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MTAC meeting #3
10-26-2026

West Snake Plain Aquifer Model update:

Extending the Treasure Valley model eastward into the Mountain Home Area

Model grid design and approach to initial hydraulic property assignment (pre-calibration status)



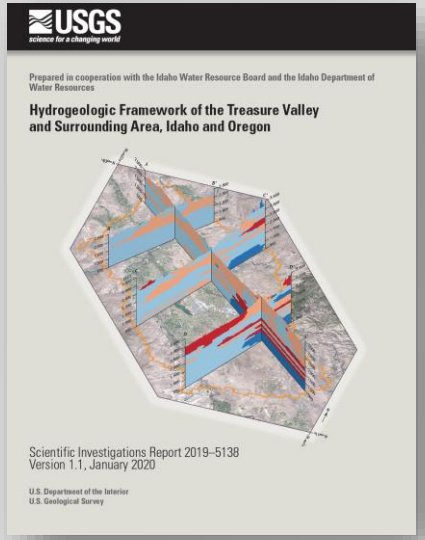
U.S. Department of the Interior
U.S. Geological Survey

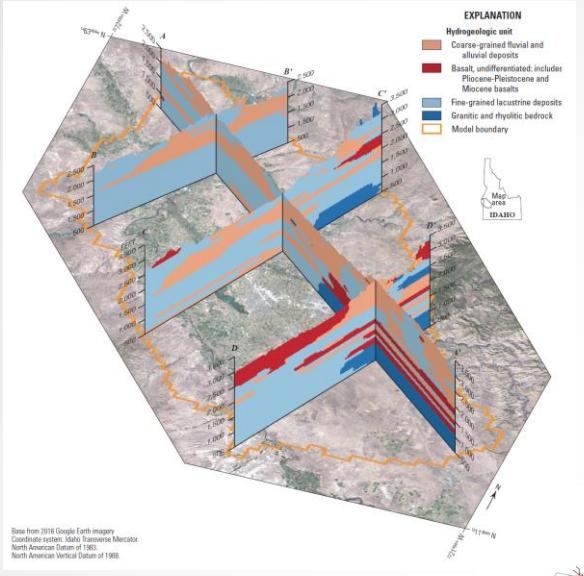
In cooperation with the
Idaho Department of Water Resources

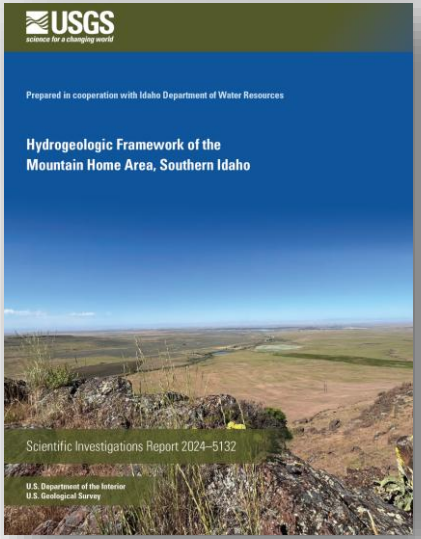
Jake Knight

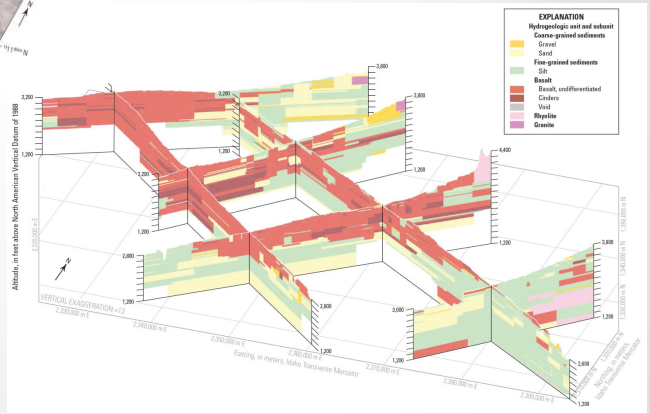
jknight@usgs.gov

Source Material



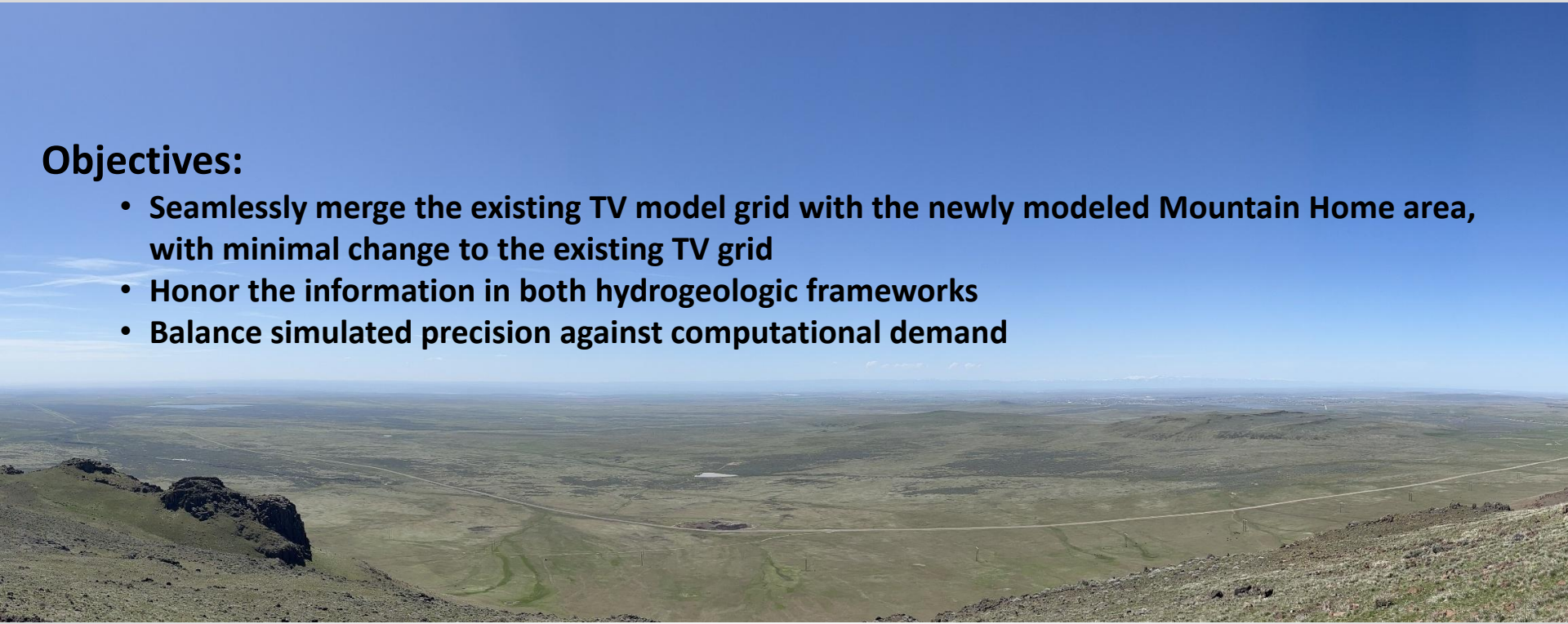






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Model grid design: Discretizing simulation of groundwater flow



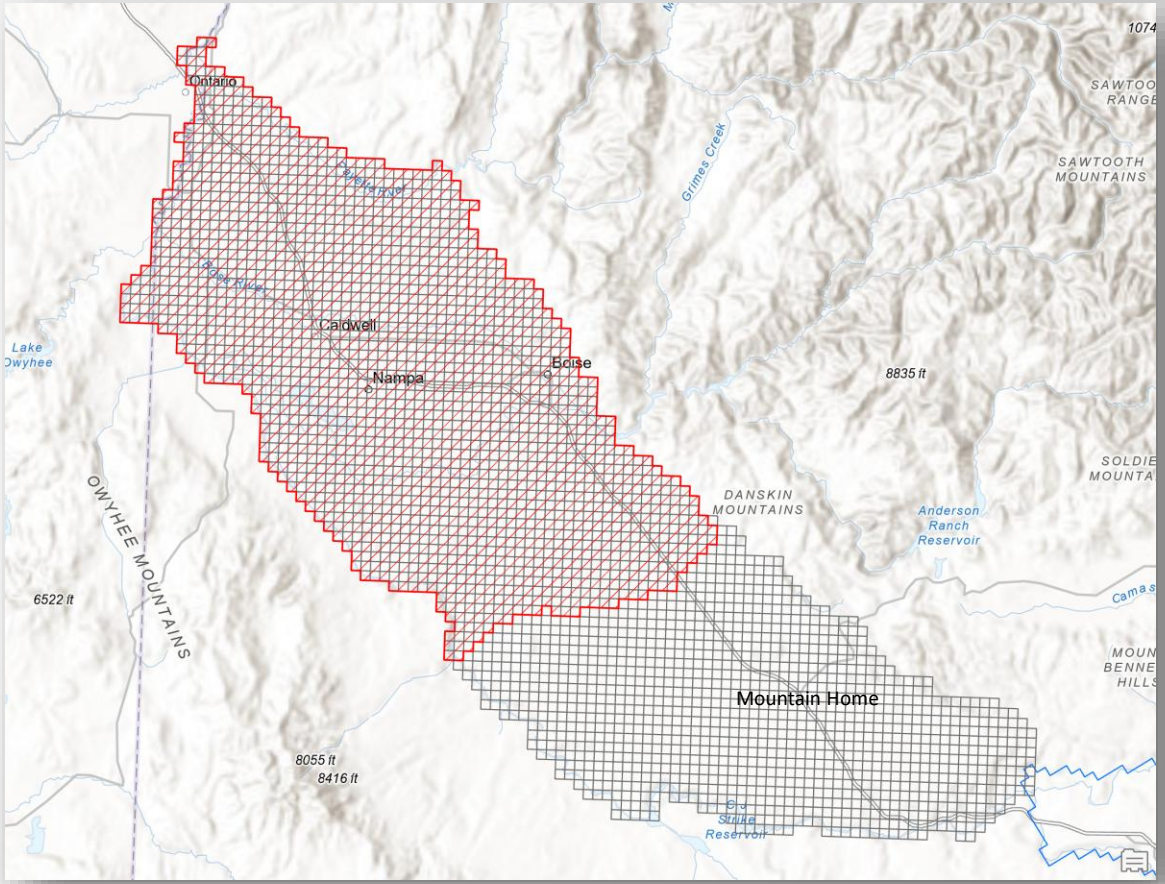
Objectives:

- **Seamlessly merge the existing TV model grid with the newly modeled Mountain Home area, with minimal change to the existing TV grid**
- **Honor the information in both hydrogeologic frameworks**
- **Balance simulated precision against computational demand**

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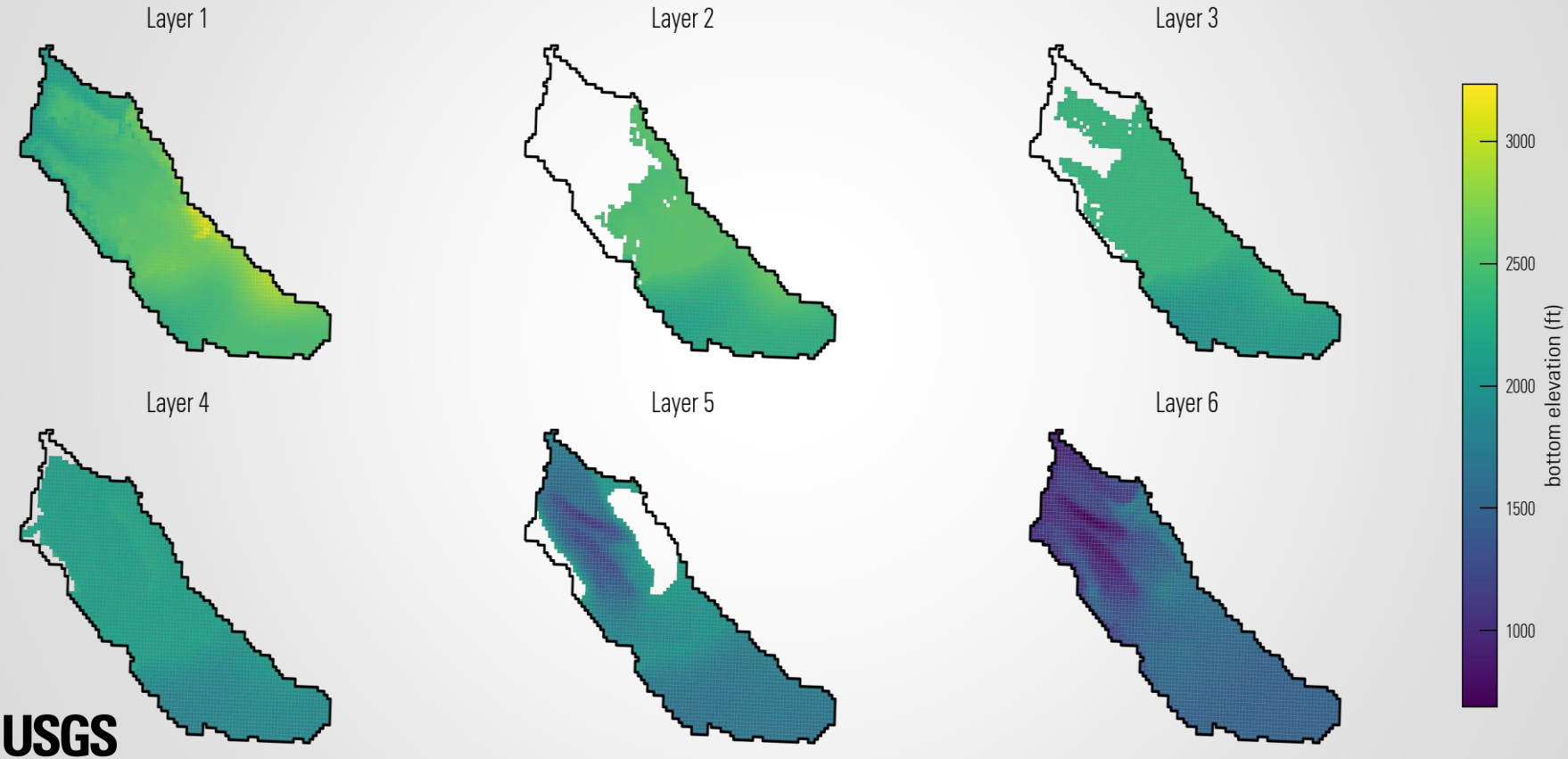
WeSPAM regional model grid

- Parent cell size 1609 m (1 mile) — same regional resolution as the TV model (objective: minimal change + computational balance)
- 6 layers, EPSG:8826 (Idaho Transverse Mercator NAD83), -2° rotation — matches TV conventions
- Layer bottoms built from framework-derived surfaces; TV model layer geometry preserved



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WeSPAM regional model grid

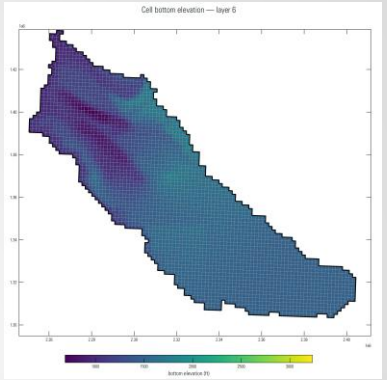


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WeSPAM regional model grid – layer selection workflow

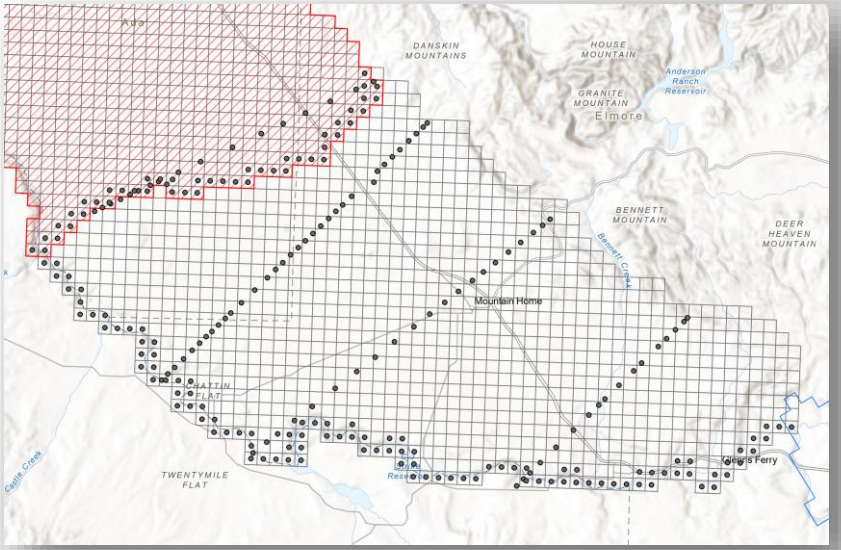
New surfaces blend into the existing Treasure Valley (TV) model along a ~46-cell "seam."

Base (layer 6): flat 1475 ft bottom across the new Mountain Home area, blended into TV layer-6 elevations within a 20-cell transition band.



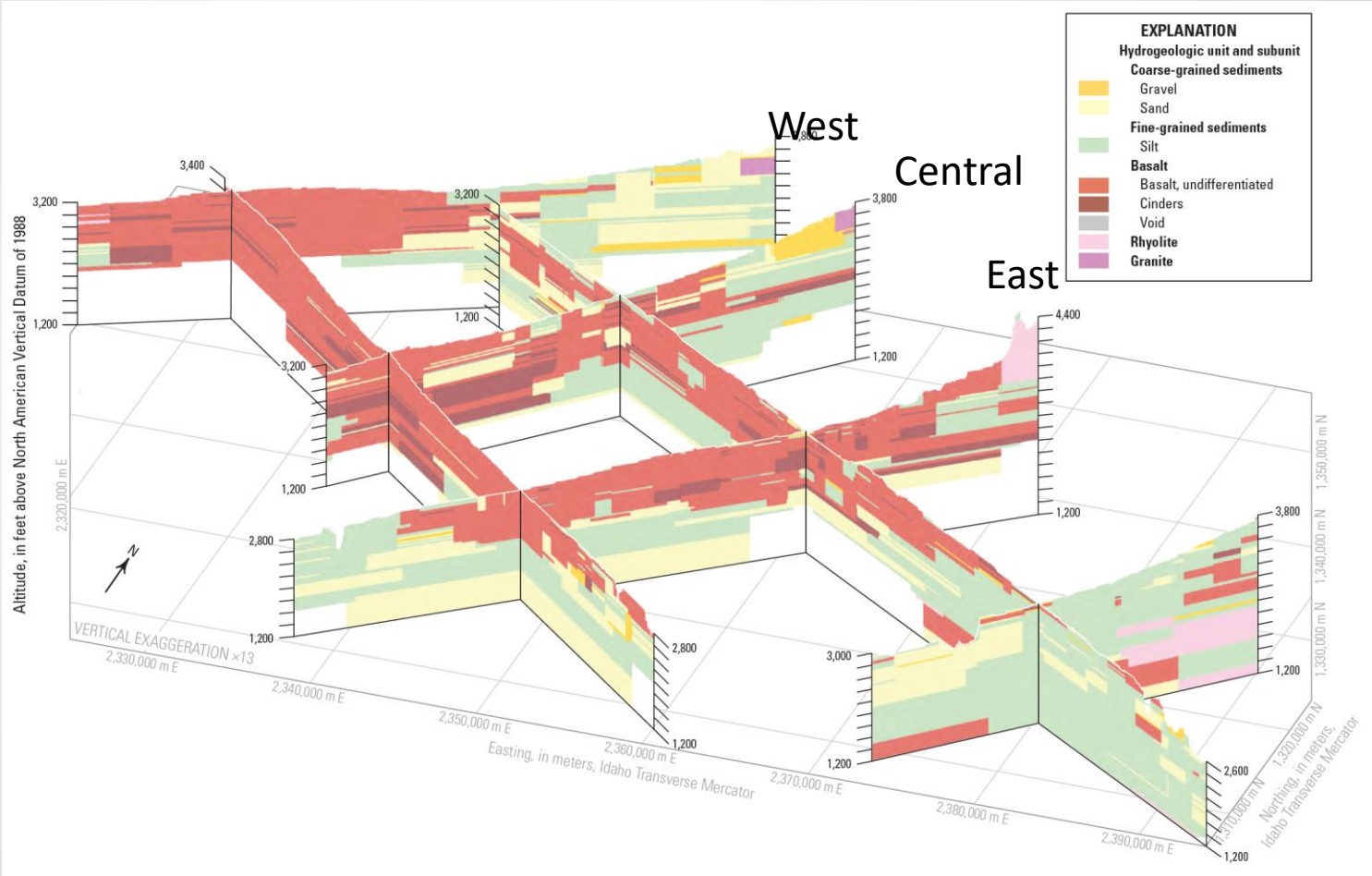
Layer 1: manually pick elevations from RockWorks fence diagrams, >100 ft below water table and Snake River stage, tracing hydrogeologic unit contacts where appropriate

Layers 2-5: initial pass to create equal-thickness layers, then re-interpolate each layer bottom, blending Mountain Home data into TV geometry at the seam.



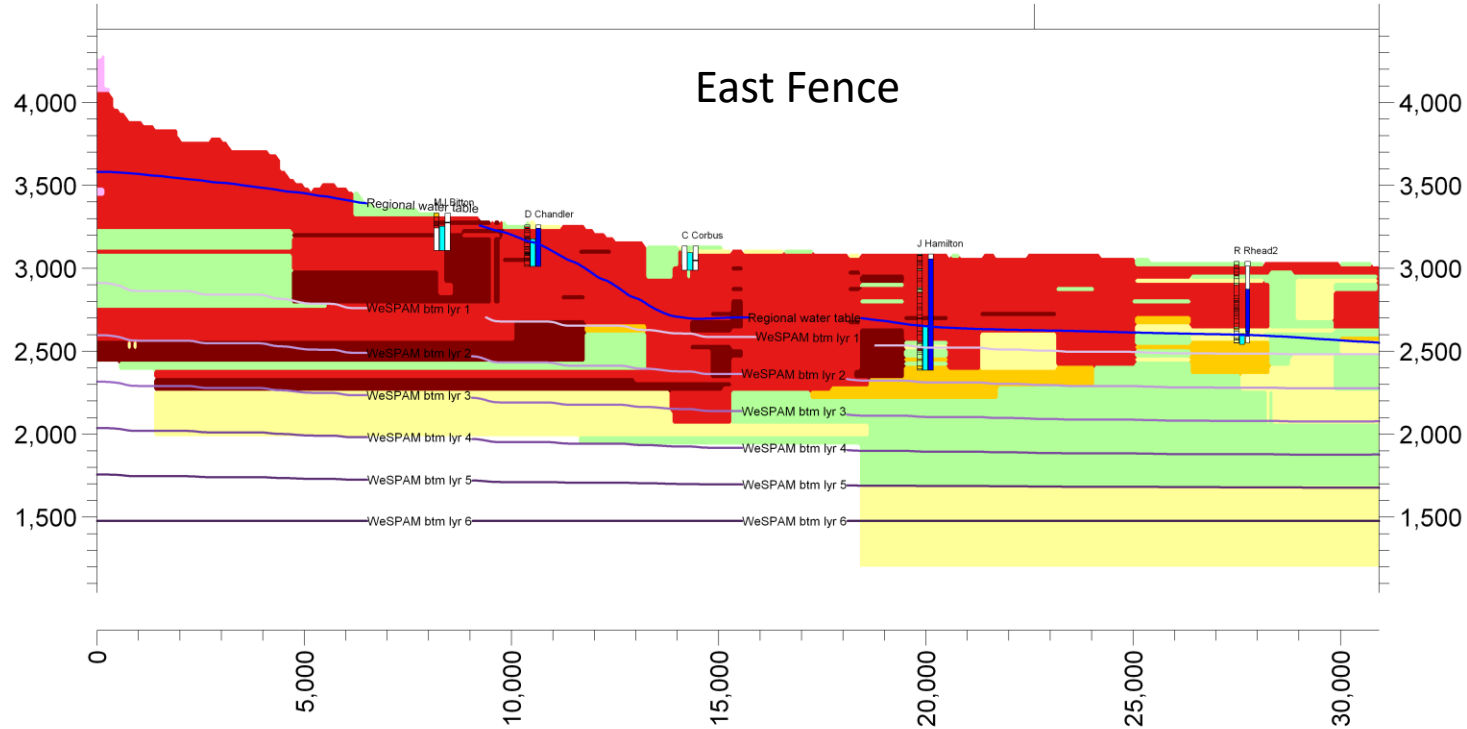
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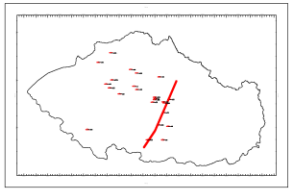
WeSPAM regional model grid – layer selection workflow



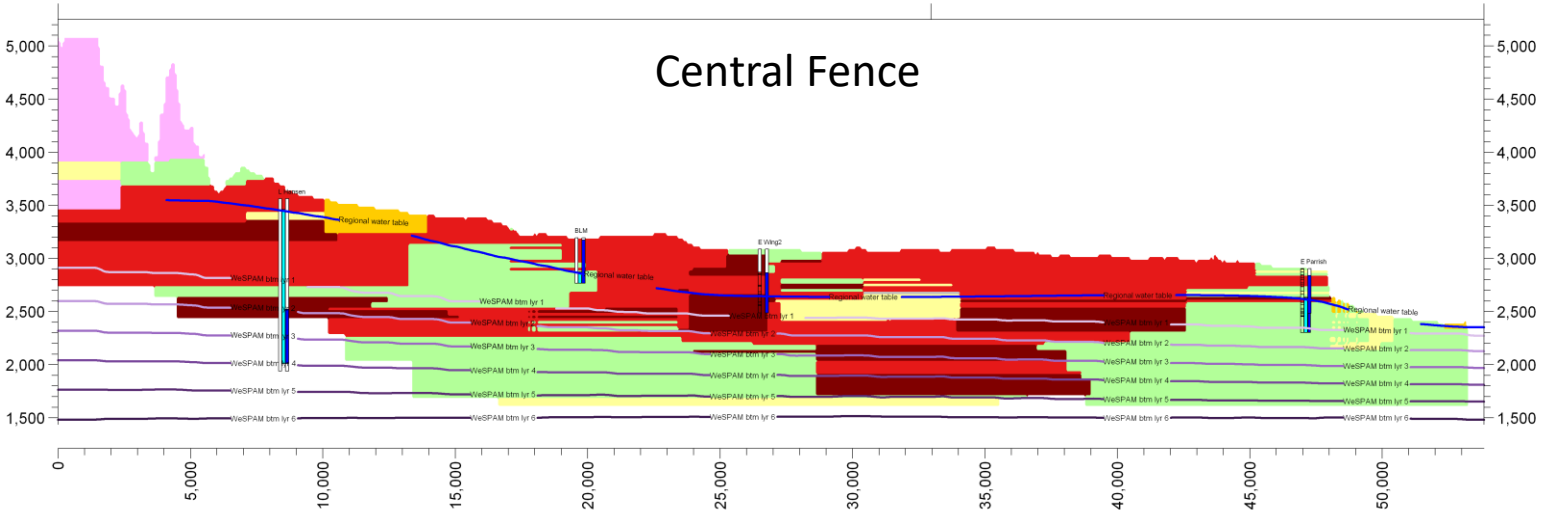
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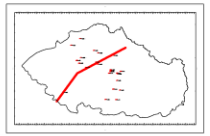
WeSPAM regional model grid – layer selection workflow



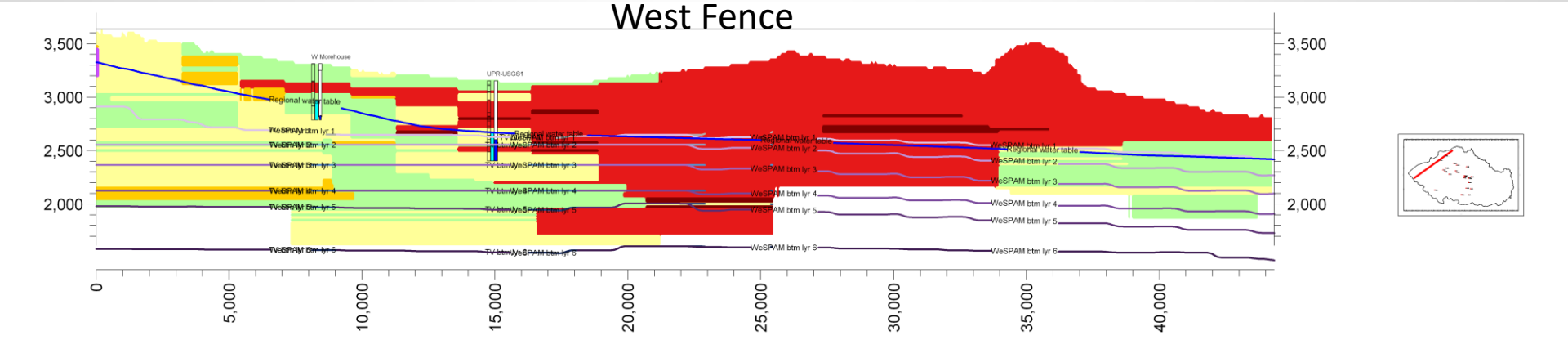


WeSPAM regional model grid – layer selection workflow

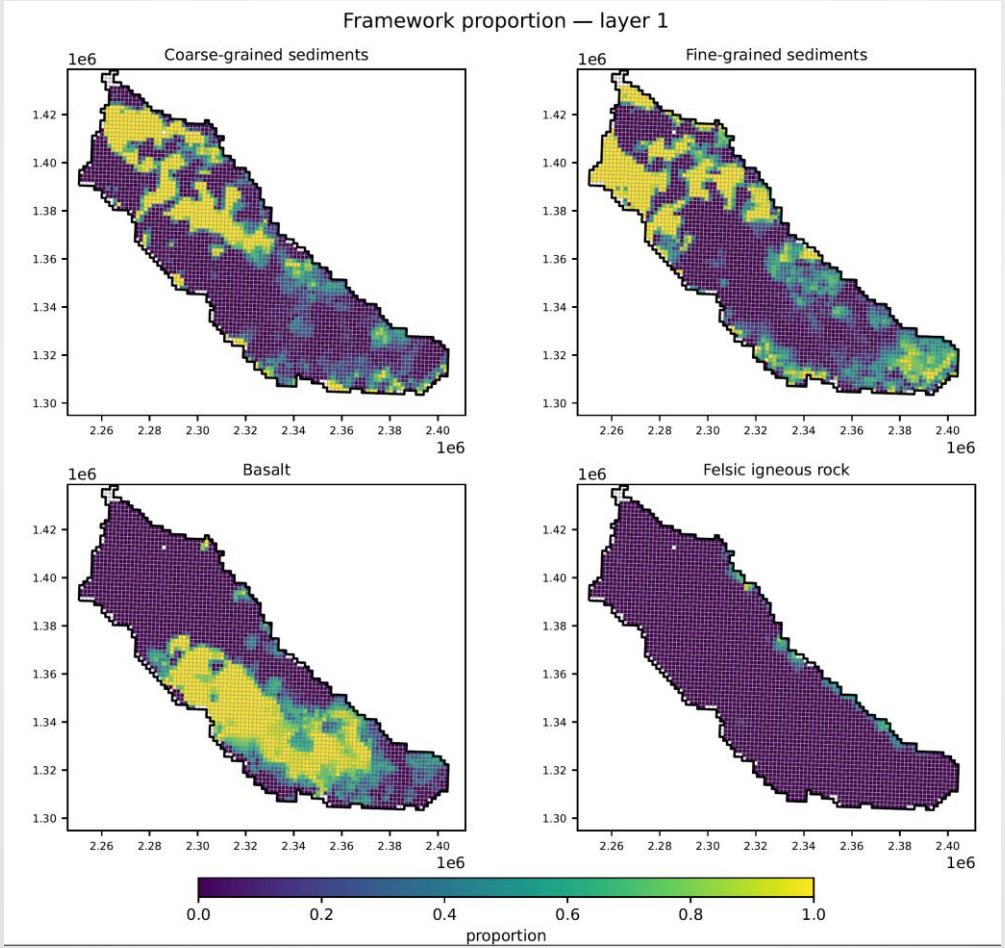




WeSPAM regional model grid – layer selection workflow

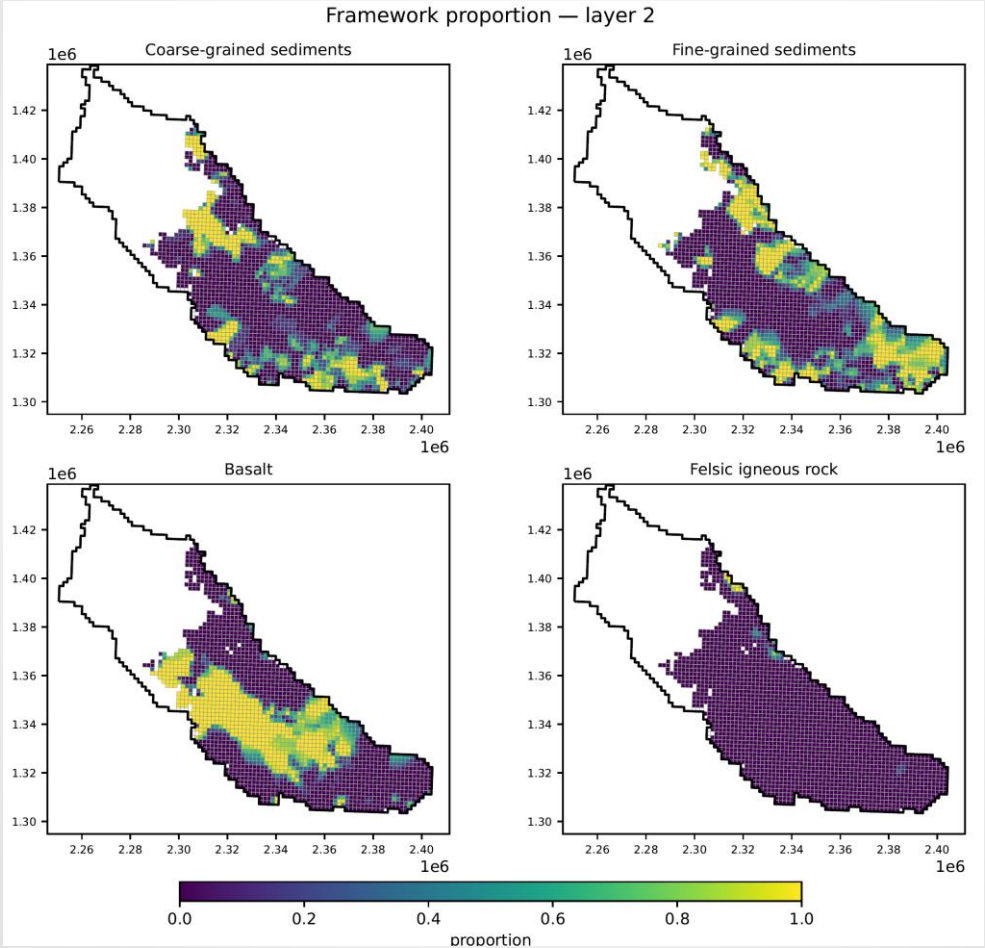


WeSPAM regional model grid – Hydrogeologic Unit Composition



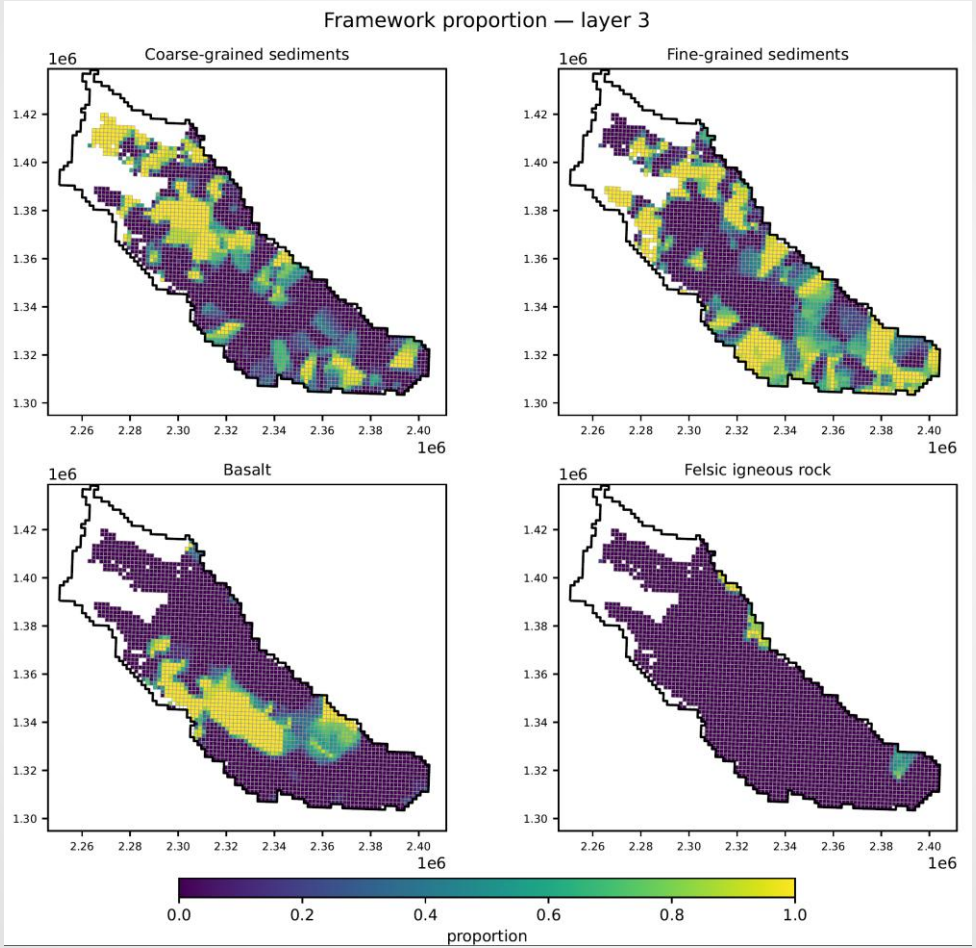
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WeSPAM regional model grid – Hydrogeologic Unit Composition



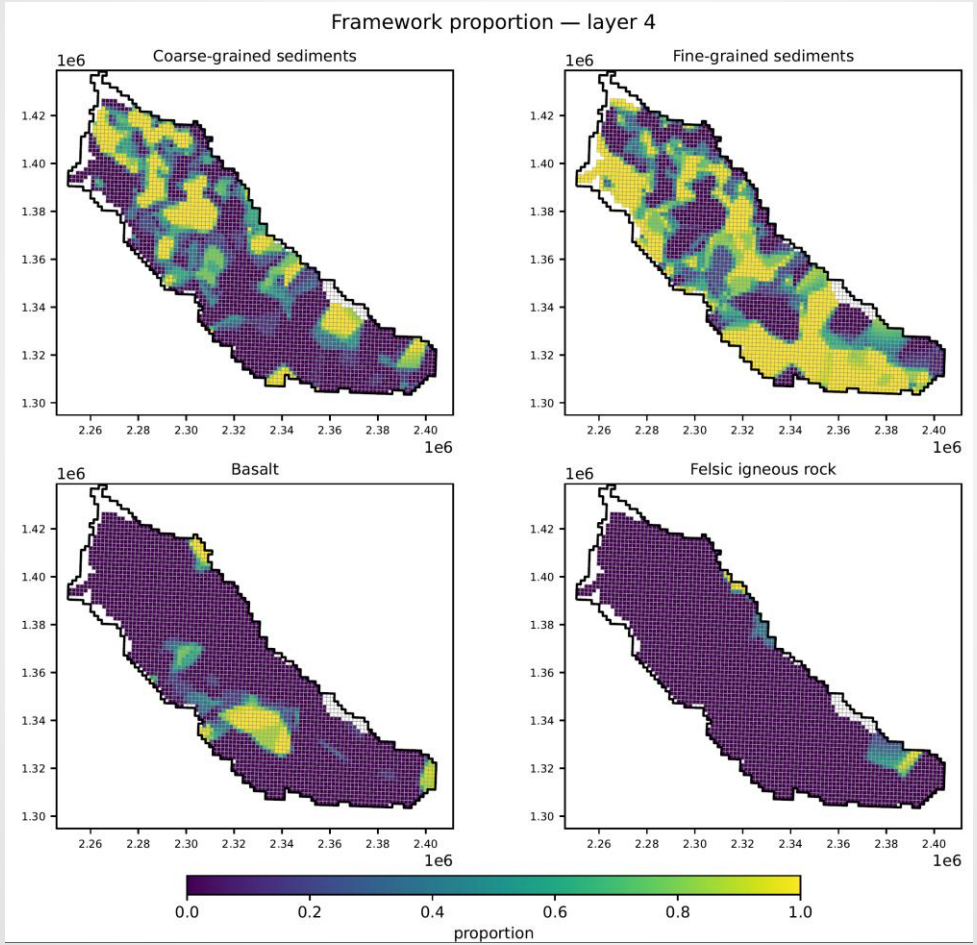
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WeSPAM regional model grid – Hydrogeologic Unit Composition



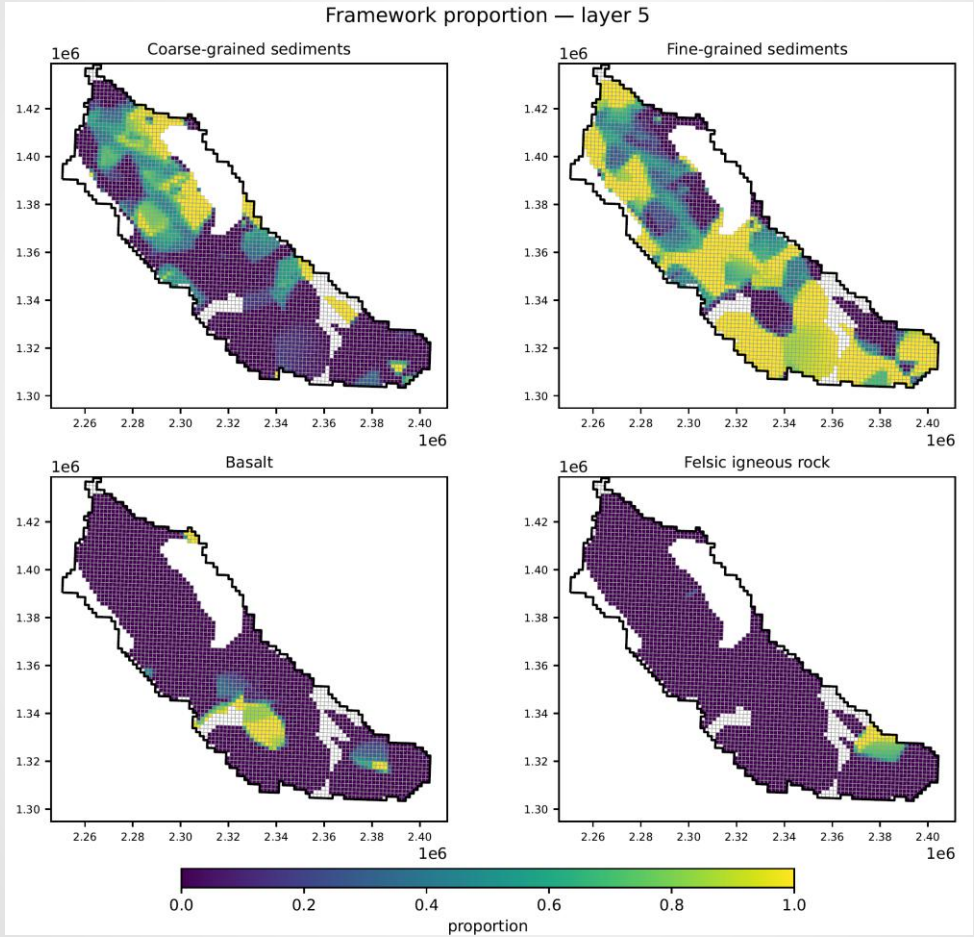
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WeSPAM regional model grid – Hydrogeologic Unit Composition



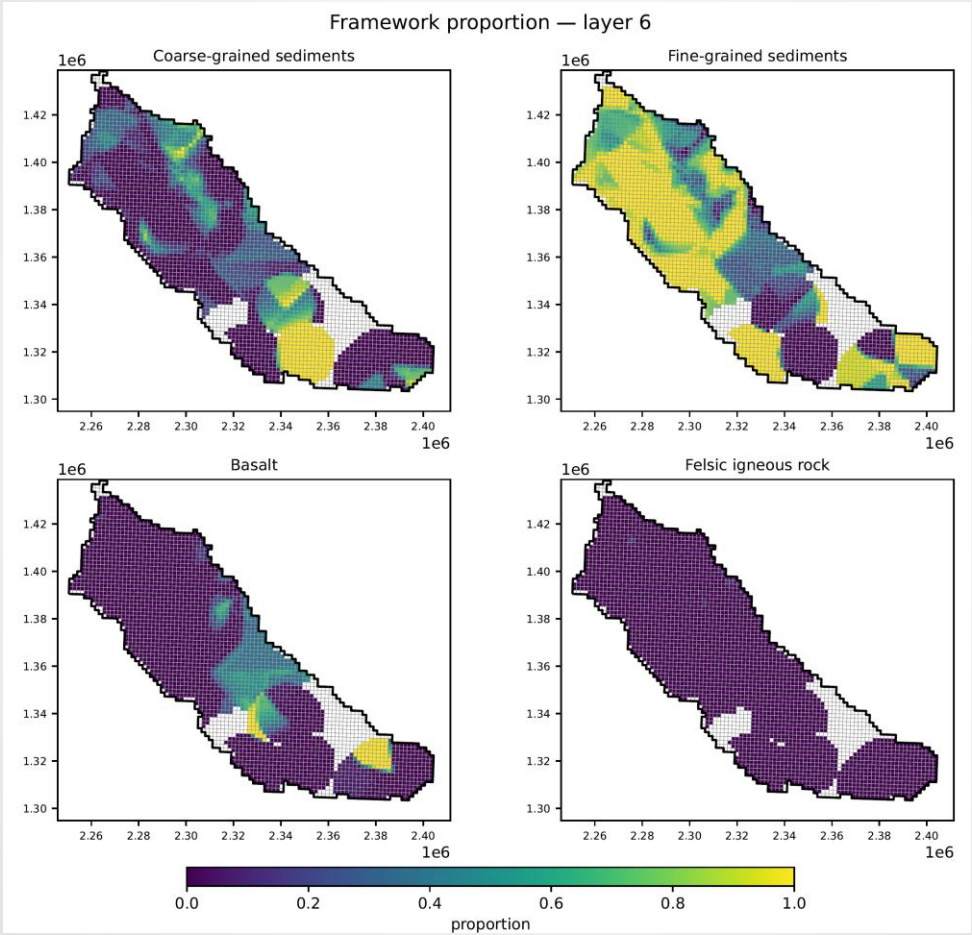
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WeSPAM regional model grid – Hydrogeologic Unit Composition



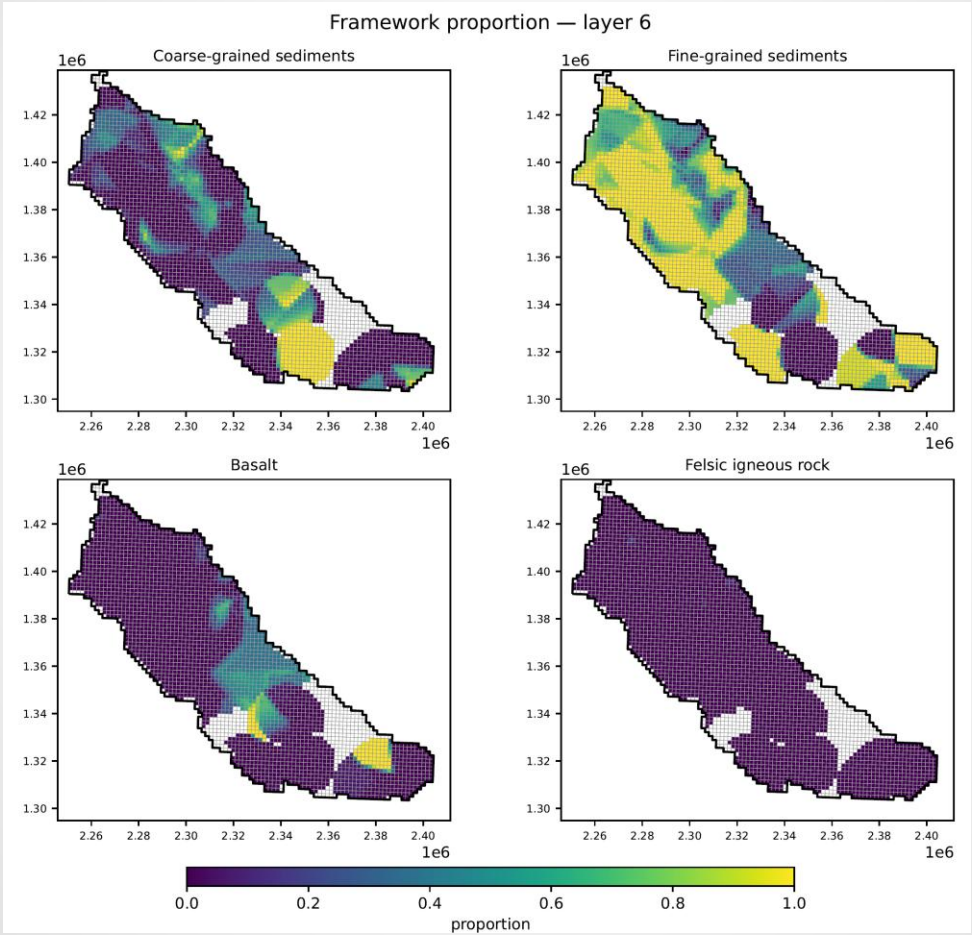
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WeSPAM regional model grid – Hydrogeologic Unit Composition



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WeSPAM regional model grid – Hydrogeologic Unit Composition



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WeSPAM initial hydraulic property assignment

Table 6. Initial, minimum, and maximum hydraulic properties assigned to each lithology type (Hundt, 2023).

[**Abbreviations**: feet/day, feet per day; Min, minimum; Max, maximum; cgf, course-grained fluvial and alluvial deposits; bas, Pliocene-Pleistocene and Miocene basalts; fgl, fine-grained lacustrine deposits; grb, granitic and rhyolitic bedrock]

Lithology unit	Lithology unit short name	Hydraulic conductivity (feet/day)			Vertical anisotropy (ratio of vertical to horizontal conductivity–unitless)			Specific storage (feet^{-1})			Specific yield (unitless)		
		Initial	Min	Max	Initial	Min	Max	Initial	Min	Max	Initial	Min	Max
Coarse-grained fluvial and alluvial deposits	cgf	1.00^{1}	1.00^{-2}	2.00^{3}	1.00^{-2}	2.50^{-3}	1.00	1.00^{-3}	1.00^{-4}	1.00^{-2}	1.50^{-1}	5.00^{-2}	3.70^{-1}
Basalt, undifferentiated: includes Pliocene-Pleistocene and Miocene basalts	bas	1.00^{1}	1.00^{-3}	2.00^{1}	1.00^{-3}	2.50^{-4}	1.00	1.00^{-2}	1.00^{-3}	1.00^{-1}	8.00^{-2}	1.00^{-2}	1.80^{-1}
Fine-grained lacustrine deposits	fgl	1.00^{2}	1.00^{-8}	1.00^{-1}	1.00^{-3}	2.50^{-4}	1.00	1.00^{-5}	1.00^{-6}	1.00^{-4}	2.00^{-2}	1.00^{-3}	5.00^{-2}
Granitic and rhyolitic bedrock	grb	1.00	1.00^{-4}	1.00	1.00^{-2}	2.50^{-3}	1.00	1.00^{-6}	1.00^{-7}	1.00^{-5}	1.00^{-3}	1.00^{-4}	1.00^{-2}

Table 5. Published ranges for hydraulic conductivity, anisotropy, storativity, specific storage, and specific yield for selected aquifer materials and groundwater-flow models.

[Abbreviations: ft/d, feet per day; ft, foot; do., ditto]

Material	Range of values	Source
	Horizontal hydraulic conductivity (ft/d)	
Clay	2.8×10^{-6} - 0.13	Spitz and Moreno (1996, p. 346)
Silt, sandy silts, clayey sands, till	2.8×10^{-3} - 0.28	Fetter (2001, p. 85)
Silty sands, fine sands	0.028 - 2.8	do.
Well-sorted sands, glacial outwash	2.8 - 280	do.
Sand	1.3 - 2.8×10^{3}	Spitz and Moreno (1996, p. 348)
Sand and gravel	27 - 650	do.
Gravel	130 - 2.8×10^{5}	Spitz and Moreno (1996, p. 347)
Basalt	5.3×10^{-6} - 0.13	Spitz and Moreno (1996, p. 346)
Basalt, permeable	0.13 - 1.3×10^{4}	do.
Basaltic lava and sediments	510 - 5.1×10^{4}	do.
Model layer 1 (sand and gravel)	3 - 43	Newton (1991, p. G32)
Model layer 2 (sedimentary rock)	900 - 1.21×10^{4}	Newton (1991, p. G33)
Model layer 3 (volcanic rock)	8.6×10^{3}	Newton (1991, p. G33)
Model layers 1 and 2	≈ 0.01 - 1.0×10^{3}	Petrich (2004, p. 62)
Model layers 3 and 4	≈ 0.01 - 1.0×10^{3}	Petrich (2004, p. 63)
Model 6, layers 1, 2, and 3	0.016 - 50	Douglas (2007, appendix D)
Model 6, layer 4	3.6×10^{-3} - 6.0	do.
Model 6, layer 5	0.068 - 800	do.
Model 6, layers 6 and 7	0.078 - 1.5×10^{5}	do.
Model 6, layer 8	1.9×10^{-4} - 790	do.
Model layer 1	≈ 0 - 2.0×10^{3}	Johnson (2013, p. 26)
Model layer 2	≈ 3 - 2.0×10^{3}	do.
Model layers 3 and 4	≈ 0 - 2.0×10^{3}	Johnson (2013, p. 27)

Table 3. Published ranges of hydraulic conductivity of hydrogeologic units in the Mountain Home area, southern Idaho.

[Shading present for visual grouping]

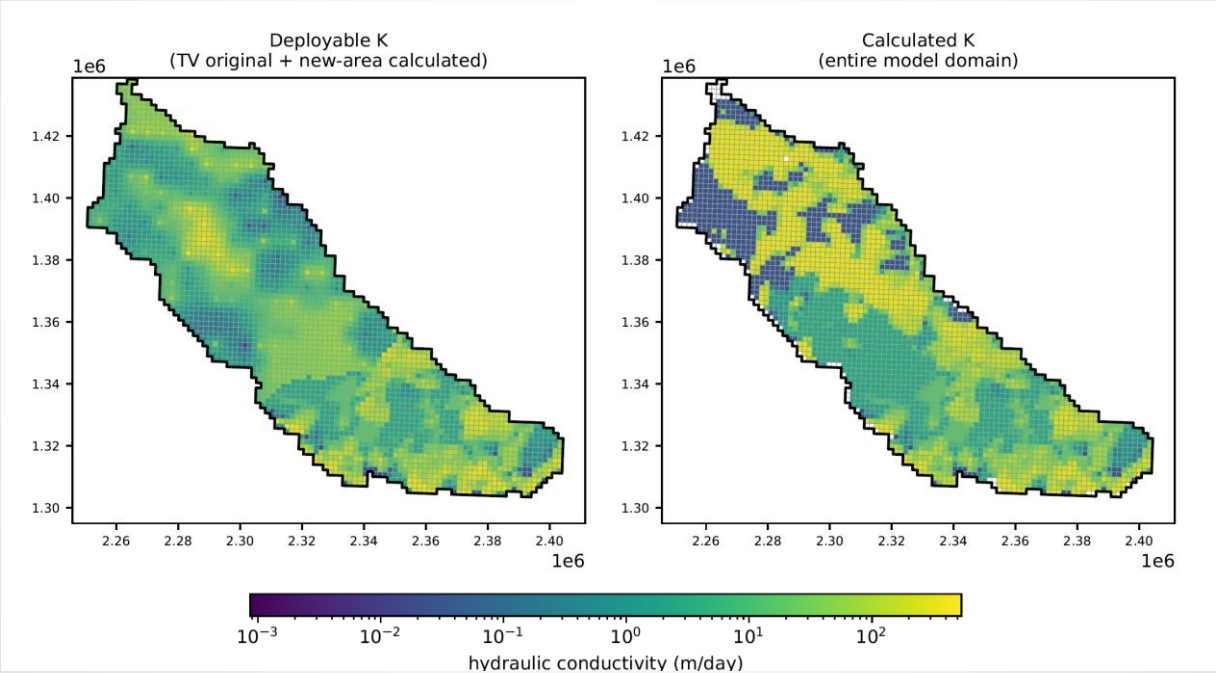
Hydrogeologic unit	Lithology	Range of hydraulic conductivity (feet per day)	Reference
Fine-grained sediments	Silt	2.6×10^{-5} to 2.0×10^{0}	Spitz and Moreno (1996)
	Clay	1.3×10^{-4} to 1.3×10^{-1}	Spitz and Moreno (1996)
	Siltstone	2.8×10^{-6} to 4.0×10^{-3}	Spitz and Moreno (1996)
	Shale	3.3×10^{-8} to 7.4×10^{0}	Spitz and Moreno (1996)
Coarse-grained sediments	Sand	1.4×10^{0} to 2.8×10^{3}	Spitz and Moreno (1996)
	Gravel	1.4×10^{2} to 2.8×10^{5}	Spitz and Moreno (1996)
	Sandstone	9.4×10^{-4} to 1.53×10^{1}	Spitz and Moreno (1996)
Basalt	Interflow zones and near-vent deposits, including cinders	1.0×10^{2} to 3.2×10^{4}	Anderson and others (1999)
	Thick and thin massive flows	1.0×10^{-2} to 1.0×10^{2}	Anderson and others (1999)
	Void[1]	3.3×10^{2} to 2.3×10^{4}	Spitz and Moreno (1996)
Rhyolite	Igneous, fine-grained rock	1.73×10^{-1} to 3.86×10^{2}	Spitz and Moreno (1996)
Granite	Igneous, coarse-grained rock	1.19×10^{-3} to 1.19×10^{1}	Spitz and Moreno (1996)

[1]Based on igneous, fine-grained, cavernous rock.

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WeSPAM initial hydraulic property assignment

Layer 1 HK based on TV model initial (pre-calibration) estimates

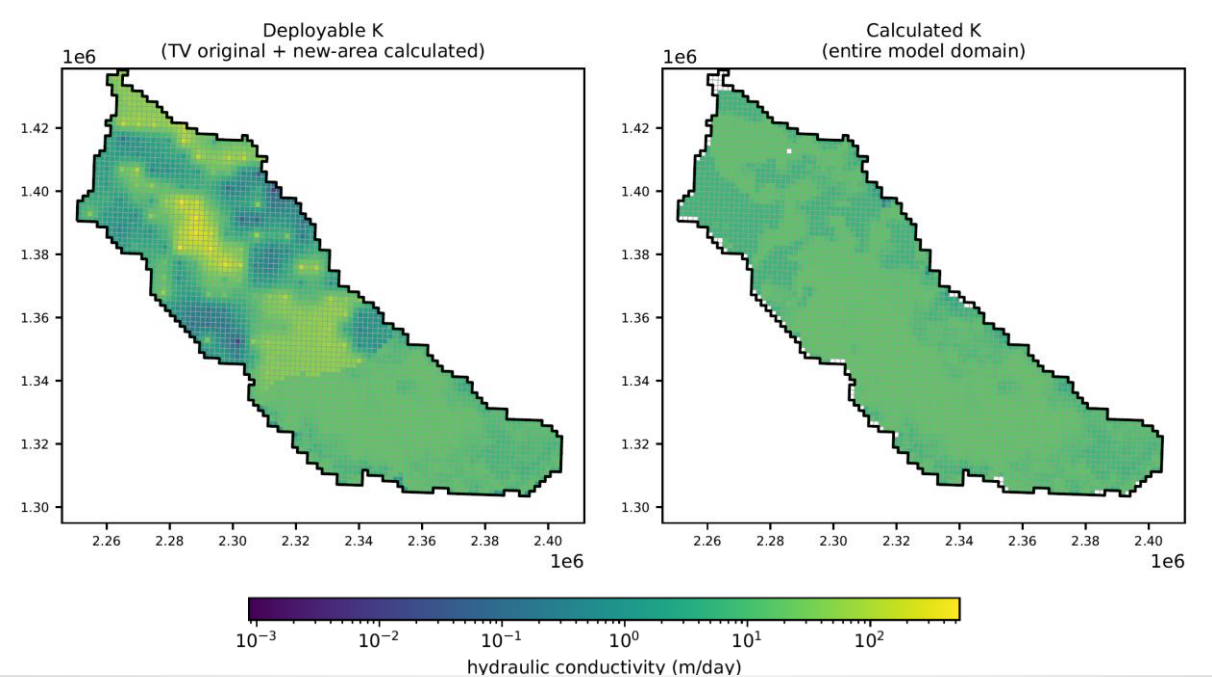


	TV initial
Coarse	1000
Fine	0.1
Basalt	10
Felsic	1

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WeSPAM initial hydraulic property assignment

Layer 1 HK based on attempt to invert calibrated TV model cell values to hydro units using their proportion by cell and least squares fit

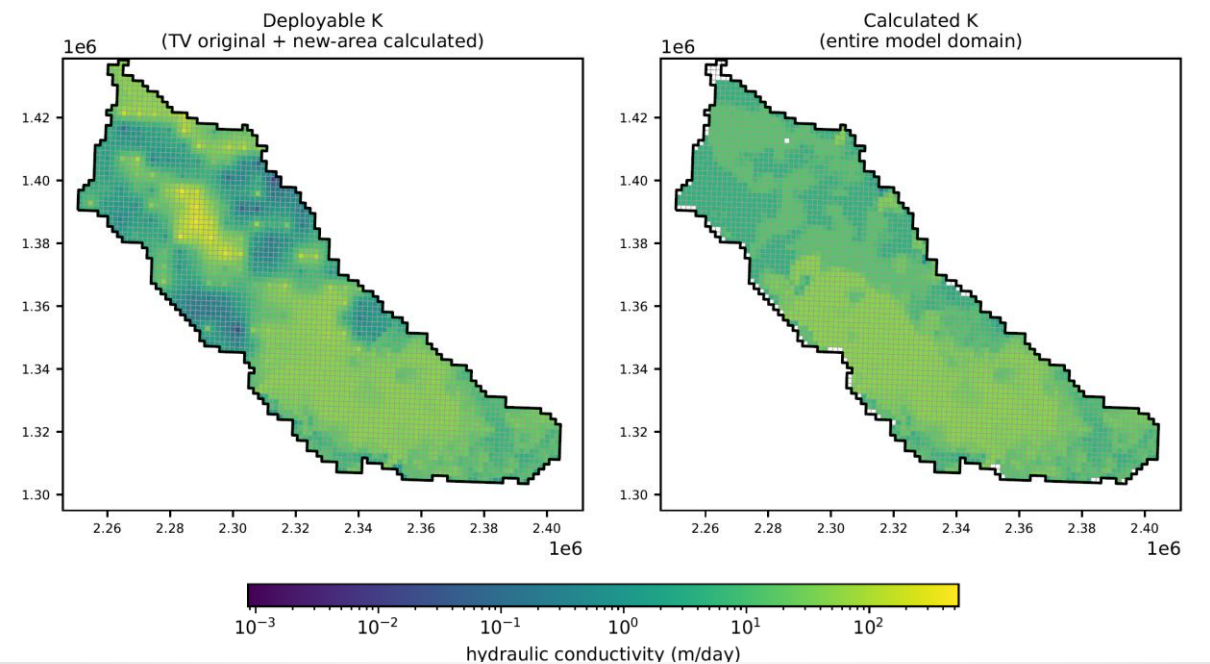


	TV back-calc
Coarse	50
Fine	20
Basalt	50
Felsic	0.05

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WeSPAM initial hydraulic property assignment

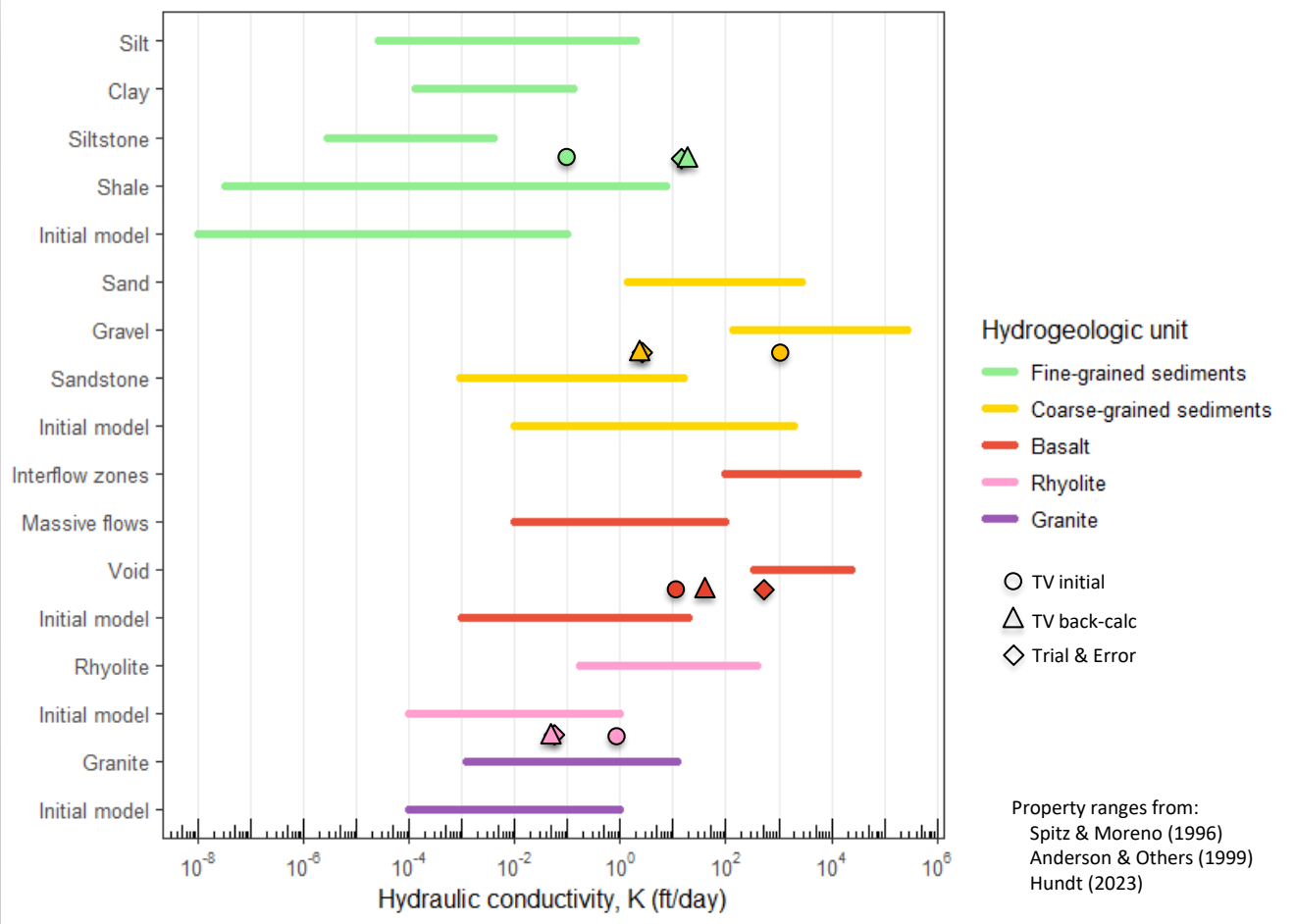
Layer 1 HK based on iterative trial & error



	Trial & error
Coarse	50
Fine	15
Basalt	150
Felsic	0.05

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WeSPAM initial hydraulic property assignment



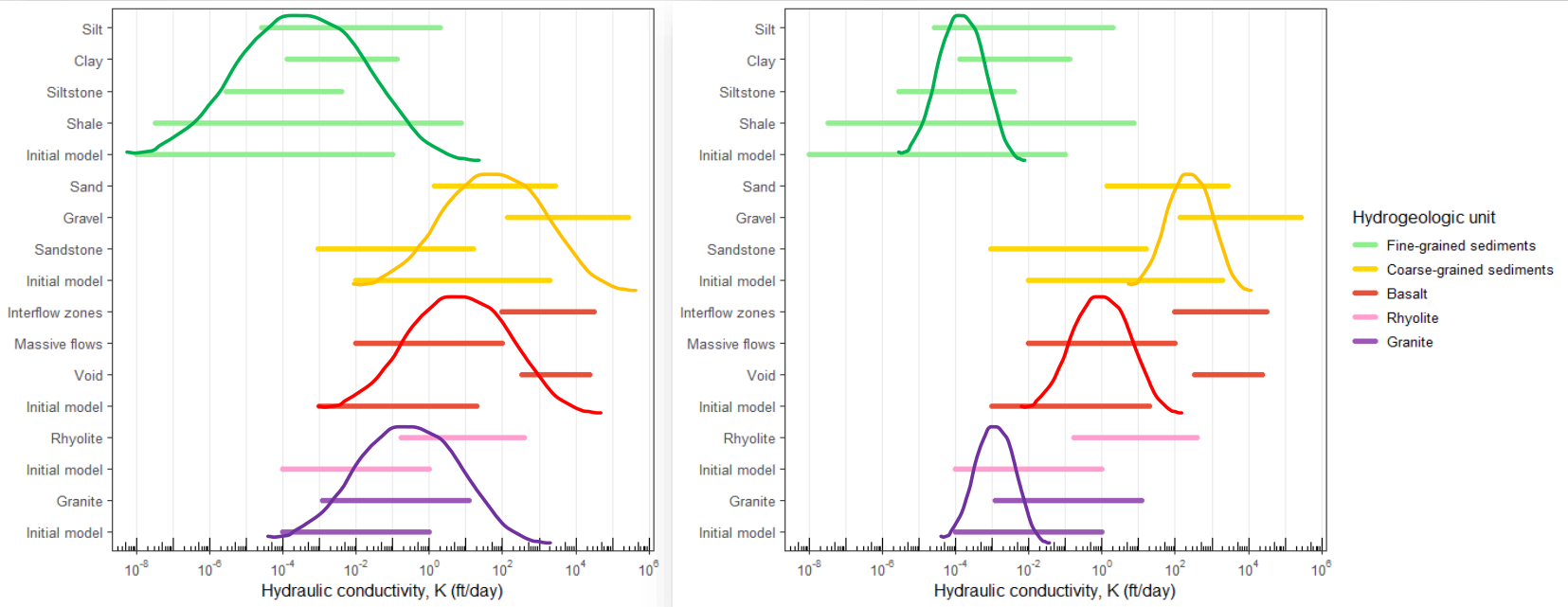
Property ranges from:
Spitz & Moreno (1996)
Anderson & Others (1999)
Hundt (2023)

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WeSPAM initial hydraulic property assignment

Ensemble approach allows simulating a wide range of property values among many model realizations.

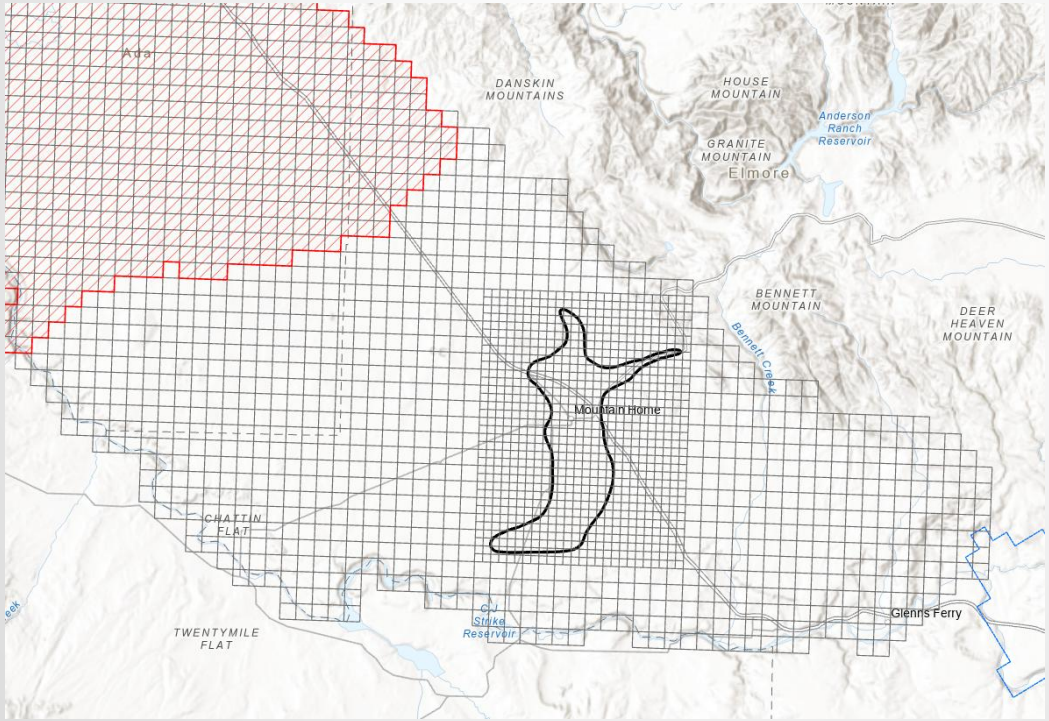
Calibration narrows the range of values if/where it leads to better fit to observations

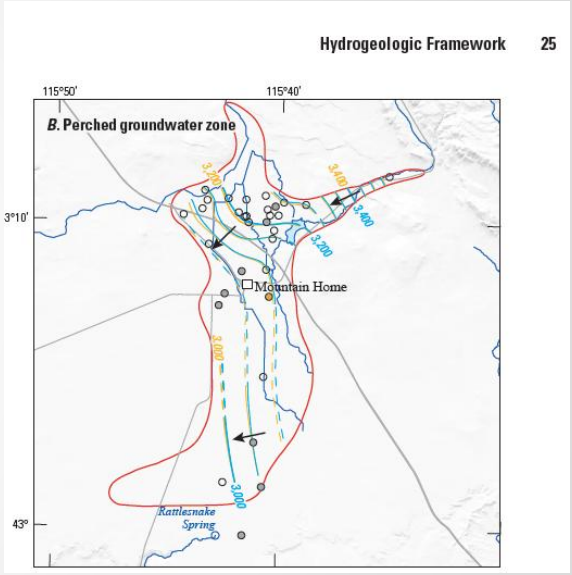


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WeSPAM coupled model approach for local scale simulation

MODFLOW 6 GWF-GWF package links multiple model grids within a single simulation. Example: Mountain Home perched aquifer

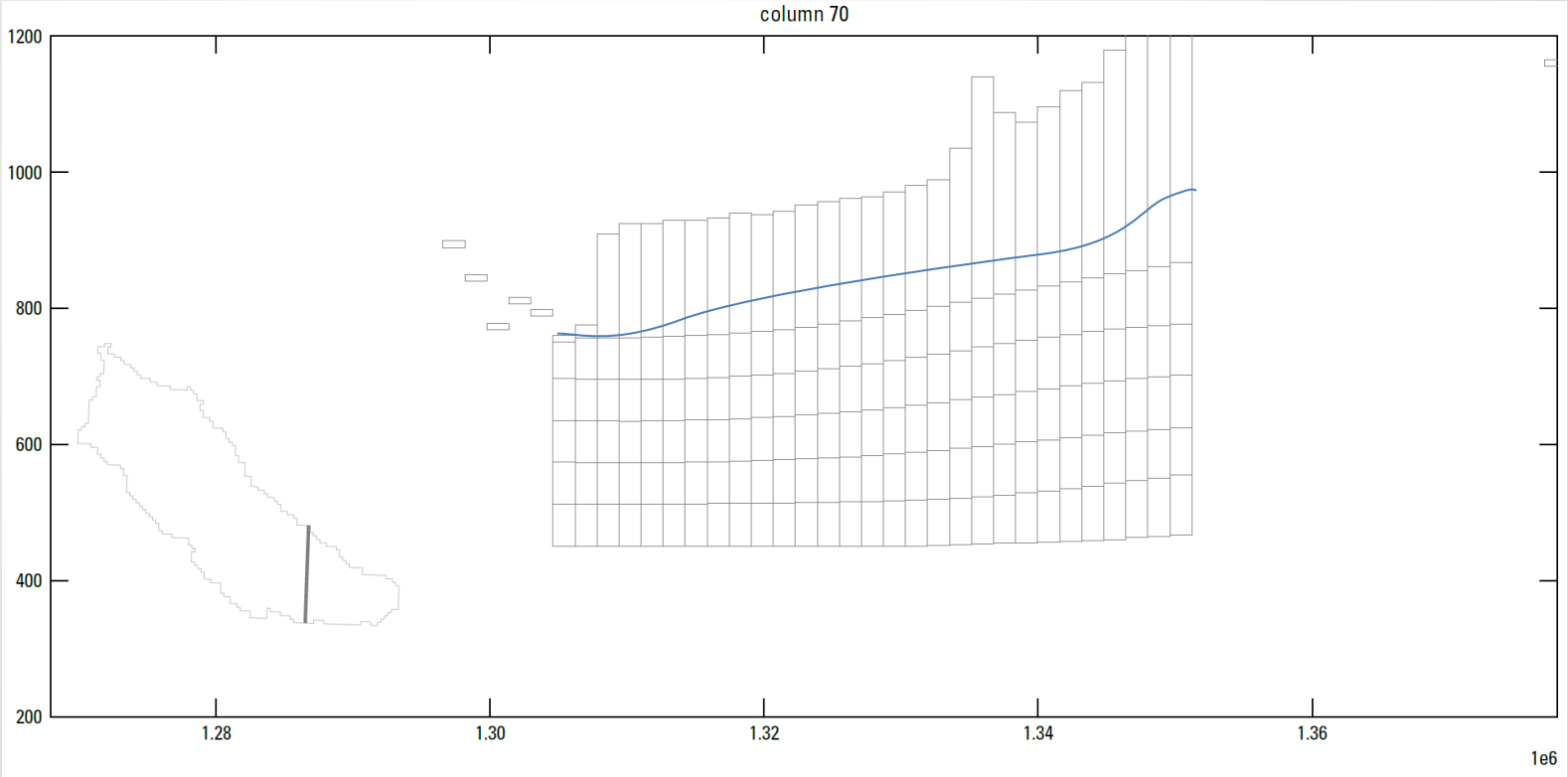




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WeSPAM coupled model approach for local scale simulation

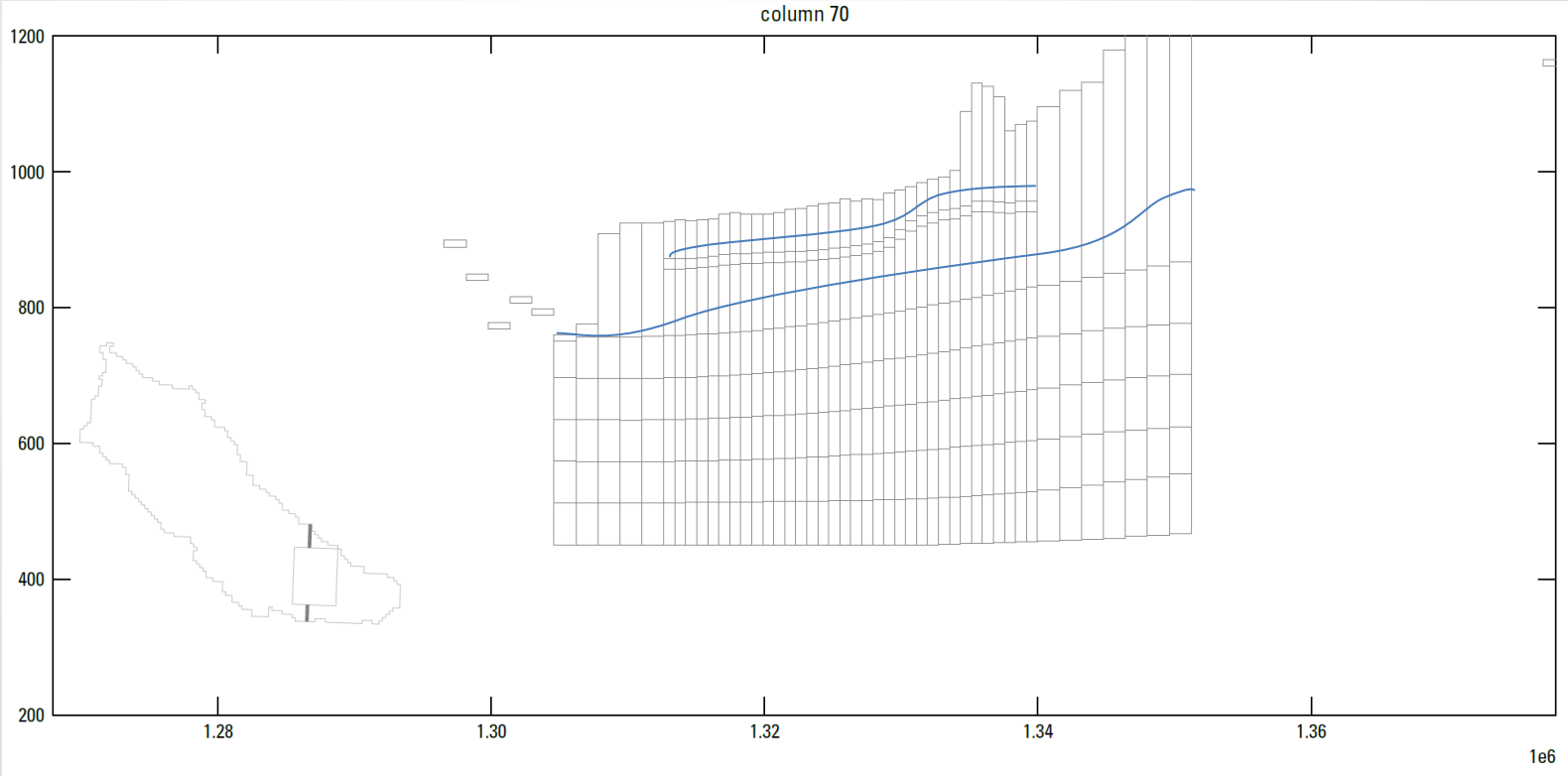
Example: finer scale horizontal resolution (2:1) and 2 additional shallow layers



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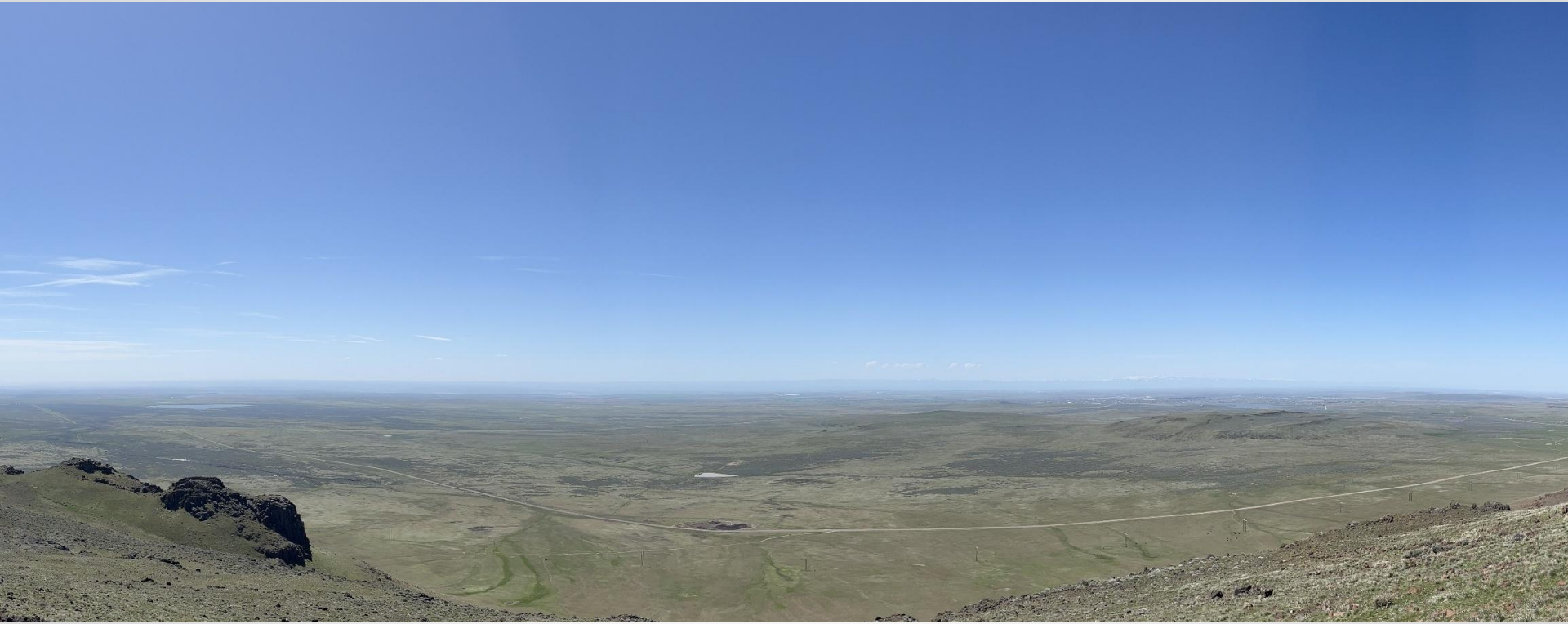
WeSPAM coupled model approach for local scale simulation

Example: finer scale horizontal resolution (2:1) and 2 additional layers



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Questions?



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In cooperation with the
Idaho Department of Water Resources

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