Simulating the New York Canal

Stephen Hundt

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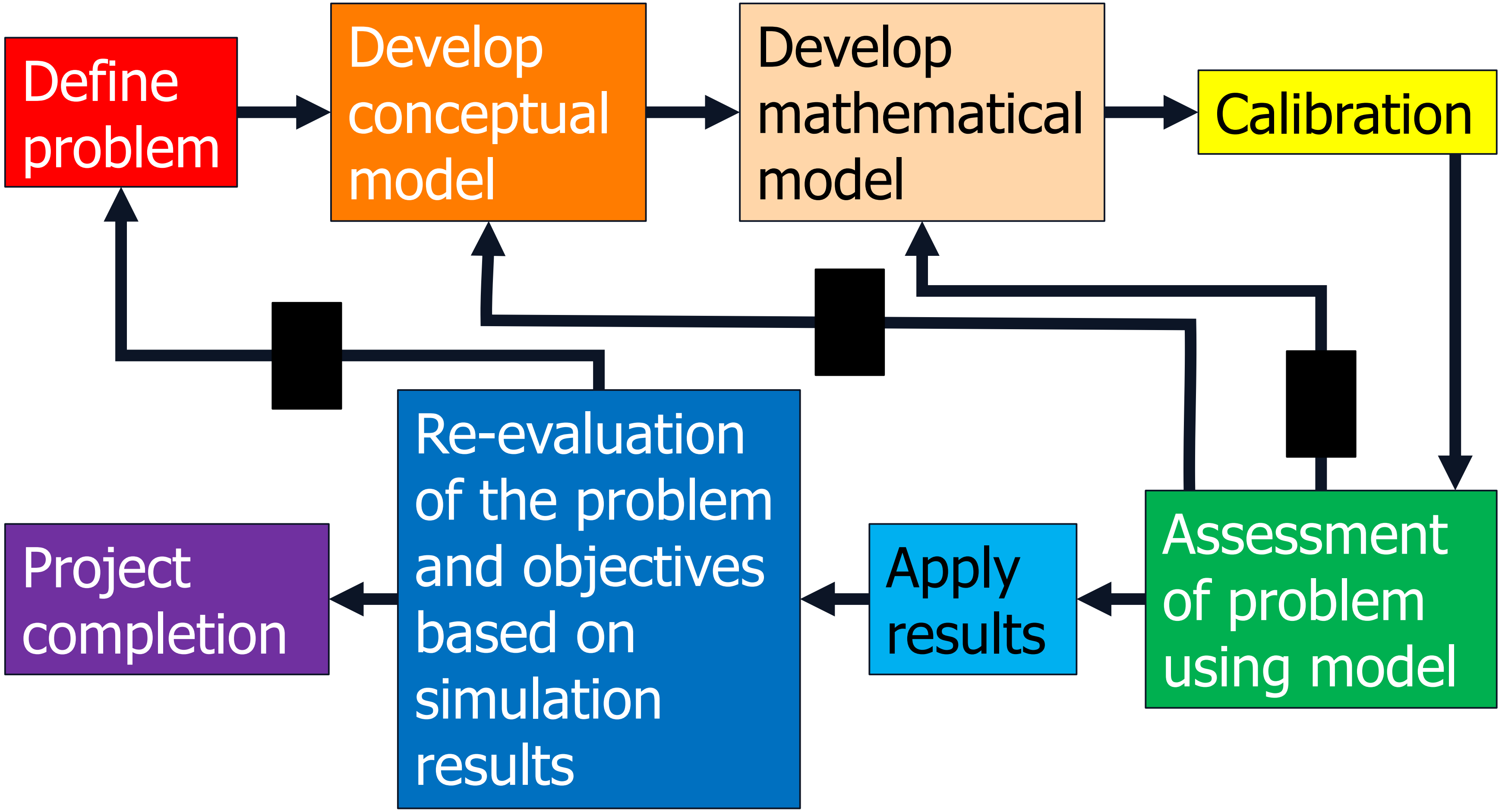
Context

Where we are

The modeling process



After Reilly (2001) TWRI 3,B8

Location

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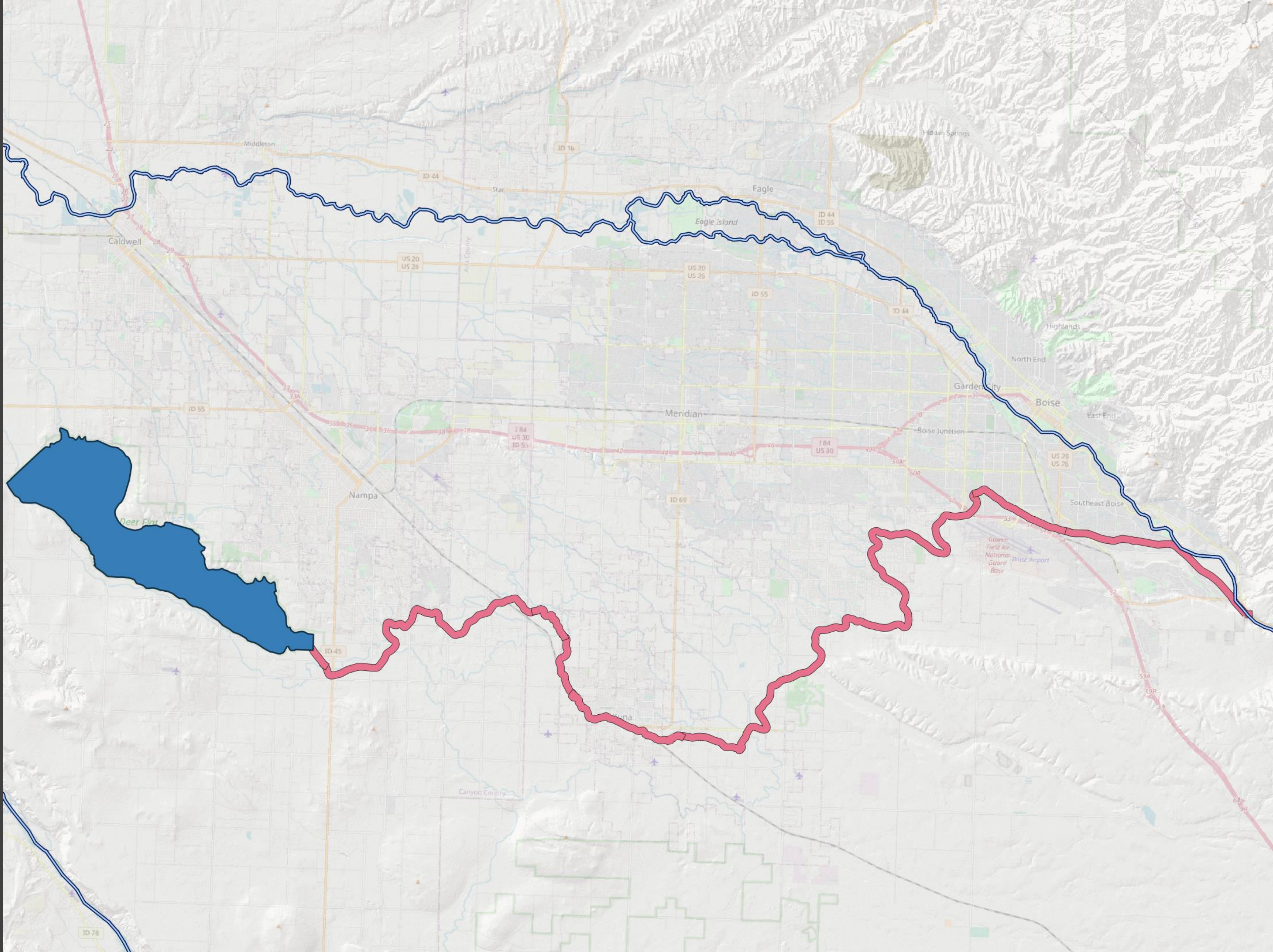
Location



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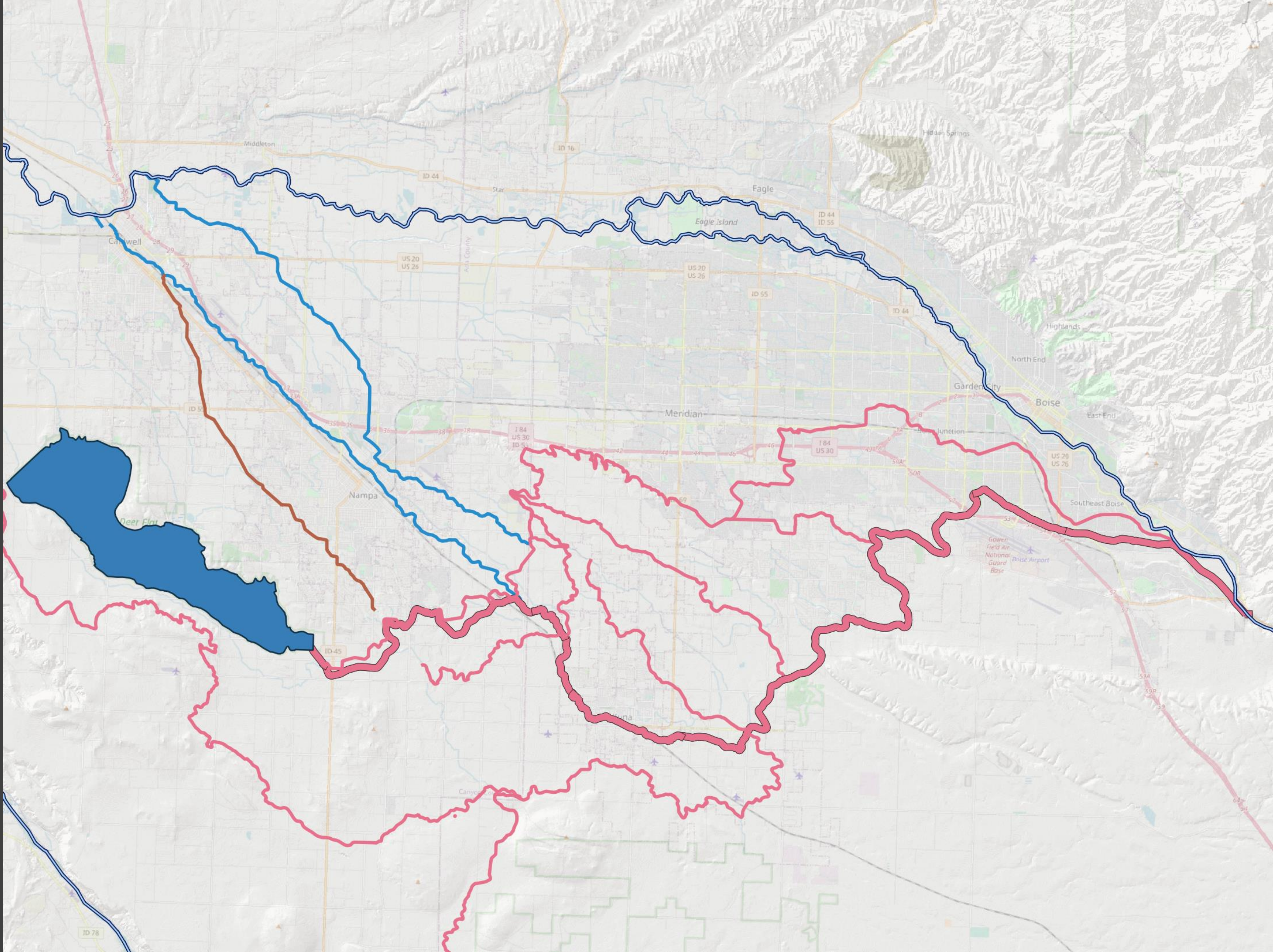
Location

Including major connections
- Canals
- Drains
- “Creeks”



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Location

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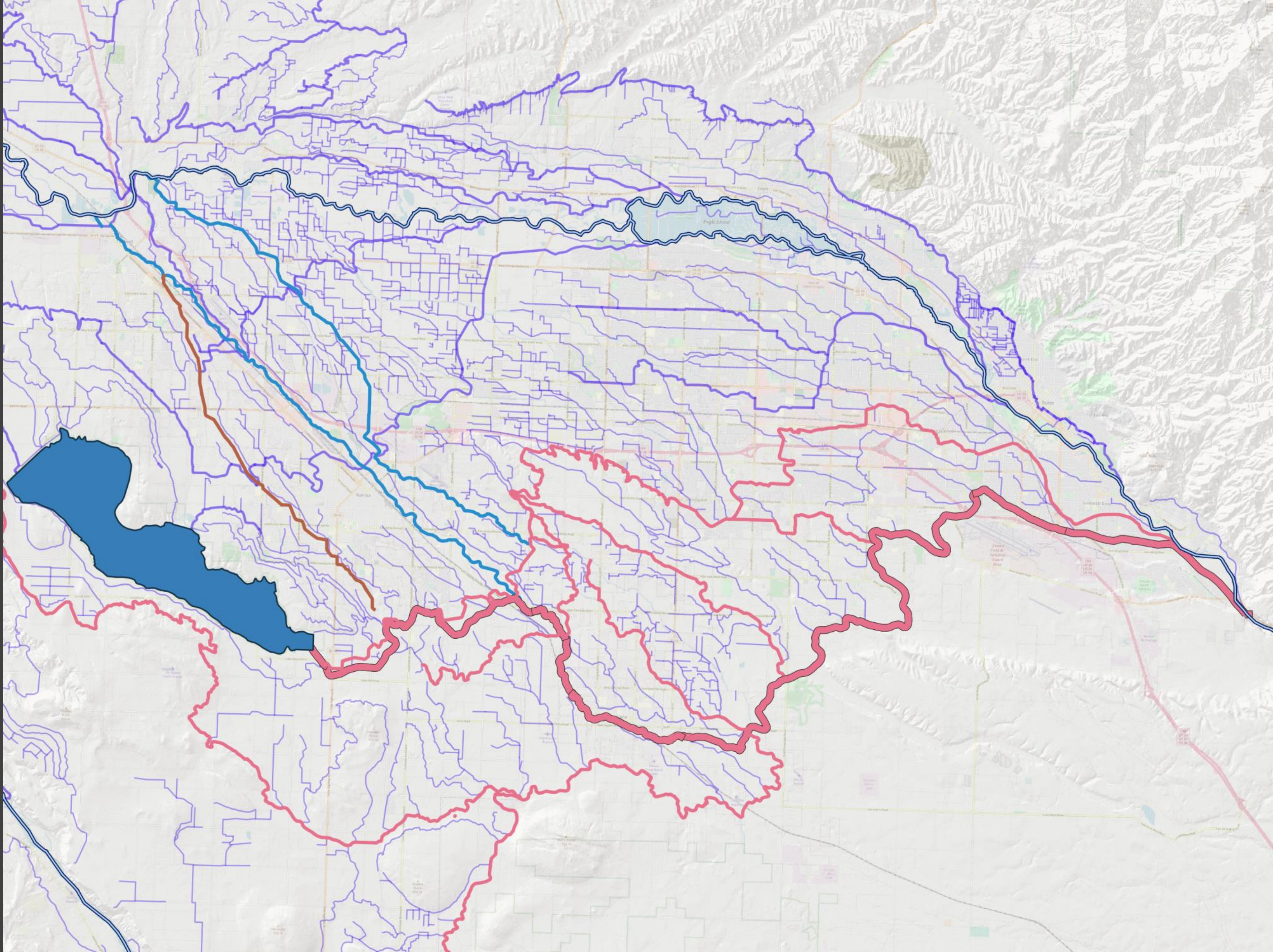

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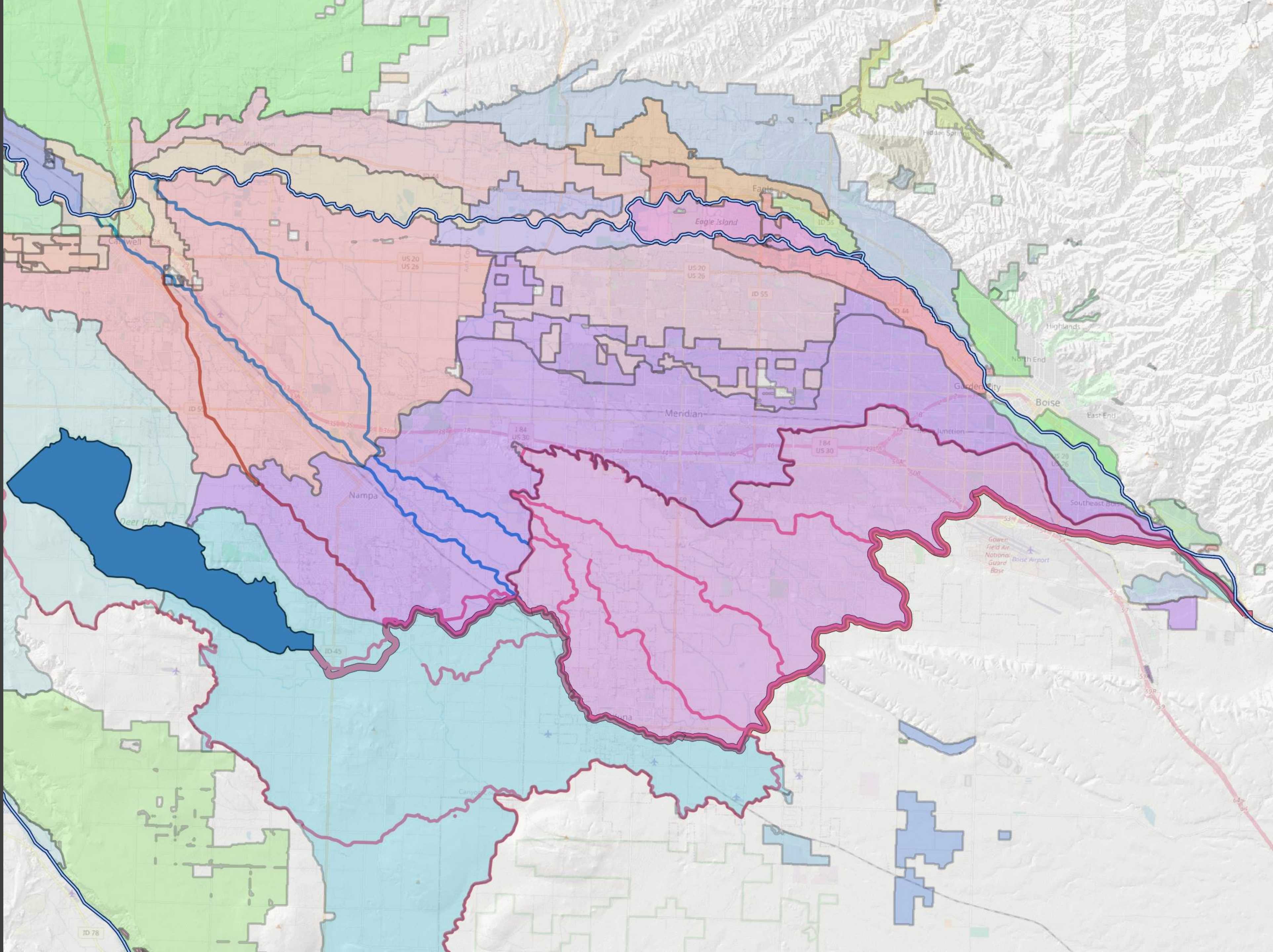
Location

Including irrigation entities



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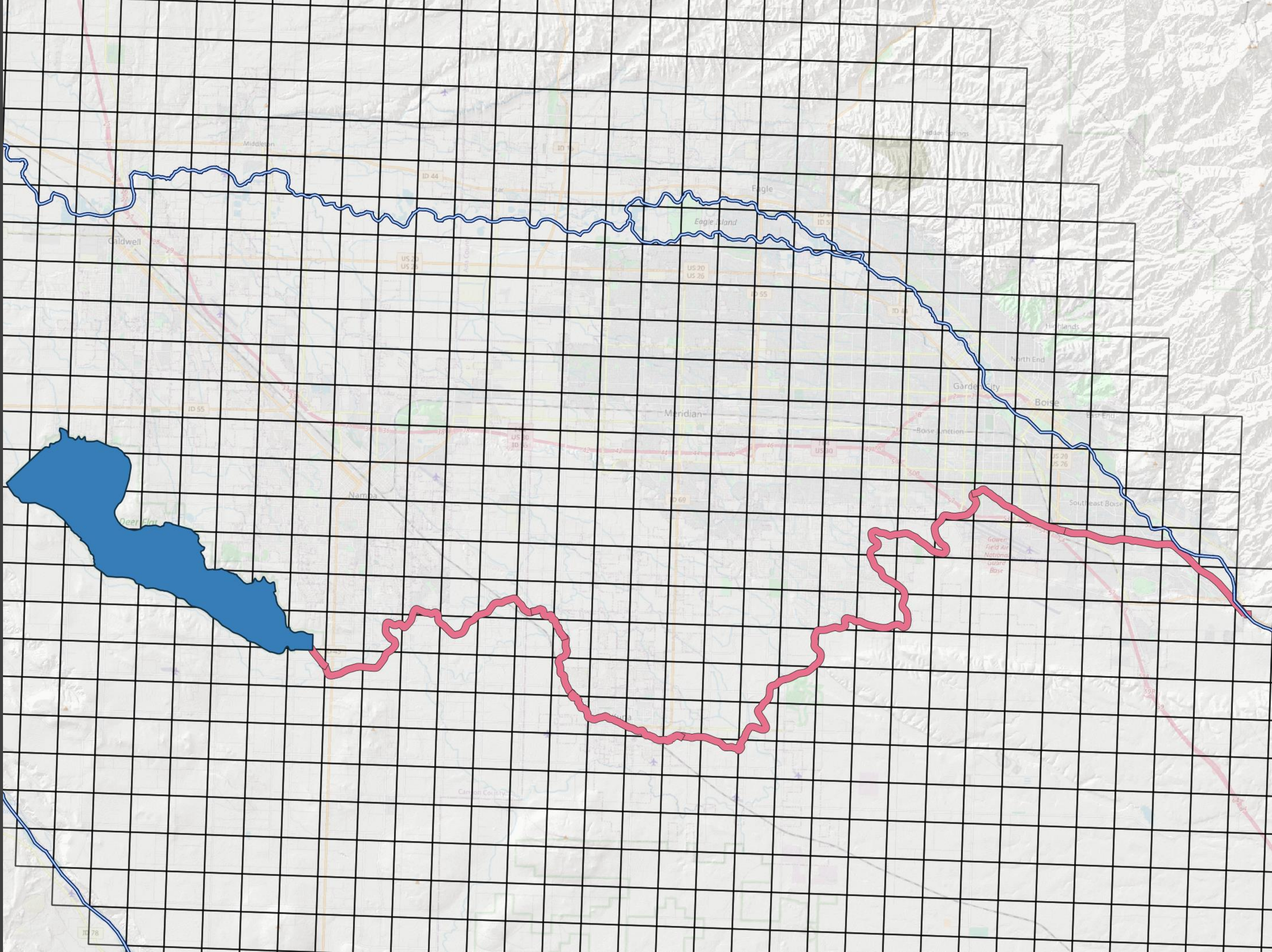
Location

With model grid (1mile x 1mile)



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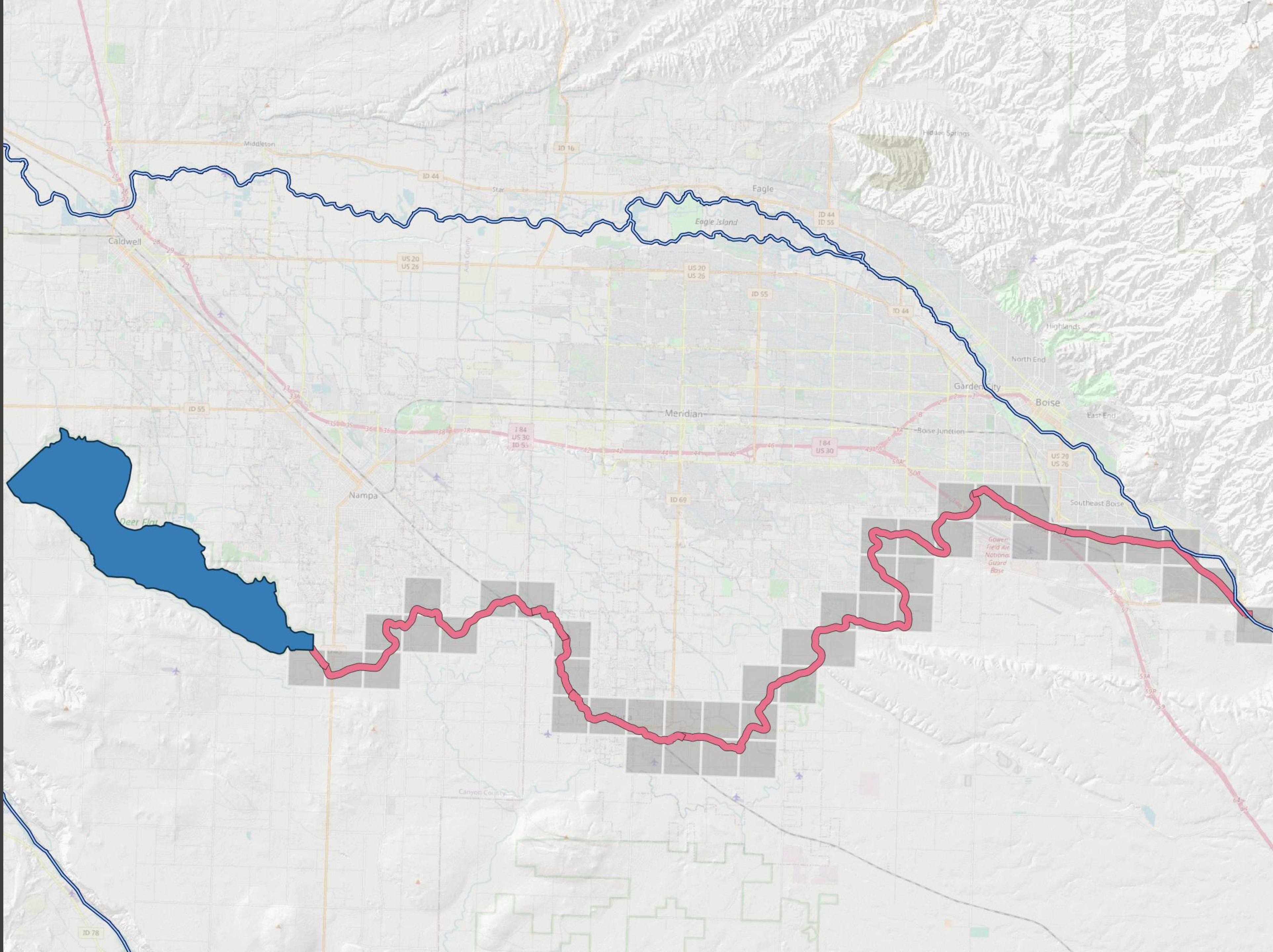
Location

Intersecting model cells



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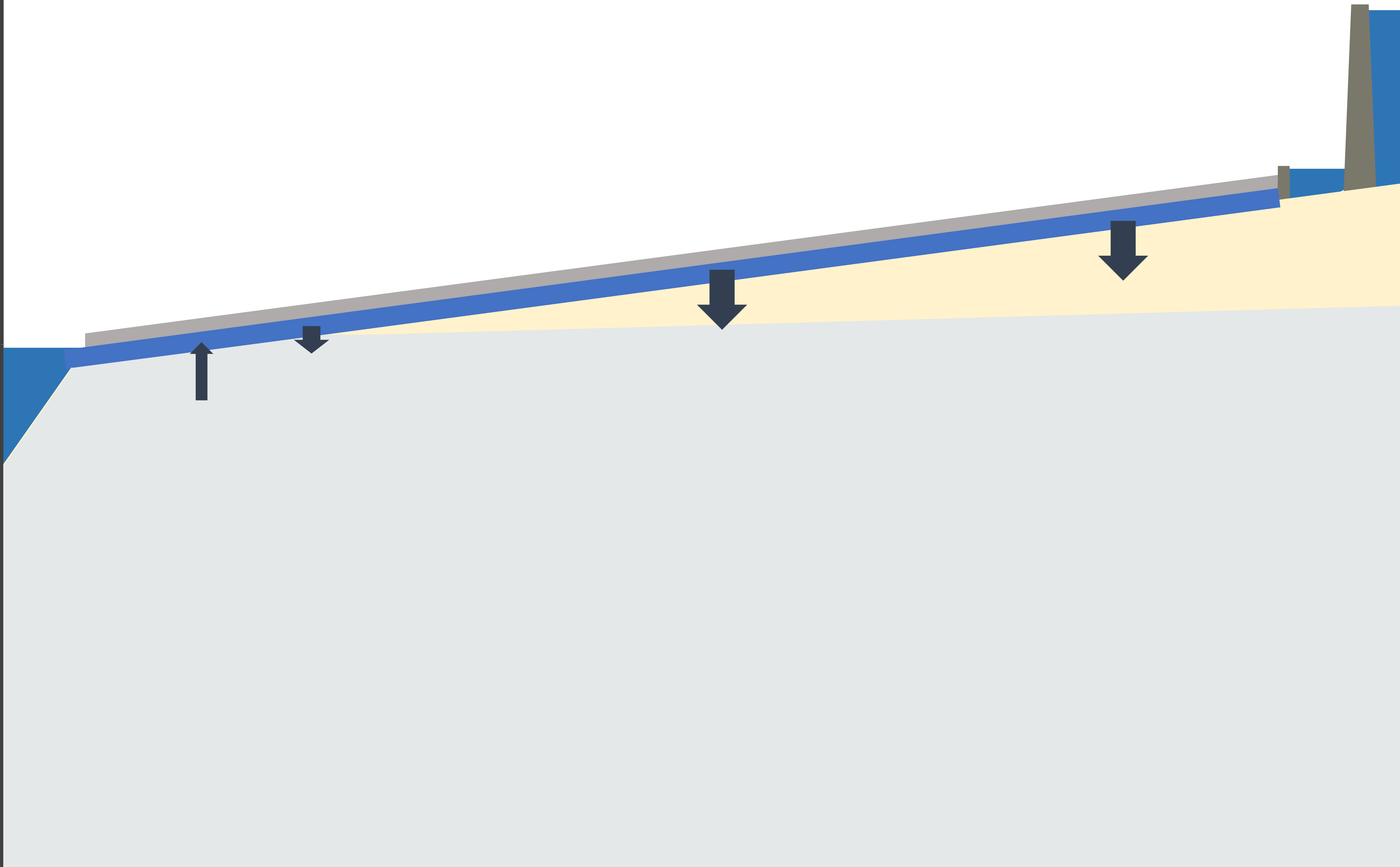
Seepage

Conceptual Model



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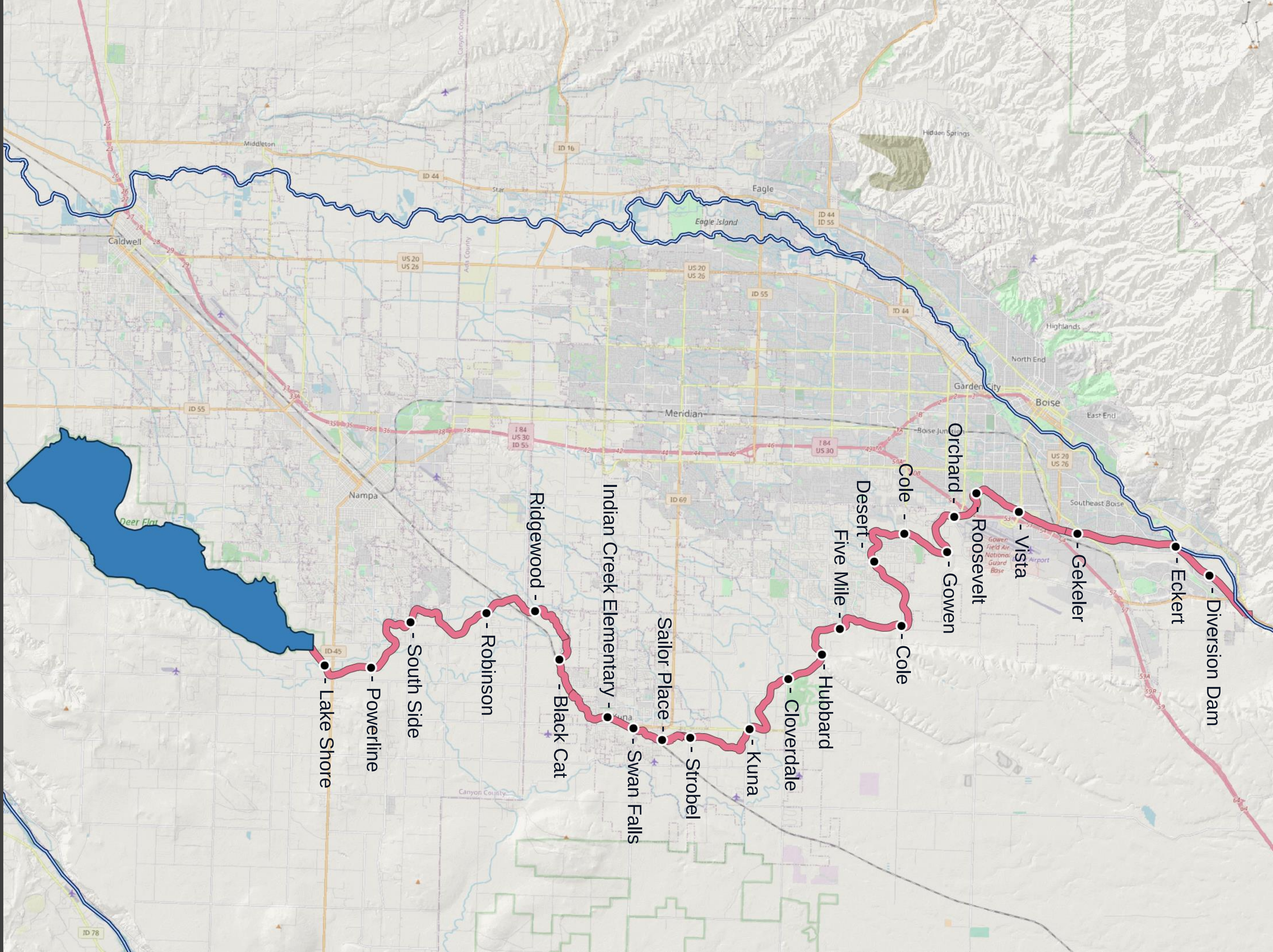
Seepage Measurements



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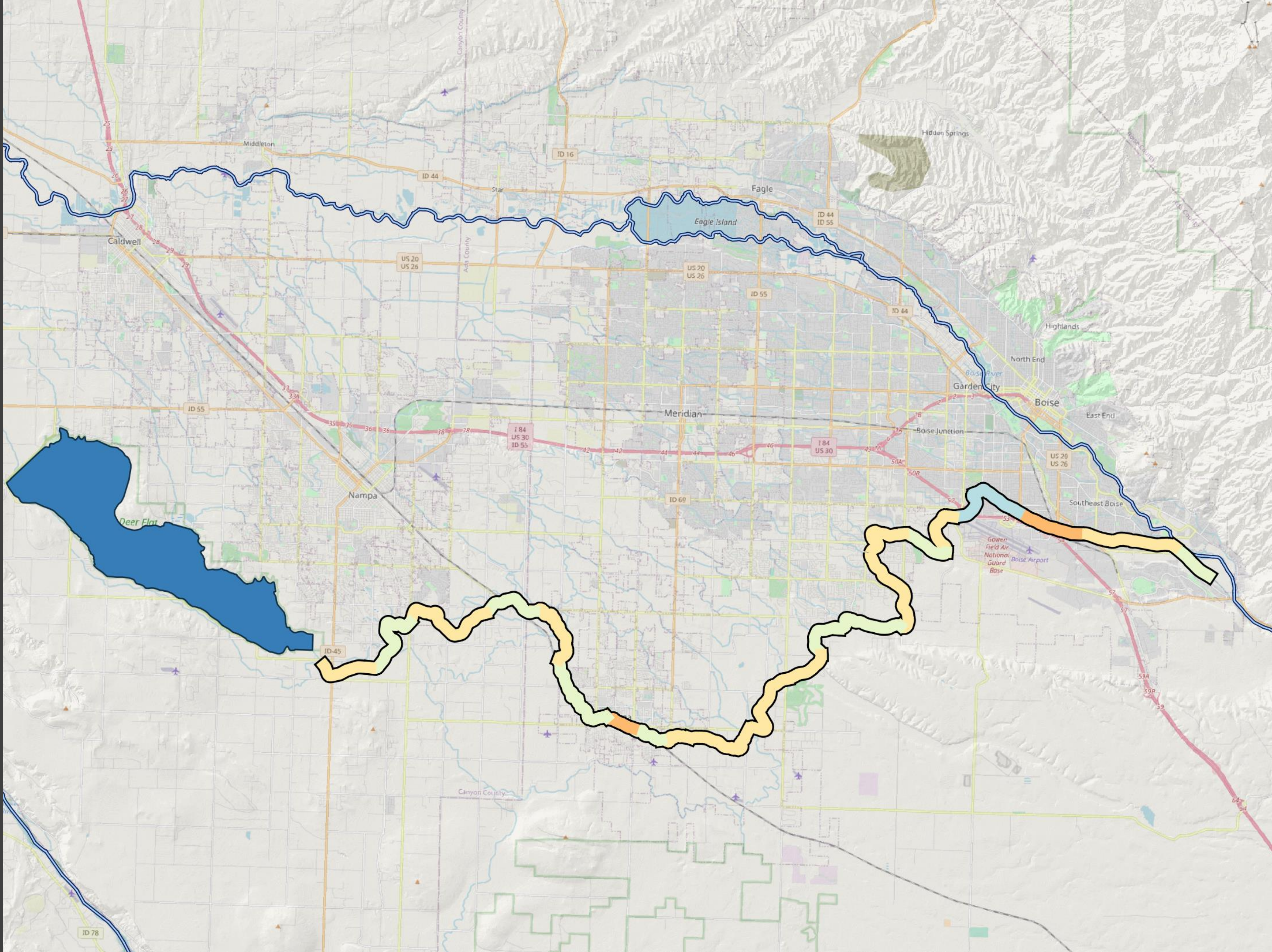
Seepage Measurements

January 28-29, 2004

New York Canal seepage

- losing: 53 - 75 cfs
- losing: 35 - 53 cfs
- losing: 18 - 35 cfs
- losing: 0 - 18 cfs
- gaining: 0 - 18 cfs
- gaining: 18 - 35 cfs
- gaining: 35 - 53 cfs
- gaining: 53 - 75 cfs



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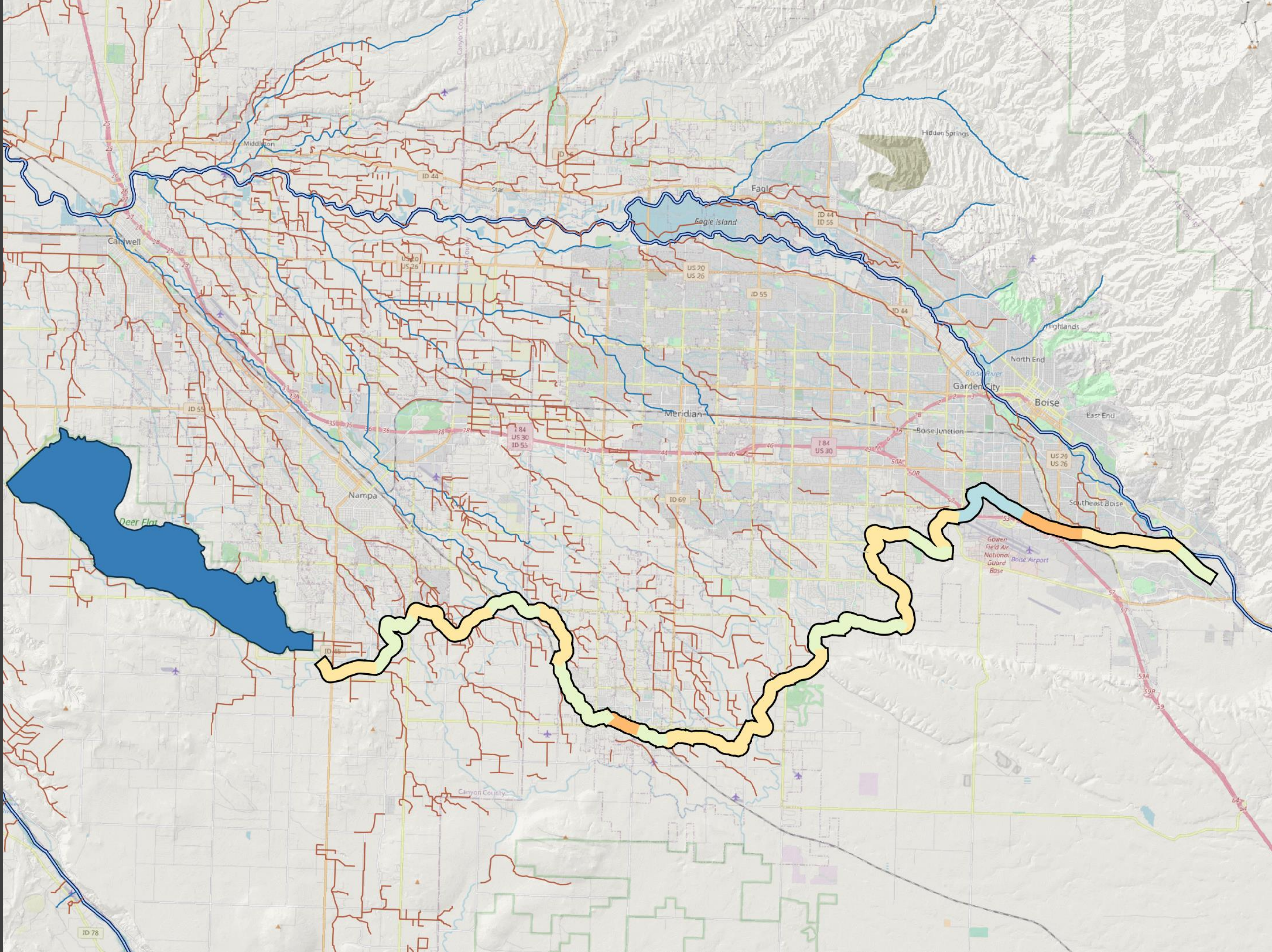

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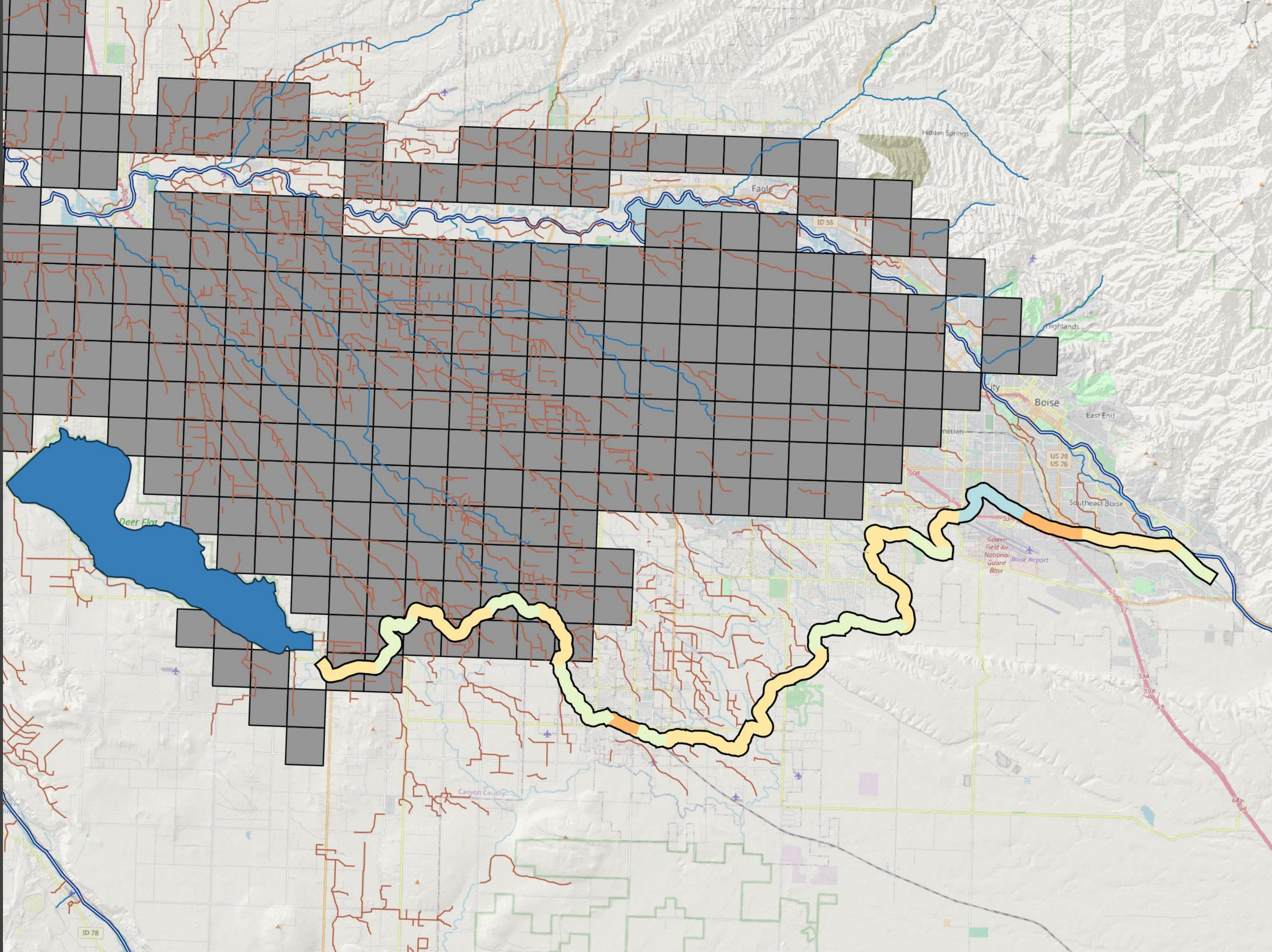

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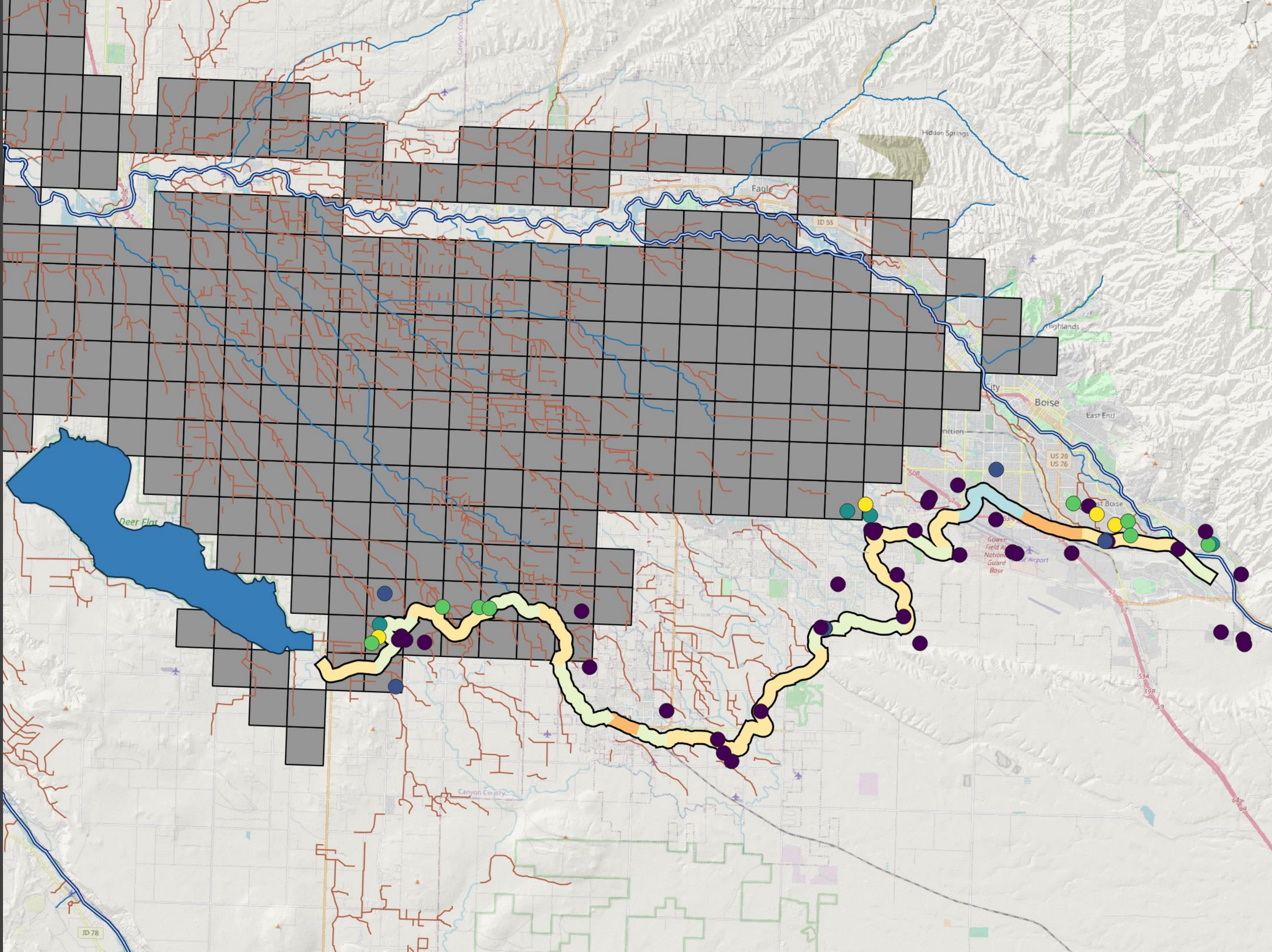
Minimum depth to water

- 0 - 10 ft
- 10 - 20 ft
- 20 - 30 ft
- 30 - 40 ft
- > 40 ft



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Seepage Measurements

March 20-21 & 27-28, 1997

New York Canal seepage

- losing: 53 - 75 cfs
- losing: 35 - 53 cfs
- losing: 18 - 35 cfs
- losing: 0 - 18 cfs
- gaining: 0 - 18 cfs
- gaining: 18 - 35 cfs
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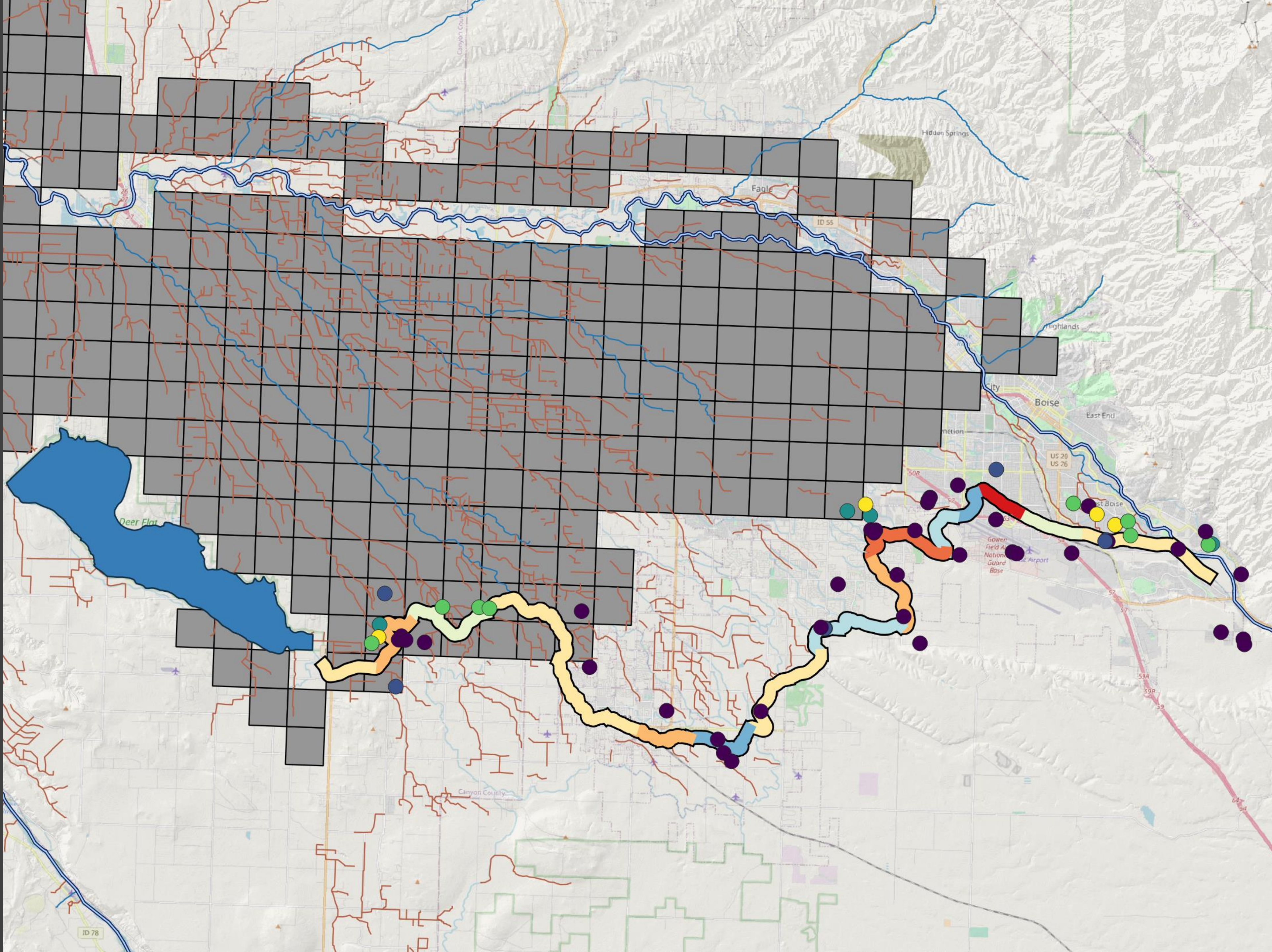

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Seepage Measurements

April 1998

New York Canal seepage

- losing: 53 - 75 cfs
- losing: 35 - 53 cfs
- losing: 18 - 35 cfs
- losing: 0 - 18 cfs
- gaining: 0 - 18 cfs
- gaining: 18 - 35 cfs
- gaining: 35 - 53 cfs
- gaining: 53 - 75 cfs

Minimum depth to water

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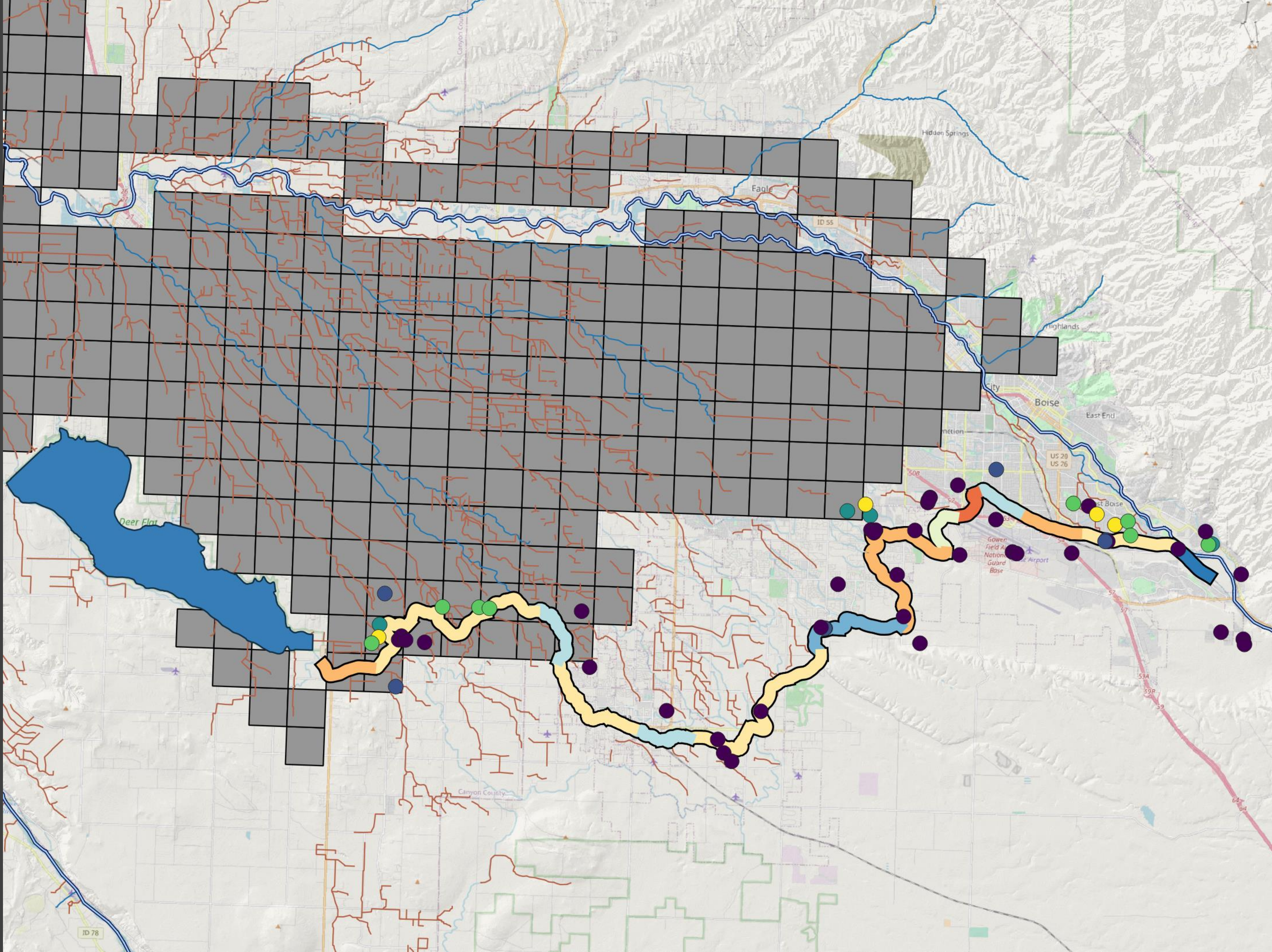
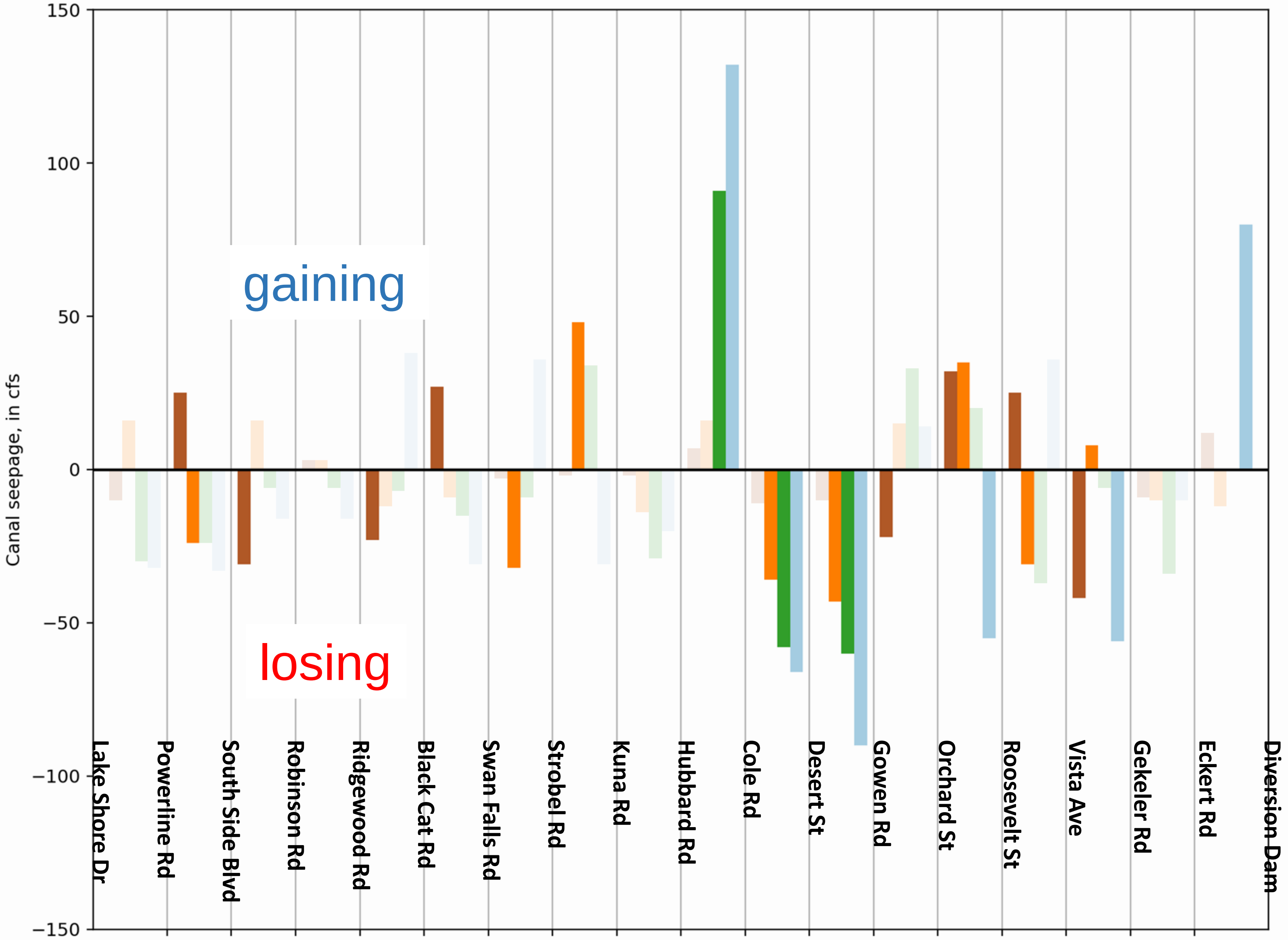


Seepage Measurements

Measured seepage > 5% of discharge



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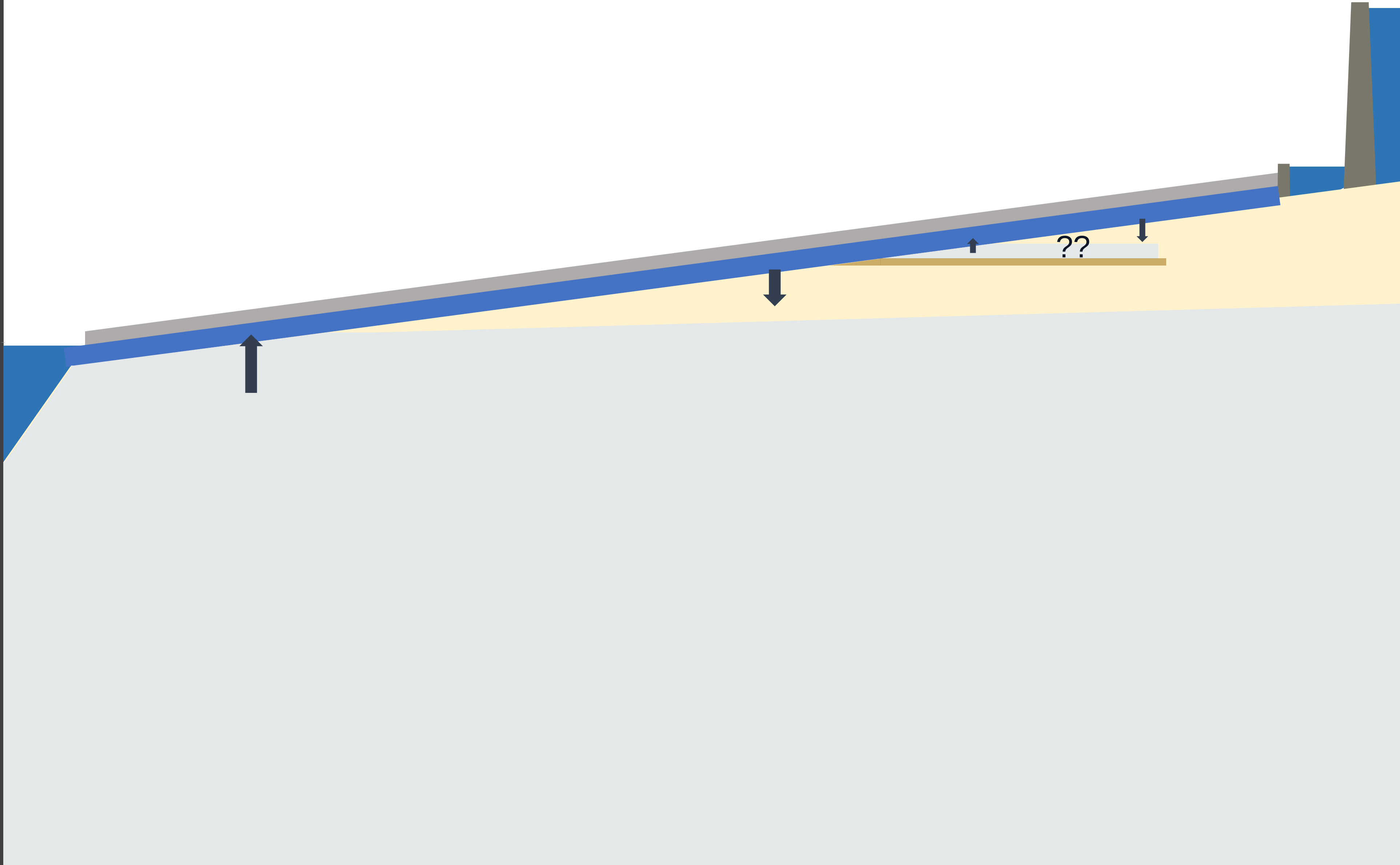
Conceptual Model



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Simulation Options

Boundary Conditions

Specified head

Specified flux

Head-dependent flux

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TVHP

Specified flux boundary

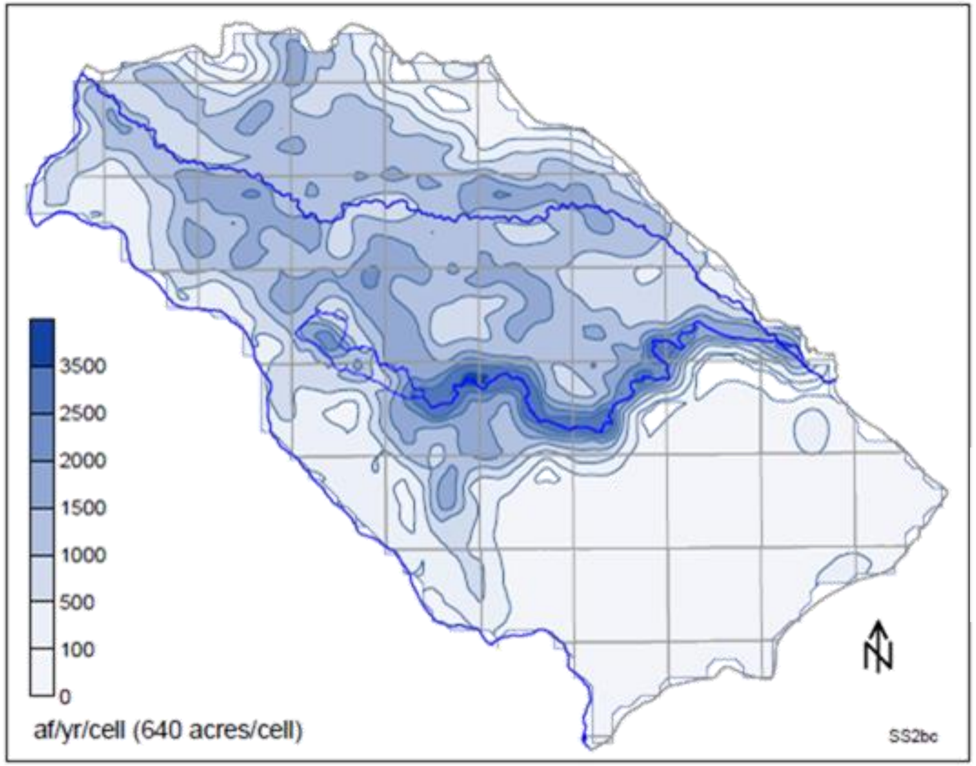


Figure 4-6: Areal distribution of estimated recharge.

1. Potentiometric contours from deeper aquifer zones indicate ground water movement in a westerly direction.
2. Potentiometric surface contours in maps indicate ground water mounding in the vicinity of the New York and Mora Canals, presumably from canal leakage (Berenbrock, 1999; Carlson and Petrich, 1998) and infiltration from irrigated fields.
3. Ground water mounding appears in the area northwest of Lake Lowell.
4. Ground water mounding appears to form a ground water divide between the Boise and Snake Rivers along the New York and Mora Canals, and extending northwest from Lake Lowell. North of these canals ground water flows toward the Boise River, south of these canals hydraulic gradients indicate ground water flow toward the Snake River. The effects of ground water mounding underneath the New York Canal are evident in both the potentiometric surfaces based on shallow and deeper wells, although water from the New York Canal is not reaching these lower zones (Hutchings and Petrich, 2002b).

4.6. Recharge Package

The recharge package was used to simulate areally distributed recharge over the uppermost Treasure Valley aquifers. The primary sources of recharge consisted of (1) seepage from canals, (2) seepage from rivers and streams, (3) seepage from Lake Lowell, (4) infiltration from precipitation and irrigation, and (5) seepage from septic systems (Urban and Petrich, 1998). A summary of estimated annual recharge rates is shown in Table 4-5.

The MODFLOW recharge file[8] was created based on estimated Treasure Valley ground water recharge rates (Urban and Petrich, 1998) for the 1996 calendar year. Average daily recharge rates in the MODFLOW recharge file were calculated based on annual recharge estimates. The recharge file does not include seepage from the Boise River (which is simulated as a head-dependent boundary based on river package parameters, see Section 4.3). It also does not include seepage from Lake Lowell, (which is simulated as a head-dependent boundary based on general head boundary package parameters, see Section 4.5).

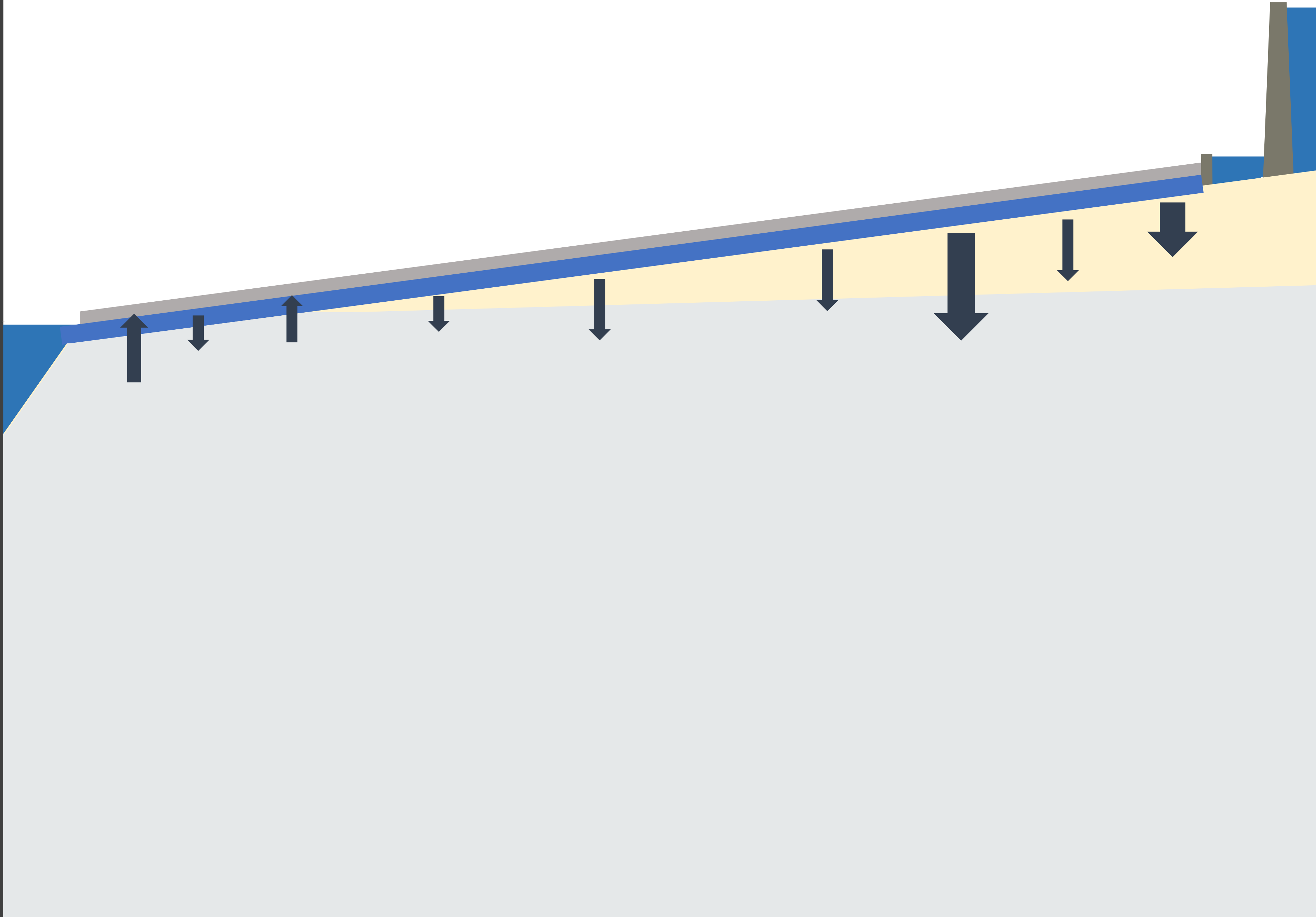
The MODFLOW recharge file represents a smaller recharge volume (973,711 af/yr) than that listed in Urban and Petrich (1998), for two reasons. First, the model domain represents a slightly smaller area than that used to estimate total recharge for the Treasure Valley. Second, the model also simulates recharge via river, underflow, and head-dependent boundary cells. Total simulated recharge is reconciled with estimated water budget inflows in Table 7-2.

The areal distribution of recharge (as applied on a cell-by-cell basis in the model) is shown in Figure 4-6. The greatest simulated recharge rates were along the New York Canal and areas of flood irrigation in central portions of the valley. Losses from (or gains to) the Boise River are not specified in the recharge package but were simulated as a head-dependent boundary in the MODFLOW river package (Section 4.3).

direction (Section 5.2.2, page 38). Downward hydraulic gradients are indicated along the Boise Foothills, the eastern part of the study area (see TVHP #4 well in Figure 4-5), and in the vicinity of the New York and Mora Canals. Upward gradients are evident in the central and western portions of the valley (see TVHP #2 hydrographs in Figure 4-3) and in the vicinity of the Boise River.

Proposal: Specified Flux

- Estimate leakage rates in New York Canal cells
- Specified flux values into those cells
- Gains of water in lower reaches can be captured in drain cells



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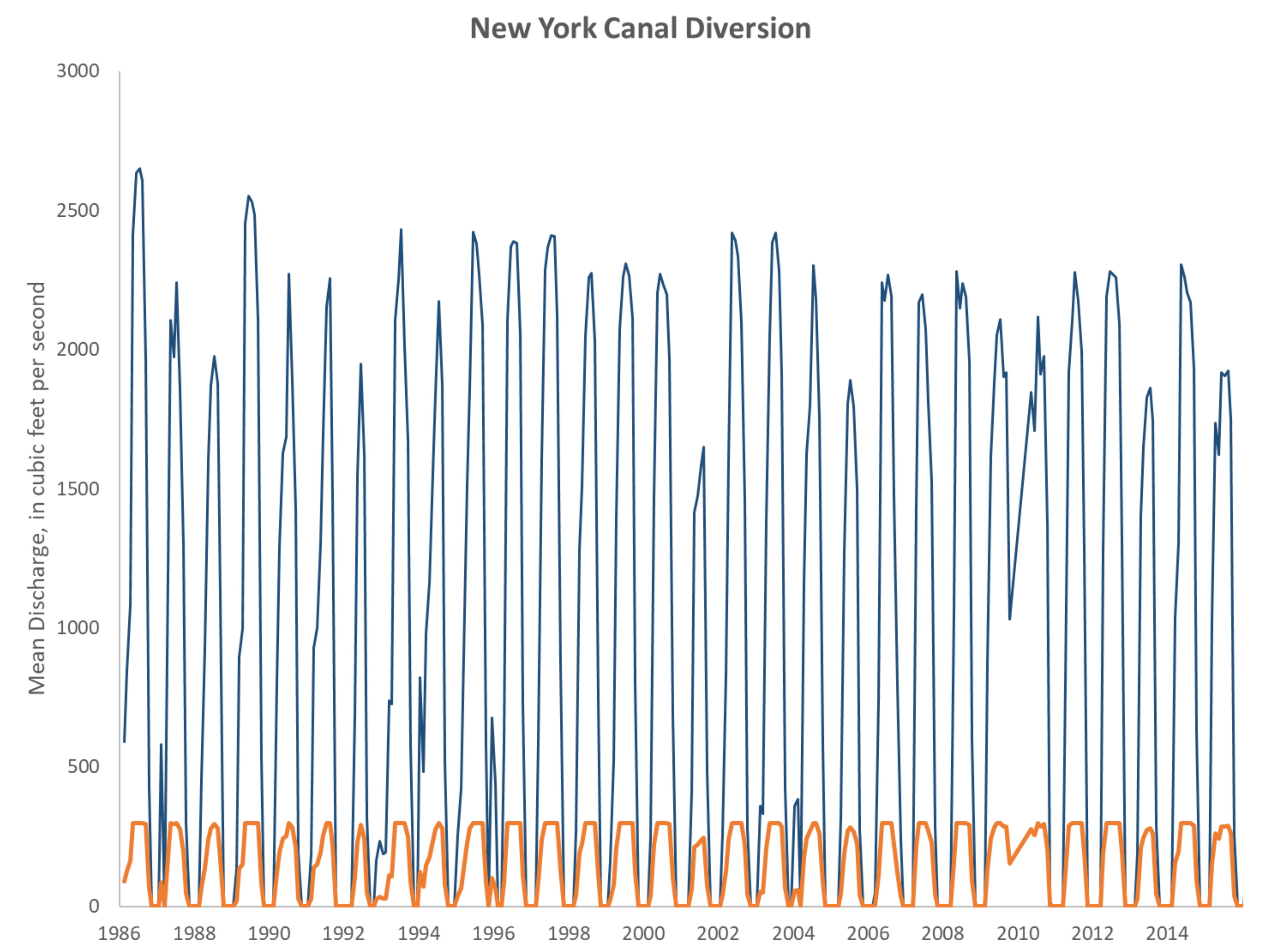
Proposal: Specified Flux

Leakage Estimate

- Seepage runs insufficient
- Total seepage as % of total diversion?
  - Estimable parameter
  - Cap??
- Spatial Distribution???



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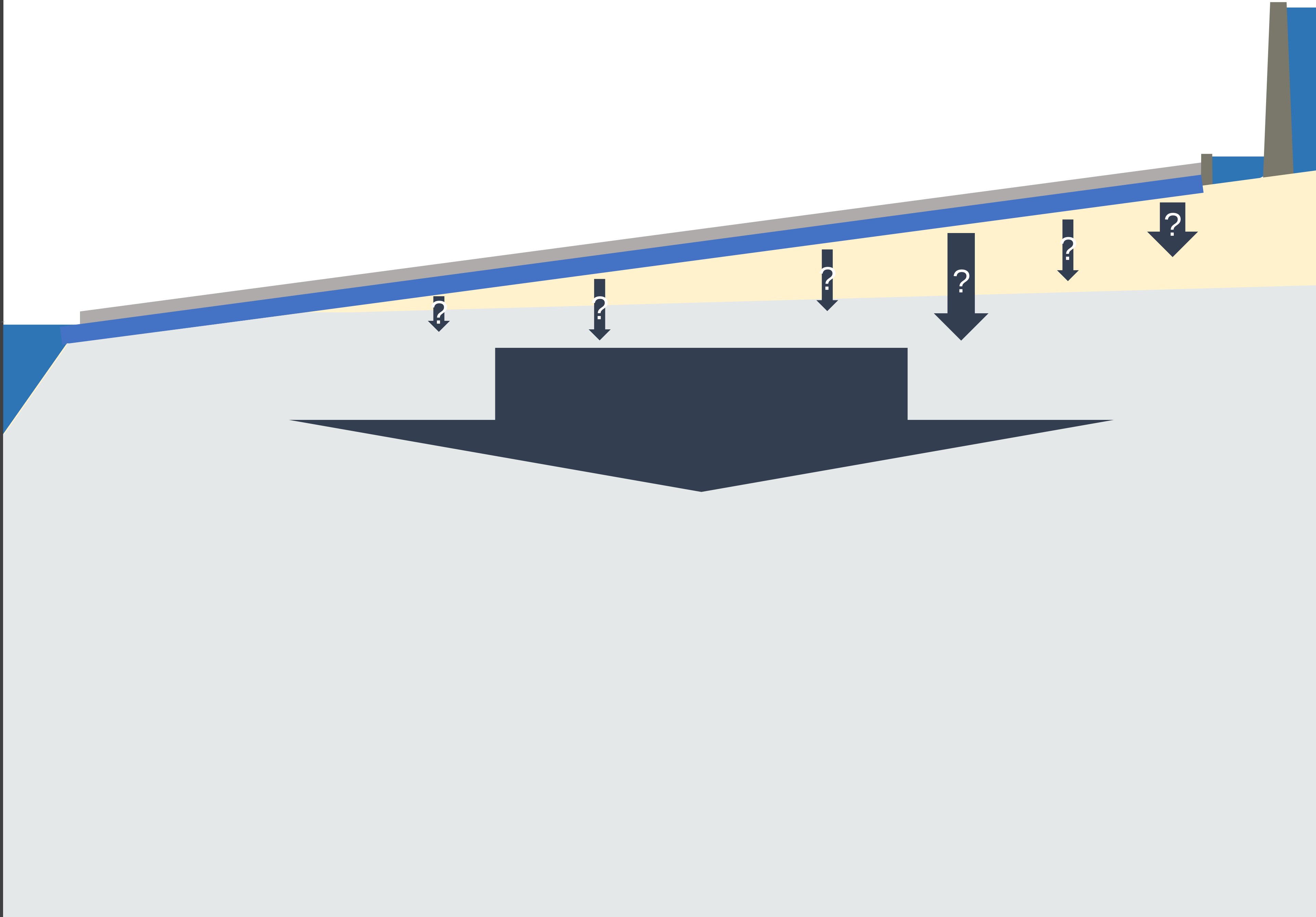
Proposal: Specified Flux

Spatial Distribution



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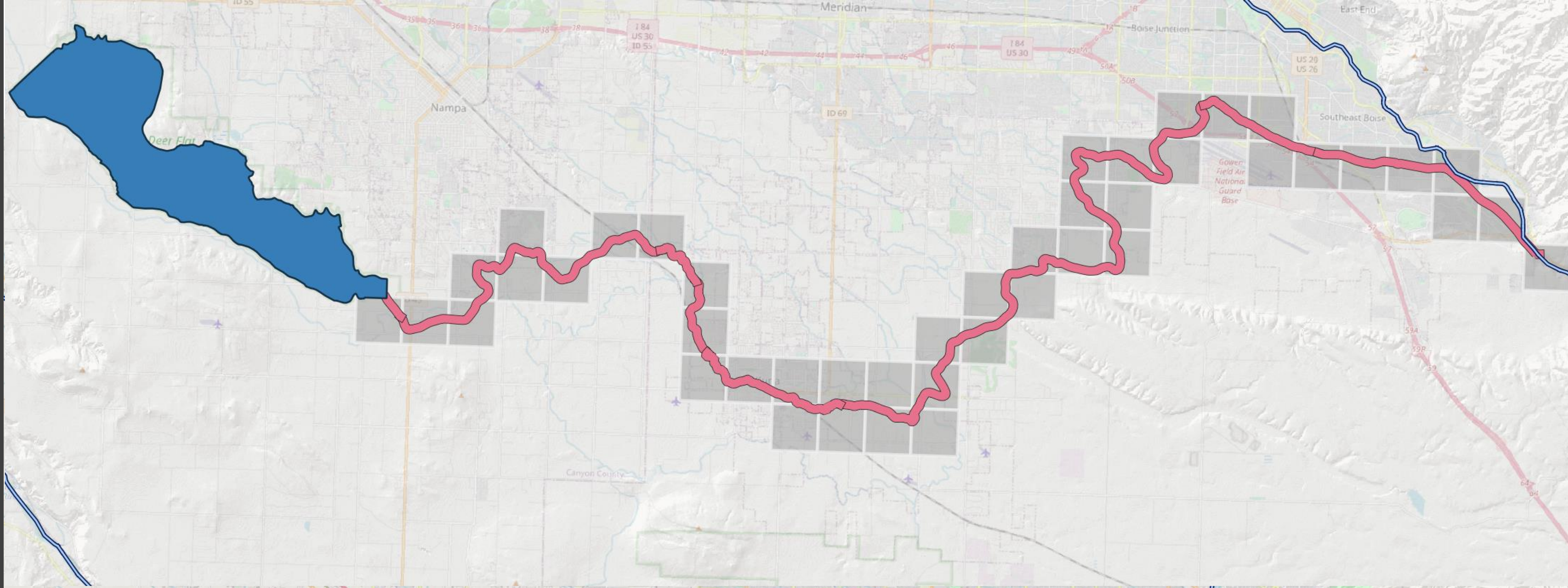
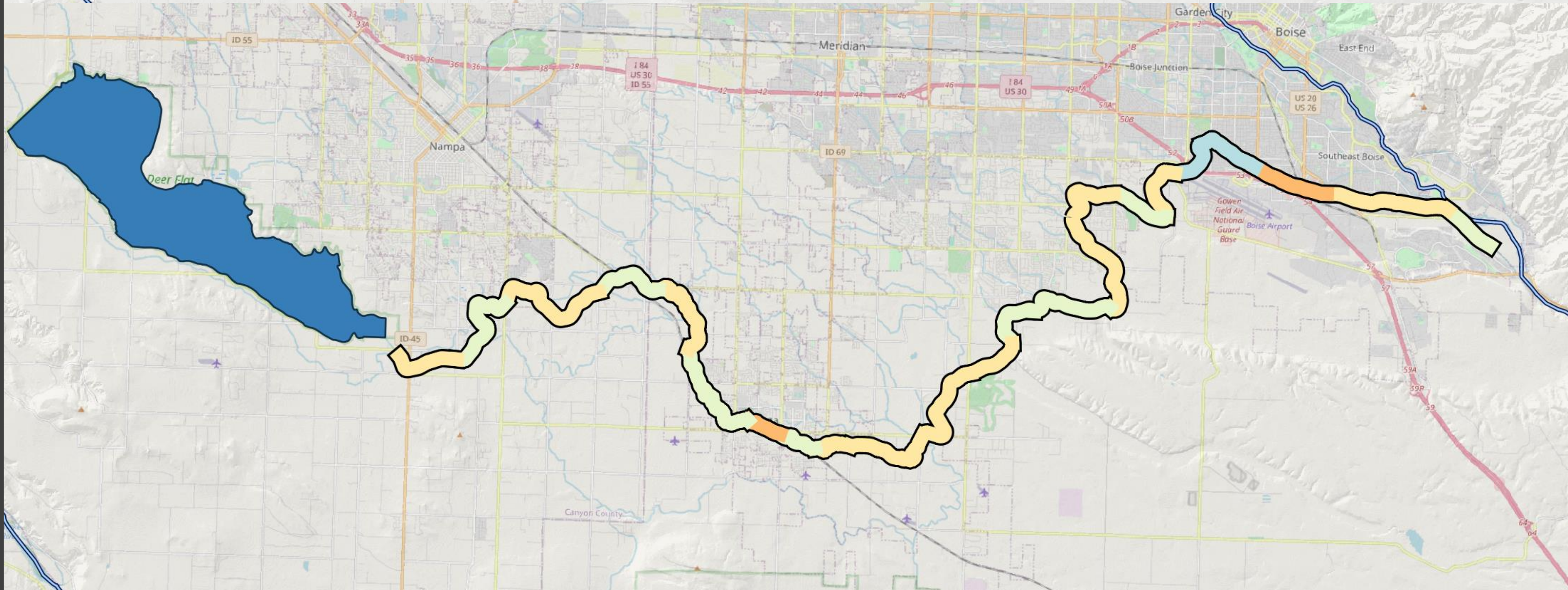
Proposal: Specified Flux

Spatial Distribution

- Proportional to canal length in cell
- Based upon seepage run spatial distribution
- Somewhere in between?
  - Estimable??





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Head Dependent Flux

- Fits conceptually
- Not recommended
  - Where canal above water table, flux is constant and determined by parameters
  - Our choice of parameters would not be driven by observation data
  - Would be specifying fluxes, just in a more complicated way
  - Where canal is connected to aquifer, flux calculation is same as DRN package

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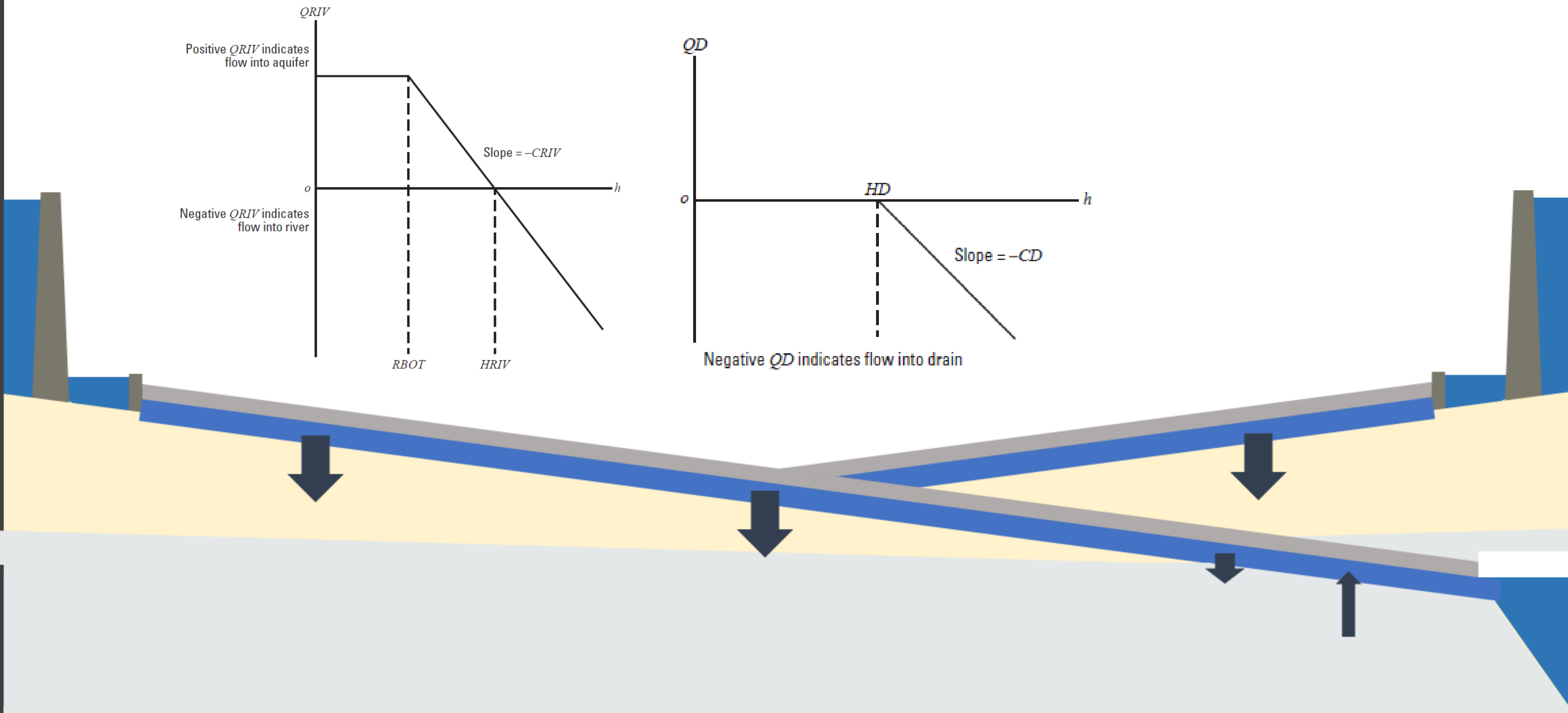
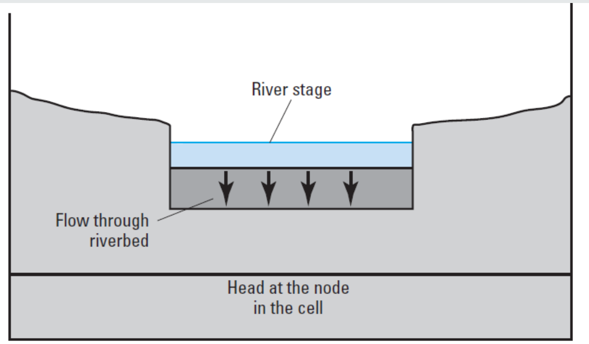
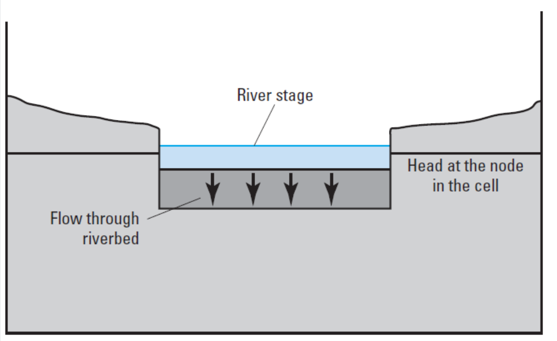
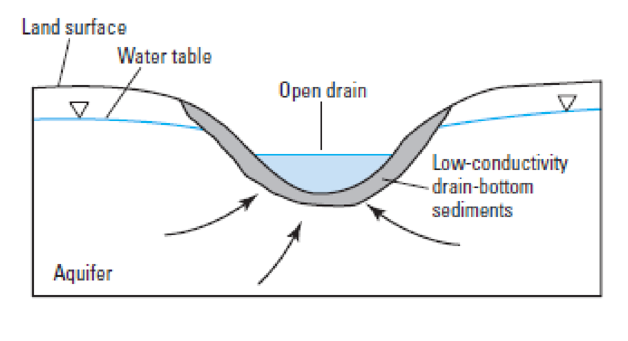
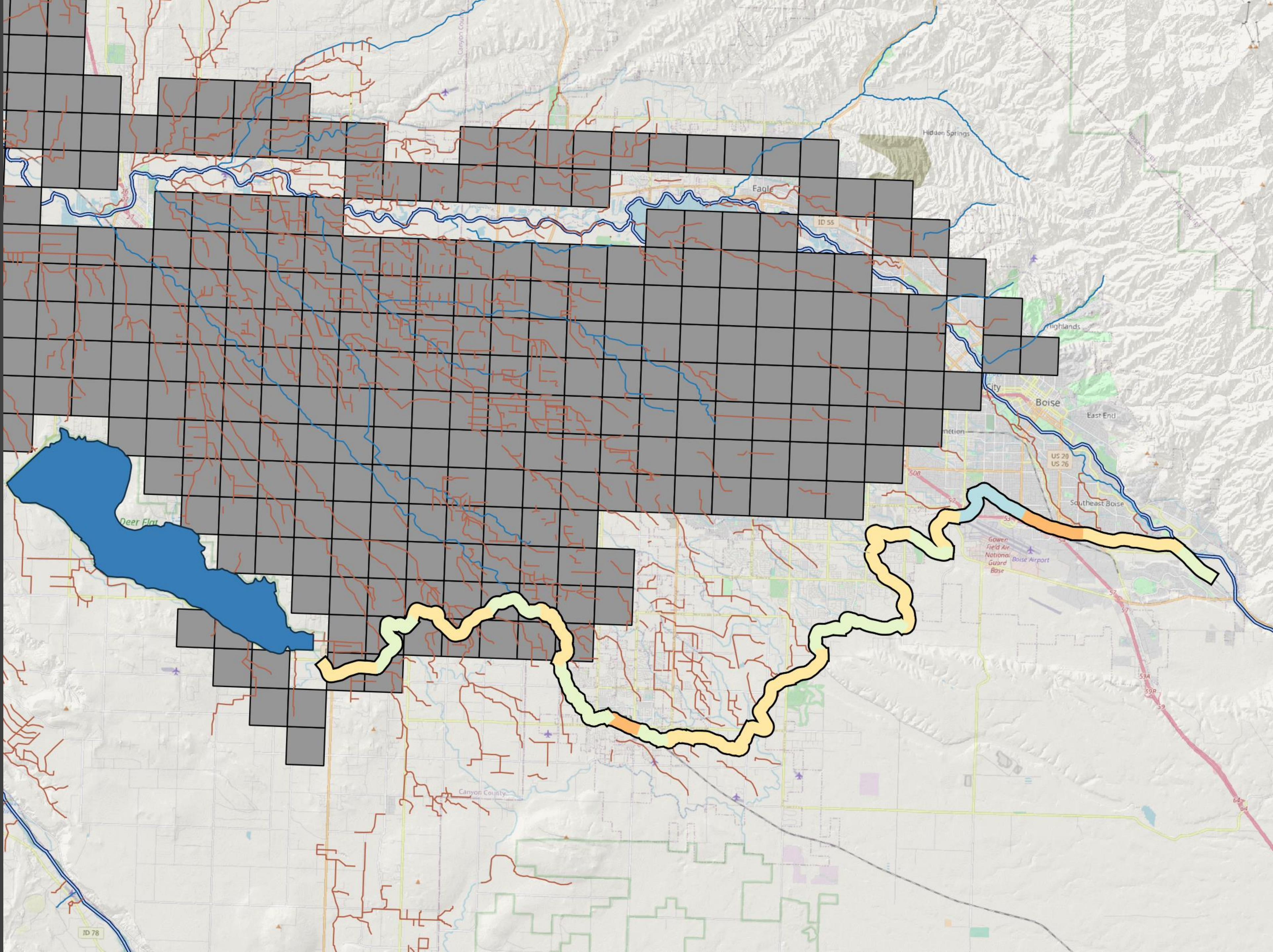








Canal & Drains



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Thanks for listening!

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