

RIVERWARE



Center for Advanced Decision Support for
Water and Environmental Systems (CADSWES)

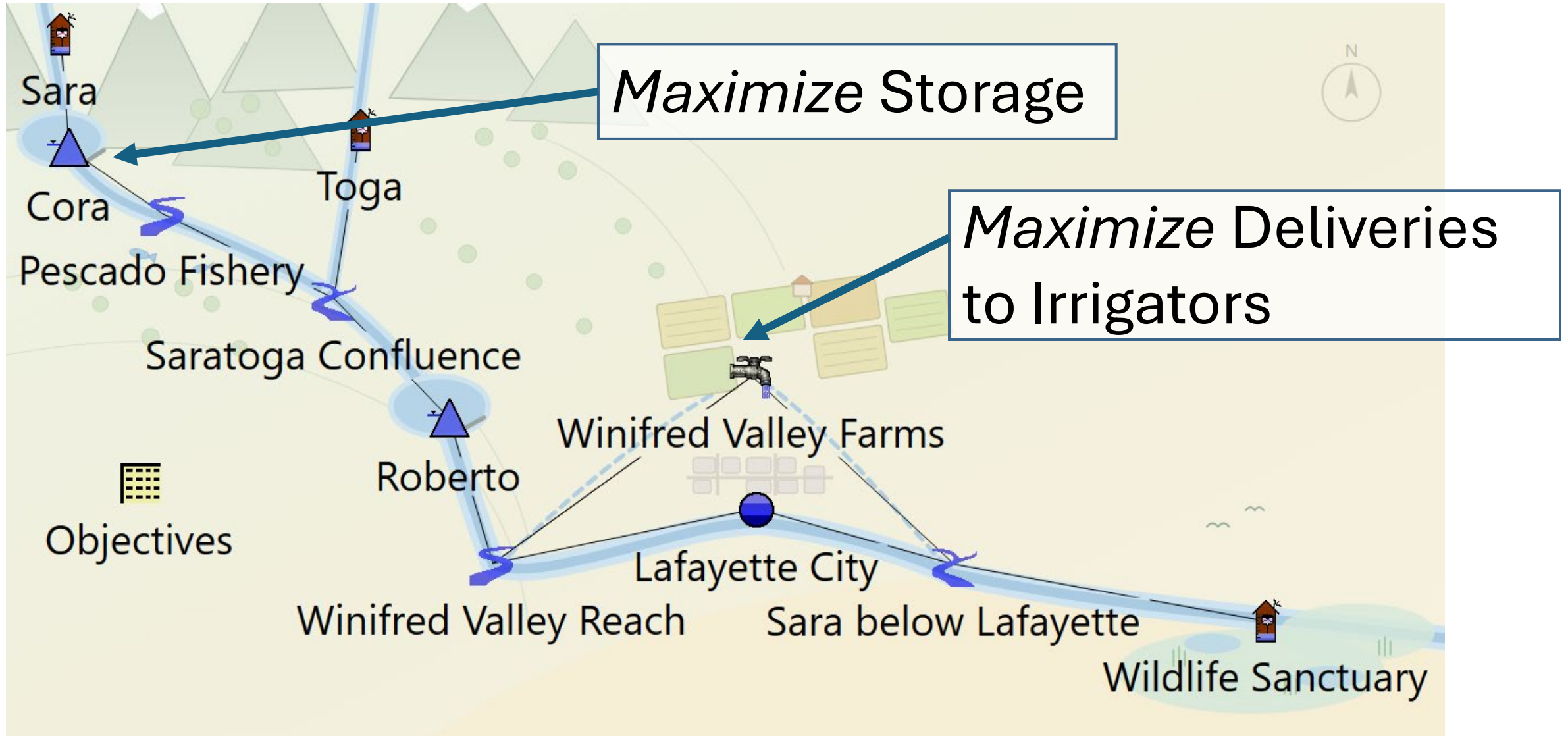
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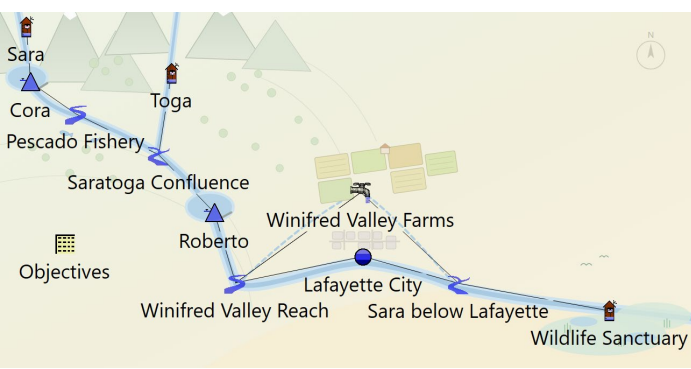
Borg-RiverWare

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RiverWare User Group Meeting 2026

Example: Two Conflicting Objectives



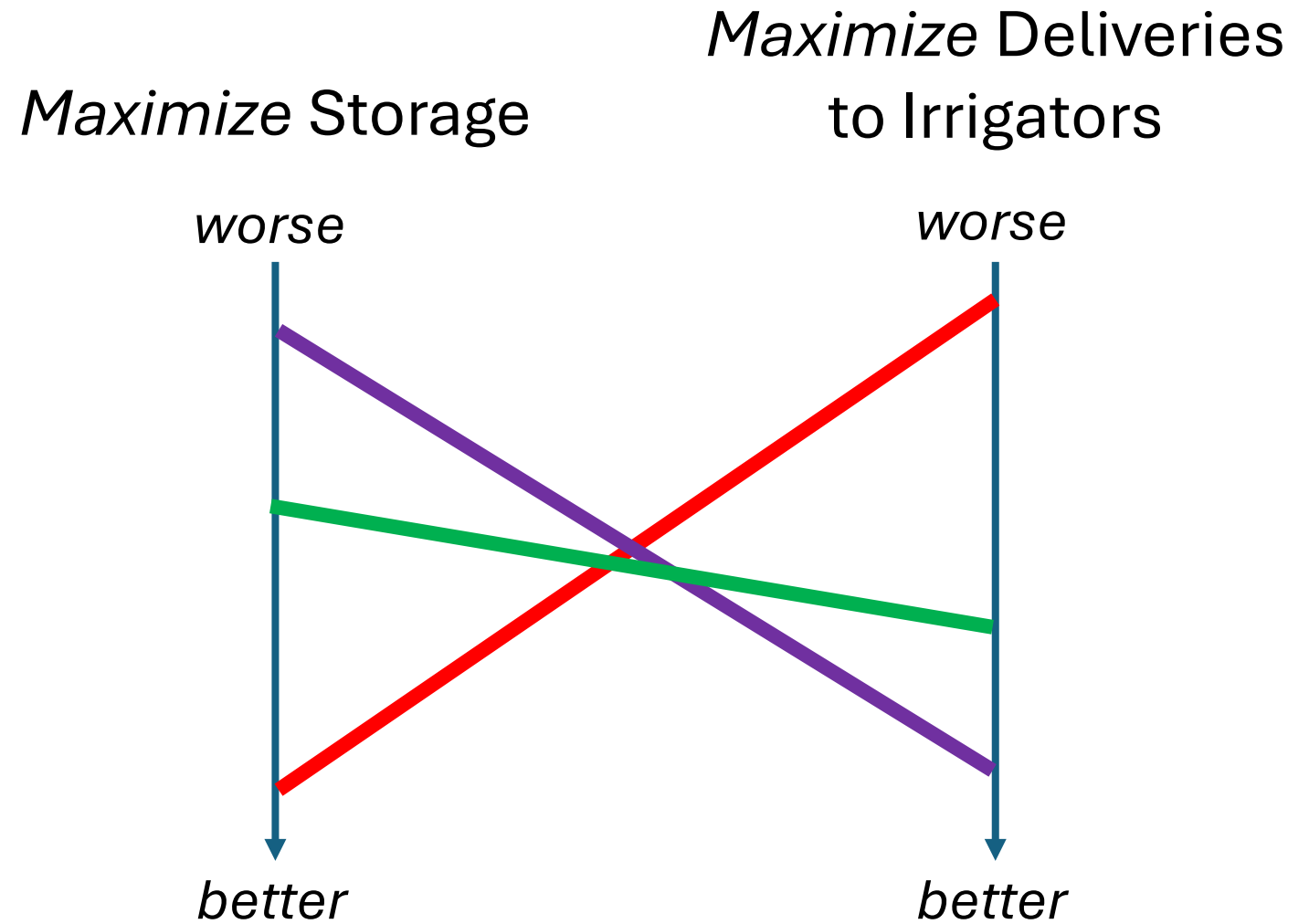


Parallel Coordinates plot: balancing objectives

***Solution A: high shortages,
to protect storage***

Solution B: no shortages

Solution C: compromise



Use Borg-RiverWare in 5
easy steps!

1. Build a rule-based simulation model



- A custom table slot
- Referenced in a rule
- With hand-created values

	Pool Elevation m	Shortage Fraction decimal
0: No Restrictions	2,173.00	0.00
1: Level 1 Restrictions	2,154.00	0.15
2: Level 2 Restrictions	2,144.00	0.18
3: Dead Pool	2,140.00	1.00

2. Modify the model to prepare for search: **decisions**



	Pool Elevation m	Shortage Fraction decimal
0: No Restrictions	2,173.00	0.00
1: Level 1 Restrictions	2,154.00	0.15
2: Level 2 Restrictions	2,144.00	0.18
3: Dead Pool	2,140.00	1.00

Pool Elevation and Shortage Fraction values
are designated as **decision slots**

Decision slots define the policy:
Level 1 at 2160, 0.05 shortage
Level 2 at 2145, 0.20 shortage
or
Level 1 at 2170, 0.10 shortage
Level 2 at 2160, 0.30 shortage
etc

2. Modify the model to prepare for search: **objectives**



Calculations made within scalar expression slots:

sense	Objective	Description
maximize	Cora Avg Storage	Maximize the average storage, in volume units, across the simulation

sense	Objective	Description
maximize	Irrigation Volumetric Reliability	Maximize the proportion of Winifred Valley Irrigators' Diversion Request that was actually received

3. Create the search configuration using the Configuration Editor in RiverWare

Borg-RiverWare Configuration Editor - two_res_ops_problem_v3_mrm.xml

File Utilities

Configuration Path: C:/GitHub/BorgRWProblems/TwoResOps/two_res_ops_problem_v3_mrm.xml

RiverWare Model & SearchDecision SlotsObjectivesMetricsConstraintsSettings

Decision Slots

Name	Type
Roberto Flood Control Level	Scalar
Cora Table Elevations	Table Column
Cora Table Shortage Fractions	Table Column
City Preferred Flow	Scalar

Properties: Cora.Shortage_Table.Pool_Elevation.txt

TypeTable Column

Slot NameCora.Shortage Table

Slot ColumnPool Elevation

NameCora Table Elevations

Borg-to-RiverWare DMI Data Filera.Shortage_Table.Pool_Elevation.txt

of Variables2

Values Lower Limit2141

Values Upper Limit2172

Rounding Increment0.1

Fixed First Row Value

Fixed Last Row Value

Column OrderingDescending

of NaNs to Append0

Show Example Input Values

SaveSave & CloseClose

Select Slot (Single)

Show Slots on: ObjectsAccountsSupplies

Object Types: 1 (of 8)Objects: 1 (of 2)Slots: 1 (of 16)

AllInvertAllInvert

Object TypeTypeObject

Confluence

Control Point

Data Object

Reach

Reservoir

Storage Reservoir

Stream Gage

Water User

Storage ReservoirCora

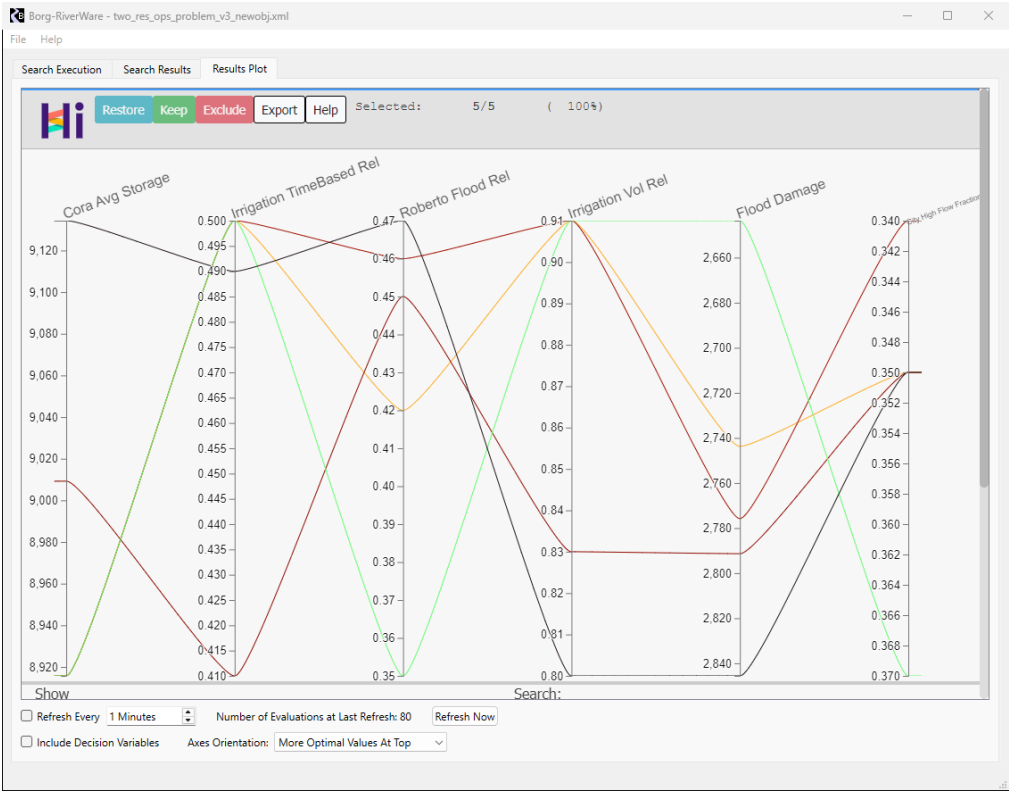
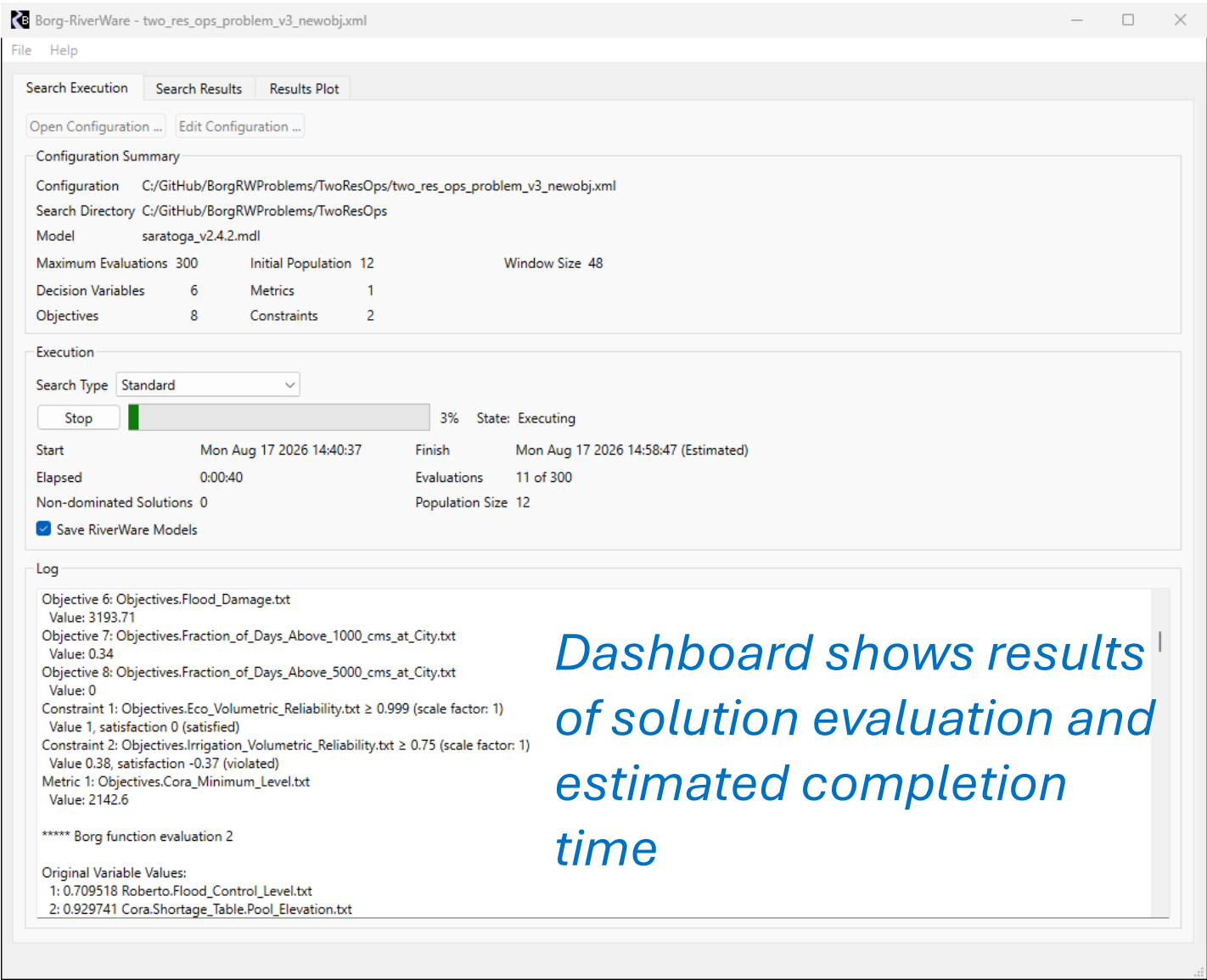
Storage ReservoirRoberto

Show Columns: Table

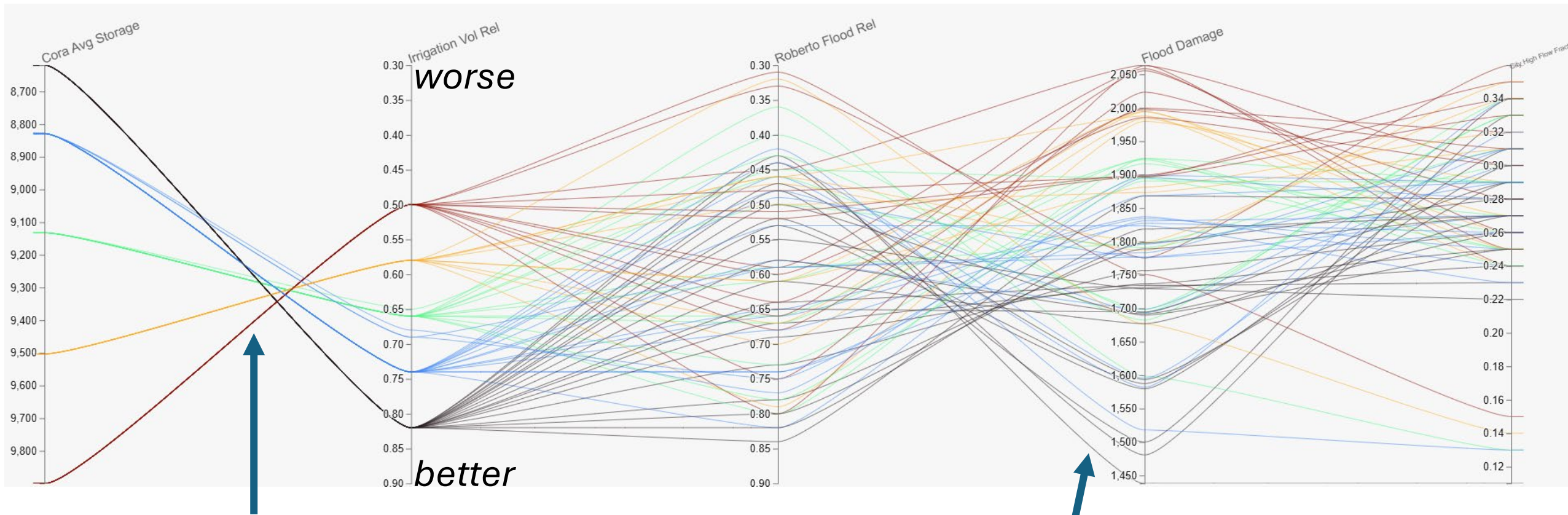
Object	Slot	Cols
Cora	Convergence Percentage	1
Cora	Convergence Value	
Cora	Elevation Volume Table	2
Cora	Pool Elevation	
Cora	Storage	
Cora	Max Iterations	1
Cora	No. of Iterations	
Cora	Max Release	2
Cora	Discharge	
Cora	Pool Elevation	
Cora	Shortage Table	2
Cora	Pool Elevation	
Cora	Shortage Fraction	
Cora	Unregulated Spill Table	2
Cora	Pool Elevation	
Cora	Unregulated Spill	

OKCancel

4. Perform the search in the Borg-RiverWare program



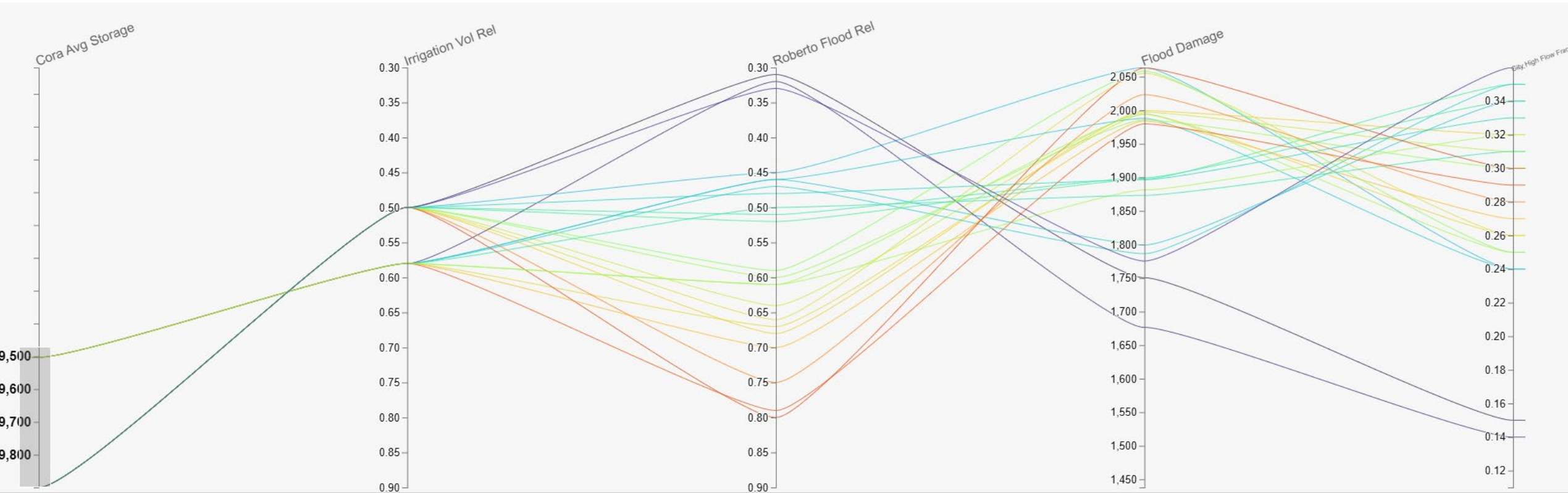
5. Analyze results: **tradeoffs**



Conflict between:
Maximize Storage
and
Maximize Deliveries

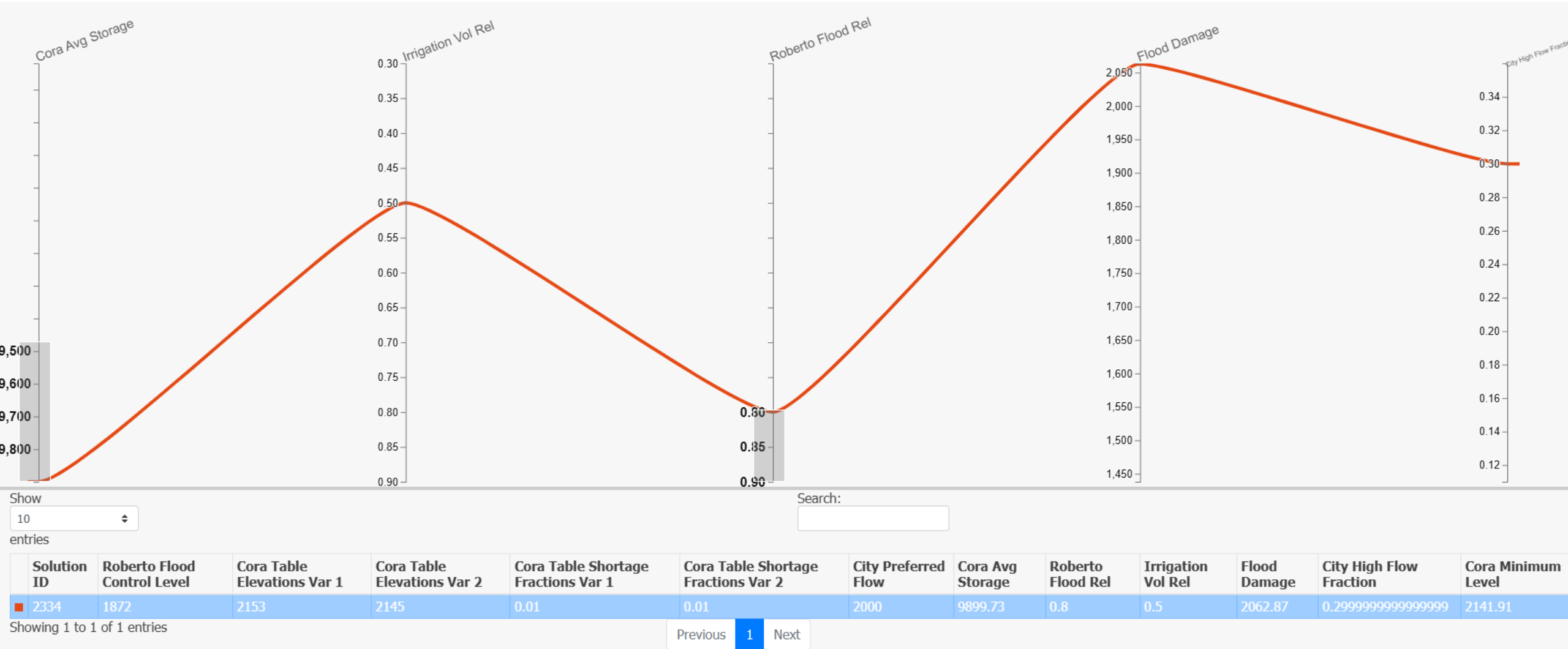
Dark blue colored solutions reveal
relationship between protecting
reservoir storage and preventing
downstream flooding

5. Analyze results: **brushing**



Drag the mouse on the 'Cora Avg Storage' objective to isolate solutions with > 9500 MCM average storage

5. Analyze results: **view individual solution**



Borg-RiverWare supports **saving solution model files** so you can load the model into RiverWare for further analysis!

You can easily change the problem formulation and optimize again to explore more.

Properties: Roberto.Flood_Control_Level.txt

Type:

Slot Name:

Name:

Borg-to-RiverWare DMI Data File:

of Variables:

Values Lower Limit:

Values Upper Limit:

Rounding Increment:

Change upper and lower bounds of decision variables

RiverWare Model & Search | Decision Slots | Objectives | Metrics | Constraints | Settings

Constraints

Name	Comparison	Threshold
Eco Vol Rel	$\geq$	0.999
Irrigation Constraint	$\geq$	0.5

Properties: Objectives.Irrigation_Volumetric_Reliability.txt

Scalar Slot:

Name:

RiverWare-to-Borg DMI Data File:

Comparison Operator:

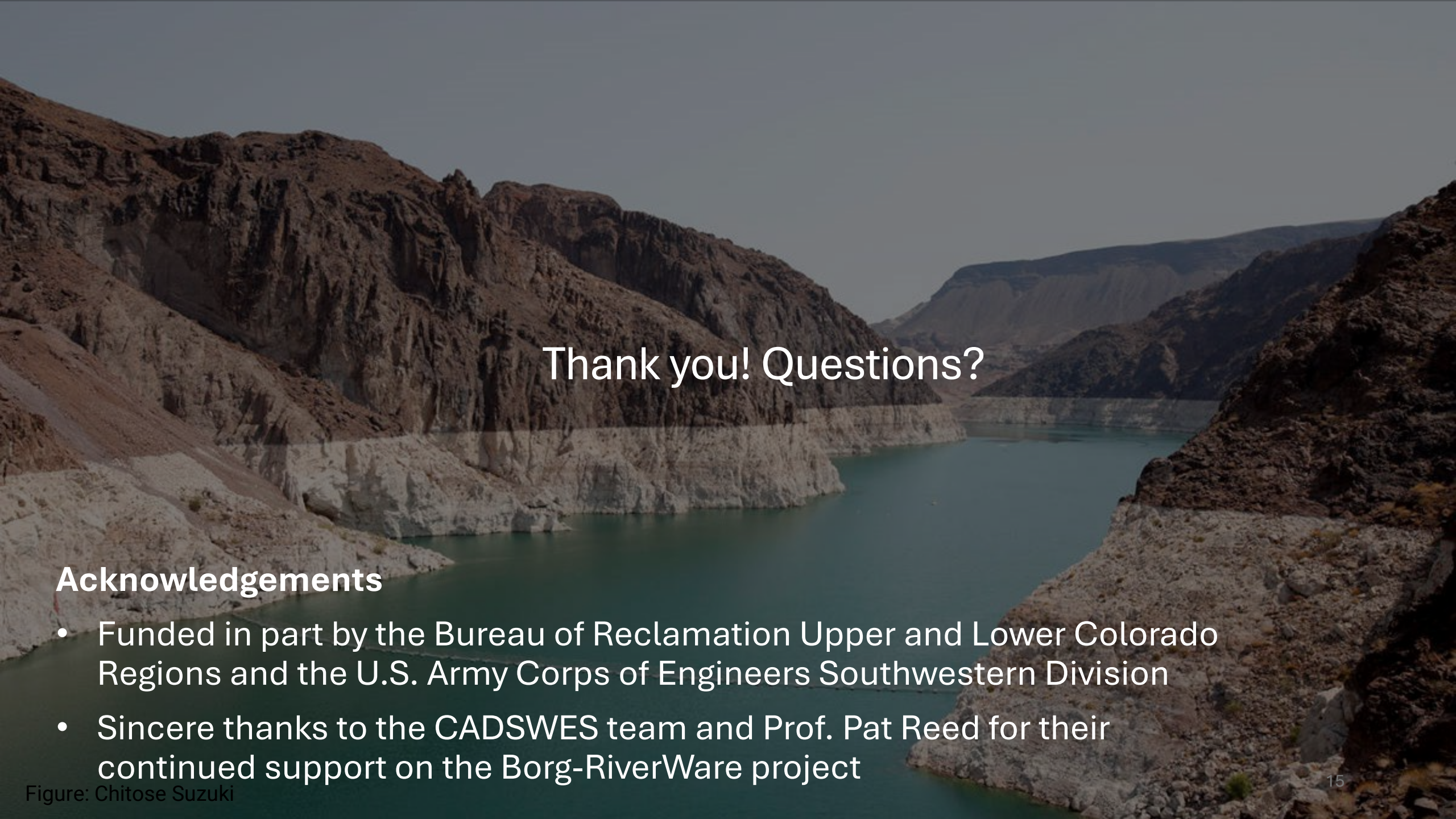
Threshold:

Scale Factor:

Aggregation Method:

NaN Satisfaction Value:

Raise or lower the threshold used in the constraint



Thank you! Questions?

Acknowledgements

- Funded in part by the Bureau of Reclamation Upper and Lower Colorado Regions and the U.S. Army Corps of Engineers Southwestern Division
- Sincere thanks to the CADSWES team and Prof. Pat Reed for their continued support on the Borg-RiverWare project