

# RiverWare as a Planning Tool for Drought Mitigation: Implementing Administrative Processes at Basin Scales

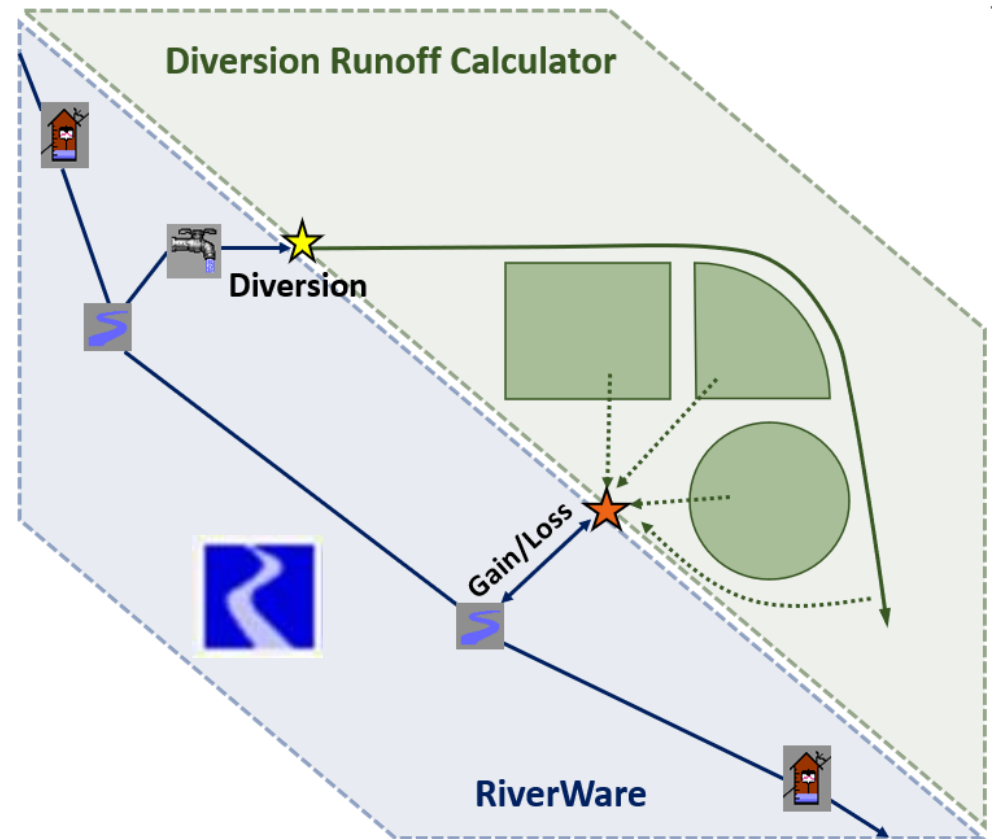
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Colorado River Authority of Utah

2025 RiverWare User Group Meeting

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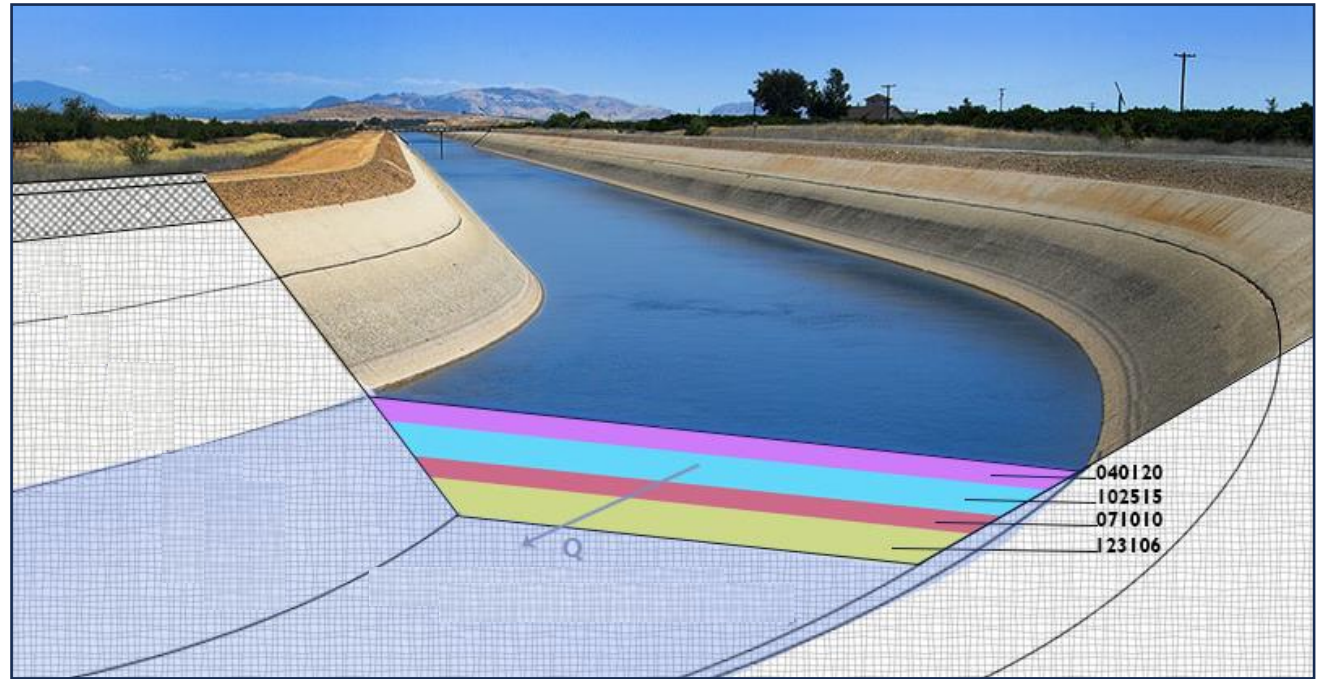
# Drought Mitigation Programs

- There is a growing interest in and need for conserving water throughout the west
- Drought Mitigation programs are being developed and implemented in the most critical basins
- The ways to conserve water are generally obvious and well known. BUT there are two challenging questions that water managers must be able to answer:
  - **How much** water was actually conserved?
  - **Where** is the conserved water?
- To answer these important questions technical tools (models) are utilized



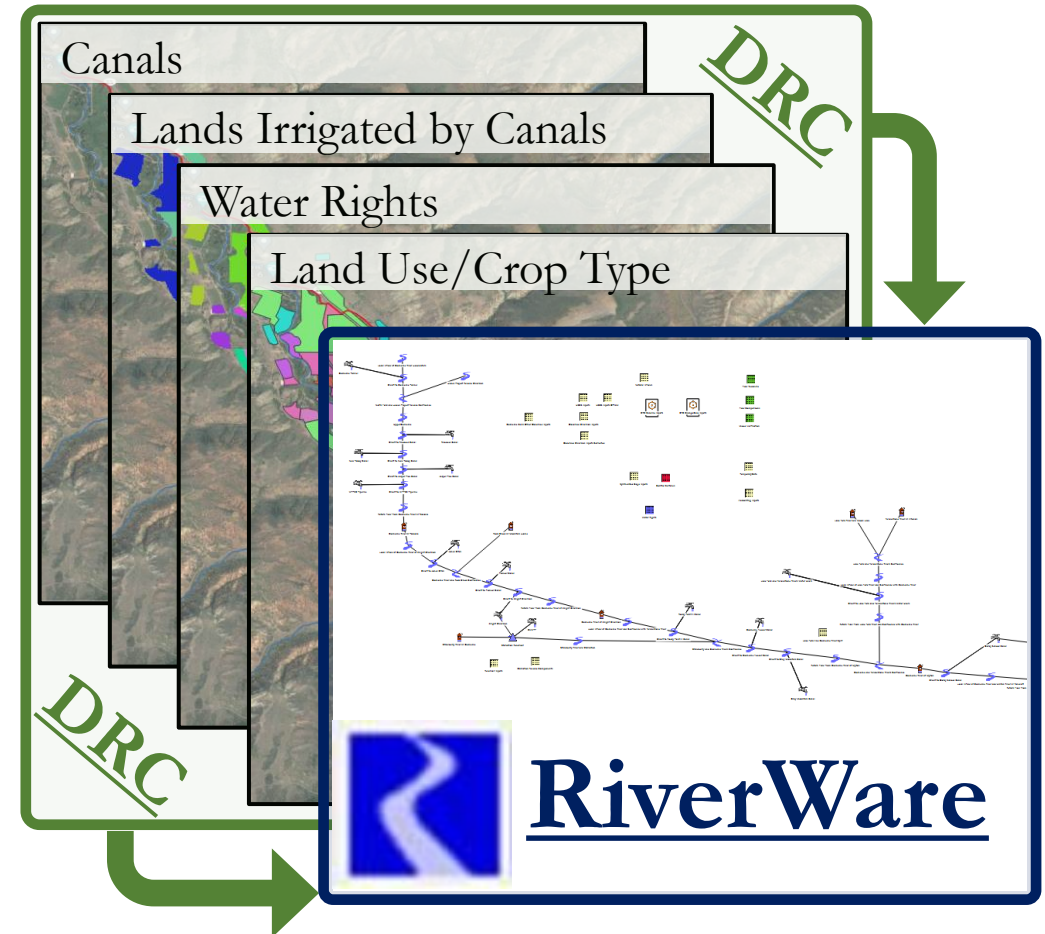
# Characterizing/Modeling Conserved Water

- When considering conservation activities, there are two main drivers of **how much** water is conserved and **where** the conserved water is located
- Physical Processes
  - Evapotranspiration
  - Transmission efficiencies
  - Irrigation efficiencies
  - Return Flows...etc.
- Administrative Processes
  - Water rights administration
  - Reservoir operating criteria
  - Water accounting
  - Shepherding



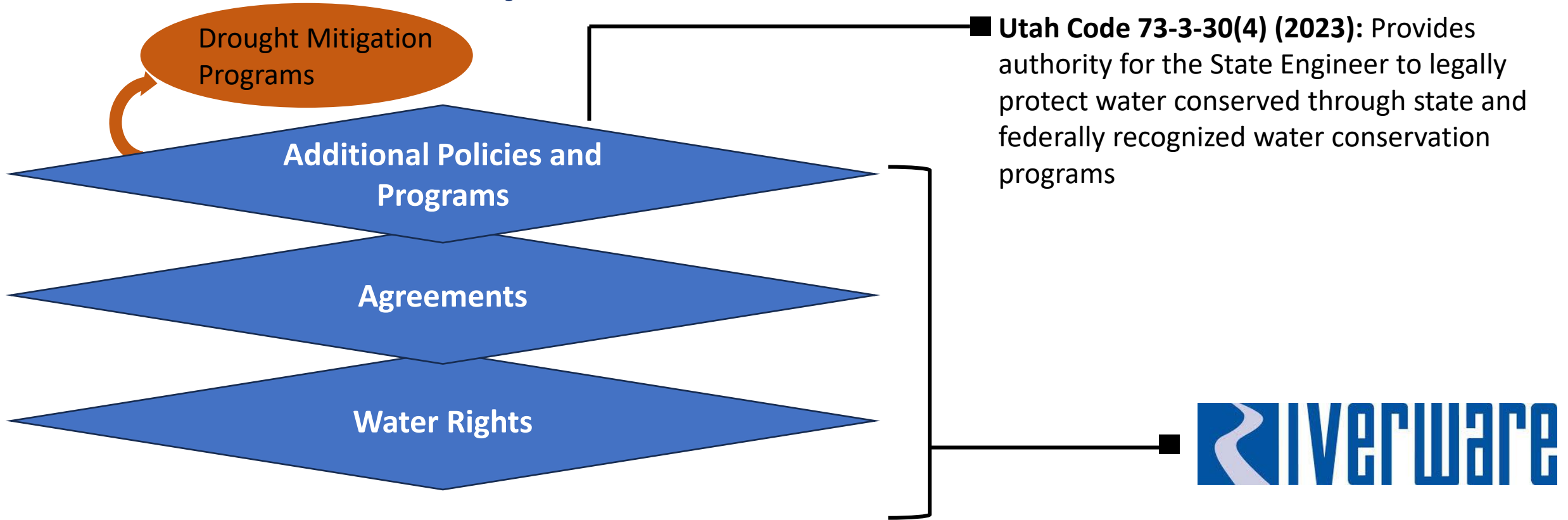
# Utah Colorado River Accounting and Forecasting (UCRAF)

- The Colorado River Authority of Utah commissioned the development of the UCRAF as a **planning tool** to develop water conservation programs for the Colorado River Basin in Utah
- Physical processes modeled in the Depletion Runoff Calculator (DRC)
  - Geospatially-based physical model
  - Models water from the headgates in the river to the fields including on-farm and transmission processes
- Administrative Processes modeled in RiverWare
  - RiverWare is an ideal tool for this role
  - Reservoir operational criteria
  - Prior Appropriation/Water Rights
  - Water Accounting

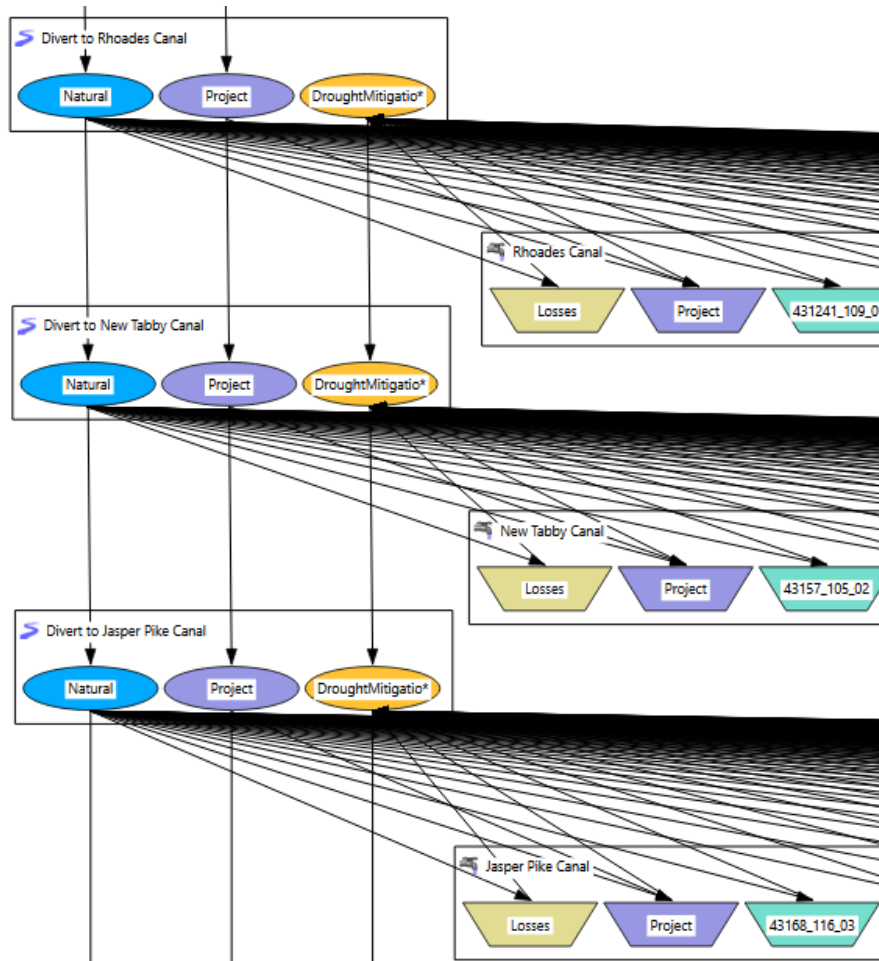


Follum, Michael, et al. "Development of the Diversion Runoff Calculator to Estimate Agricultural Water Consumption and Irrigation Diversions at the Field-to Basin-Scale in Northeastern Utah." *Journal of Irrigation and Drainage Engineering* 151.2 (2025): 04025004

# Why is UCRAF Needed?



# RiverWare is the computational hub of UCRAF



Development of the basin-wide mass balance

Integration with geospatial datasets

RiverWare accounting framework

Enables distribution downstream in accounts

Water rights solver OR priority allocation via RPL

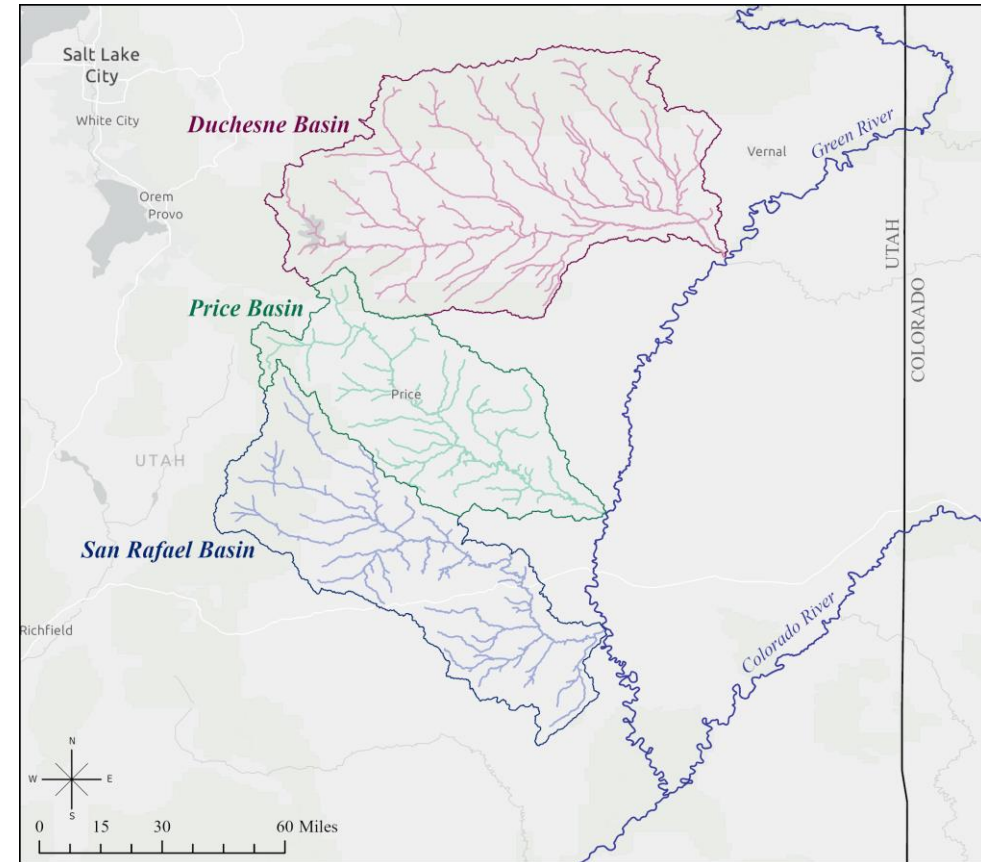
Allocation via prior appropriation and subsequent administrative methods

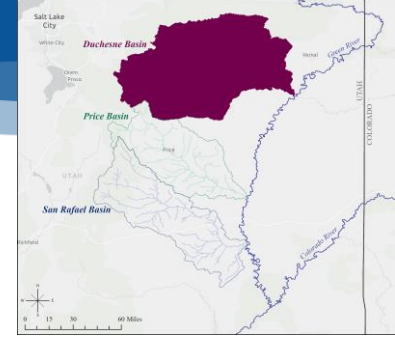
Facilitates estimated volume of conserved water

*Water rights administration occurs by accounts, classes, and irrigation district*

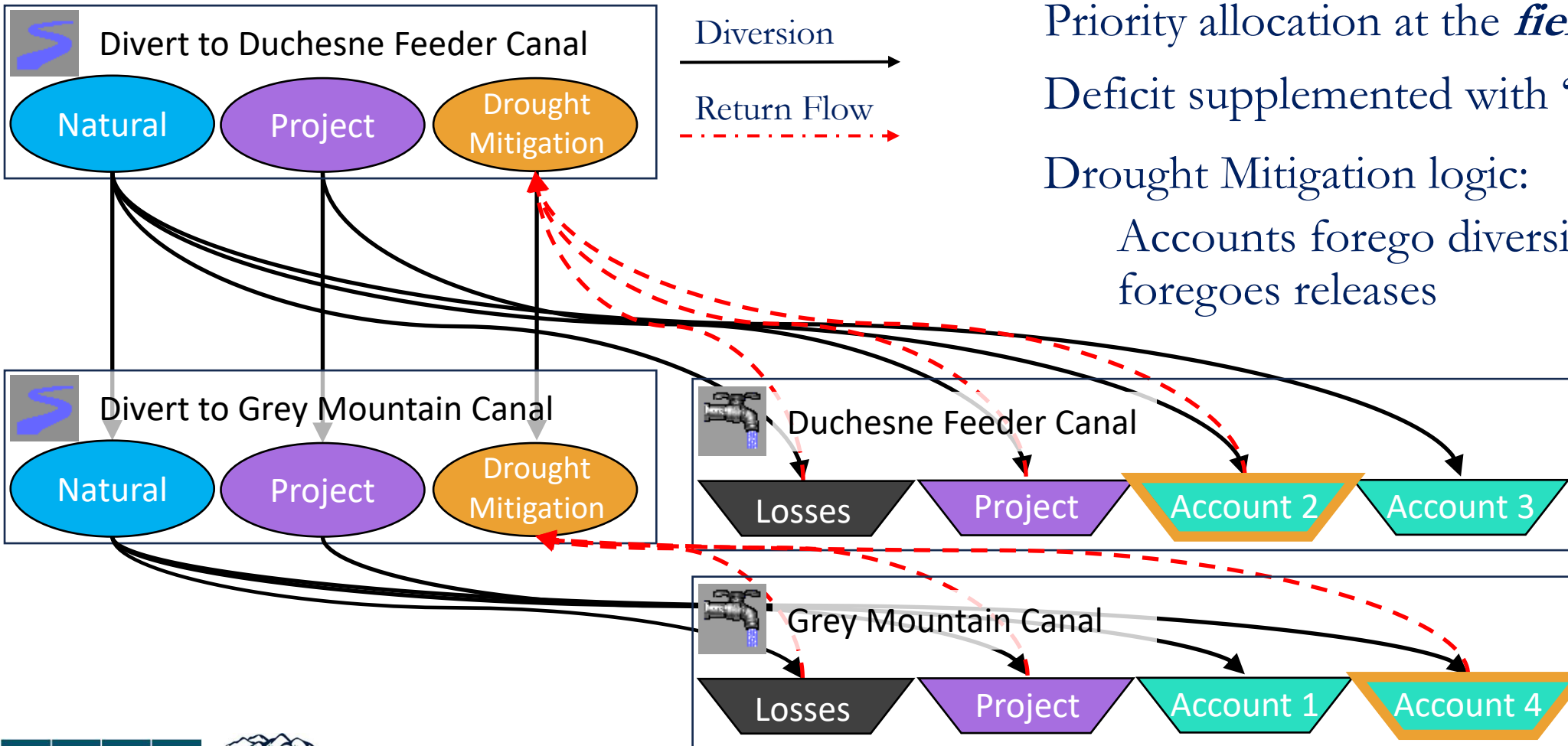
# Modeled Basins

- Duchesne Basin
  - Priority allocation via Water Rights Solver
- Price Basin
  - Priority Class allocation via RPL logic
- San Rafael Basin
  - Irrigation District water right pooling administered through RPL logic
- All are predicated on Prior Appropriation
- All are tributaries to the Green River





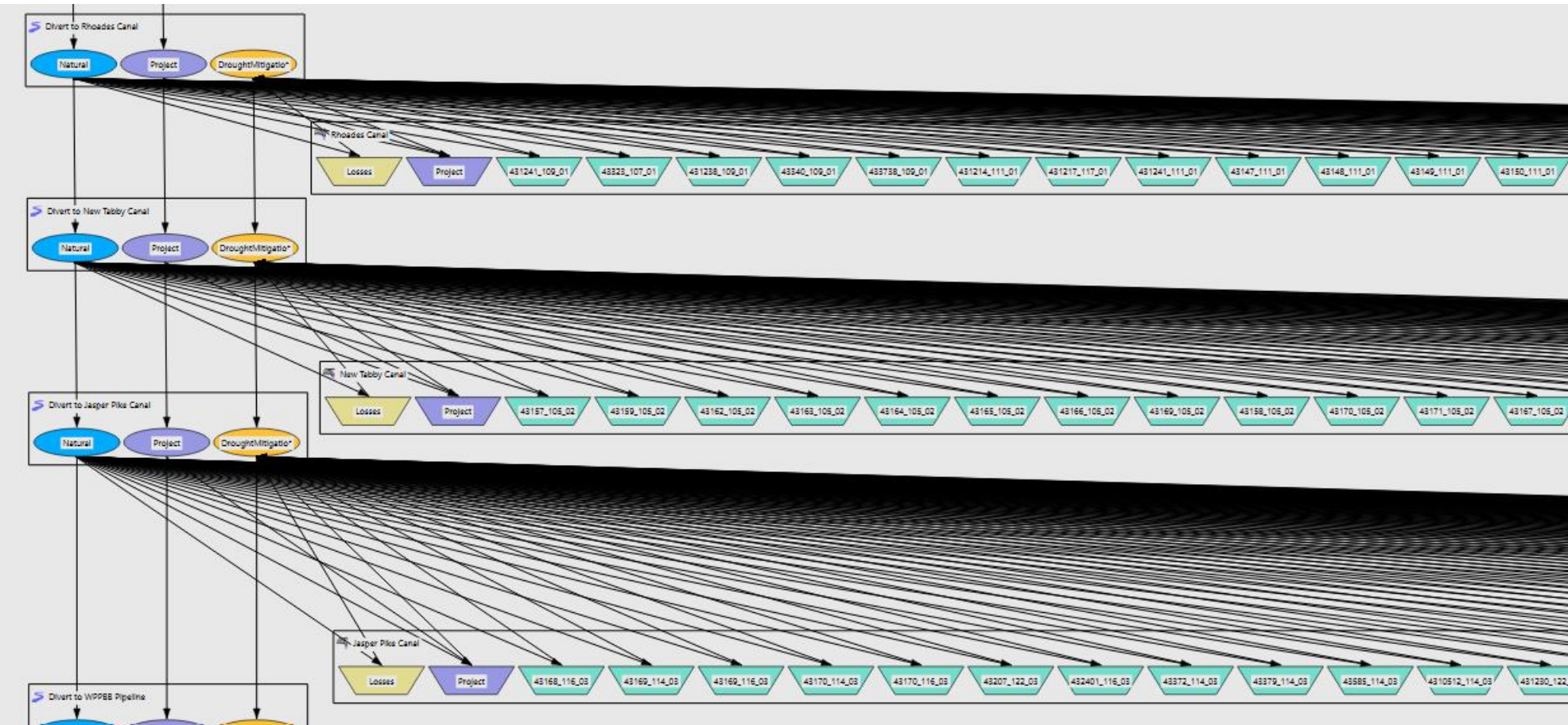
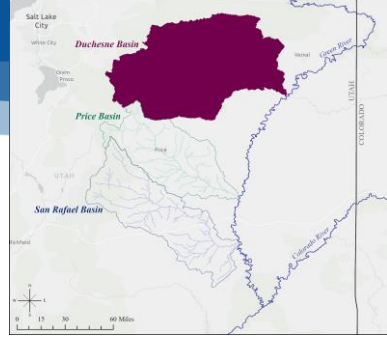
# Accounting Structure, *Duchesne*



Priority allocation at the *field level*.  
 Deficit supplemented with “Project” water  
 Drought Mitigation logic:  
 Accounts forego diversion *or* reservoir foregoes releases



# Accounting Structure, *Duchesne*



13 Consumptive use nodes

600+ Diversion Accounts



# Accounting Results, *Duchesne*

	<b>Grey Mountain Canal</b>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey M <sup>c</sup>	Grey Mountain Canal	
<b>SUM</b>	<b>^43120</b>	<b>^43255</b>	<b>^43443_</b>	<b>^43444</b>	<b>^43452</b>	<b>^43452_</b>	<b>^43453_</b>	<b>^43453_</b>	<b>^43453</b>	<b>^43459</b>	<b>^43459_0</b>	<b>^Losses</b>	<b>^Project</b>						
<b>Diversio</b>	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio	Diversio						
<b>Total</b>	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total						
<b>cfs</b>	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs						
04-01-2000 Sat	69.63	4.28 R	0.39 R	0.30 R	0.30 R	0.61 R	0.90 R	3.37 R	0.13 R	0.97 R	24.24 R	24.13 R	0.00 R						
04-02-2000 Sun	69.63	4.28 R	0.39 R	0.30 R	0.30 R	0.61 R	0.90 R	3.37 R	0.13 R	0.97 R	24.24 R	24.13 R	0.00 R						
04-03-2000 Mon	69.63	4.28 R	0.39 R	0.30 R	0.30 R	0.61 R	0.90 R	3.37 R	0.13 R	0.97 R	24.24 R	24.13 R	0.00 R						

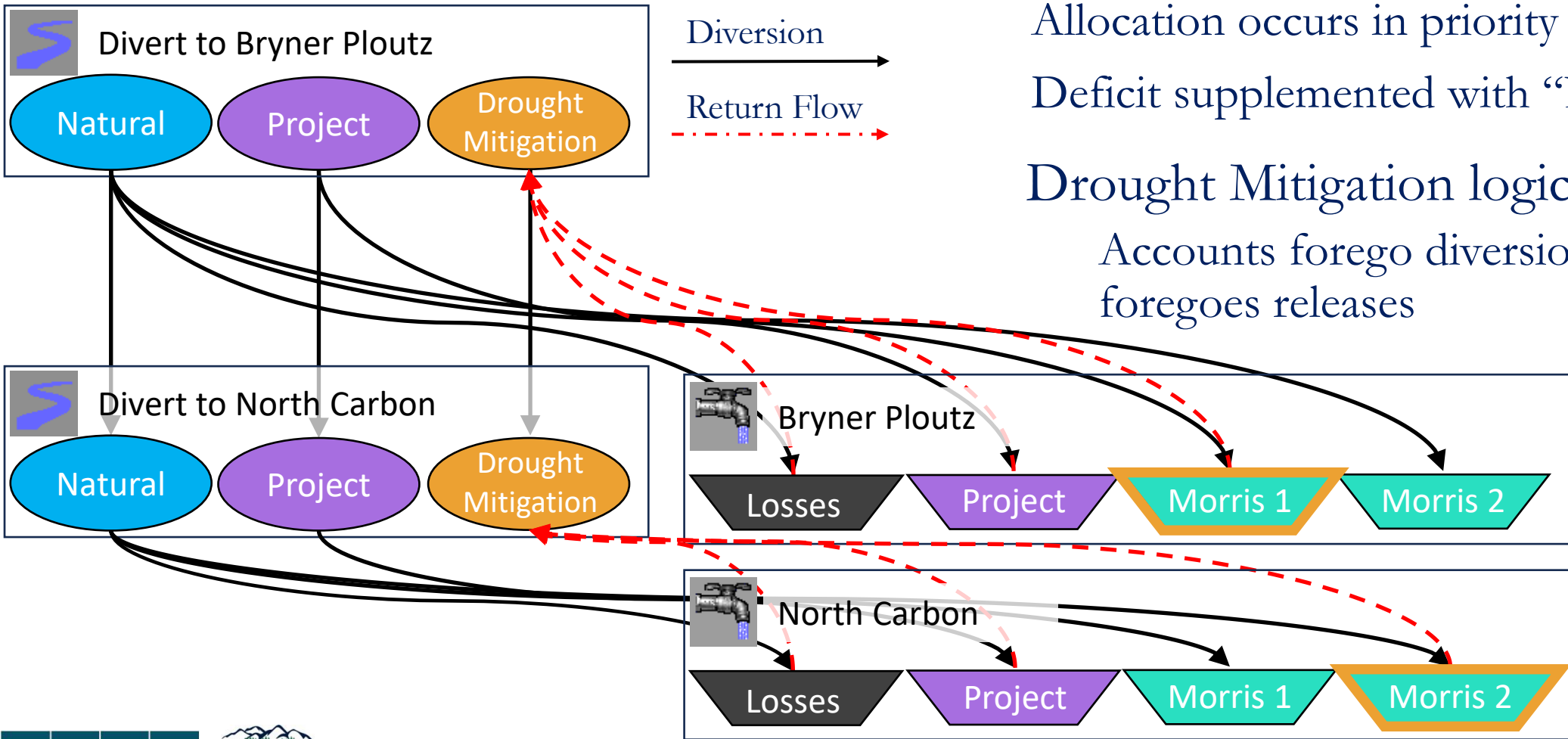


	Grey Mo	Grey Mounta	Grey Mounta	Grey Mounta	Grey Mounta	Grey Mounta	Grey Mounta	Grey Mounta	
<b>SUM</b>	<b>^431204_087</b>	<b>^43443_087_</b>	<b>^43444_087_</b>	<b>^43452_068_</b>	<b>^43452_087_</b>	<b>^43459_087_</b>	<b>^Project</b>		
<b>returnFlc</b>	returnFlow	returnFlow	returnFlow	returnFlow	returnFlow	returnFlow	returnFlow	returnFlow	returnFlow
<b>cfs</b>	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs
04-01-2000 Sat	3.66	0.39 R	0.03 R	0.03 R	0.96 R	0.08 R	2.18 R	0.00 A	
04-02-2000 Sun	3.66	0.39 R	0.03 R	0.03 R	0.96 R	0.08 R	2.18 R	0.00 A	
04-03-2000 Mon	3.66	0.39 R	0.03 R	0.03 R	0.96 R	0.08 R	2.18 R	0.00 A	



# Accounting Structure, *Price*

Allocation occurs in priority for ***Classes***.  
 Deficit supplemented with “Project” water  
 Drought Mitigation logic:  
 Accounts forego diversion *or* reservoir foregoes releases

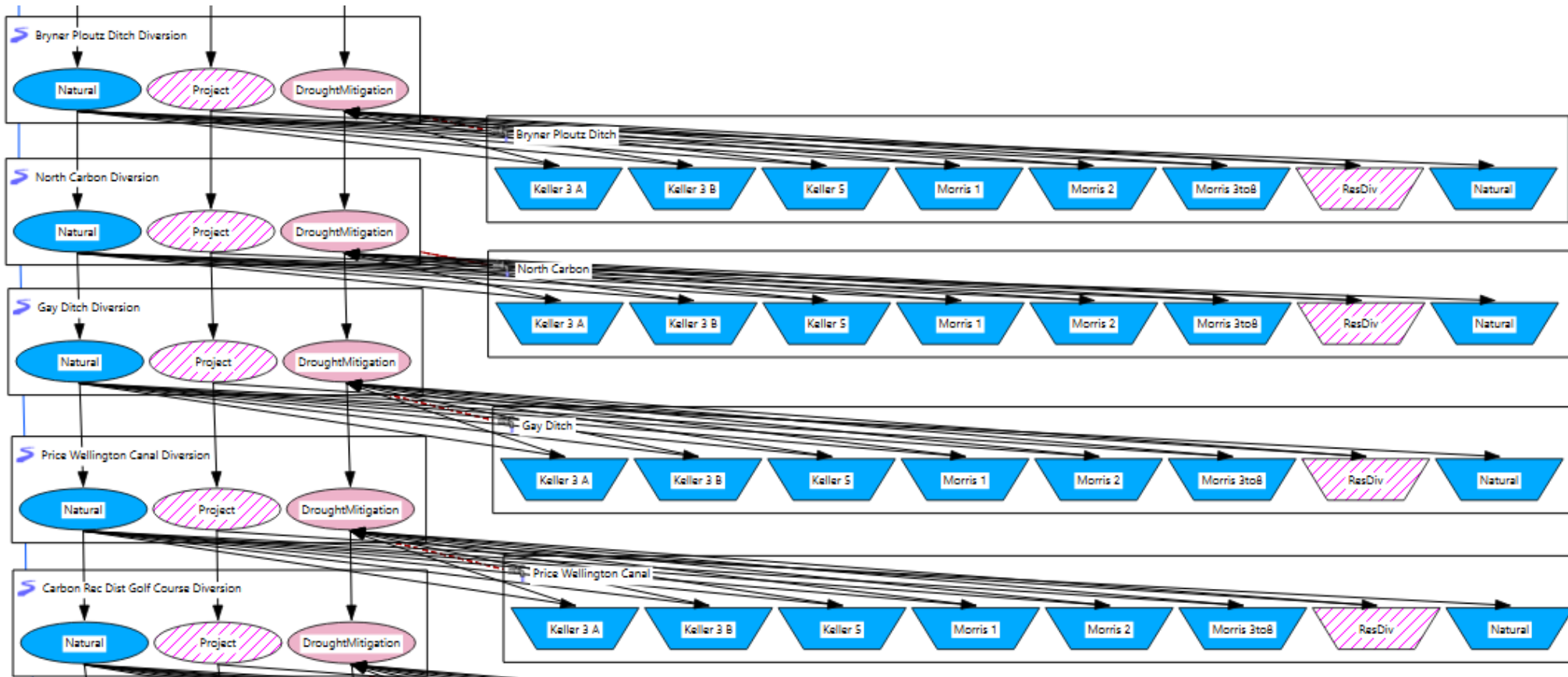


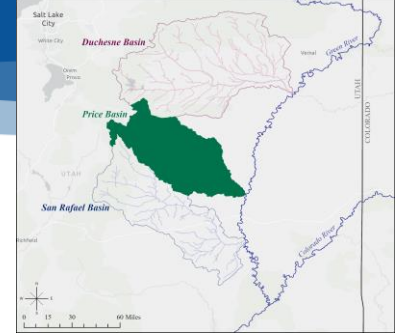
# Accounting Structure, *Price*



Consumptive use nodes: 6 ag diverters

6 Classes representing 400+ water rights



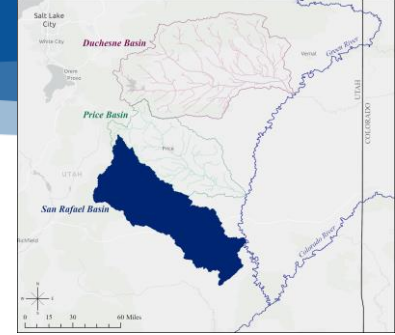


# Accounting Results, Price

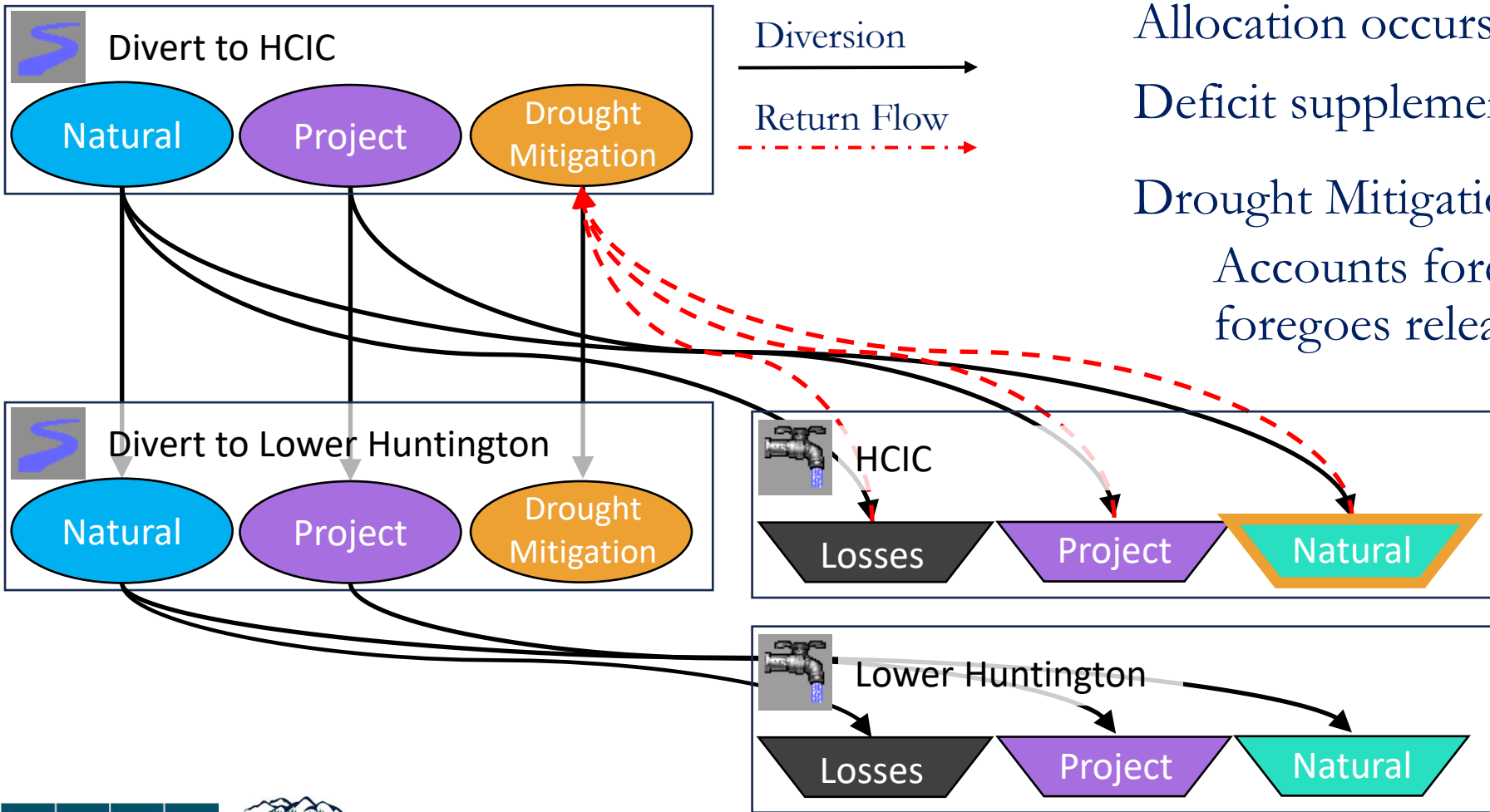
	Carbon Canal SUM Diversion cfs	Carbon Canal ^Keller 3 A Diversion Total cfs	Carbon Canal ^Keller 3 B Diversion Total cfs	Carbon Canal ^Morris 1 Diversion Total cfs	Carbon Canal ^Morris 2 Diversion Total cfs	Carbon Canal ^ResDiv Diversion Total cfs
09-12-2002 Thu	12.34	0.00 R	0.00 R	1.51 R	0.00 R	10.83 R
09-13-2002 Fri	12.34	0.00 R	0.00 R	0.47 R	0.00 R	11.87 R
09-14-2002 Sat	12.34	0.00 R	0.00 R	0.00 R	0.00 R	12.34 R
09-15-2002 Sun	12.34	3.18 R	0.00 R	8.83 R	0.33 R	0.00 R



	Carbon Canal SUM returnFlow cfs	Carbon Canal ^Keller 3 A returnFlow cfs	Carbon Canal ^Keller 3 B returnFlow cfs	Carbon Canal ^Keller returnFlow cfs	Carbon Canal ^Morris 1 returnFlow cfs	Carbon Canal ^Morris 2 returnFlow cfs	Carbon Canal ^ResDiv returnFlow cfs
09-12-2002 Thu	1.33	0.00 R	0.00 R	0.00 R	1.33 R	0.00 R	0.00 R
09-13-2002 Fri	1.33	0.00 R	0.00 R	0.00 R	0.47 R	0.00 R	0.86 R
09-14-2002 Sat	1.33	0.00 R	0.00 R	0.00 R	0.00 R	0.00 R	1.33 R
09-15-2002 Sun	1.33	1.24 R	0.00 R	0.00 R	0.09 R	0.00 R	0.00 R



# Accounting Structure, *San Rafael*



Allocation occurs in by *Irrigation District*

Deficit supplemented with “Project” water

Drought Mitigation logic:

Accounts forego diversion *or* reservoir foregoes releases

# Accounting assumptions

We require the model to reconcile the physical and accounting sides.

Drought mitigation water will be “Charged” a transit loss and (when applicable) a storage losses.

Drought mitigation water will not impact other accounts and vice versa.

# Project Challenges

- Water rights administration is *layered* and *different* in each basin.
  - Each basin is built on prior appropriation, and supplemented with reservoir storage in accordance with local policies
    - Duchesne: Allocation by “Prior Appropriation”, No Aggregation
    - Price: Allocation by and aggregation to “Class”
    - San Rafael: Allocation by and aggregation to “Irrigation District”
  - RiverWare facilitates a strong administrative model to perform drought mitigation measures
- Mining of institutional knowledge
- Overcoming challenges thanks to collaboration
  - DWRe, DWRe, CRAU, CUWCD, and water users within each basin



# Lessons Learned

- RiverWare
  - RiverWare handles layering of *administrative* and *accounting* processes well.
- Water rights administration requires adequate data.
  - Ongoing statewide efforts are improving data.
- Future efforts will explore improvements to RiverWare accounting mechanisms to increase flexibility.

# Questions?

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