CAN COMBINING THE MIDDLE RIO GRANDE MOBILE BED HEC-RAS MODEL AND URGWOM CONTRIBUTE TO IMPROVED RESTORATION PLANNING

Middle Rio Grande Endangered Species Collaborative Program – 2019 Science Symposium

Prepared by Kyle Shour, PE – Tetra Tech

Jonathan AuBuchon, PE – Albuquerque District, USACE

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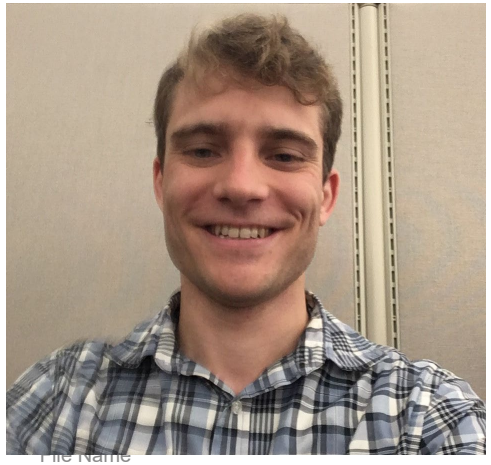
BIOS

Kyle Shour, P.E.
Hydraulic Engineer, Tetra Tech, Inc.

M.S. Civil Engineering from UNM (2011)
Thesis: Evaluated sustainability of Rio Grande Nature Center High-Flow Channel

Worked on hydrographic survey; sediment sampling, geomorphology assessment; sediment transport, hydraulics, and water operations



Jonathan AuBuchon, P.E.
Regional Technical Specialist, USACE – Albuquerque District

Hydraulic Engineer with the U.S. Department of Interior, Bureau of Reclamation for 14 years

Worked on variety of projects including ecosystem restoration, field data acquisitions, geomorphic assessments, sediment transport analyses, hydraulic modeling, river engineering designs, etc.

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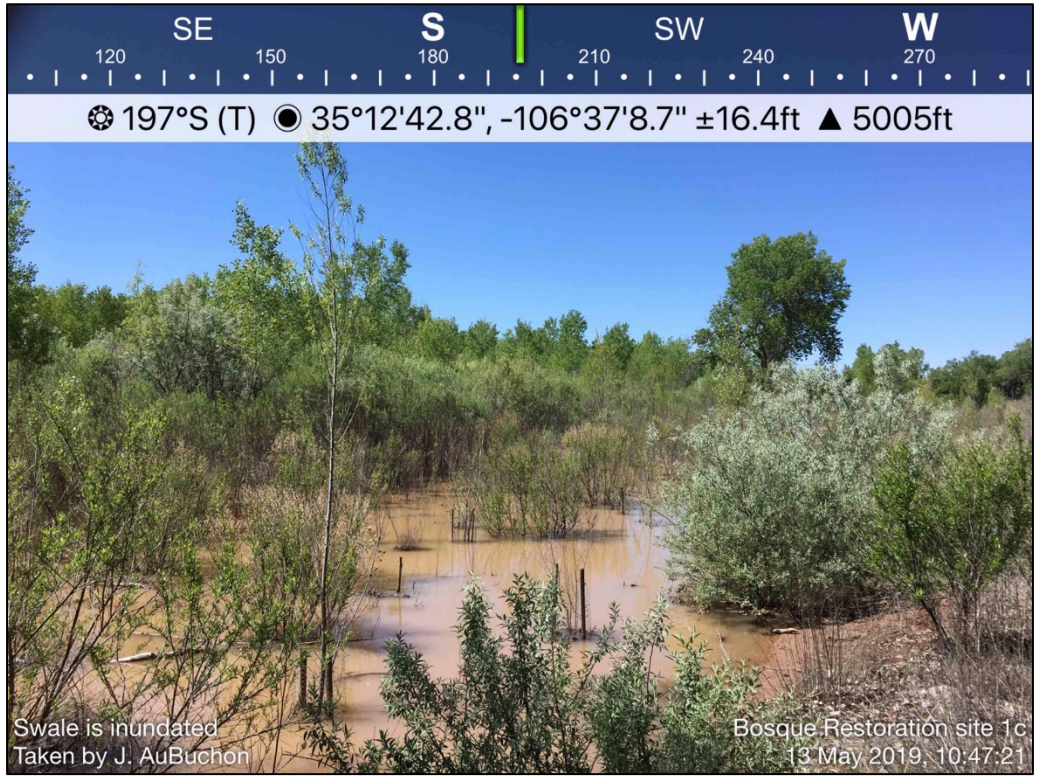
WHY SEDIMENT AND WATER ARE SO IMPORTANT?

$$QS \propto Q_s d$$



Sediment fan in the Rio Grande at Calabacillas Confluence
19 July 2013

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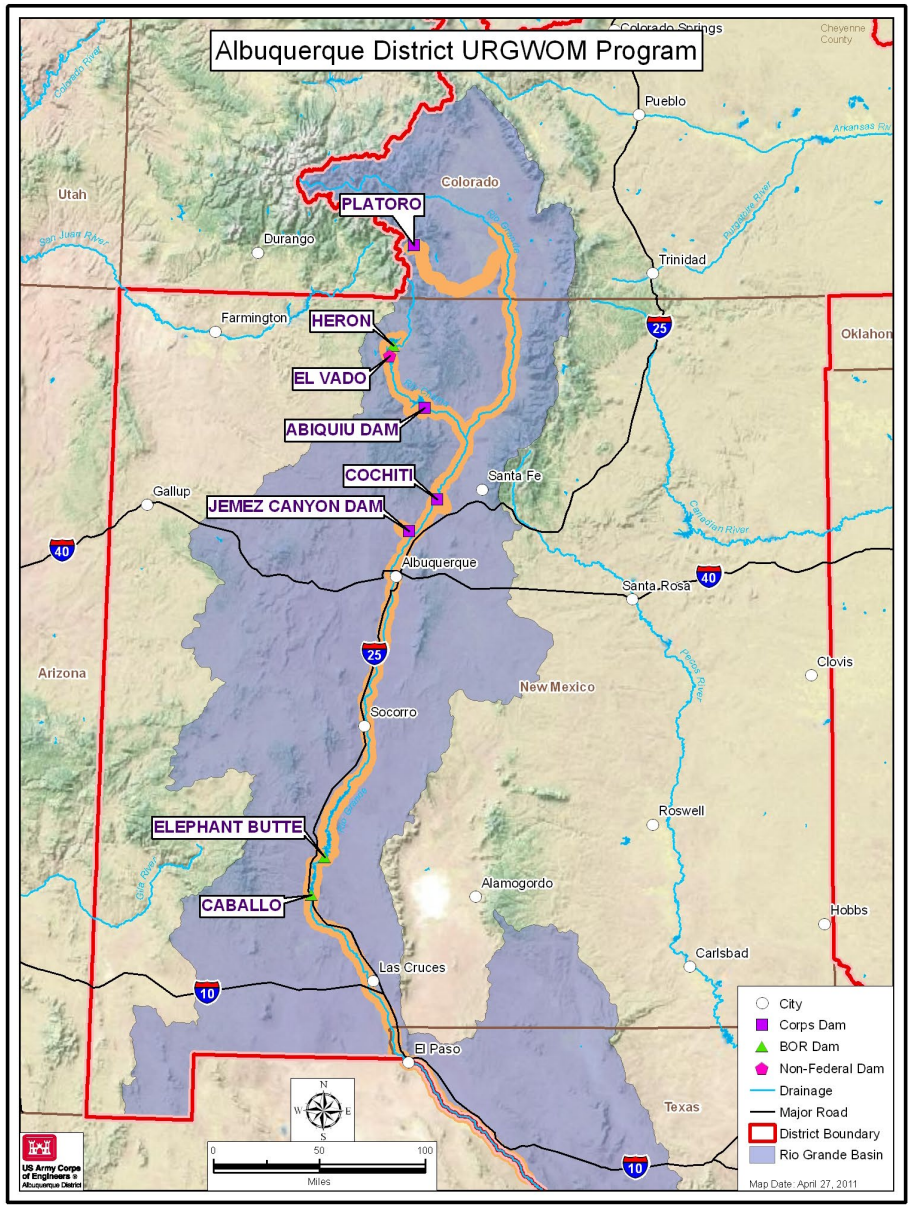
URGWOM



Upper **R**io **G**rande **W**ater **O**perations **M**odel:

- CO headwaters to Ft. Quitman, TX
- Single ruleset to define all operations
- Daily or monthly timestep

Run Types:

1. **Accounting**: Daily, data driven (No rules). Typically run daily by Reclamation.

2. Annual operating plan (**AOP**): Start with accounting model; forecast flows for remainder of year (uses rules to replicate operations).

3. **Planning** runs: Long-term forecasting (uses rules to replicate operations)

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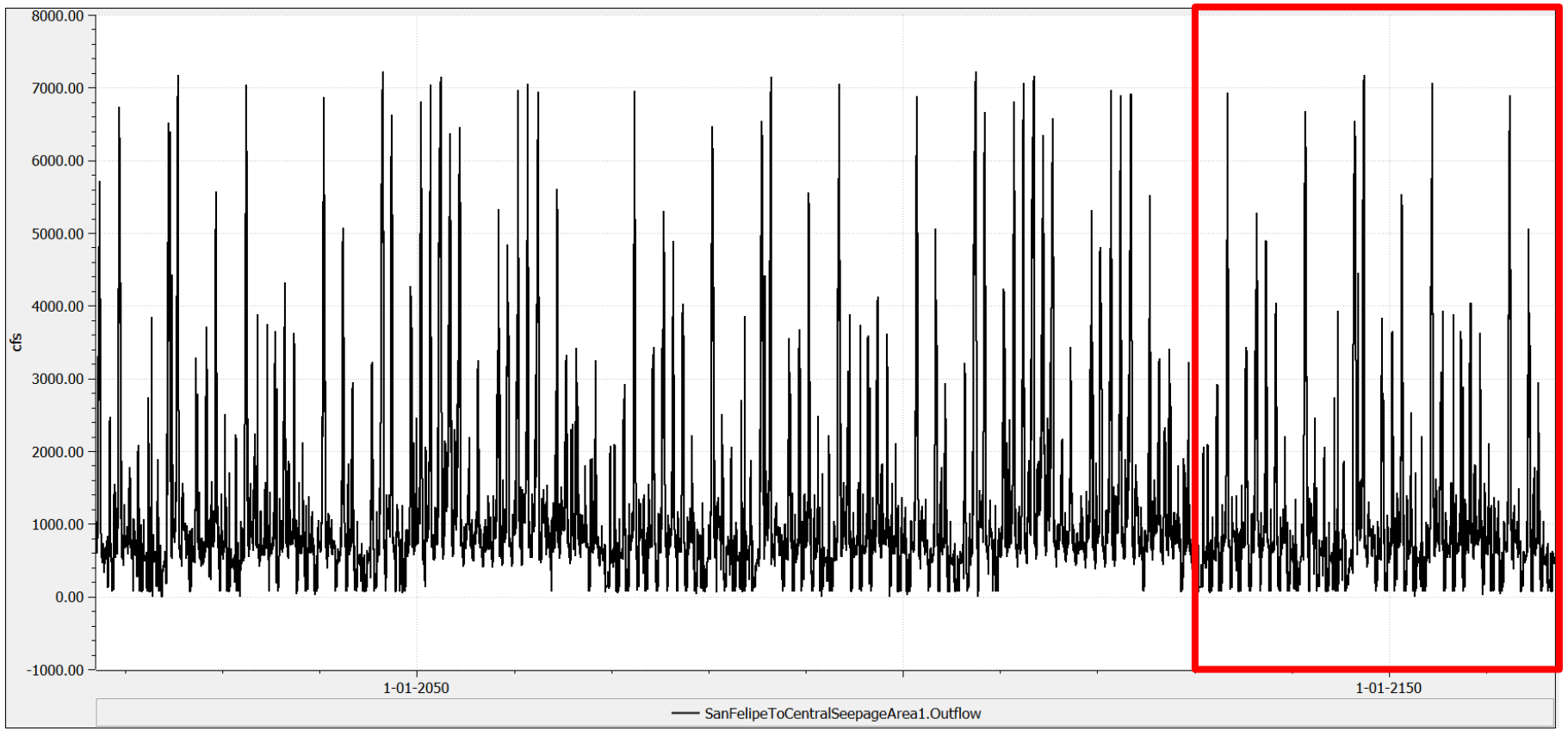
URGWOM (150-YEAR RUN)

- Does not model a specific climate scenario
- Intended to evaluate performance of recent model improvements; monthly/daily timesteps
- Flows from Albuquerque Reach input to MRG HEC-RAS model (tributaries; mainstem; irrigation; and diversions)



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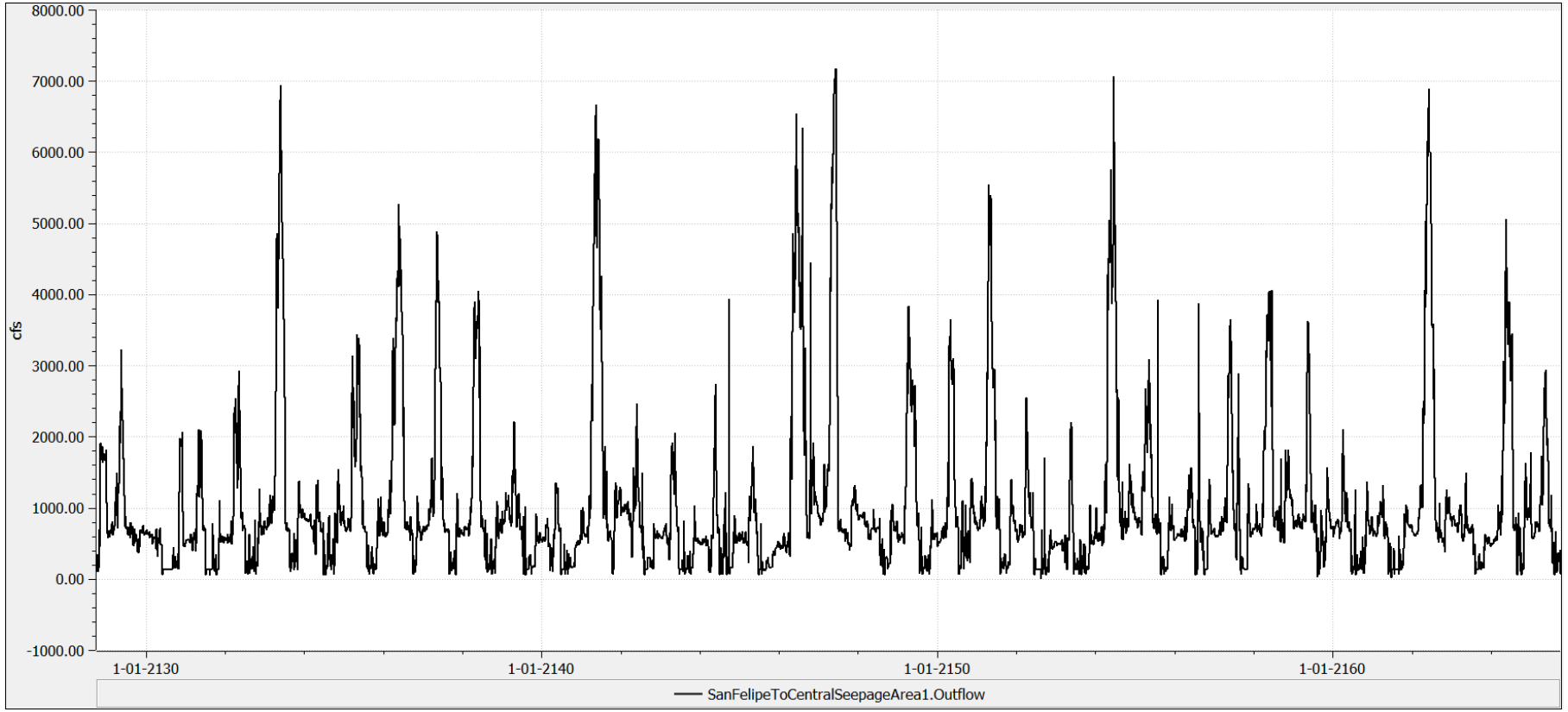
URGWOM (150-YEAR RUN)

- Annual Volume passing Angostura Diversion Dam was 89% of baseline
- Annual Maximum tributary flows were 107% of baseline



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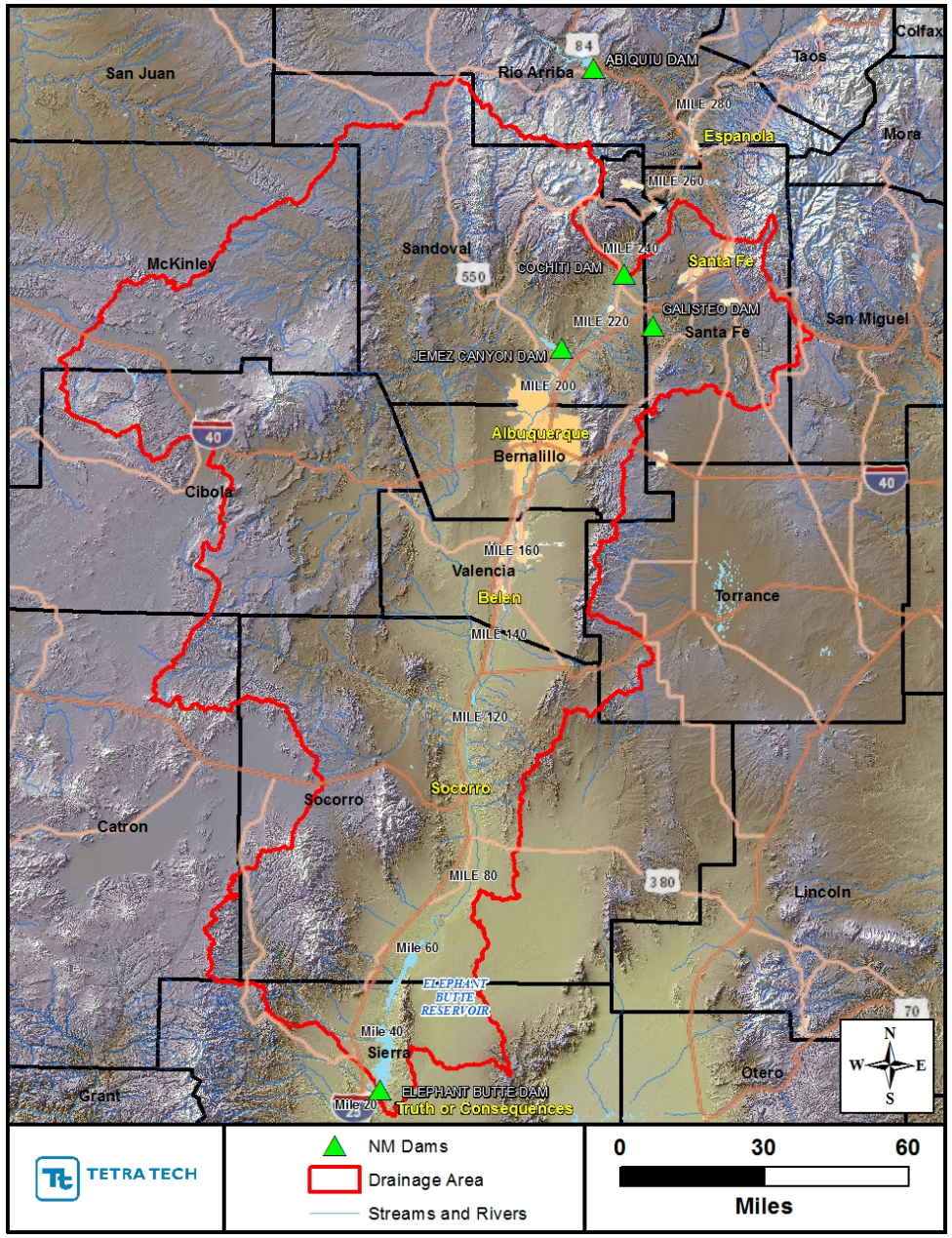
MRG MOBILE BED HEC-RAS



COCHITI REACH

22.5 River Miles

10 Contributing Tributaries

ALBUQUERQUE REACH

40.5 River Miles

8 Contributing Tributaries

ISLETA REACH

53.0 River Miles

6 Contributing Tributaries

SAN ACACIA REACH

56.2 River Miles

11 Contributing Tributaries

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TRIBUTARY FLOWS

- Simulated in URGWOM: Jemez, North Diversion Channel (NDC), Tijeras/South Diversion Channel (SDC), MRGCD Drains
- NOT simulated by UGWOM: Las Huertas, Venada, Baranca, Harvey Jones/Montoyas, Calabacillas
- Assumed: Changes from baseline to URGWOM for NDC and SDC, scale to non-simulated tributaries

BED MATERIAL SUPPLY

- Upstream: Developed rating curve based on MRG model baseline
  - Upstream load is supply limited;
  - Ideally, run Cochiti Reach model first
- Tributaries:
  - Based on rating curves developed with the MRG Model
  - Bed material sampled on all tributaries during model development
- Channel: Bed material (surface and sub-surface) sampled during model development
- No silt or clay transport simulated

GENERAL

- Daily timestep model

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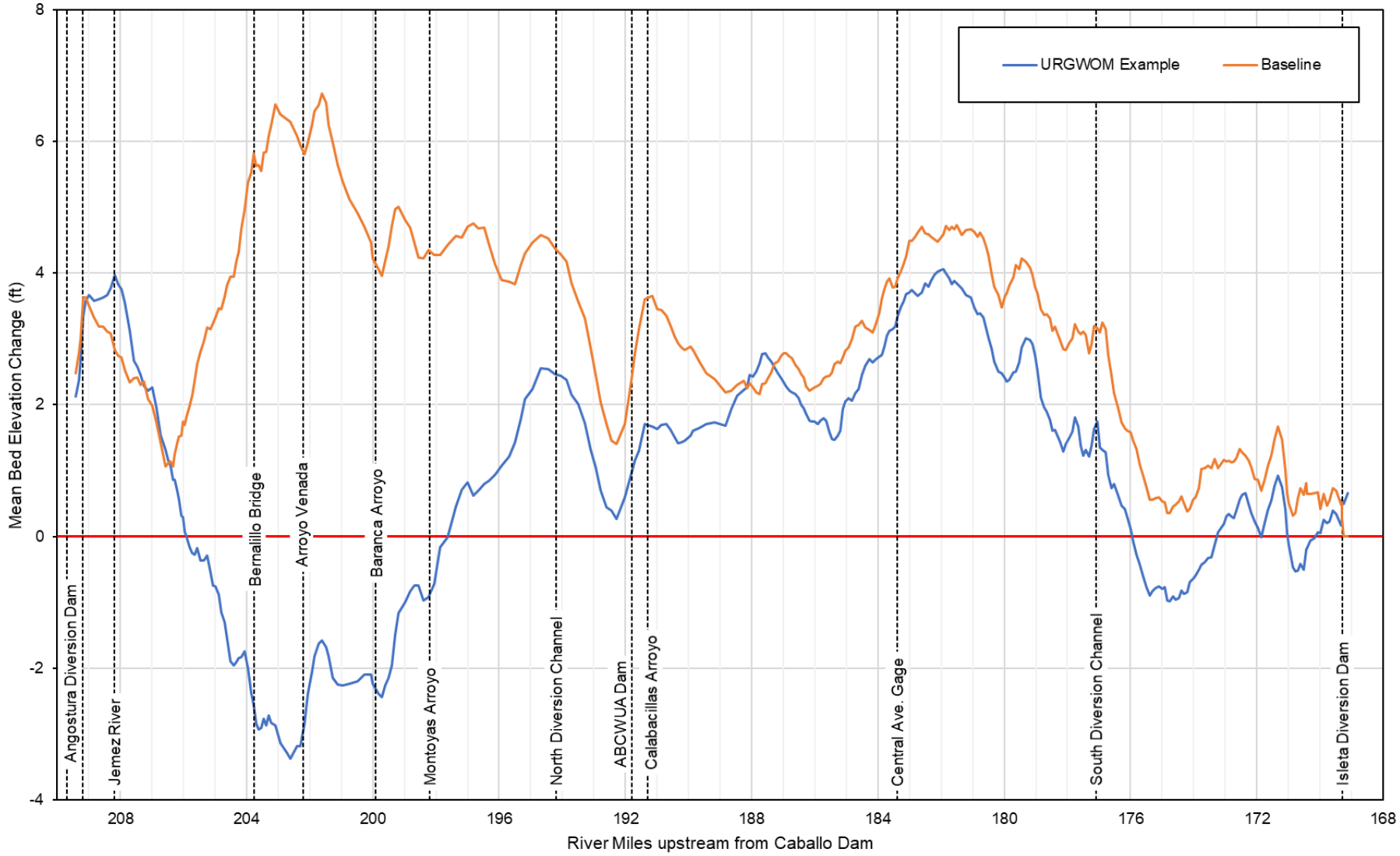
MEAN BED ELEVATION



Baseline:
Aggrades everywhere

URGWOM Example:
Degrades in Bernalillo, southern ABQ;
Aggrades elsewhere, but less than baseline

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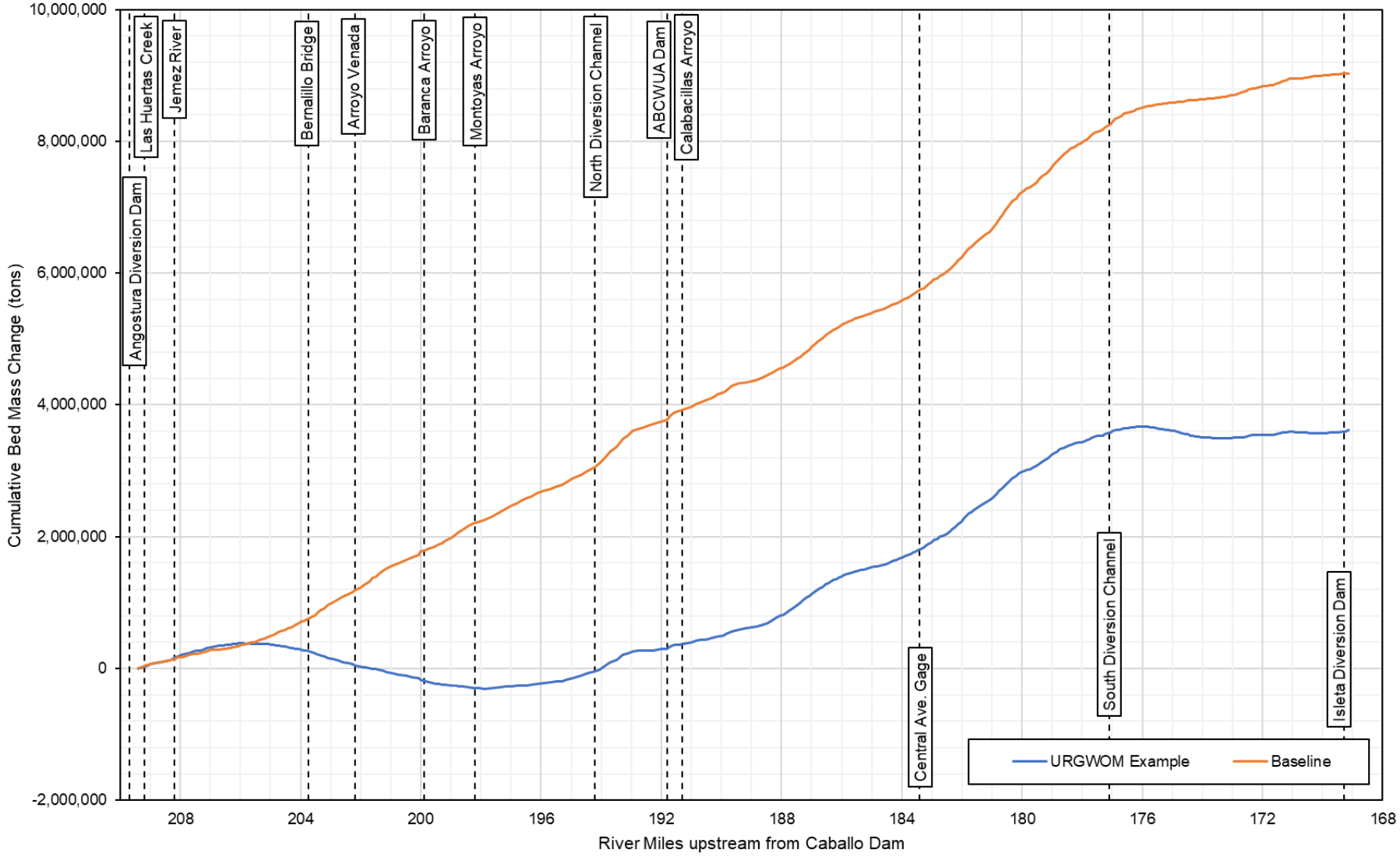
TOTAL MASS CHANGE (CHANNEL)



Baseline:

Aggrades everywhere

URGWOM Example:

Degrades in Bernalillo, southern ABQ;

Aggrades elsewhere, but less than baseline

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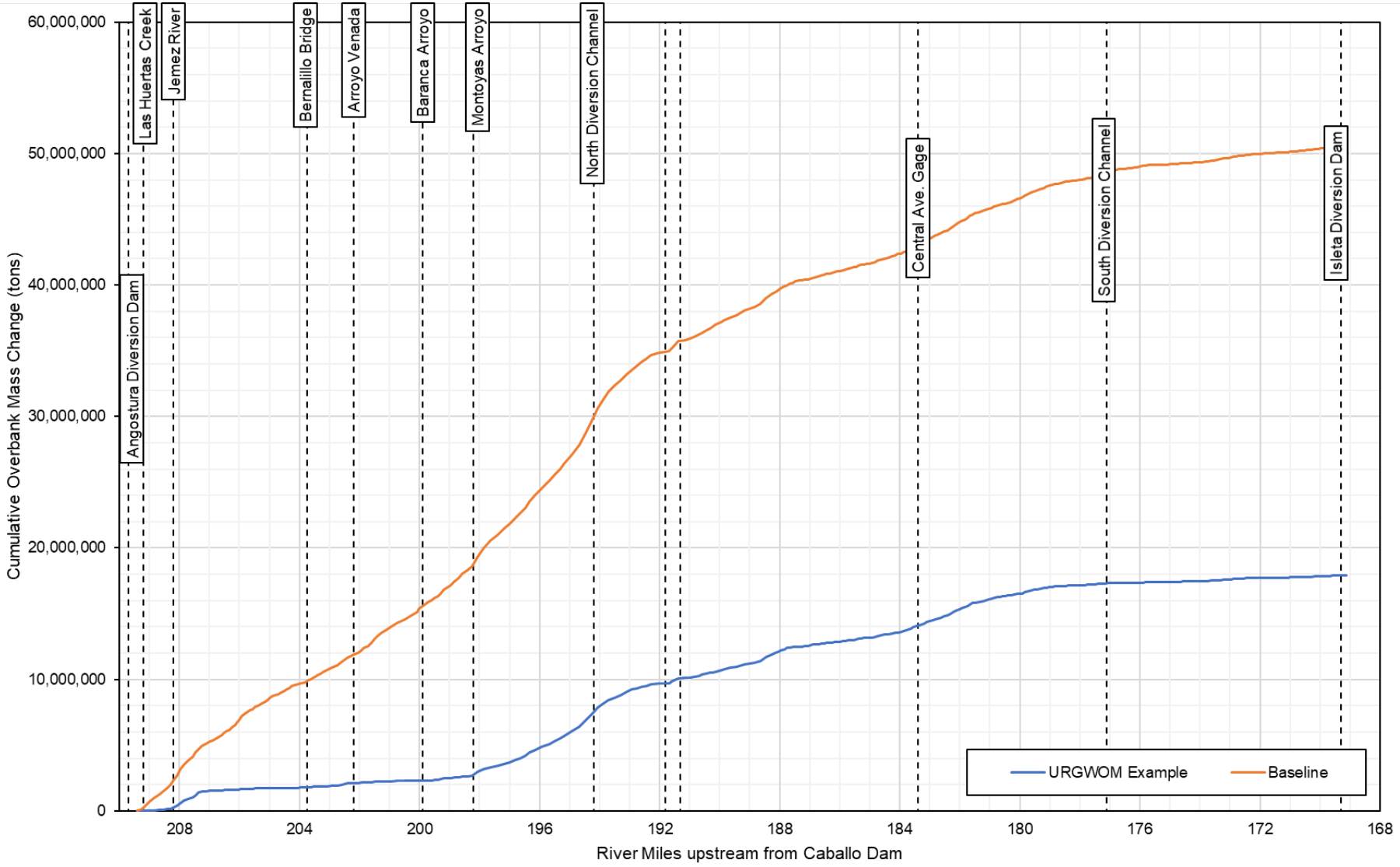
TOTAL MASS CHANGE (FLOODPLAIN)



Baseline:

Aggrades most everywhere;

Most sediment stored upstream of ABCWUA Diversion

URGWOM Example:

Less aggradation than baseline

Minimal aggradation where channel degradation is simulated

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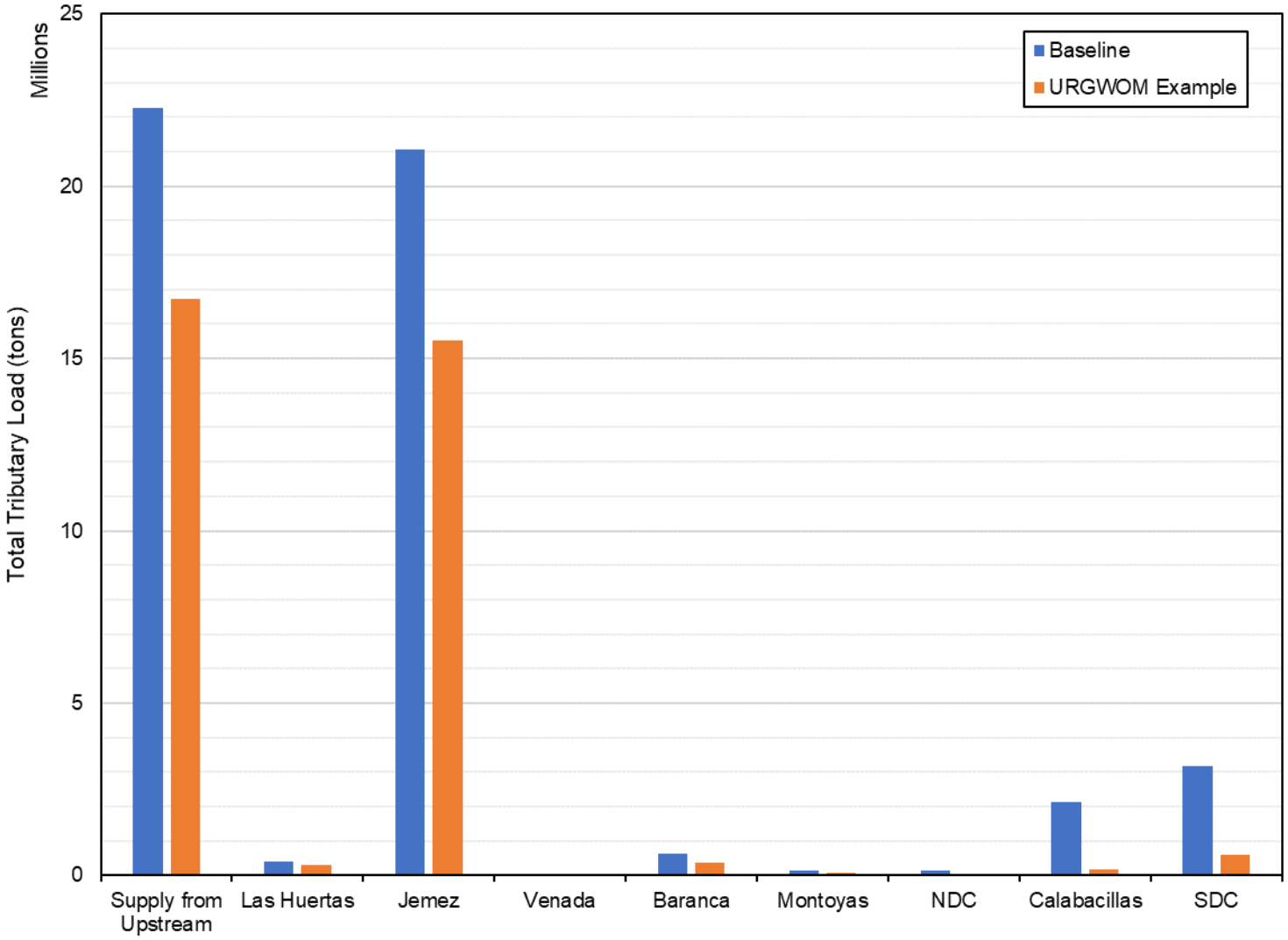
TRIBUTARY SEDIMENT INPUTS



Bed material supply from upstream and Jemez are important

Size of supply matters too

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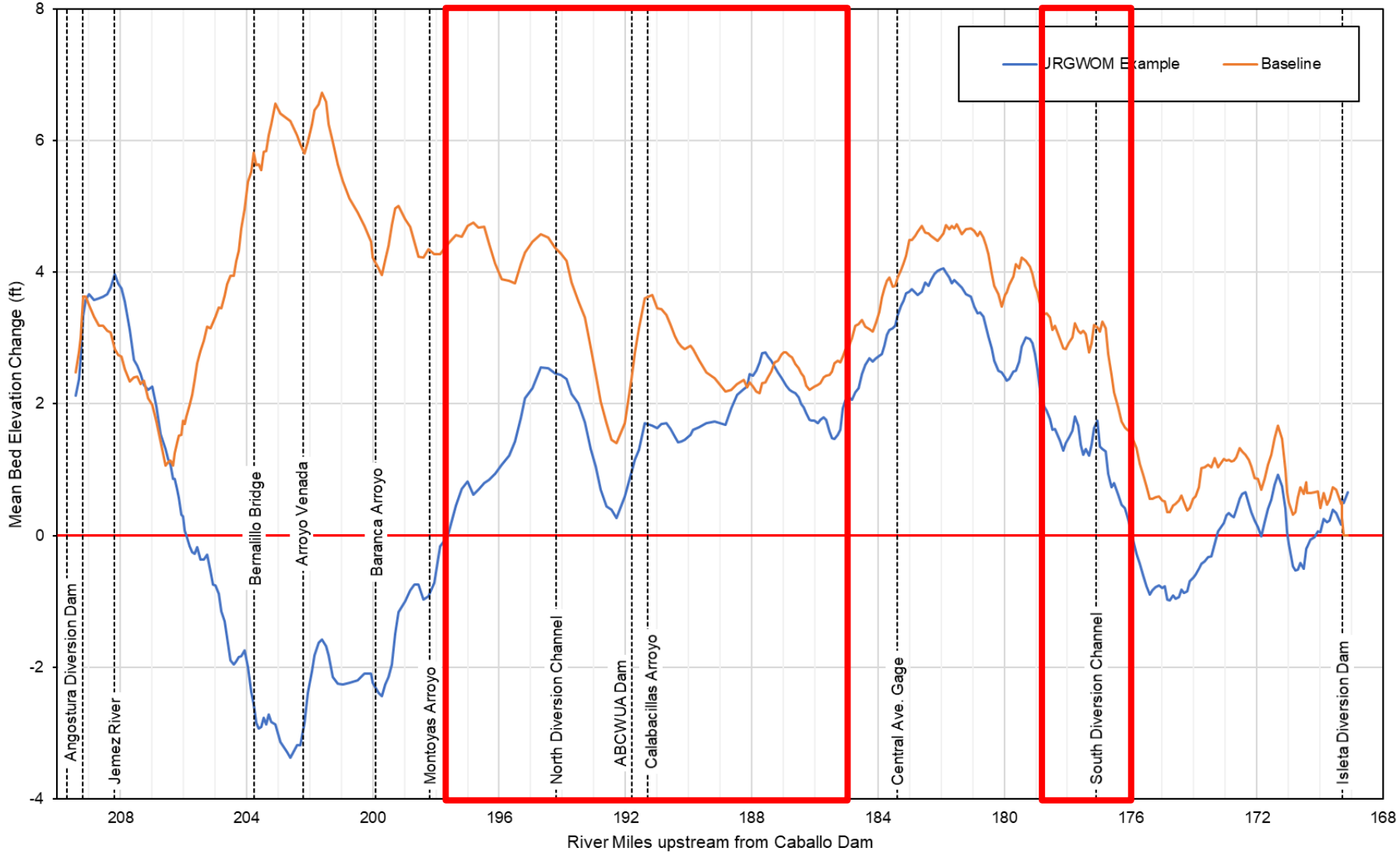
EXAMPLE APPLICATION



New High Flow Channel in ABQ Limits

Bed stable to slightly aggrading

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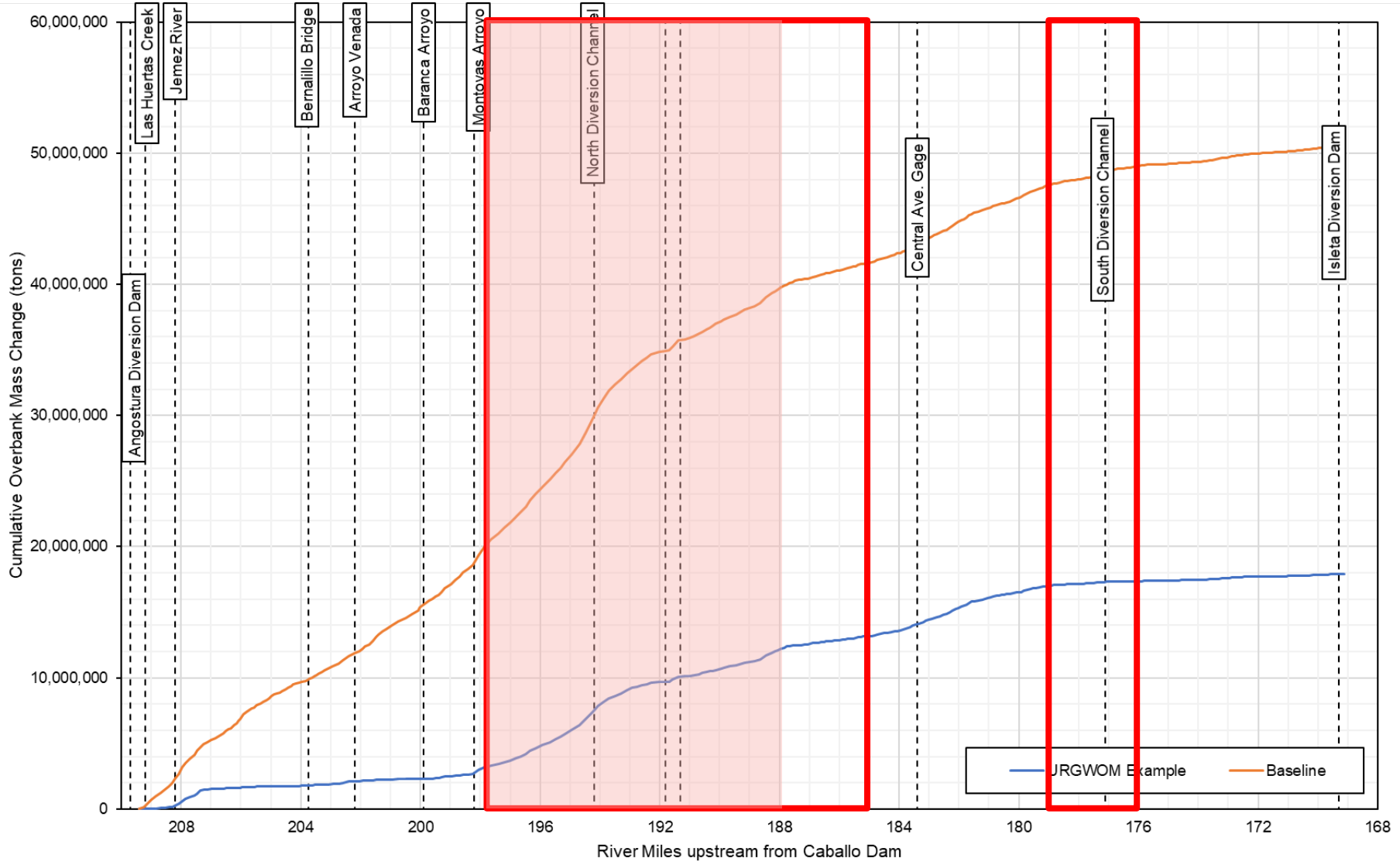
EXAMPLE APPLICATION



New High Flow Channel in ABQ Limits

Bed stable to slightly aggrading

Limited floodplain aggradation

Next steps

1. Flow duration based on URGWOM
2. Set Inundation criteria
3. Fixed-bed simulation
4. Estimate required earthwork

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CONCLUSIONS

URGWOM results can be used to drive the MRG HEC-RAS

- Restoration Planning
- Changes to floodplain extents

Sediment inputs from major tributaries influence geomorphic changes

Morphology is sensitive to relatively small changes in runoff volume

OTHER APPLICATIONS

Running AOP flows in fixed bed to prioritize:

1. minnow sampling or
2. adaptive management of existing restoration projects

This would require routine bathymetry updates

Could be done before or after long-term simulation

Plan adaptive management surveys

LIMITATIONS

No simulation of sediment plugs

No simulation of width change and vegetation encroachment

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THANK YOU

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