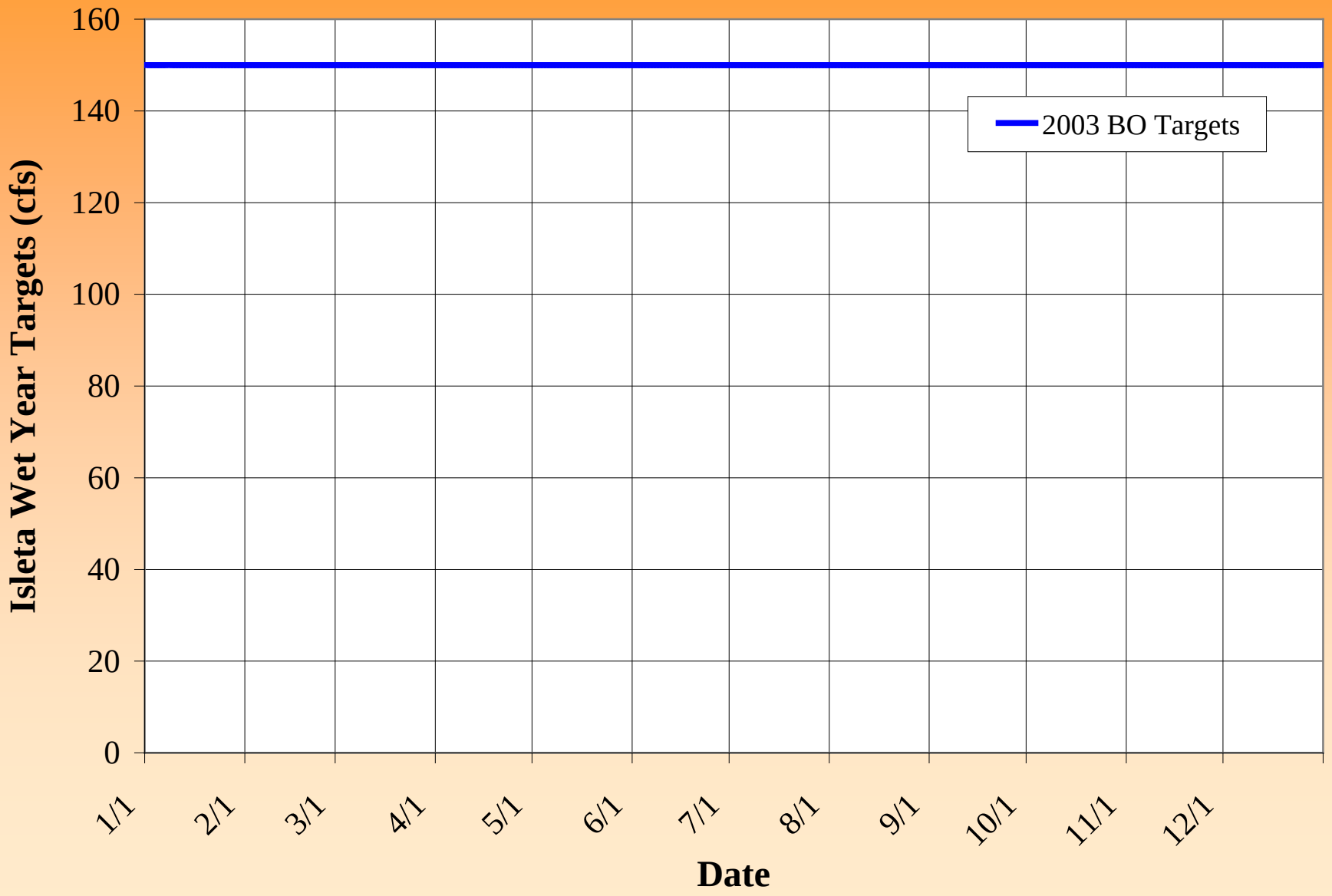

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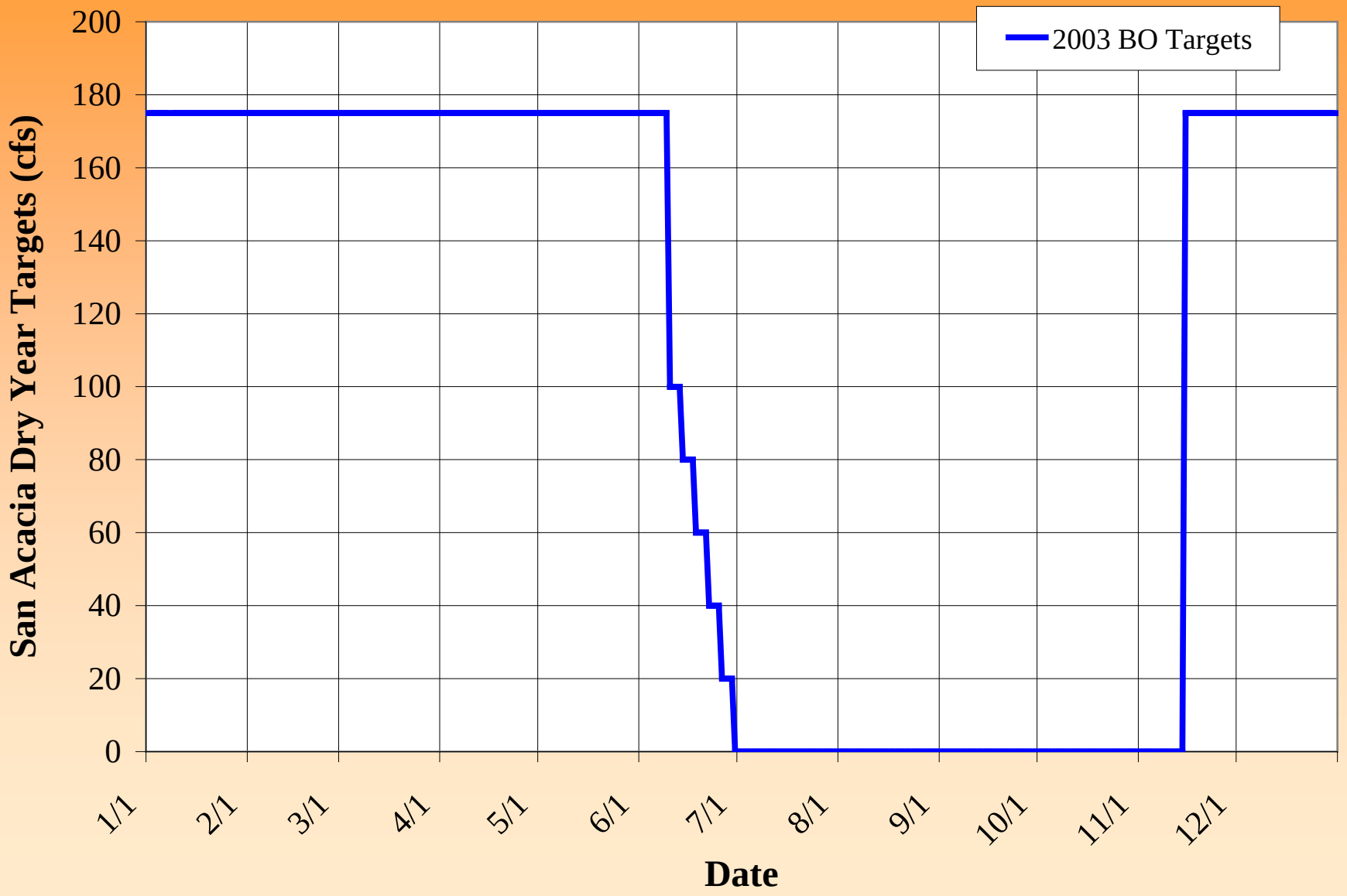

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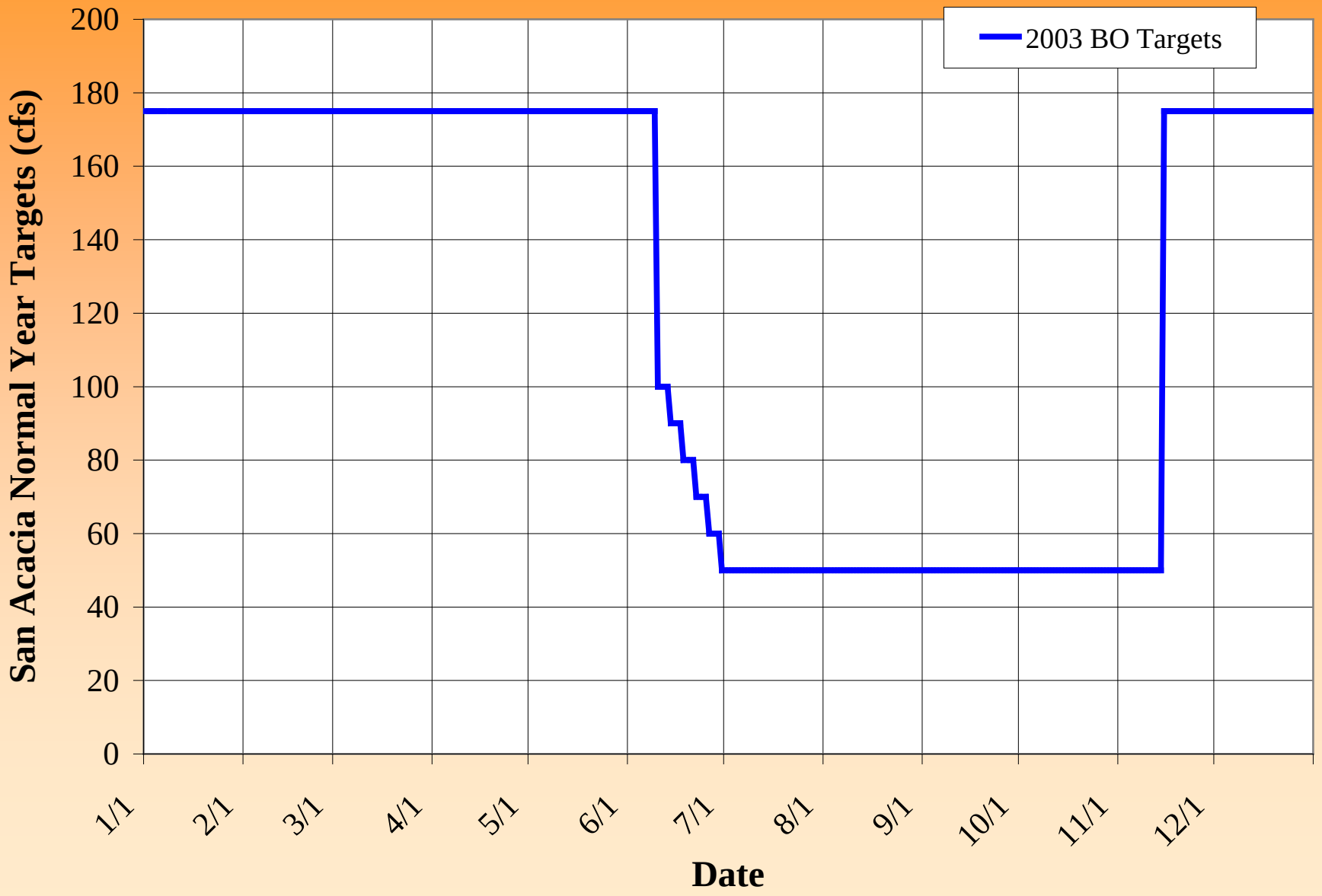

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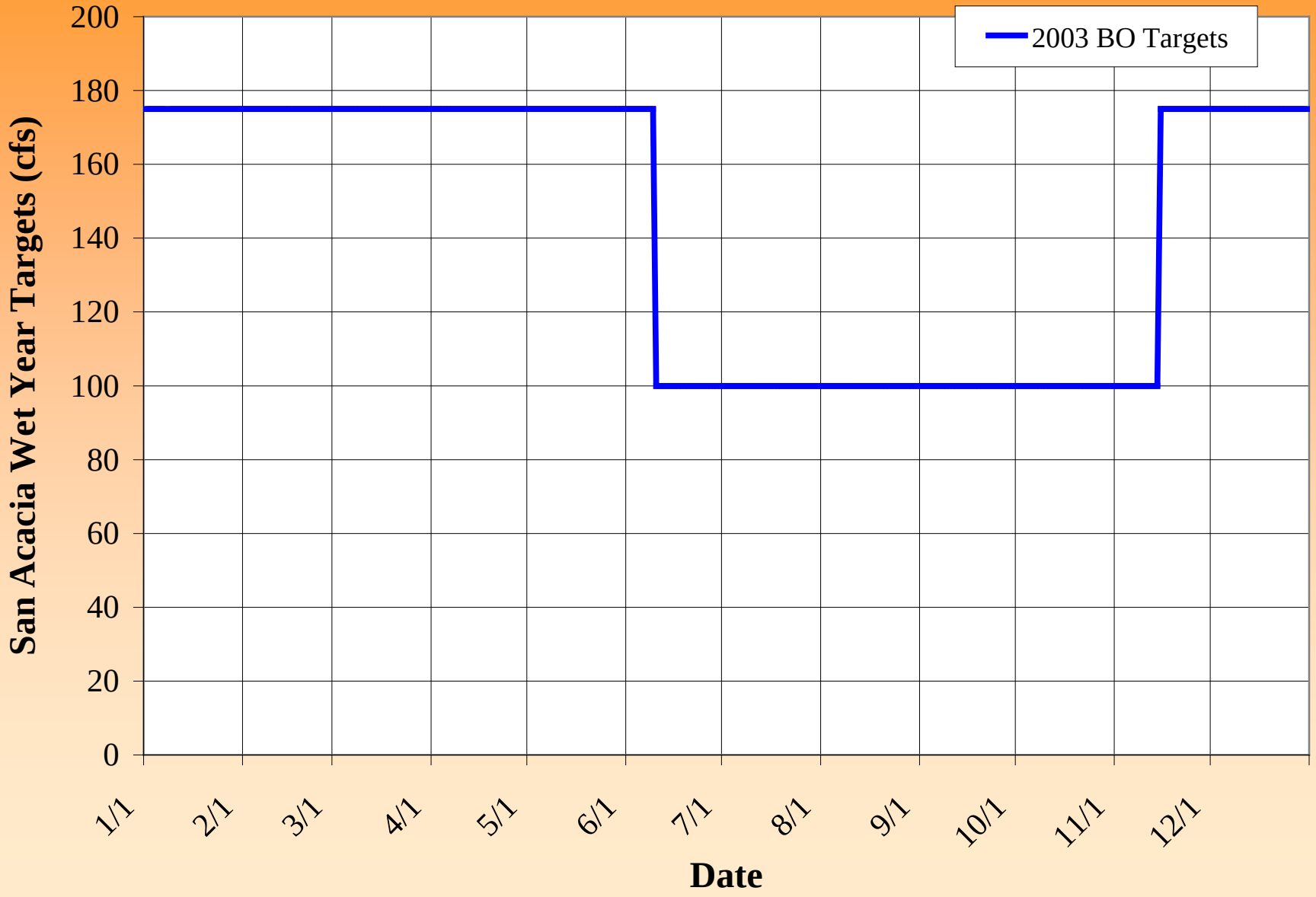

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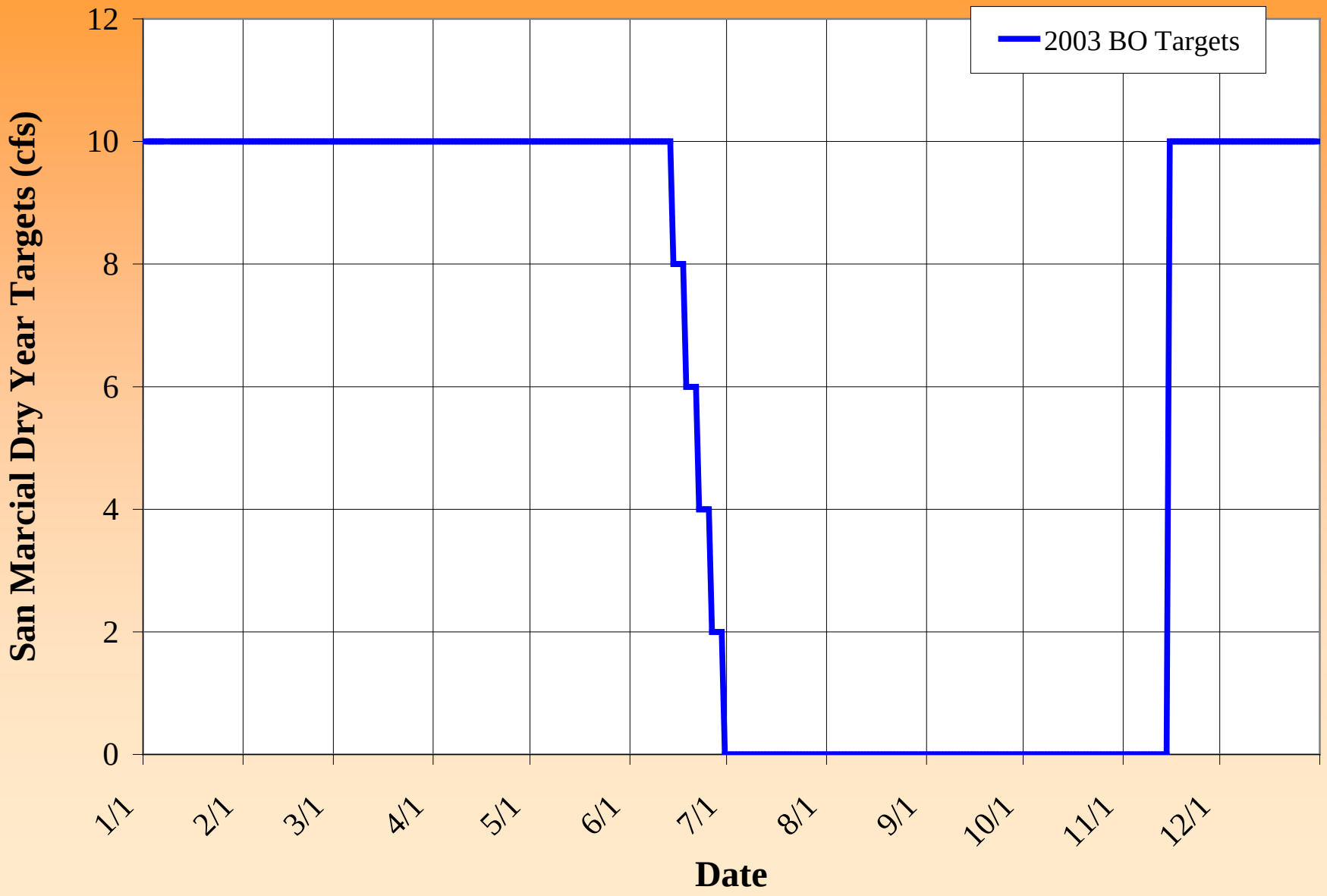

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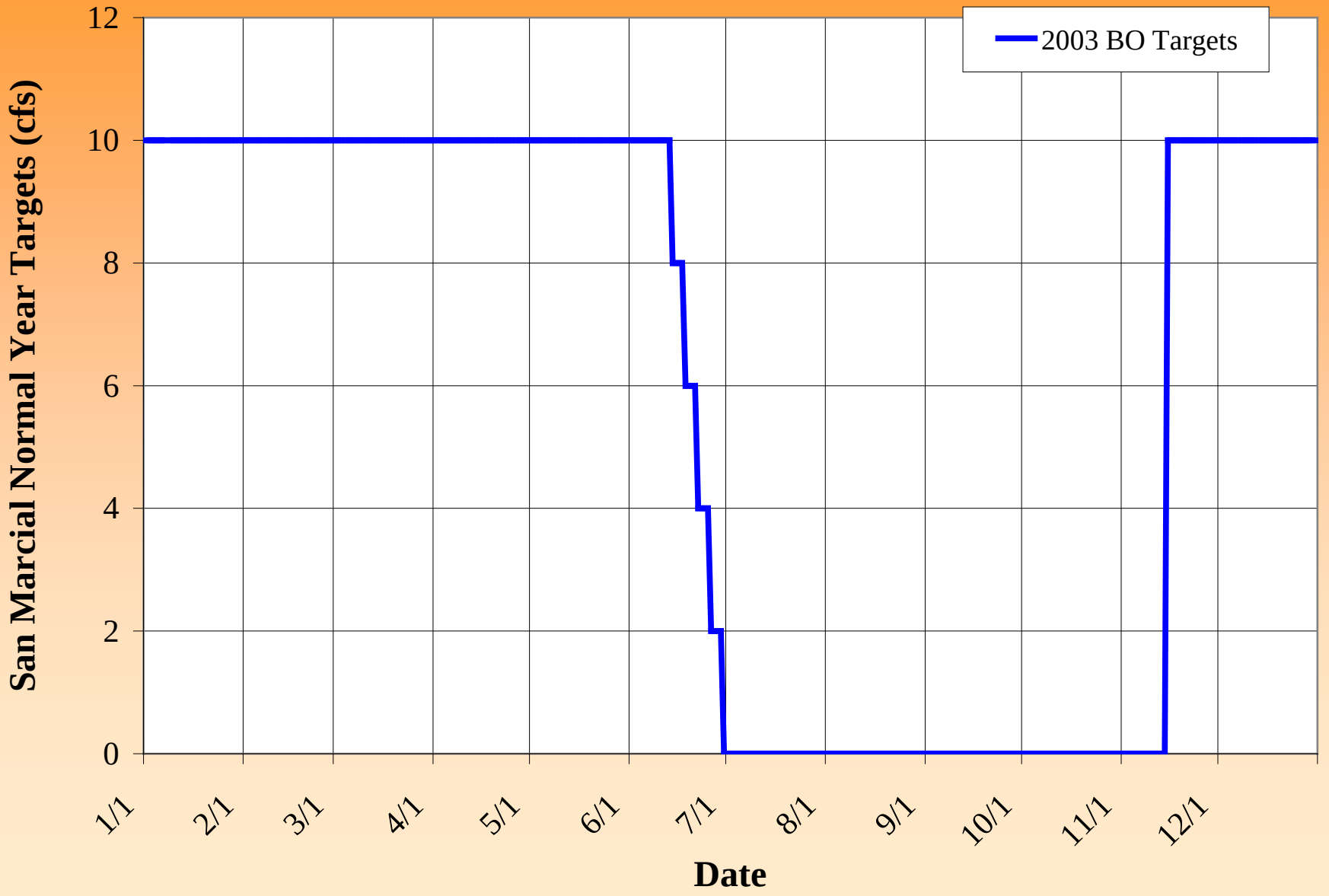

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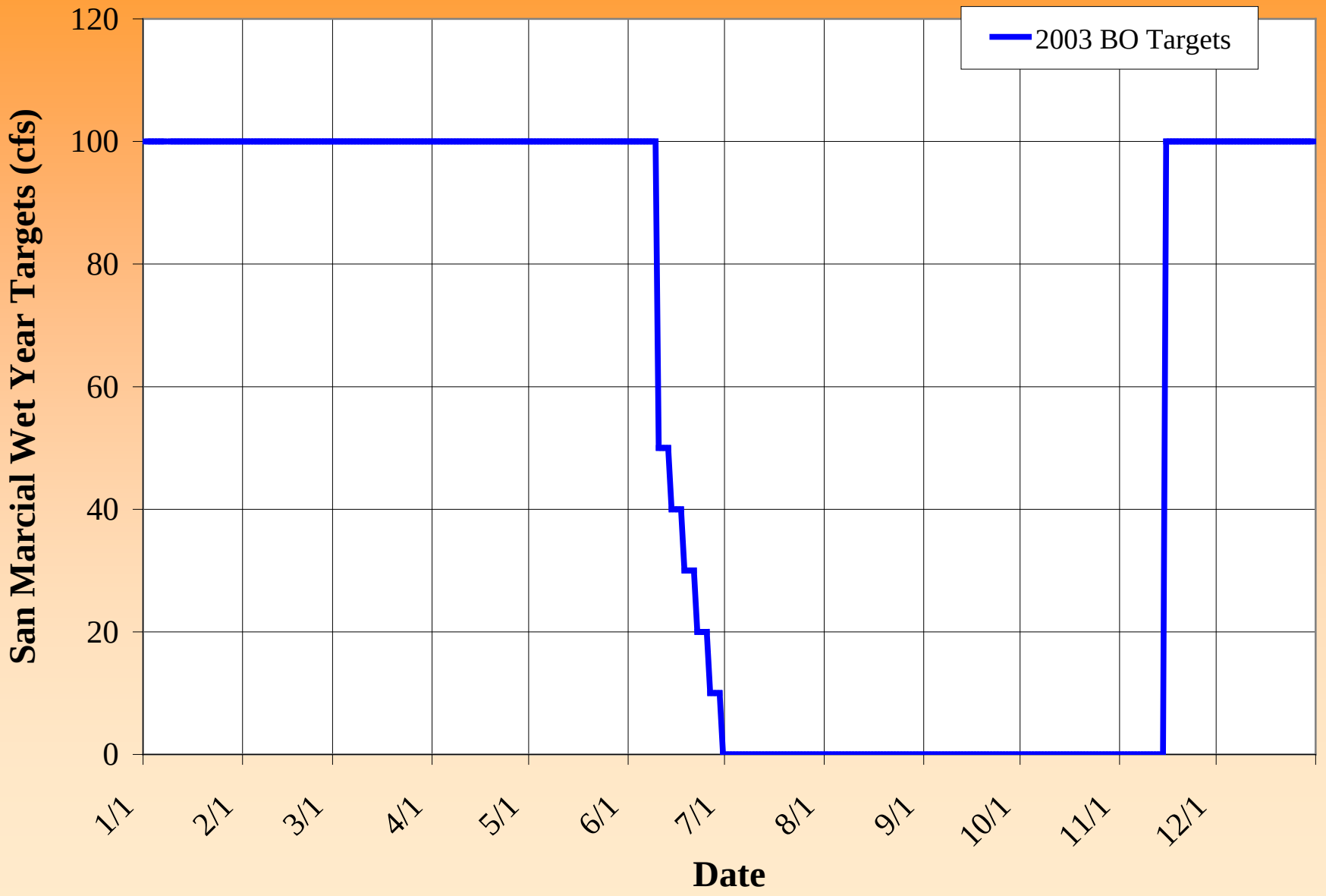

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- Scenario Defined Inputs and Potential Flow Tools,
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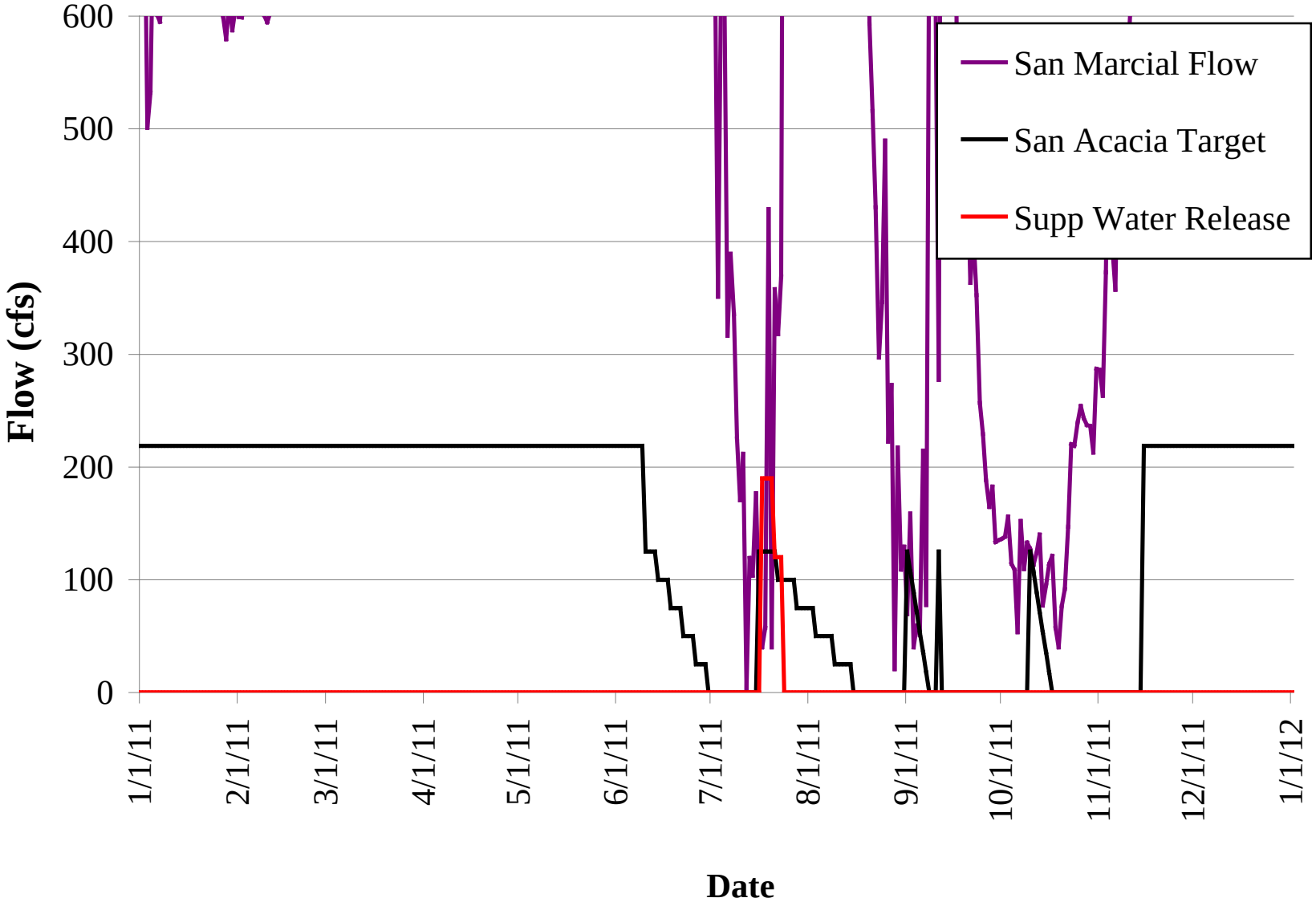
    - Step downs to manage recession and control rate of drying after rewetting,

Step Downs in Targets



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    - Adjustment factor applied to targets,
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    - Short MRGCD diversions (i.e. prevent diversion of supplemental water),
  - Reclamation leases of San Juan-Chama water from each contractor,
    - Threshold year-to-date Otowi flow volume to conserve lease water,
  - Relinquished Compact credits and Emergency Drought water,

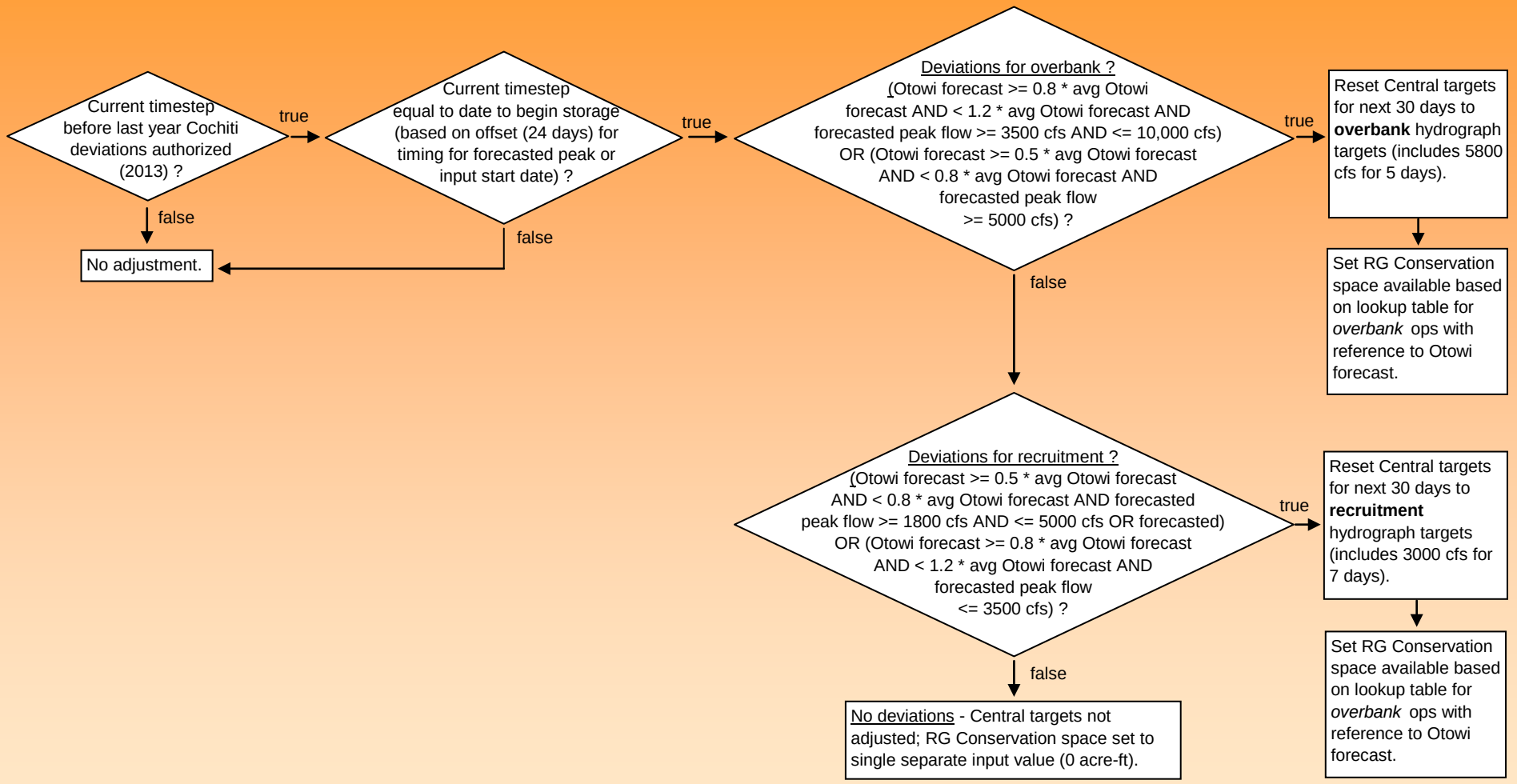
Relinquished Credits

- Relinquished Credits
  - If the Compact Credit, on an input date, is greater than an input threshold (100,000 acre-ft), Credits are relinquished to reduce the credit to an input target (70,000 acre-ft).
  - Allocations are made for storage of Emergency Drought water at El Vado Reservoir, when Article VII is in effect,
    - 1/3 of Relinquishment to MRGCD,
    - 1/3 to Reclamation for ESA,
    - 1/3 to municipalities.
  - Emergency Drought water stored up to the allocation amount when Article VII is in effect *after P&P storage*.
  - MRGCD Emergency Drought water used to meet their demand as not needed after native supplies exhausted.
  - Reclamation water used to meet targets before lease water.

Model Set Up

- Scenario Defined Inputs and Potential Flow Tools,
  - Middle Valley targets,
    - Criteria for year classifications,
    - Adjustment factor applied to targets,
    - Step downs to manage recession and control rate of drying after rewetting,
    - Short MRGCD diversions (i.e. prevent diversion of supplemental water),
  - Reclamation leases of San Juan-Chama water from each contractor,
    - Threshold year-to-date Otowi flow volume to conserve lease water,
  - Relinquished Compact credits and Emergency Drought water,
  - Cochiti Deviations,
    - Last Year authorized,

Cochiti Deviations



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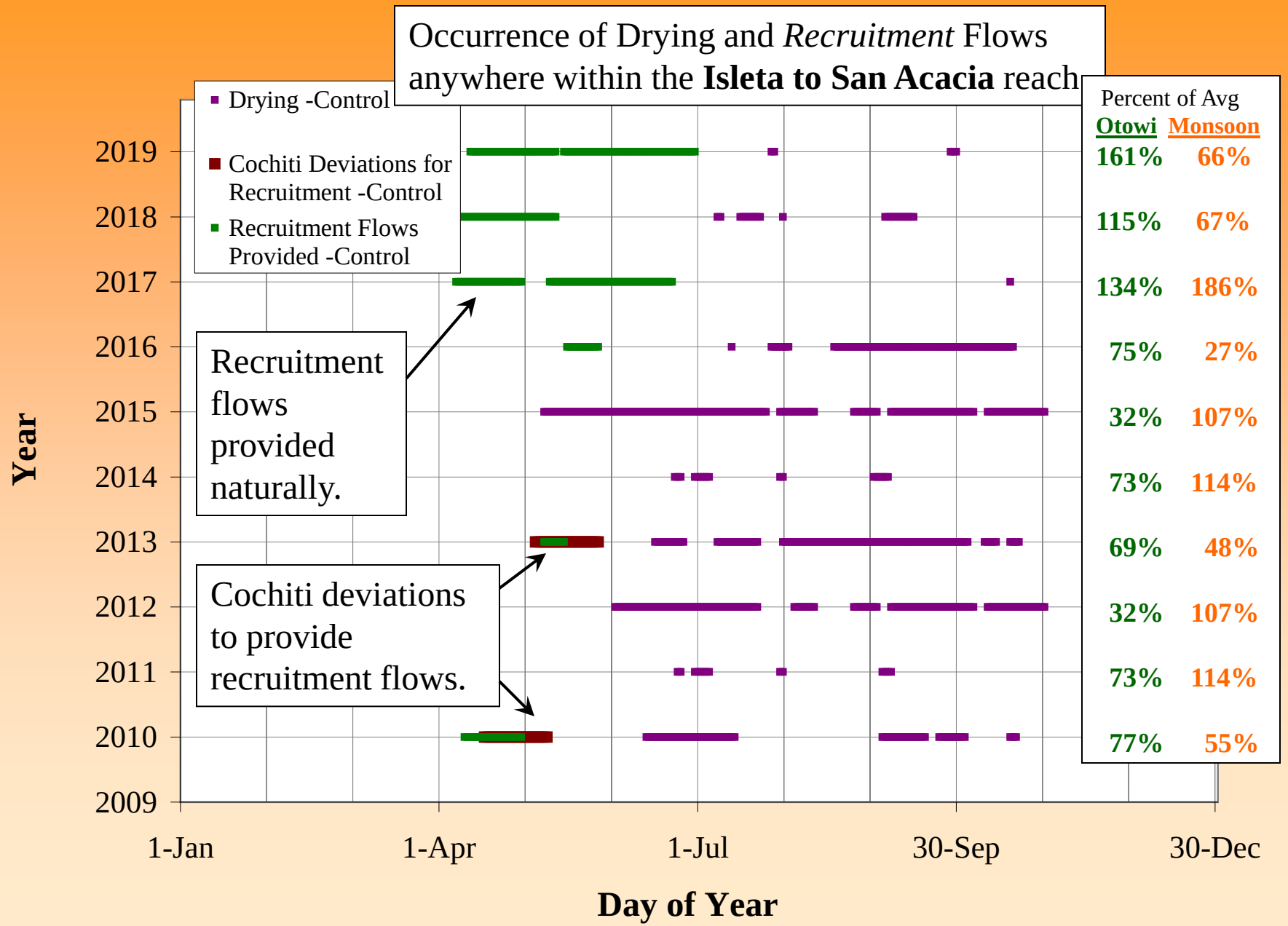
  - Pumping from the Low Flow Conveyance Channel,
  - Reregulation storage at Abiquiu above easement pool elev of 6220 ft.

Model Results

- Numerous tools available for reviewing results
  - in RiverWare,
  - Pisces,
  - in DSS, and
  - Template spreadsheet.

Pre-ESA Mgmt Scenario – River Drying – 70% exceedence sequence



Water Operations Model

- Controls for water deliveries.
  - Account Fill Max Volume
  - Cochiti Rec Pool Max Volume
  - Account, Release Type, and Reservoir Priority Tables
  - San Juan-Chama Max Release
- Database DMIs set up for completing Water Operations Model runs to prepare Annual Operating Plans (AOP).