Sulphur Basin Feasibility Study
Revised Yield Study

FREESE AND NICHOLS
Celebrating 120 YEARS of Service

Presentation to SRBA

June 16, 2015

SBG
Sulphur Basin Group

Outline

- Purpose of Project
- Model Description
  - Method to mimic priority assumption
  - Environmental flow requirements
- Updated Stand-Alone Yields
- Combination Yields
- Results
- Alternatives that reach supply goal
- Conclusions

Description of Project

- Meet regional need of 604,000 ac-ft/yr
  - Region C = 584,000 ac-ft/yr
  - Region D = 20,000 ac-ft/yr
- Find combinations of Patman reallocation and Marvin Nichols that meet need
  - Patman between 232.5 and 242.5 feet
  - Nichols between 296.5 and 313.5 feet
- Using updated RiverWare model
  - Removed precipitation on reservoir from inflows
  - Hydrology extended through 2014
  - Add eflows and priority pass-throughs

Modeling Approach

- Wright Patman water right
  - Current
    - Senior to Ralph Hall and Marvin Nichols
    - Partially senior to Lake Chapman (60,000 ac-ft/yr)
    - Uses Ultimate Curve
  - Reallocation assumed to be junior to Nichols
- Other water rights represented by historical operation

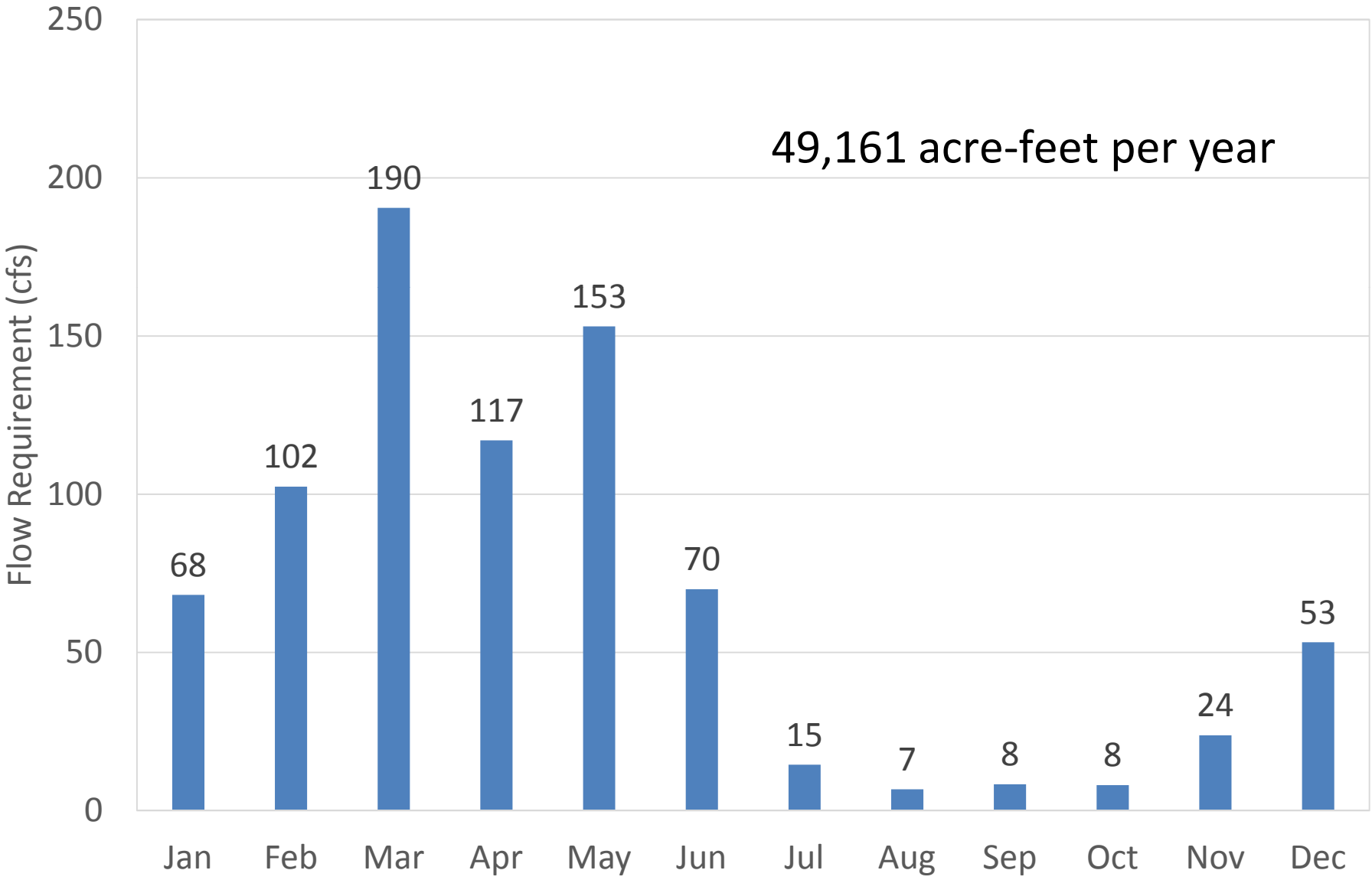
Modeling Approach

- Developed a WRAP “mini-WAM” using COE hydrology
  - Only Sulphur Basin features in COE model
  - Determined monthly priority pass-throughs at each project
  - Distributed evenly to each day of month and input into RiverWare model

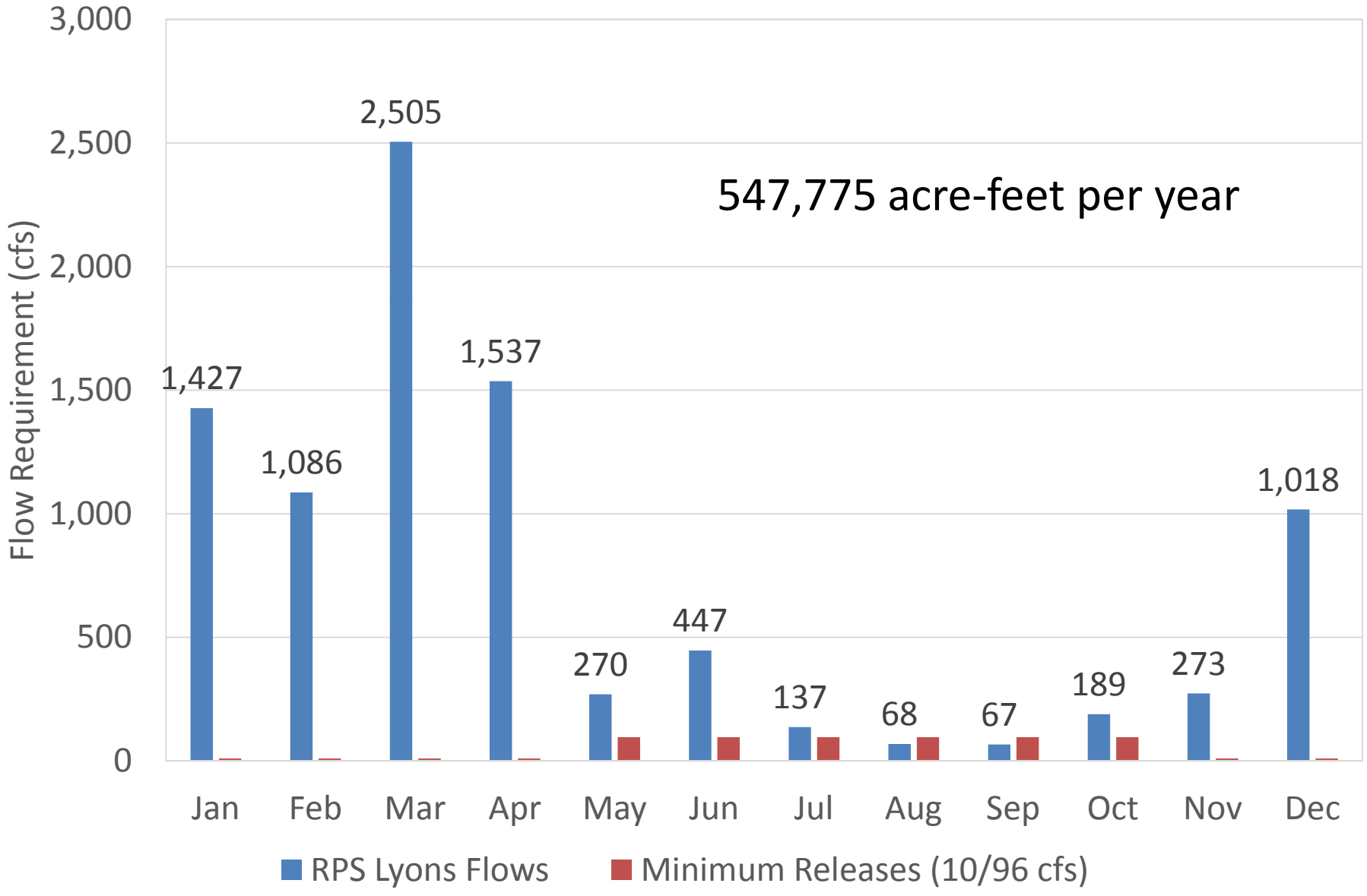
Modeling Approach

- Environmental Flows
  - Lyons method
    - Default when no SB3 flows
    - Previously developed by RPS
  - Limited to inflows
  - Applied at Patman when storage is above Ultimate Curve
  - Existing Patman rights using current 10/96 cfs release
  - Releases never less than current practice

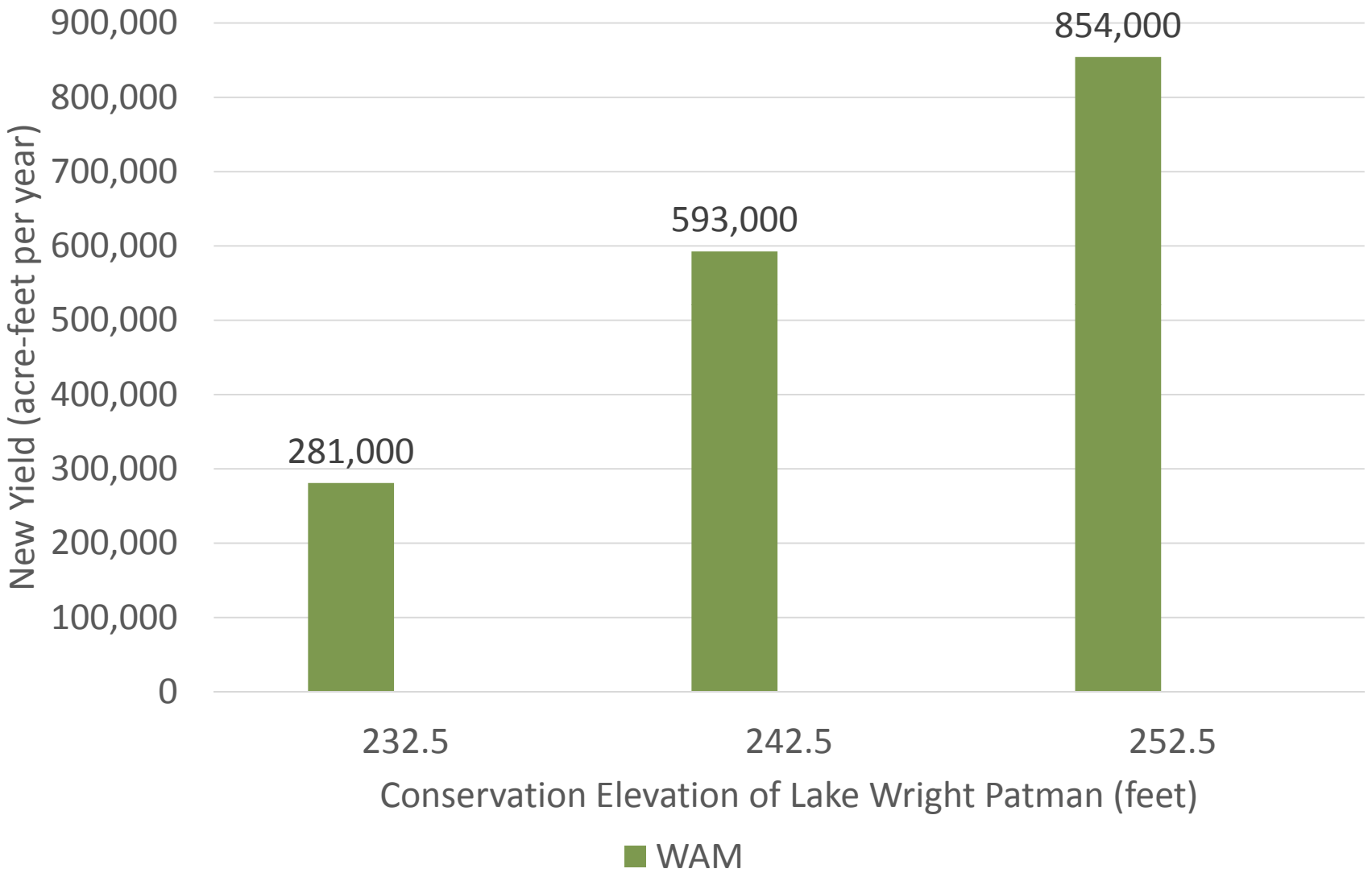
Nichols Lyons Flows



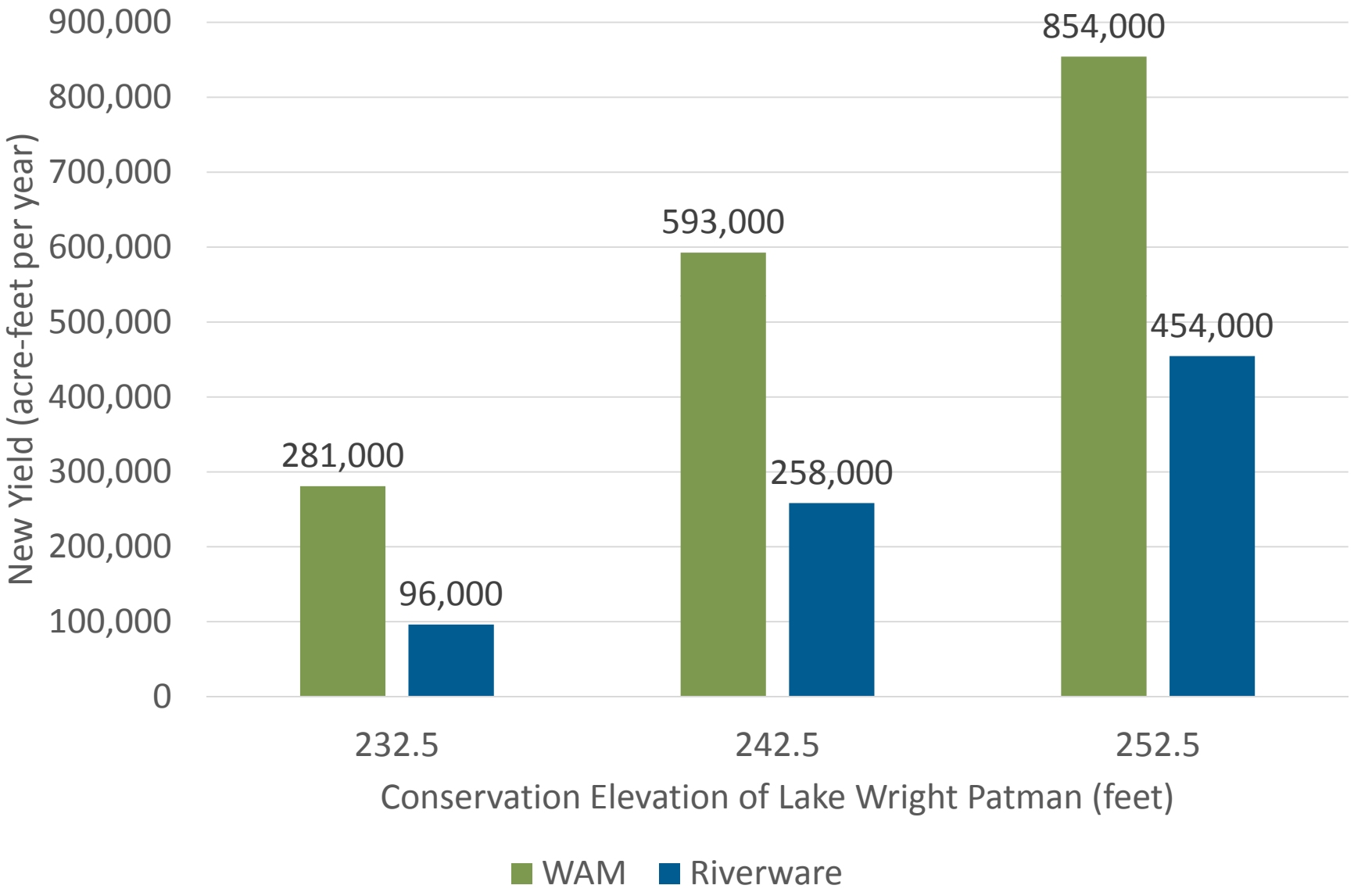
Patman Eflows



Patman Stand-Alone Yields



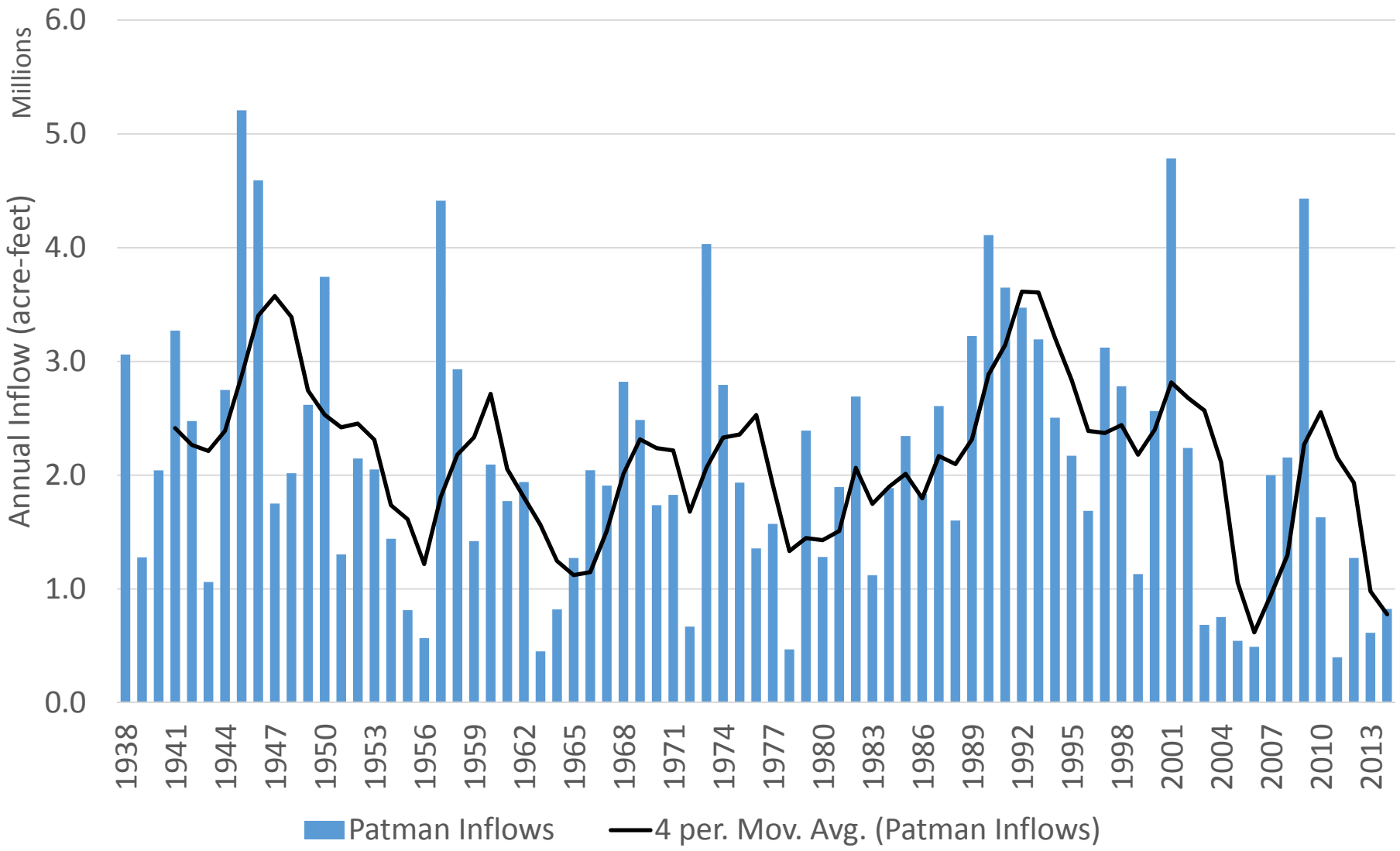
Patman Stand-Alone Yields



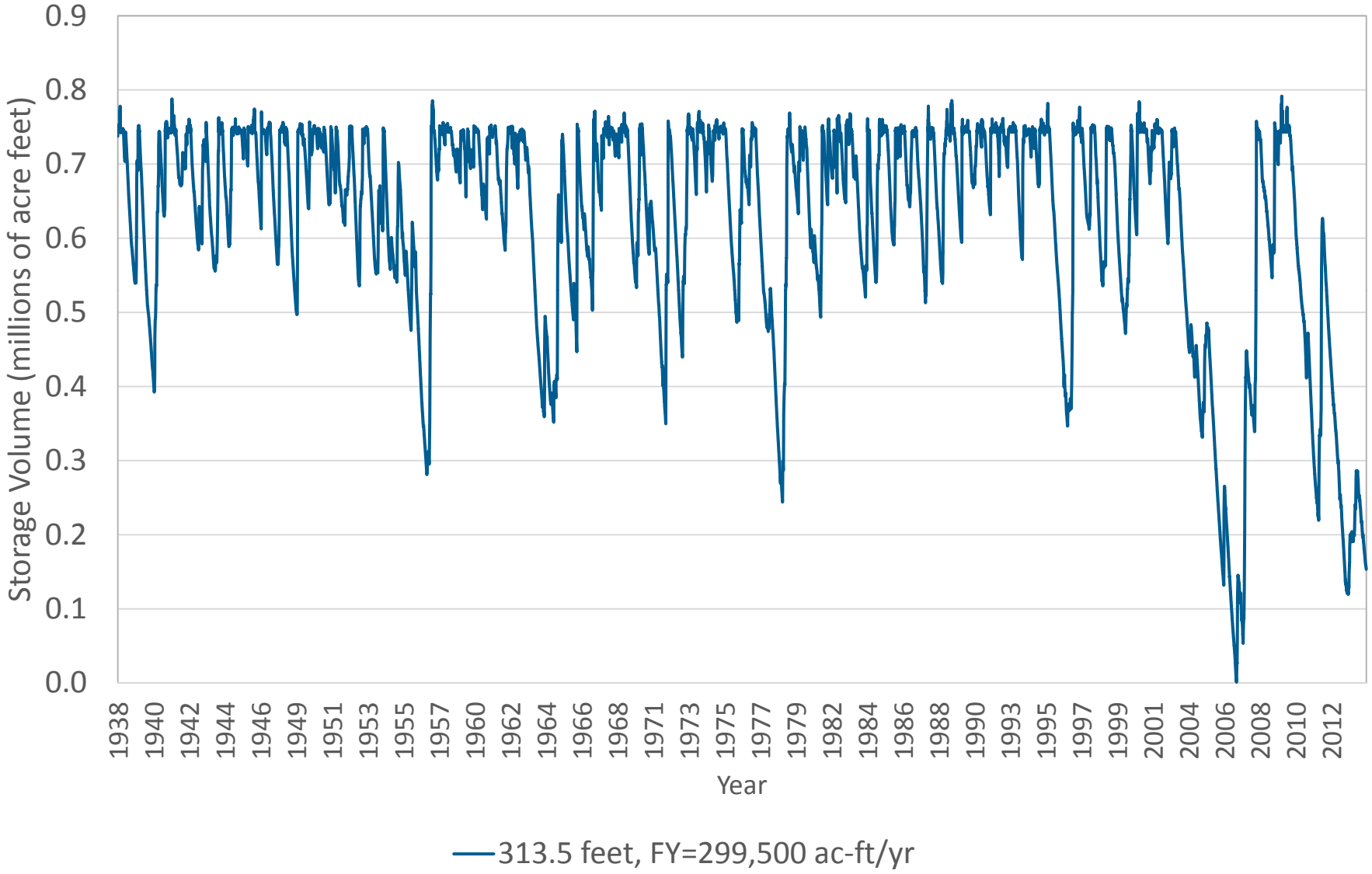
What is going on?

- Most significant
  - New drought of record
  - Environmental flows
  - Current Patman release policy
- Less significant
  - Different application of priority
  - Time step, hydrology, flood ops etc.

Annual Patman Inflows



Nichols Storage Traces



Sensitivity analysis

- Modeling Assumptions: Four ON-OFF Switches

Priority Releases

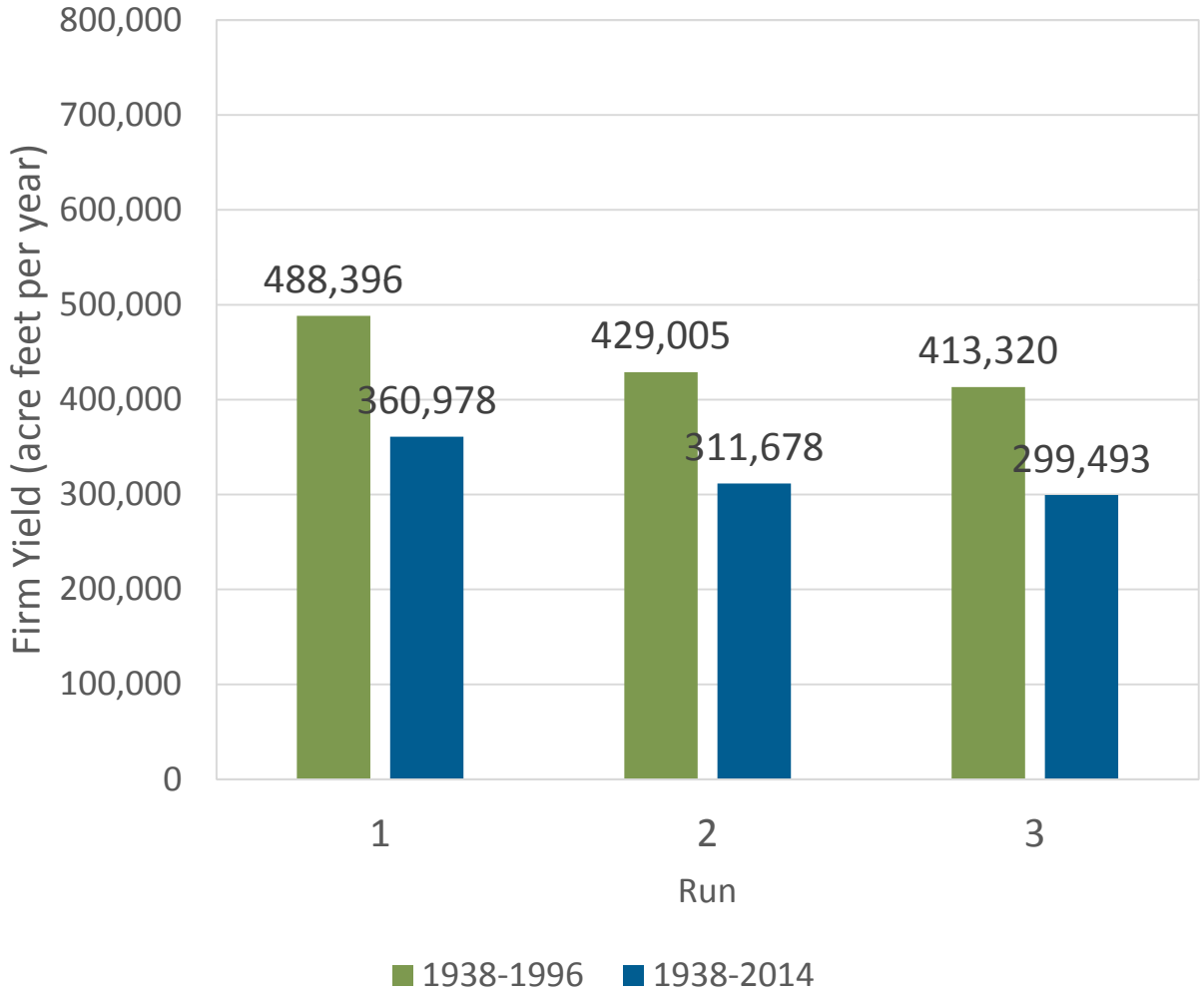
Lyons Flows

Period of Record

Patman Releases

Nichols Stand-Alone Yields

- Impact of modeling assumptions at 313.5 feet

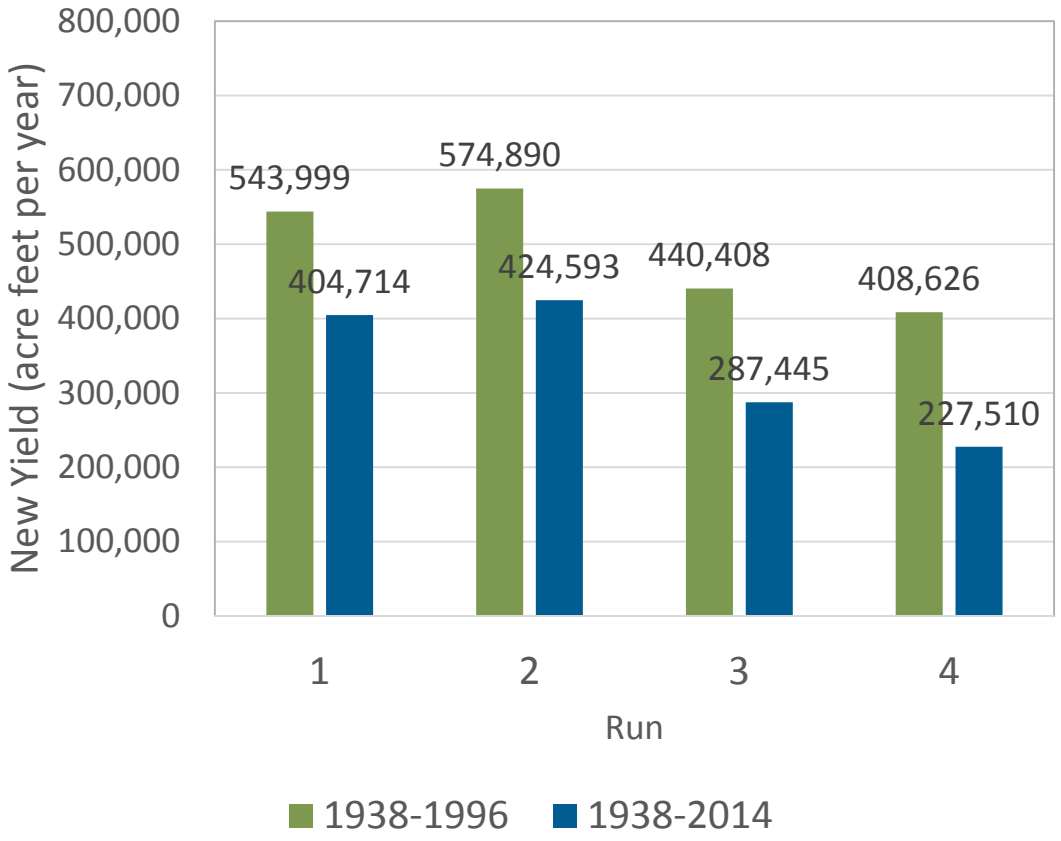


Run	Priority?	Lyons?
1	No	No
2	Yes	No
3	Yes	Yes

Patman Stand-Alone Yields

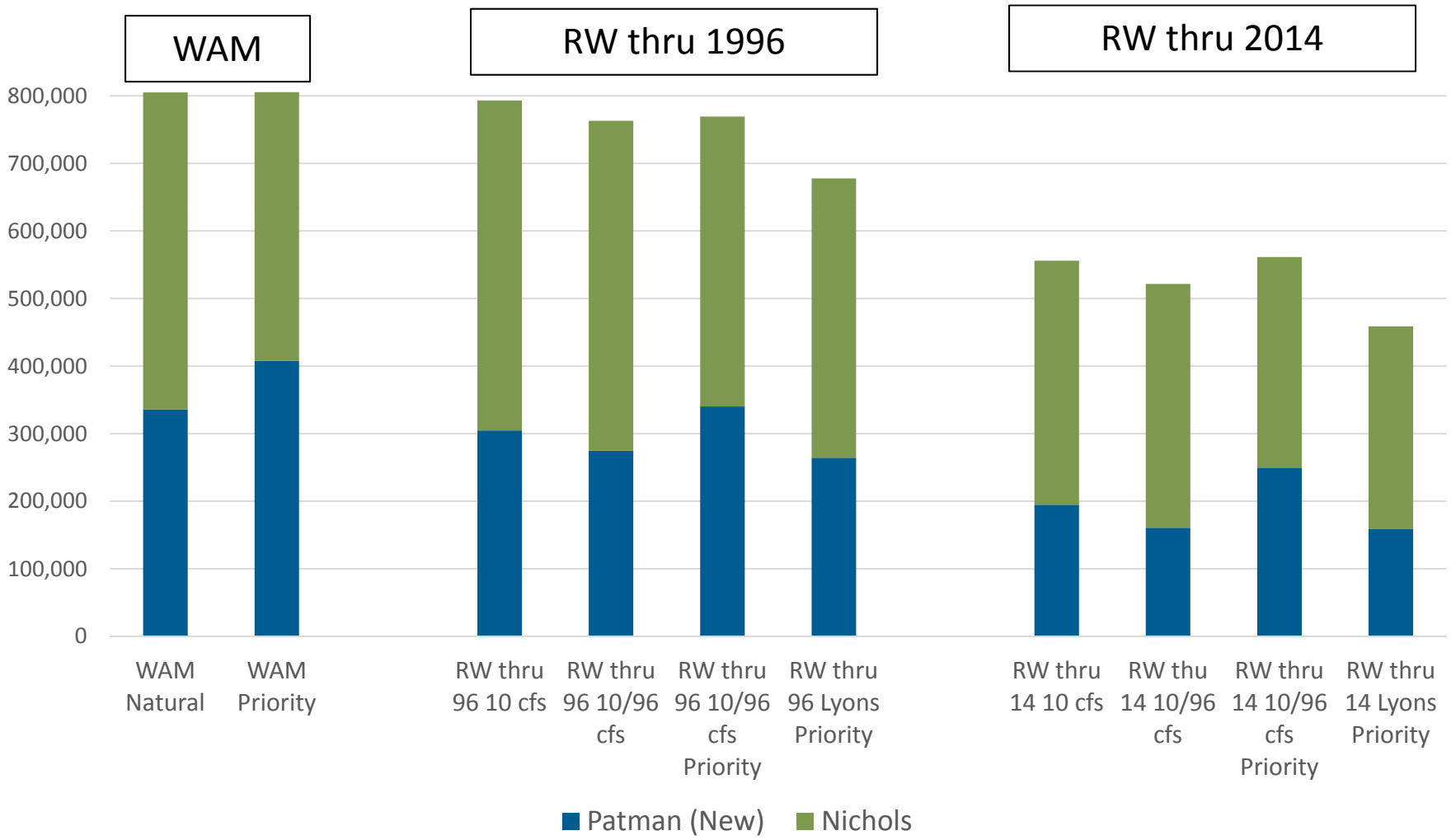
- Impact of modeling assumptions at 242.5 feet

Run	Priority?	Lyons?	Patman Releases
1	No	No	10 cfs
2	Yes	No	10 cfs
3	Yes	Yes	10 cfs
4	Yes	Yes	10/96 cfs



Combination Yields

- Patman at 242.5 ft, and Nichols at 313.5 ft



Interim Results

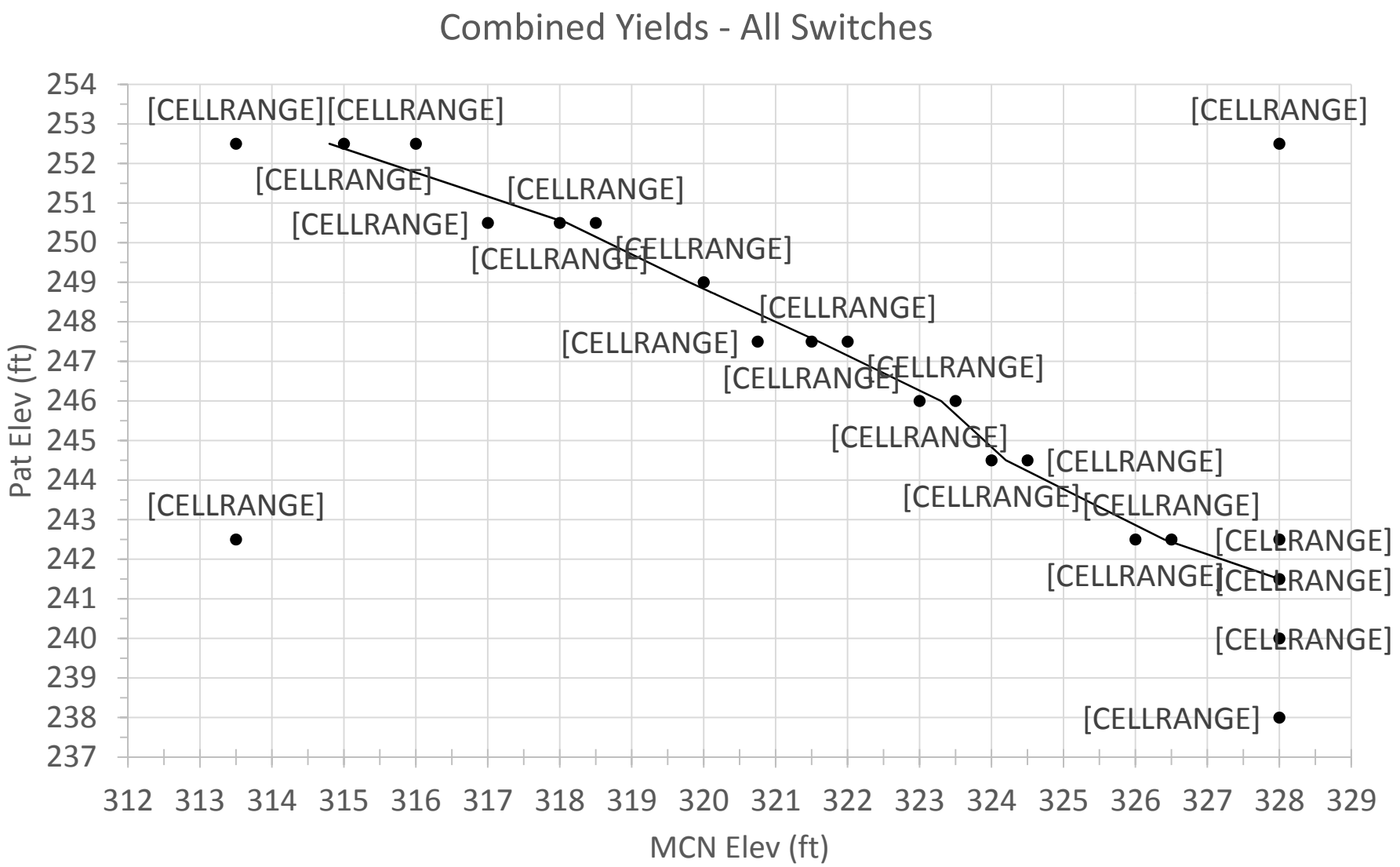
1. New critical period is 2002-2006/07
2. Storage still very low at end of 2014
3. Eflows have a very large impact on Patman reallocation
4. Yield goals not met because of combination of eflows and new drought
5. Source of yield impacts*
   - Loss due to drought: ~210,000 ac-ft/yr
   - Loss due to eflows: ~105,000 ac-ft/yr
   - Loss due to 96 cfs Patman release: ~30,000 ac-ft/yr
6. **Selected elevation ranges do not meet supply goals**

* For MCN at 313.5ft and Patman at 242.5ft

Path Forward

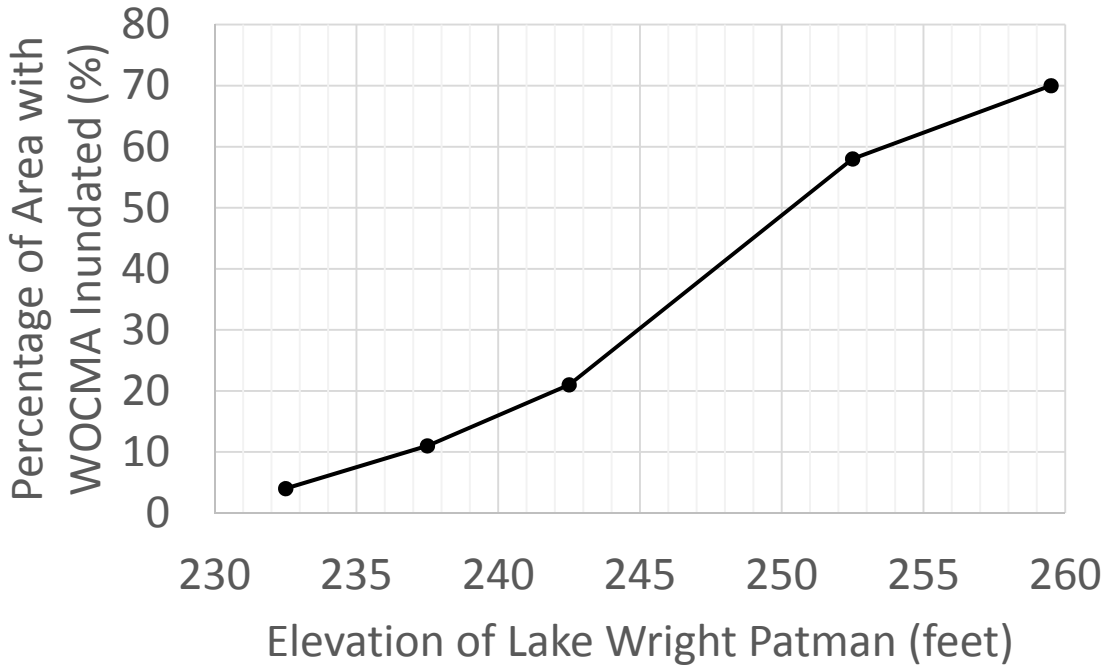
- What does meet supply goals?
  - Larger MCN
  - Larger Patman
  - Alternative eflows at Patman
  - Changes in current Patman releases

Elevations that meet goals



White Oak Creek Impact

Reallocation Elevation at Wright Patman (Feet)	Approximate Area (Acres) Inundated	Percentage of Area with WOCMA Inundated
232.5	1,000	4
237.5	2,750	11
242.5	5,250	21
252.5	14,500	58
259.5	18,286	70



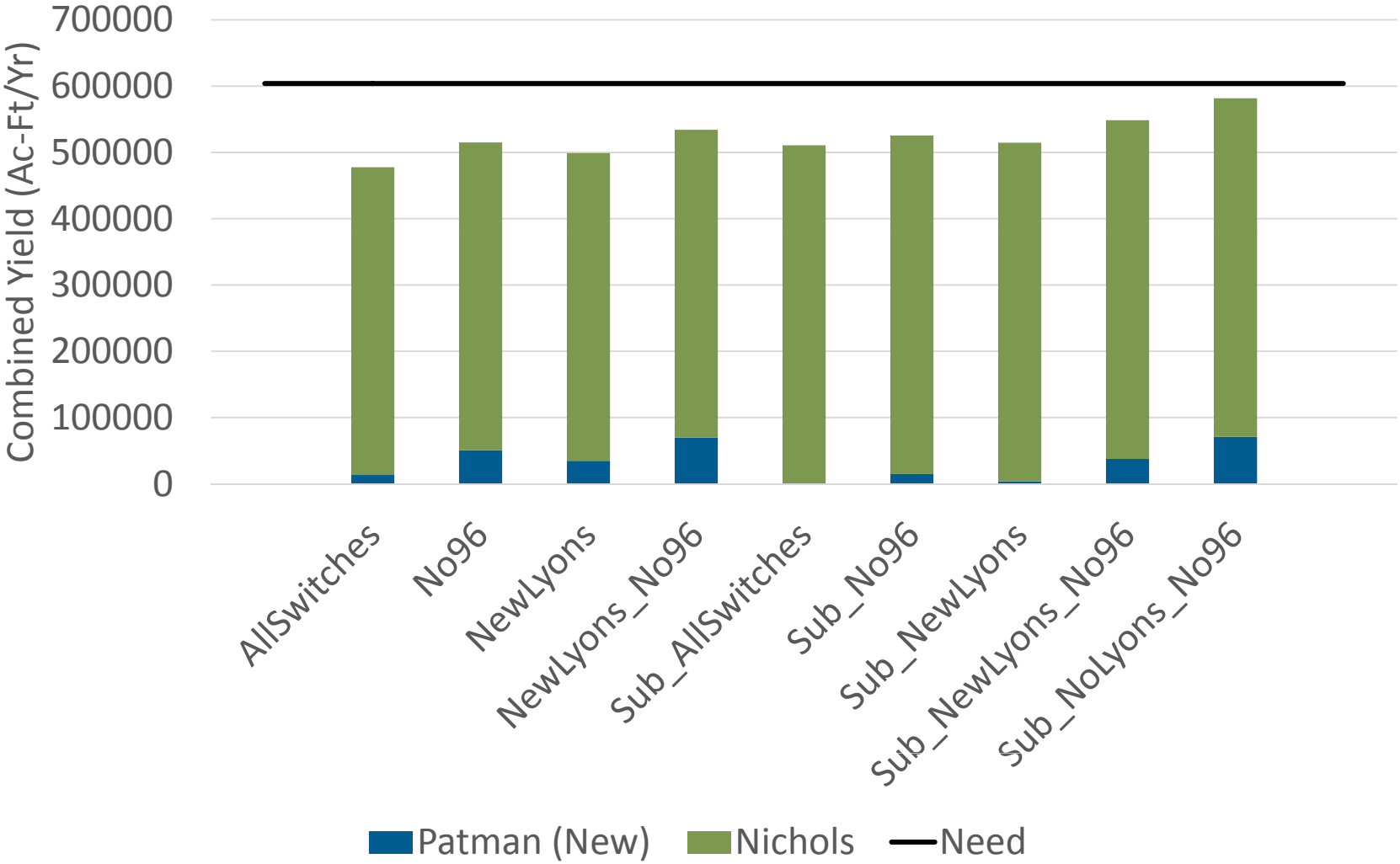
Model Alternatives

- Modeling Assumptions: Three **New** Switches

Priority Releases	Lyons Flows	Patman Releases
		
Strict Priority vs. Patman Subordination	RPS Flows vs. Inflow-Based	Constant 10 cfs vs. 10/96 cfs Releases

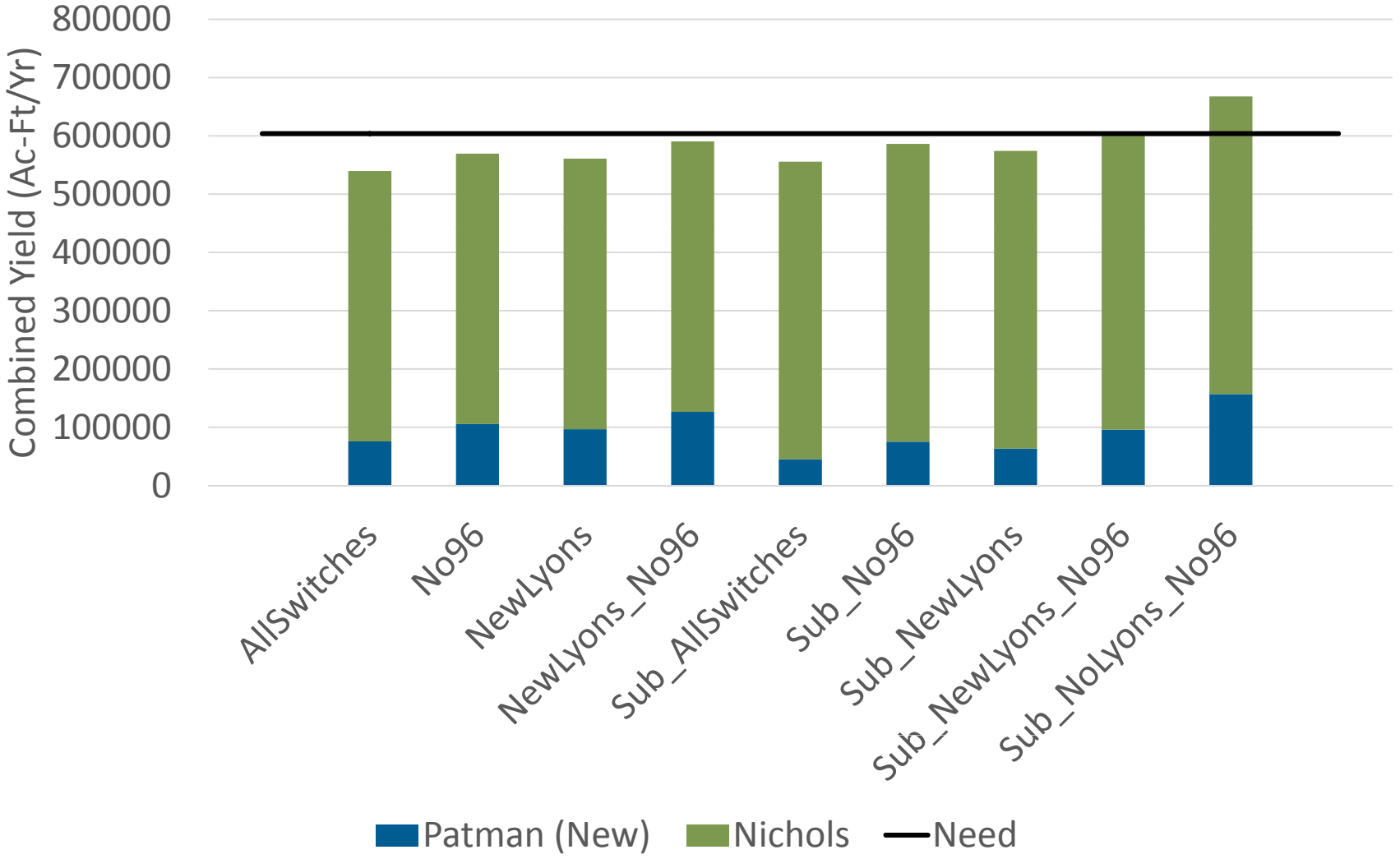
Preliminary Results

- Patman at 232.5 ft, Nichols at 328.0 ft



Preliminary Results

- Patman at 237.5 ft, Nichols at 328.0 ft



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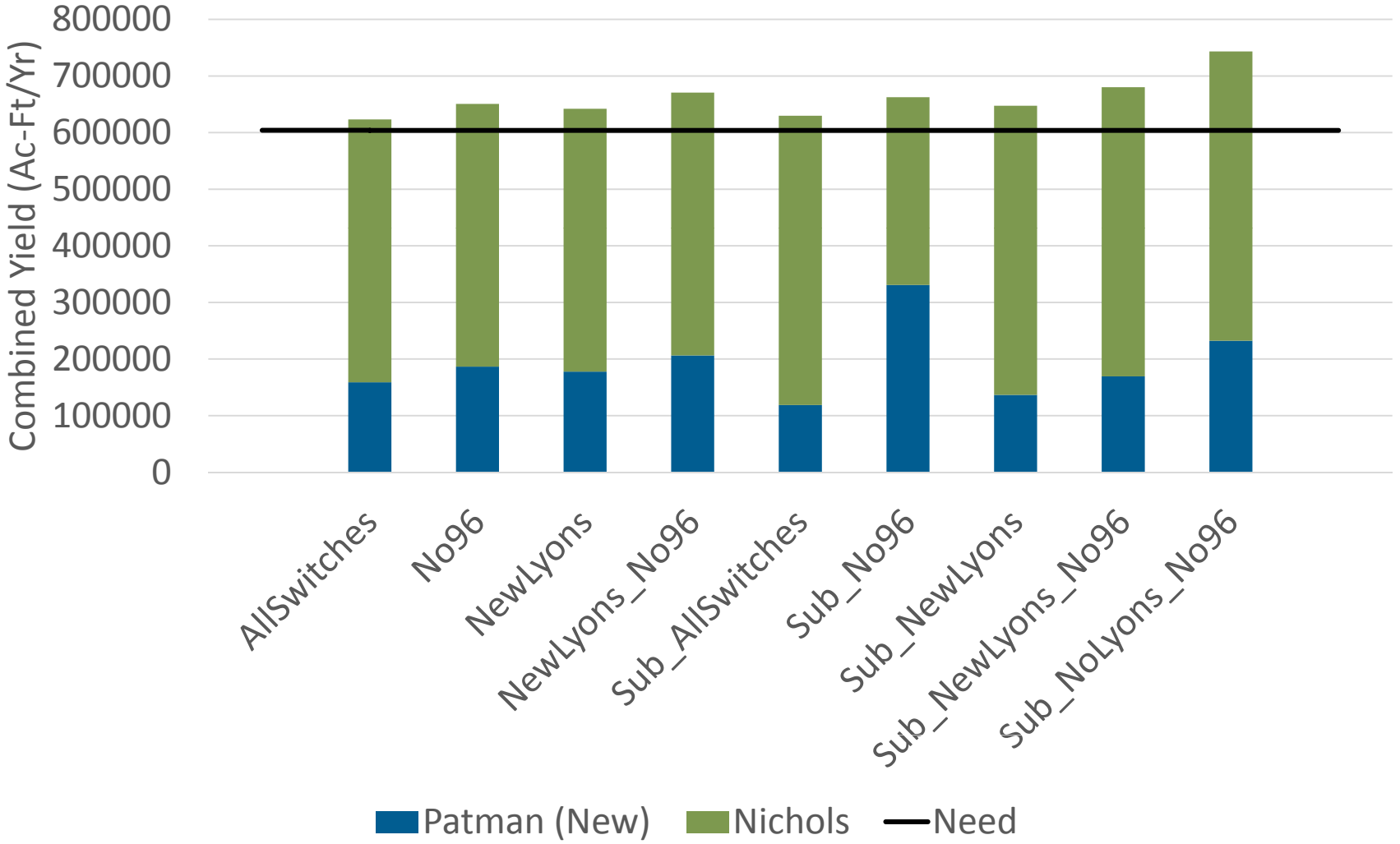

Increases In Yield

- Due to inflow-based Lyons flows: ~20,000 ac-ft/yr (4%)
- Due to constant 10 cfs release: ~30,000 ac-ft/yr (6%)
- Due to Patman subordination:
  - Bigger impact when Patman is small and Nichols is large
  - ~4,000 ac-ft/yr (<1%) for Patman >242.5ft
  - ~15,000 ac-ft/yr (3%) for Patman at 232.5ft-237.5ft
- Due to all three switches: ~70,000 ac-ft/yr (14%)

Conclusions

- Using project assumptions, smallest Patman reallocation that meets supply goals is 241.5 feet (Nichols at 328 feet)
- Can meet supply goals at 237.5 feet reallocation with significant modifications to assumptions
- White Oak Creek impacts problematic
- Further work on Patman releases may be needed

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Thank you for your attention!

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