Integrated Water Resource Plan

Water and Sewer Board Update

January 20, 2023

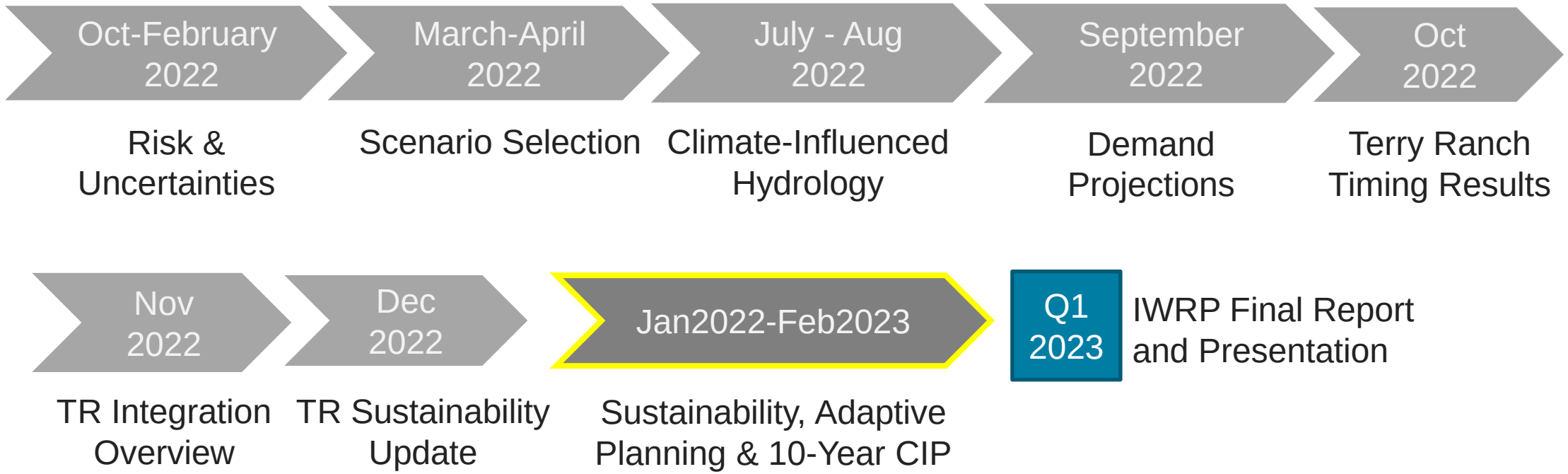
City of Greeley Colorado

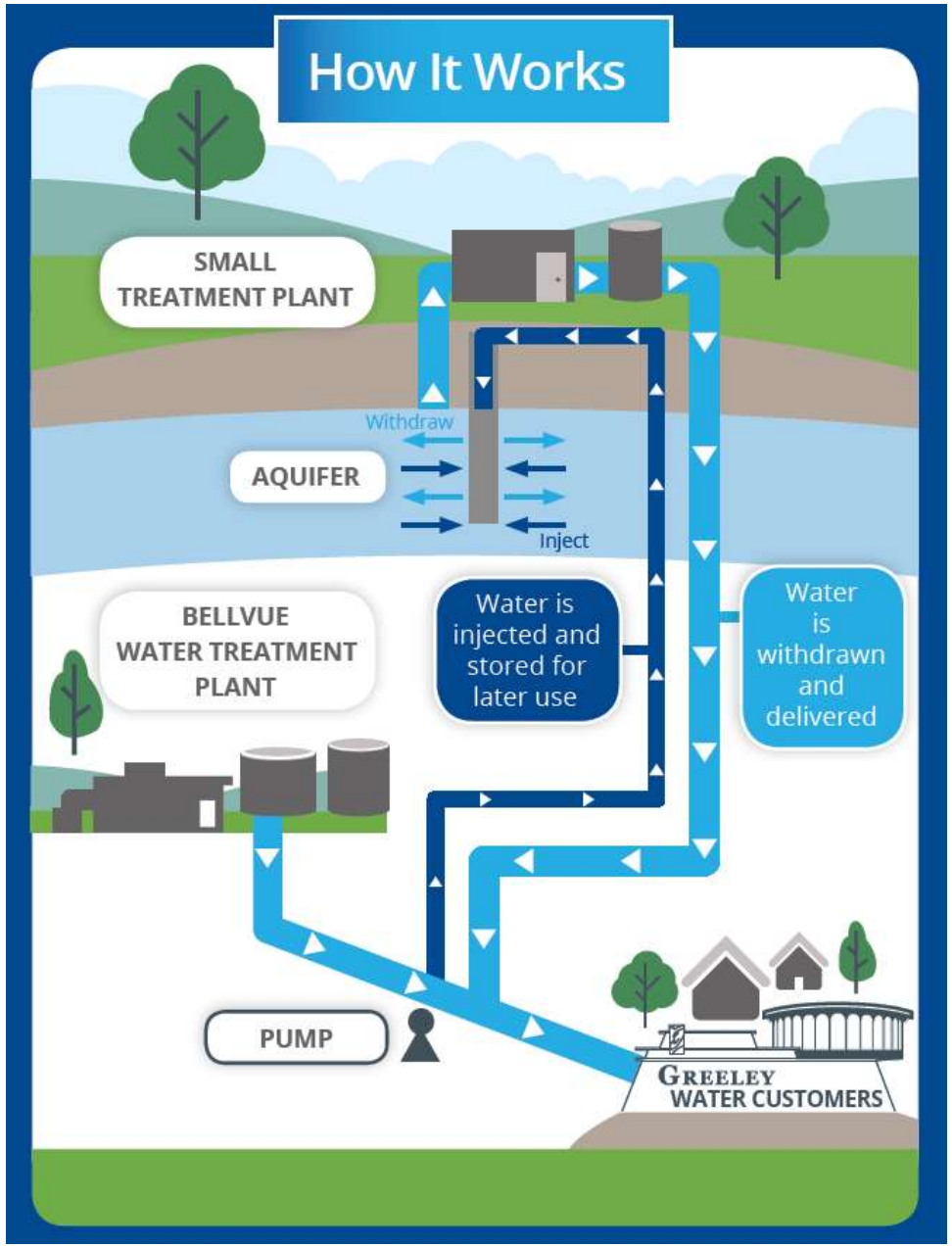
Stantec

IWRP Vision Statement

"An actionable and adaptive master plan for Greeley's water resources that uses modern, defensible methods to develop a roadmap ensuring a reliable water supply for our community through an uncertain future."

IWRP Timeline





Terry Ranch

Key components:

- Aquifer storage and recovery project
- 1,200,000 AF decreed volume; 12,100 AF/yr decreed withdrawal
- Aquifer storage of wholly consumptive supplies
- Closed system with no functional losses (Non-Tributary Decree 11CW275)

Terry Ranch Integration in the IWRP

1. What is a sustainable use of Terry Ranch?

2. What does Greeley need to do to sustainably use Terry Ranch while meeting Level of Service?

Terry Ranch Integration

Terry Ranch Integration Modeling

- Simulate Terry Ranch fully integrated (injection and recovery) at largest feasible size (30 wells)
- Develop tradeoffs between Terry Ranch use and integration alternatives
- Results will identify the long-term Terry Ranch sustainability target the IWRP will plan for

Reminder: Terry Ranch fully integrated is likely far off into the future. The IWRP goal is to identify near-term projects that are effective regardless of integration details.

Analyzing Sustainable Use

Model Runs	Initial Observations
Terry Ranch on	Large injection/recovery delta
Terry Ranch on with drought response	Lowers drawdown need
Drought response triggers varied	Tradeoff between recovery and drought response
Sensitivity to annual demand	Biggest impact on Terry Ranch sustainability
Bring on additional sources and/or storage	Lowers drawdown need
Alternative analysis	Initial look into how other projects impact the injection/recovery delta

Terry Ranch Integration Alternatives

- Annual Demand Terry Ranch is online
- Drought Response Use
- Physical Infrastructure
- Water Rights Acquisitions
- Operational Changes

Possible Greeley System Model Settings

Annual Demand (acre-feet per year)	Drought Response Settings	Water Rights Acquisitions	Physical Infrastructure
• 50,000 • 45,000	• Off • Triggered at 1 YOD • Triggered at 0.75 YOD	• None • Additional Acquistion	• None • Retiming Storage

Terry Ranch Integration Simulations

Preliminary Model Results Subject to Change

Set	Annual Demand	Drought Response	New Water Rights	New Infrastructure	Purpose
A	50,000 af	Off	None	None	Terry Ranch sustainability without drought response actions
B	50,000 af	1 YOD Trigger	None	None	Terry Ranch sustainability and drought response frequency tradeoff
C	50,000 af	0.75 YOD Trigger	None	None	
D	45,000 af	0.75 YOD Trigger	None	None	Terry Ranch sustainability with lower annual demand
E	50,000 af	0.75 YOD Trigger	Yes	None	Effect of water resources alternatives that could improve the sustainability of Terry Ranch use
F	50,000 af	0.75 YOD Trigger	None	Retiming Storage	
G	50,000 af	0.75 YOD Trigger	Yes	Retiming Storage	

Key Terry Ranch Integration Take Aways

Preliminary Model Results Subject to Change

- Terry Ranch works as envisioned
- The annual demand when Terry Ranch is fully integrated is the biggest driver of sustainability
- Some level of drought response may be required to improve long-term Terry Ranch sustainability
- Water resources alternatives can improve Terry Ranch sustainability:
  - Retiming surplus water supplies for injection
  - Acquire new water rights that reduce Terry Ranch usage

Terry Ranch Integration Results

Preliminary Model Results Subject to Change

Set	Settings	% of Years with Drought Response	Average Annual Terry Ranch Extraction	Average Annual Terry Ranch Injection	Terry Ranch Long-Term Delta
A	No Drought Response	N/A	5,300	1,400	-337,400

Terry Ranch is drawn down long-term by ~337,000 acre feet

Terry Ranch Integration Results

Preliminary Model Results Subject to Change

Set	Settings	% of Years with Drought Response	Average Annual Terry Ranch Extraction	Average Annual Terry Ranch Injection	Terry Ranch Long-Term Delta
A	No Drought Response	N/A	5,300	1,400	-337,400
B	Drought Response Triggered at 1 YOD	62%	4,100	2,000	-180,300

Drought Response at 1 YOD reduces the long-term use by 157,000 acre-feet. However, restrictions are active in 62% of years

Terry Ranch Integration Results

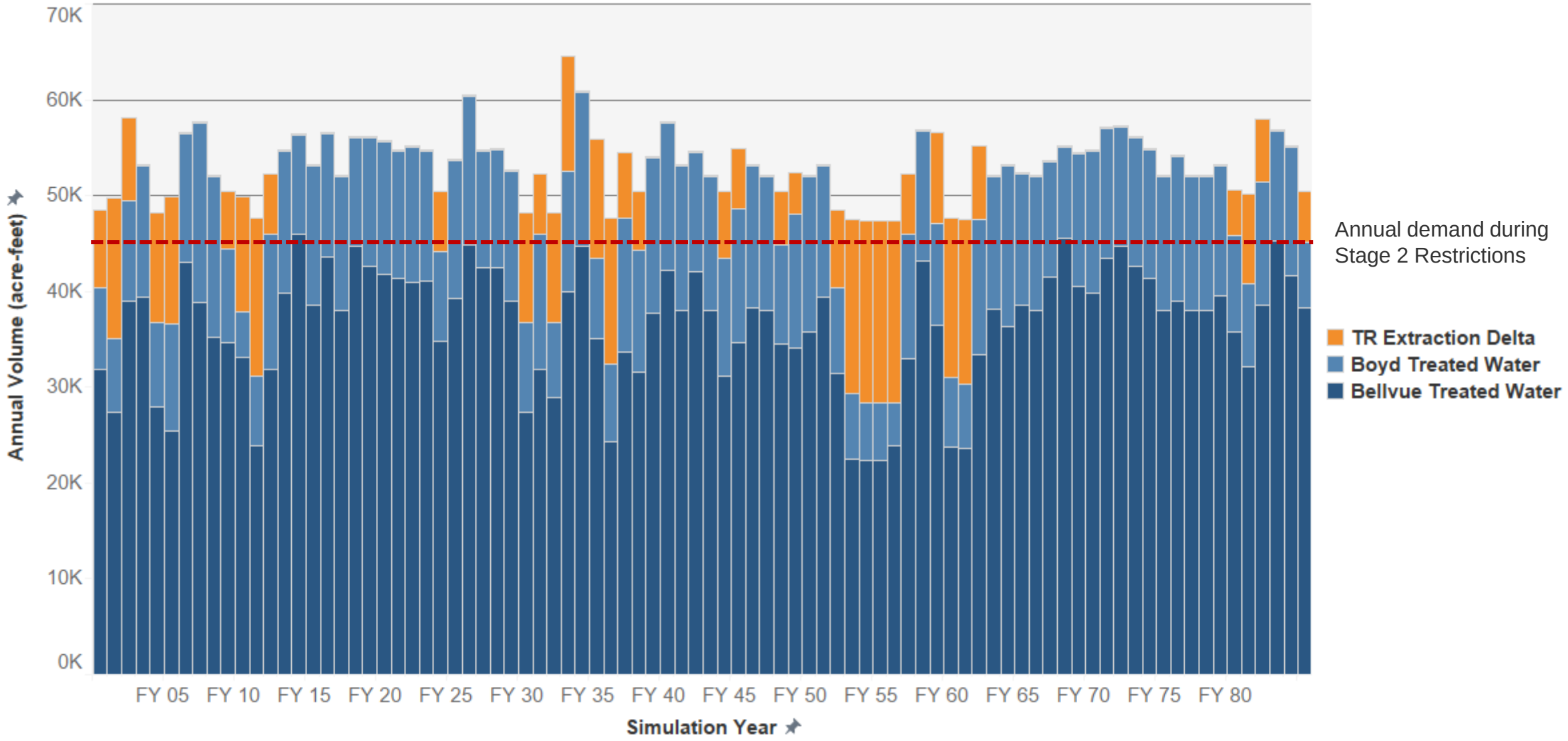
Preliminary Model Results Subject to Change

Set	Settings	% of Years with Drought Response	Average Annual Terry Ranch Extraction	Average Annual Terry Ranch Injection	Terry Ranch Long-Term Delta
A	No Drought Response	N/A	5,300	1,400	-337,400
B	Drought Response Triggered at 1 YOD	62%	4,100	2,000	-180,300
C	Drought Response Triggered at 0.75 YOD	32%	4,600	1,700	-254,100

Drought Response at 0.75 YOD reduces the long-term use by 83,000 acre-feet. Restrictions are active in 32% of years

Water Supply Sources

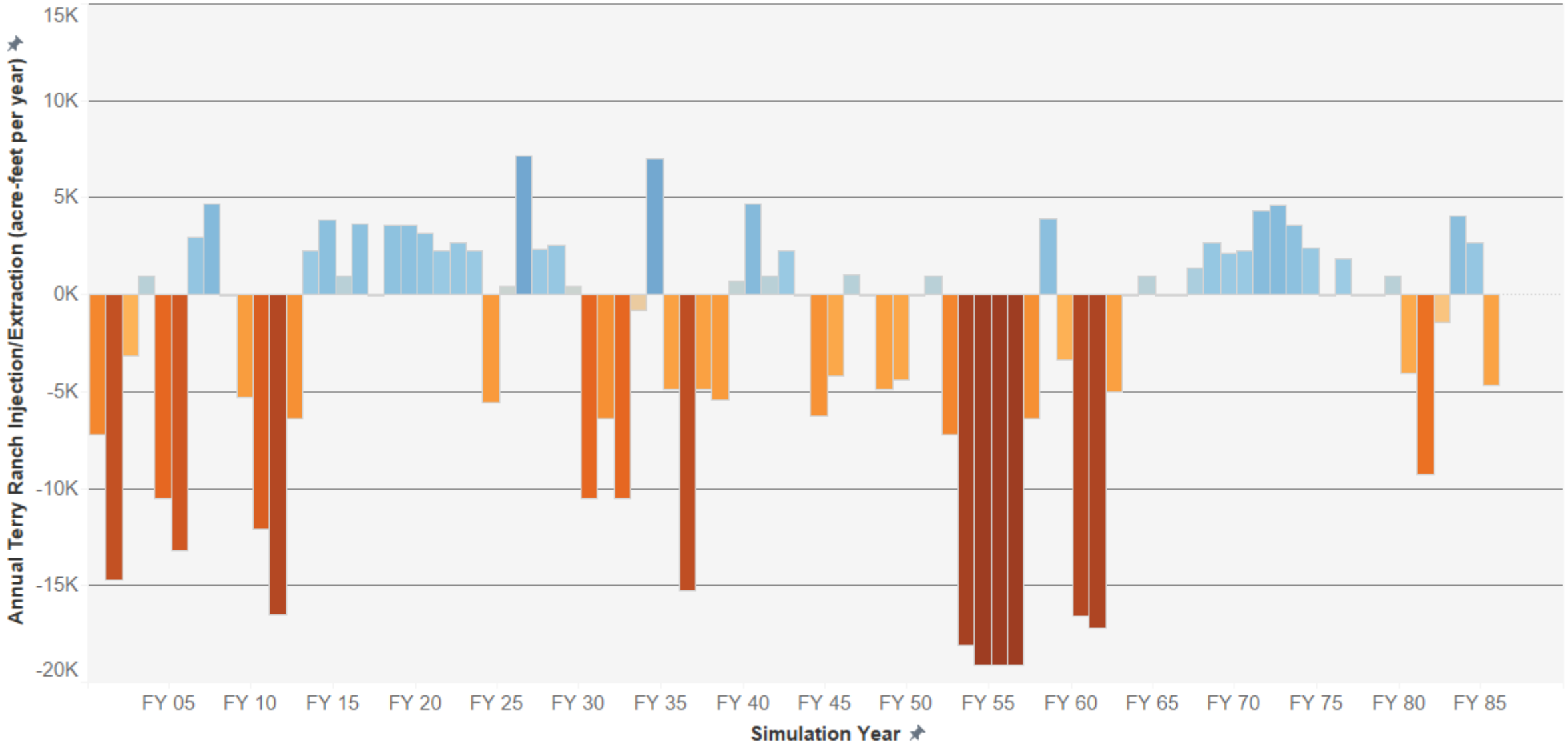
Preliminary Model Results Subject to Change



During severe droughts, most outdoor demands are met from Terry Ranch to preserve sufficient surface water storage. TR Supplies are also used to enhance surface water supplies.

Terry Ranch Injection/Extraction

Preliminary Model Results Subject to Change



Terry Ranch is used during droughts, and significantly during severe droughts.
Injection outside of droughts cannot make up for extraction use during droughts.

Terry Ranch Integration Results

Preliminary Model Results Subject to Change

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Increasing the frequency of drought response decreases the Terry Ranch use. What is the appropriate balance?

Terry Ranch Integration Results

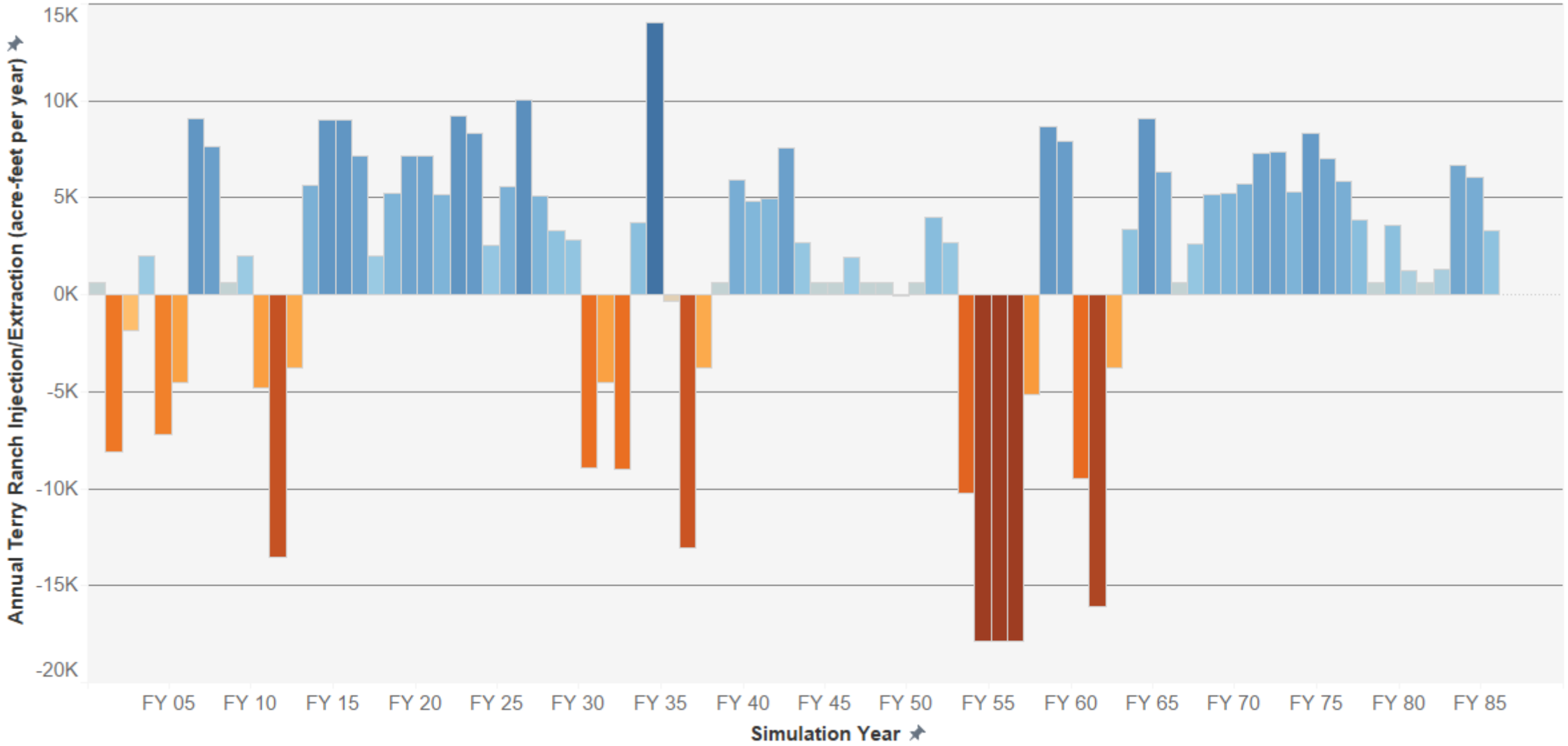
Preliminary Model Results Subject to Change

Set	Settings	% of Years with Drought Response	Average Annual Terry Ranch Extraction	Average Annual Terry Ranch Injection	Terry Ranch Long-Term Delta
C	Drought Response Triggered at 0.75 YOD	32%	4,600	1,700	-254,100
D	45,000 acre-feet demand	19%	2,700	3,600	82,500

With an annual demand to 45,000 acre-feet, Terry Ranch is used less overall. This creates a positive long-term delta of ~82,000 acre-feet.

Terry Ranch Use w/45,000 af Demand

Preliminary Model Results Subject to Change



At a lower demand, Terry Ranch is still a significant supply source during droughts, but has better opportunity to inject outside of droughts.

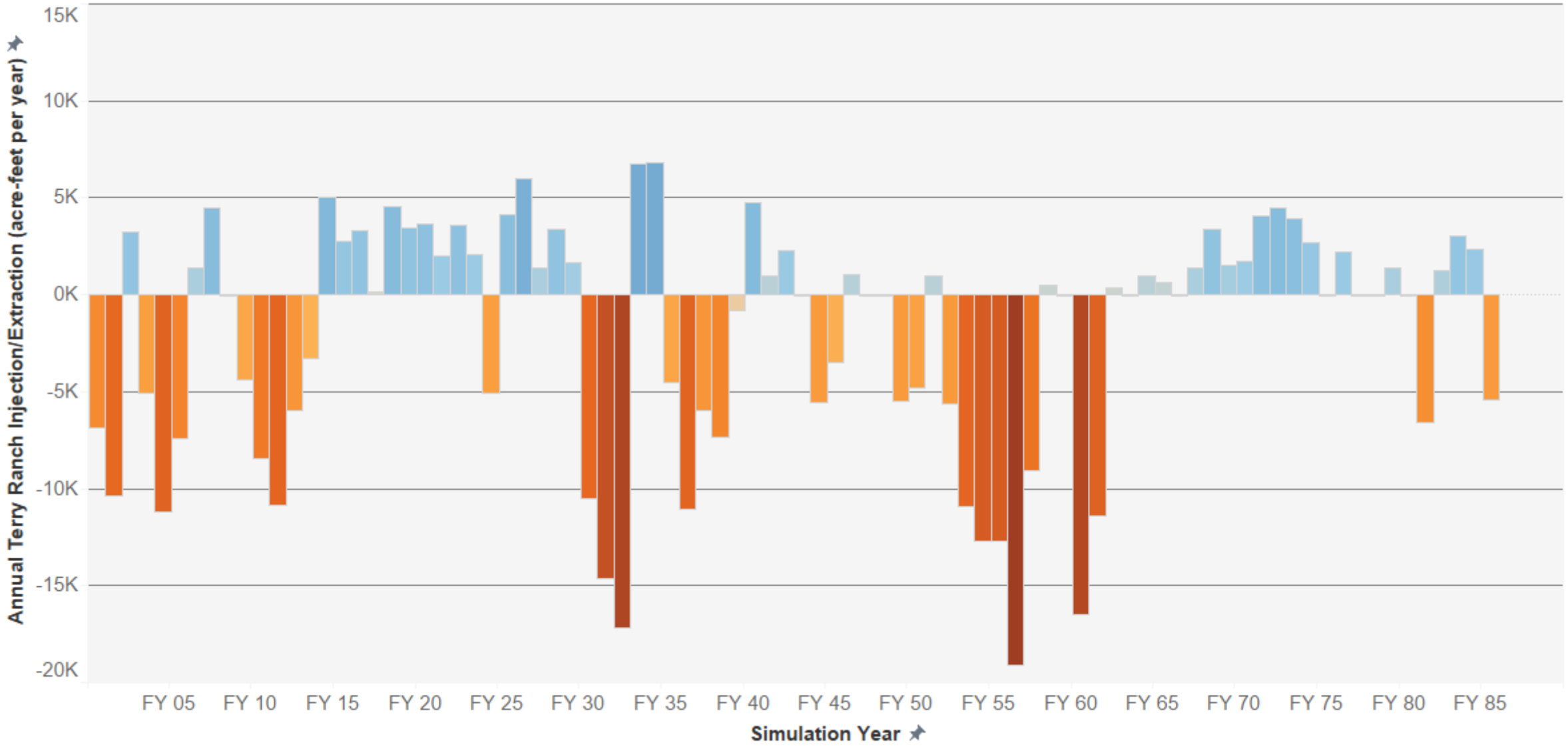
Terry Ranch Integration Results

Preliminary Model Results Subject to Change

Set	Settings	% of Years with Drought Response	Average Annual Terry Ranch Extraction	Average Annual Terry Ranch Injection	Terry Ranch Long-Term Delta
Additional water resources alternatives could improve the long-term Terry Ranch sustainability					
C	Drought Response Triggered at 0.75 YOD	32%	4,600	1,700	-254,100
E	Additional Water Rights	30%	4,300	1,800	-217,500
F	Retiming Storage	38%	4,300	2,100	-188,300
G	Water Rights + Retiming Storage	35%	3,900	2,100	-156,200

Terry Ranch Use w/Supply and Retiming Alternatives

Preliminary Model Results Subject to Change



Adding new supply helps reduce the Terry Ranch use during droughts while retiming storage increases the injection outside of droughts.

Terry Ranch Integration Results

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- Terry Ranch works as envisioned
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- Water resources alternatives can improve Terry Ranch sustainability. What should Greeley act on now?
  - Retiming surplus water supplies for injection
  - Acquire new water rights that reduce Terry Ranch usage

Water Acquisition Decision Tool Purpose

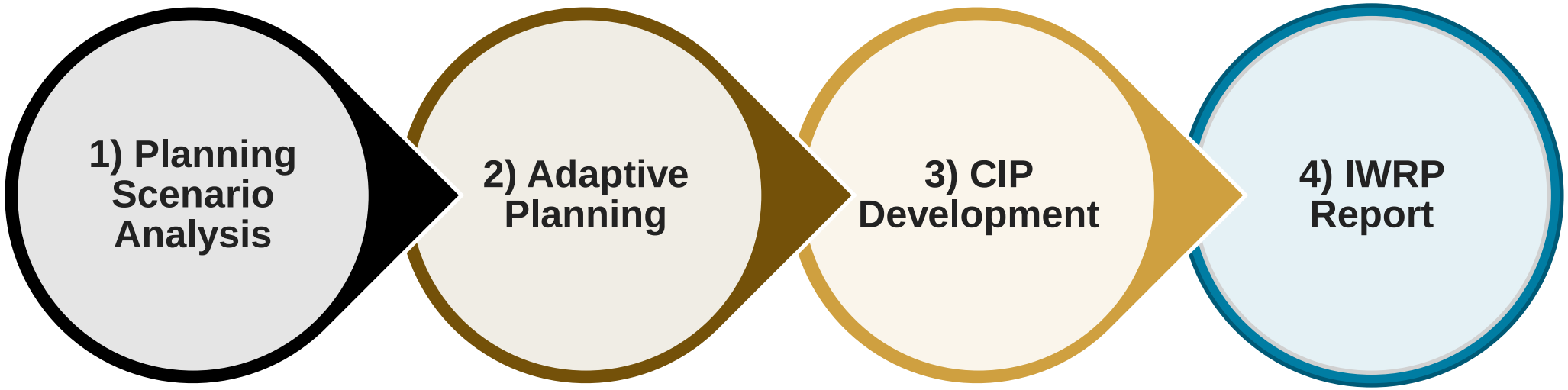
- Greeley frequently evaluates water rights acquisitions
- Future water rights acquisitions will be focused
- Each system has unique challenges, opportunities, and barriers specific to Greeley
- Need adaptable tool to support decision-making when evaluating acquisitions

Water Acquisition Decision Tool Overview

- Identify individual systems that Greeley could acquire water rights in
- Define important criteria that separate benefits and challenges of individual systems
- Assess how individual systems score on each criteria

Potential Evaluation Criteria			
Cost	• Purchase Price • Integration Cost • Operating Cost	System Integration	• Integration into Existing System • Integration into Terry Ranch • Implementability
Reliability	• Potential Yield under Shifted Hydrograph • Seniority • Vulnerability to Change	Availability	• Availability of water for Acquisition • Willingness of Owner to Sell • Risk of Price Escalation
Water Right/ Administration Considerations	• Legal Complexity • Ditch/Reservoir Company Considerations • Water Right Operational Flexibility		

Next Steps



- How is Terry Ranch used in the Planning Scenarios?
- What conditions does Greeley need to monitor and what is the plan to do so?
- What are the costs and timing for water resource projects for the next 10 years?
- Present IWRP outcomes to Board and City Council in March and April

Questions?