Oak Ridge National Laboratory

Planned Water Table Drawdown Update

1. April 1, 2025 SPRUCE meeting
2. Melanie Mayes, Jon Stelling, Kenneth Lowe, Jeff Riggs, David Weston, Stephen Sebestyen, Kyle Pearson, Mark Guilliams, Dan Ricciuto, Xiaoying Shi, Keith Olehauser, Jeff Warren, Sören Weber, Verity Salmon, Natalie Griffiths, Paul Hanson

Purpose of study

- Goal – deconvolute drying from temperature effects
- Objective – use test corral near EM-1 to draw down the water table over the summer

- ”Pilot” or test-scale study
- Limited scope to test hypotheses and capabilities

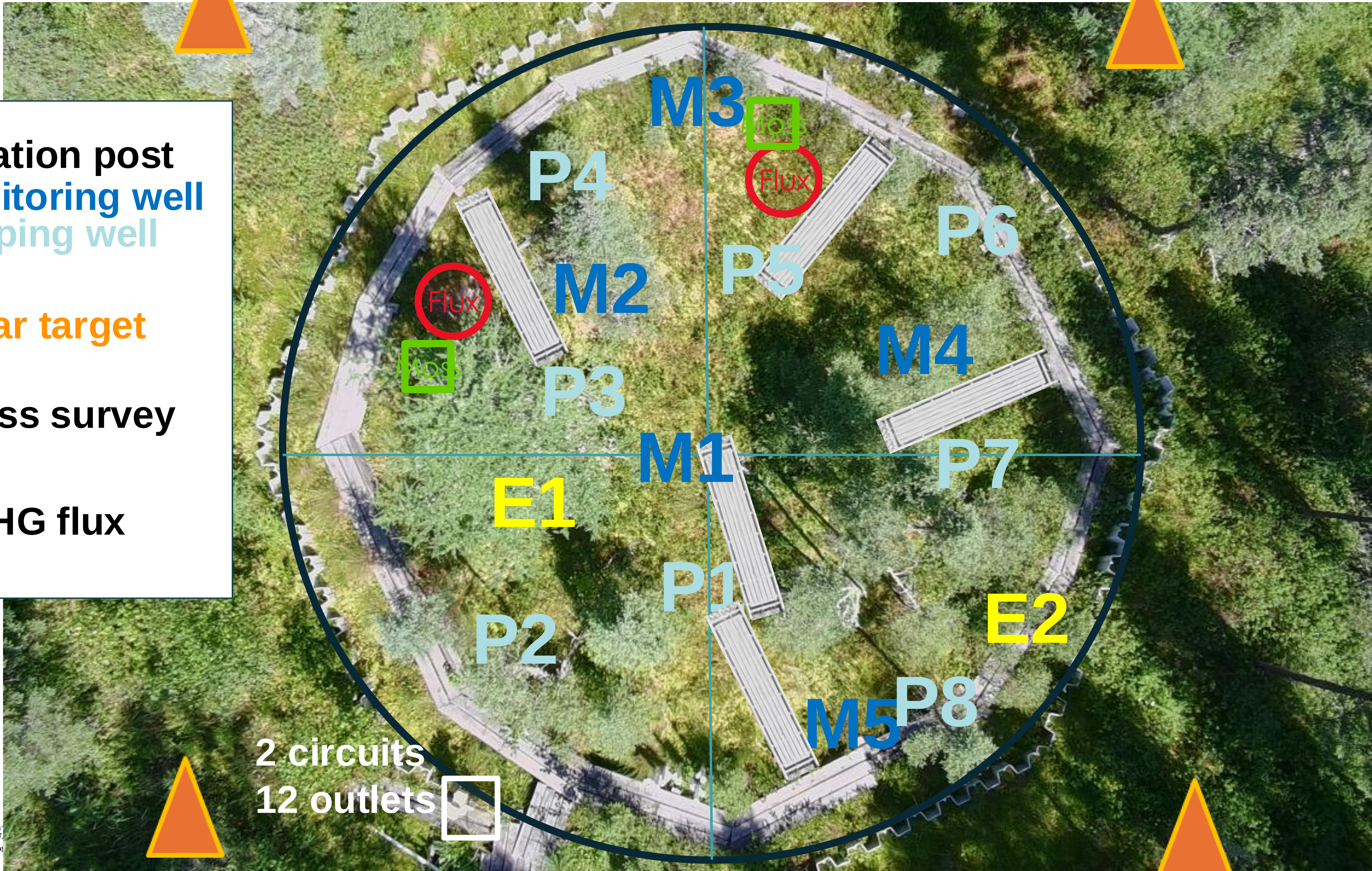
Purpose of update

- Review status of what we learned from October pumping tests
- Discuss plans for spring visit to add a few more wells and test the system
- Discuss plans for how to implement the experiment
  - And collect other companion data

SPRUCE - Water table drawdown experiment update

- Sept 30 – Oct 4 installation and testing
- Installed ladder extension supports, reference locations for Lidar surveys (BSU, Apr and Aug 2025), 13 wells, collars for GHG systems
- Manual elevation measurements
- Reference survey to get elevation of top of well casings

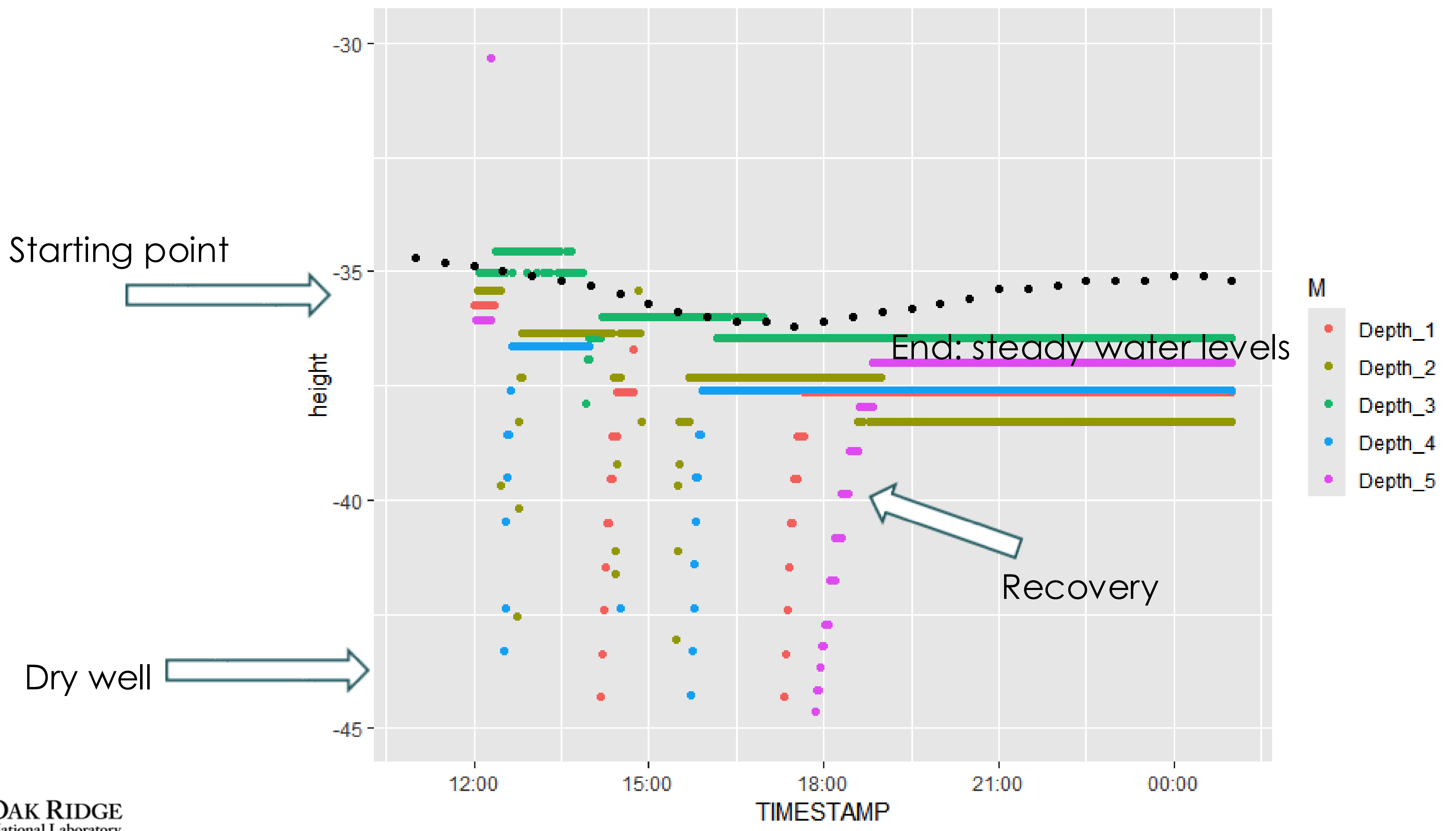
E = elevation post
M = monitoring well
P = pumping well
= Lidar target
= Moss survey
= GHG flux



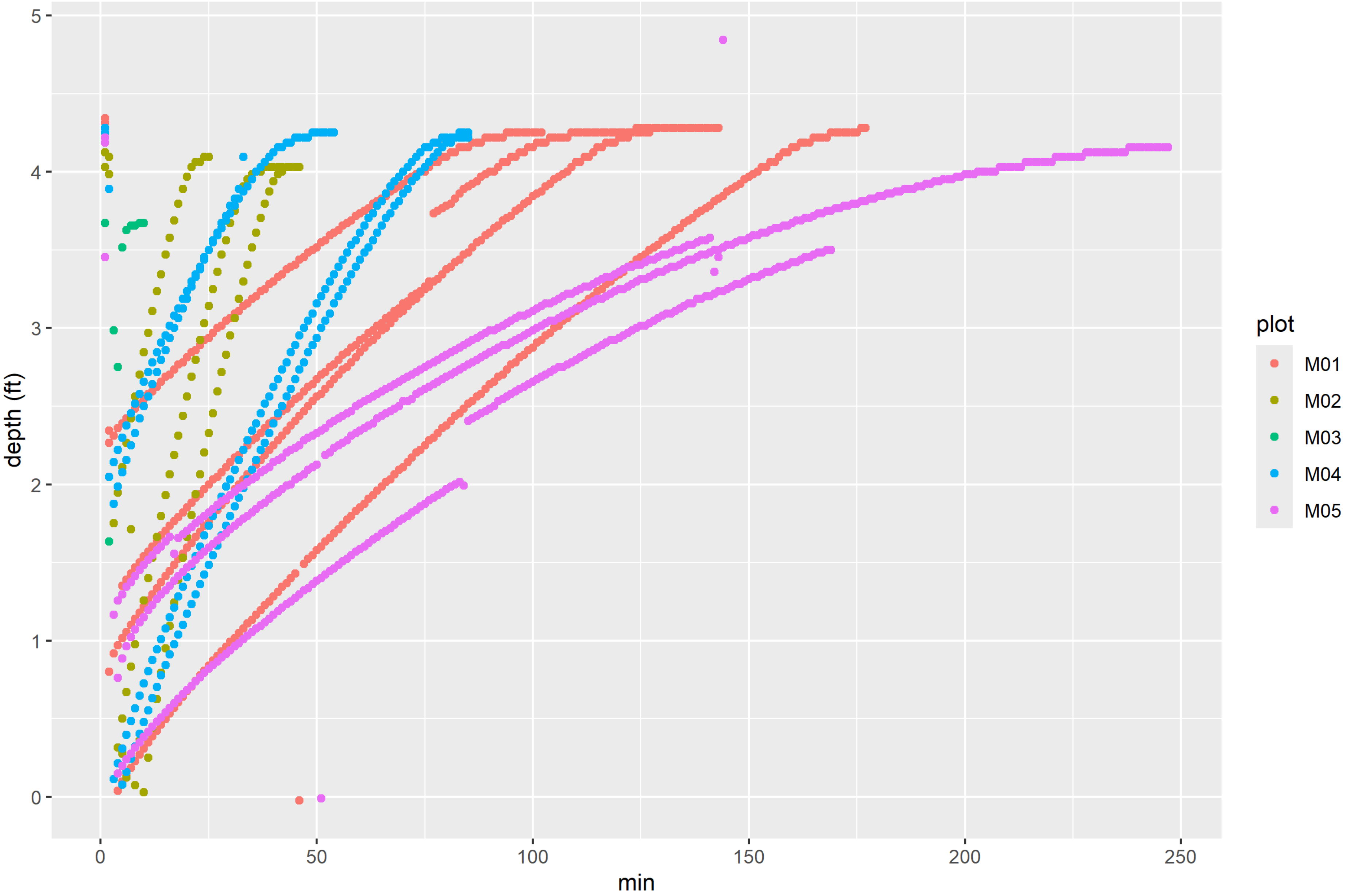
SPRUCE - Water table drawdown experiment update

- Conducted pump tests on all 13 wells
  - Pumped each well dry => monitor recovery
    - 7 wells with recovery times < 2 h ➔ will be new "pumping wells"
    - 6 wells with longer recovery times (up to 14 h) ➔ will be new "monitoring wells"
- "P" and "M" naming scheme DOES NOT MEAN pumping/monitoring

Pump "monitoring" wells dry – watch response



“Monitoring” wells 1-5 (many tests/well)



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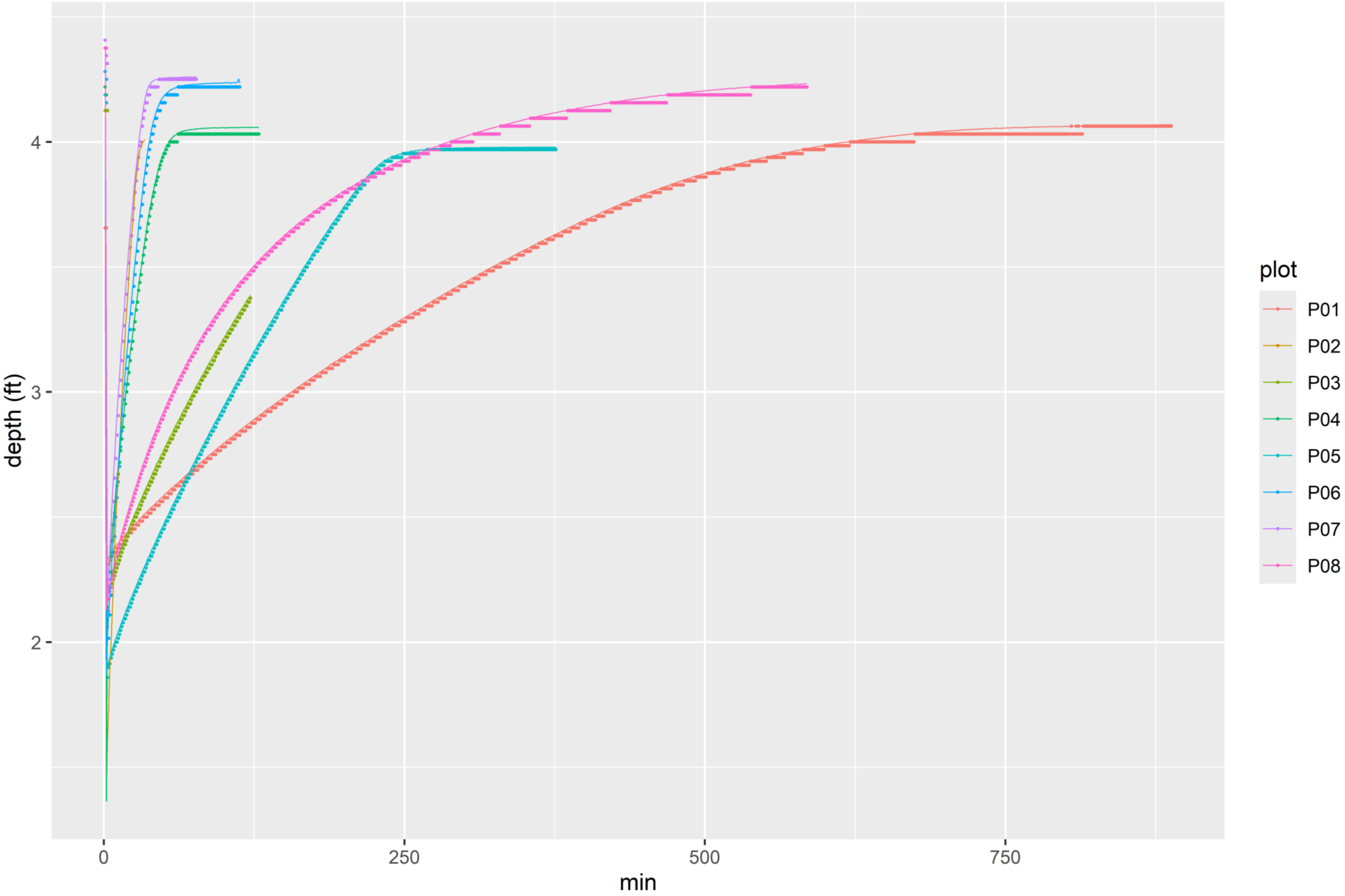
“Pumping” wells 1-8 (1 test/well)



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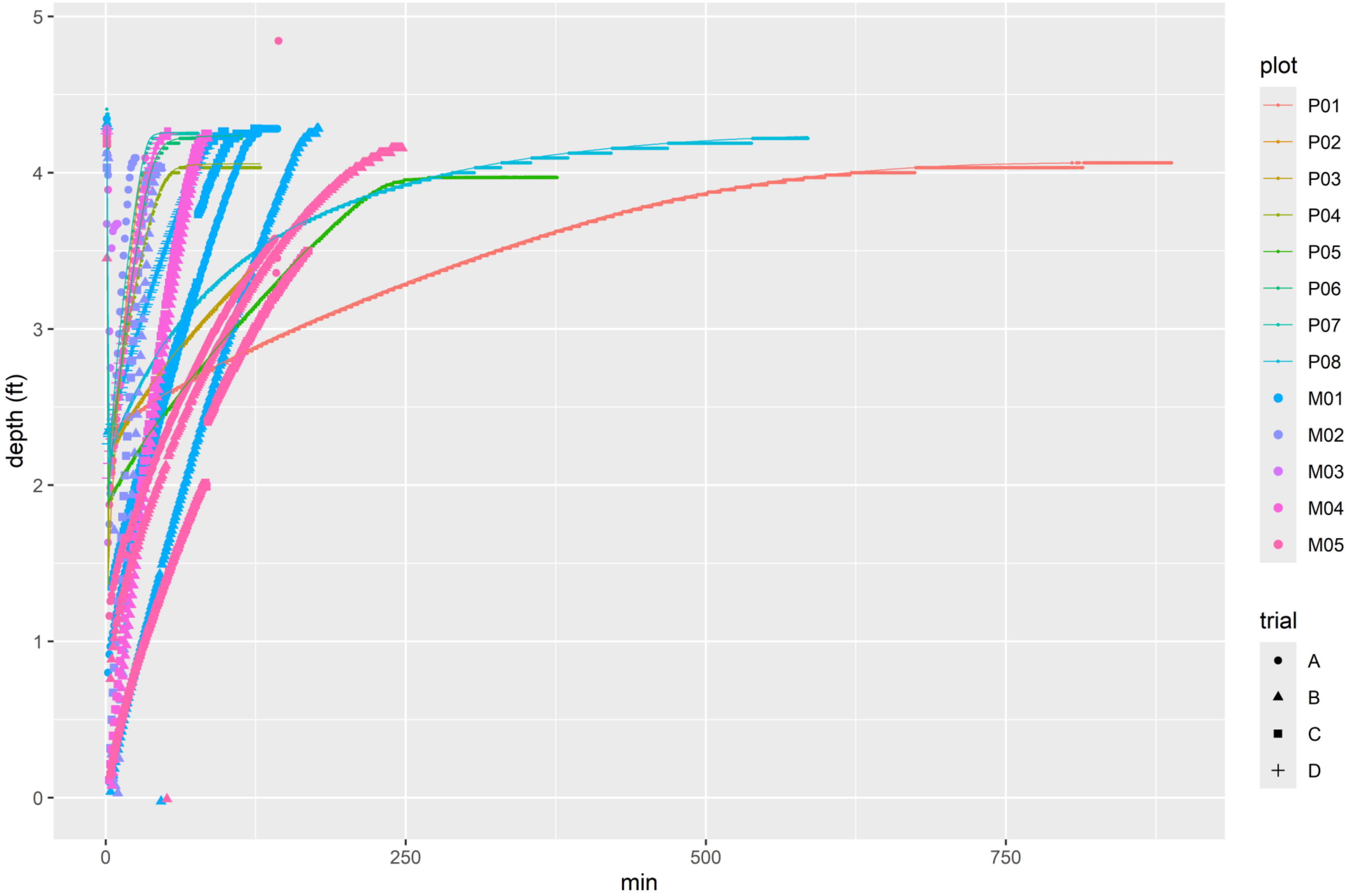
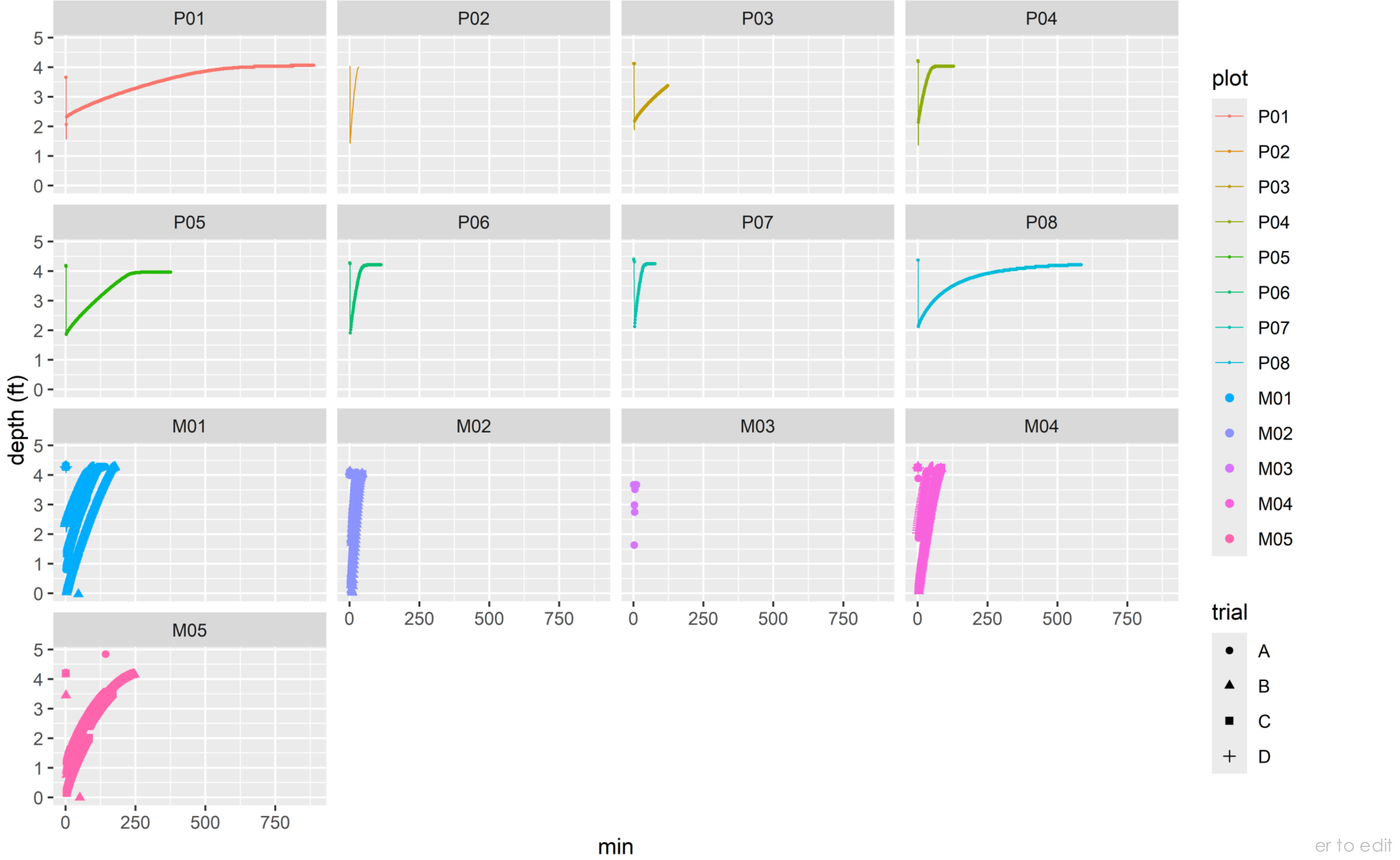
All 13 “pumping” & “monitoring” wells together



All 13 “pumping” & “monitoring” wells together



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Saturated Hydraulic Conductivity: Ksat

Hvorslev Method

- Price, J. S., McCarter, C. P., & Quinton, W. L. (2023). *Groundwater in peat and peatlands*. Groundwater Project.

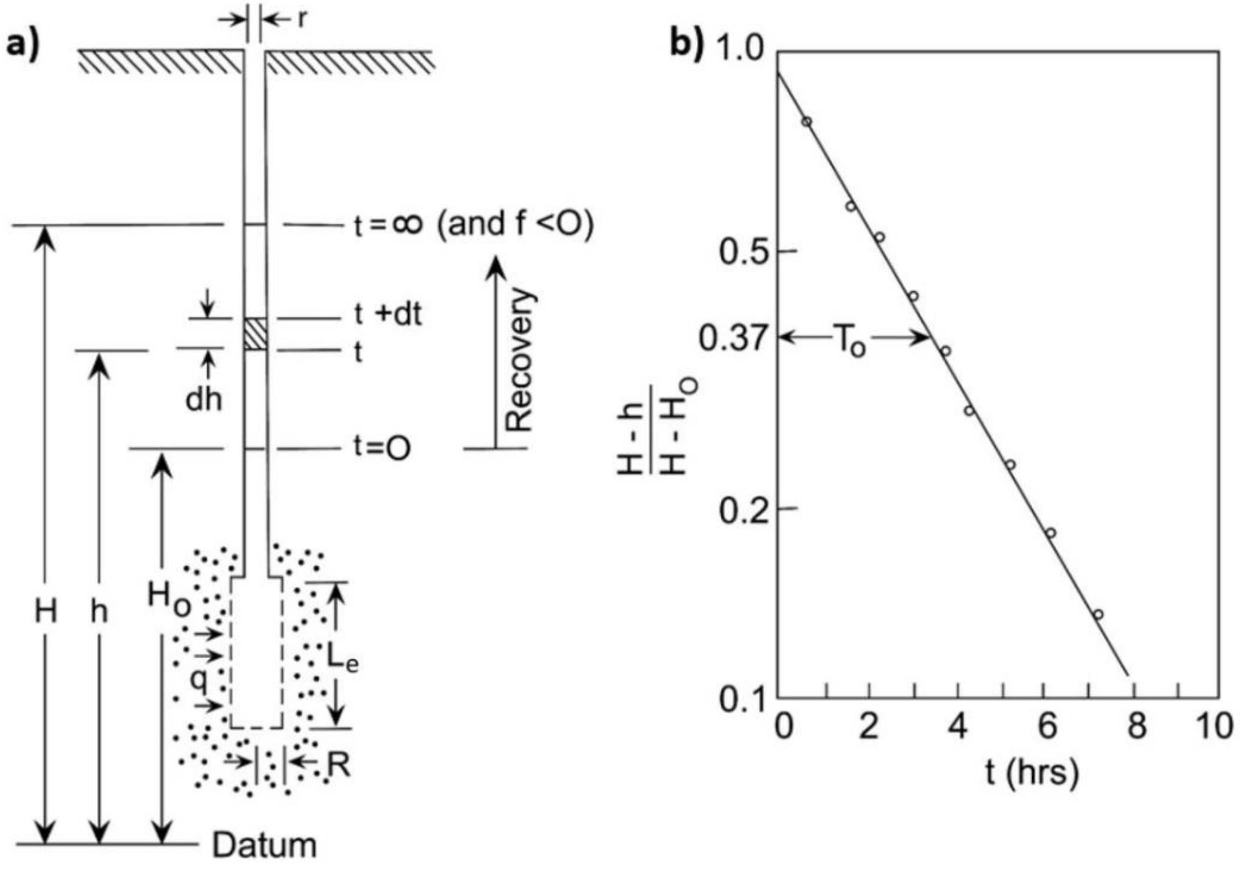
$$K_{sat} = \frac{r^2 \ln(L_e/R)}{2LT_o}$$

where:

K_{sat} = saturated hydraulic conductivity (LT^{-1})

R = external radius of the intake (L)

L_e = length of the intake (L)



Summary of Ksats
7 wells Ksat >0.2 m/d ➔ "pumping wells"
6 wells Ksat < 0.08 m/d ➔ "monitoring wells"

	Pump 01	Pump 02	Pump 03	Pump 04	Pump 05	Pump 06	Pump 07	Pump 08
ksat_full intake(m/d)	0.072	0.520	0.077	0.334	0.059	0.374	0.440	0.066
ksat(m/d)	**0.058**	**0.446**	**0.062**	**0.292**	**0.047**	**0.303**	**0.341**	**0.052**

borderline pumping well?

	Monitor 1A	Monitor 1B	Monitor 1C	Monitor 1D		Monitor 2A	Monitor 2B	Monitor 2C		Monitor 3
ksat_full in	0.083	0.050	0.096	[illegible]		0.801	0.271	[illegible]		8.893
ksat(m/d)	**0.078**	**0.050**	**0.084**	**0.145**		**0.658**	**0.270**	**0.291**		**7.135**
	average	**0.089**				average	**0.406**			

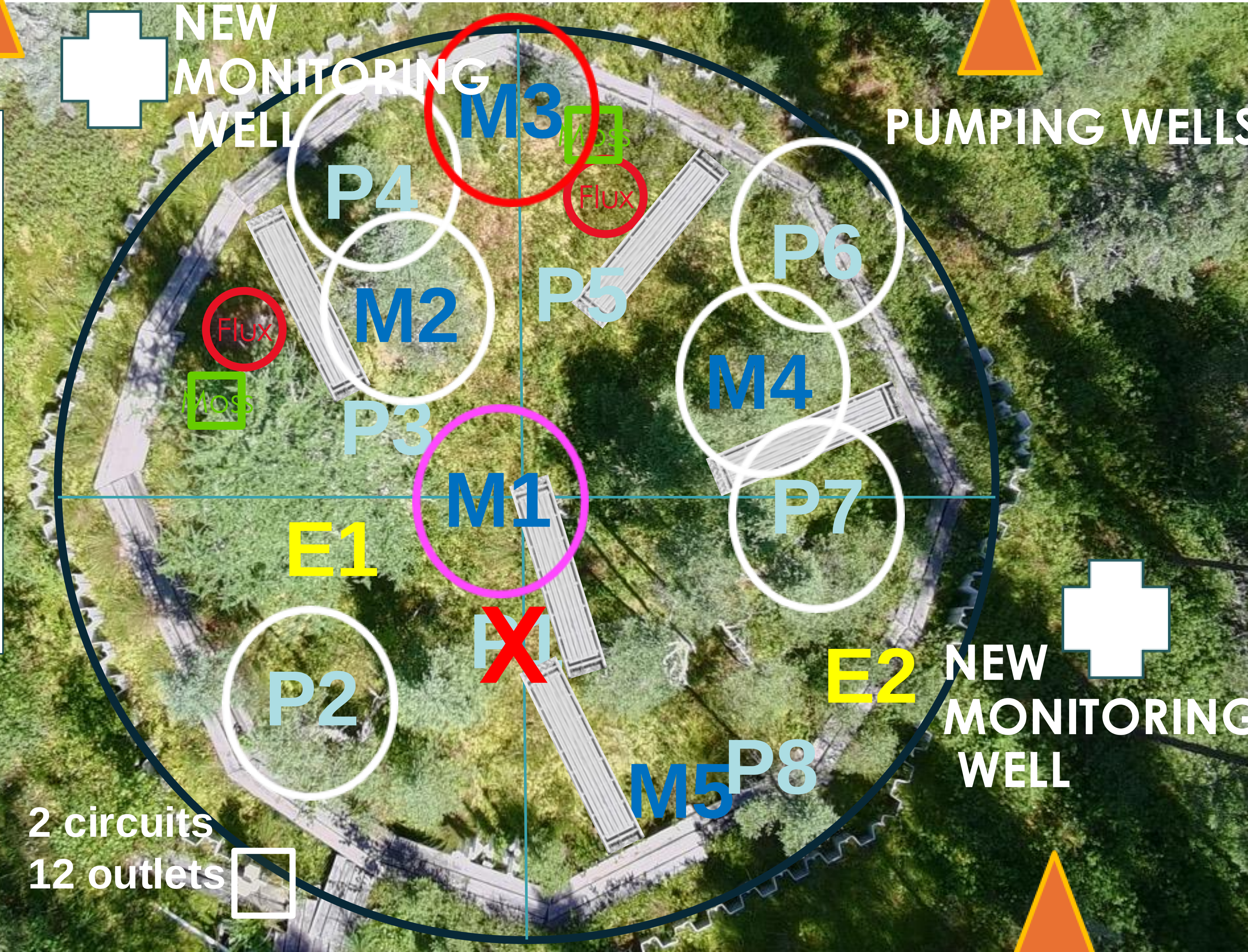
Sooo fast! pump well ?

	Monitor 4A	Monitor 4B	Monitor 4C	Monitor 4D		Monitor 5A	Monitor 5B	Monitor 5C
	0.388	0.111	0.117	0.388		0.065	0.089	0.048
	0.317	**0.110**	**0.116**	**0.307**		**0.058**	**0.083**	**0.047**
	average	0.213				average	0.063	

Summary findings

- We ordered sondes to instrument every well.
- A good mix of high and low Ksat wells – ie, pumping/monitoring
  - The one with very long recovery time P1 will probably not be useful.
- Install 2 more wells outside the corral to see if we are affecting groundwater beyond the corral. This is possible due to leakage and would be important to know

E = elevation post
M = monitoring well
P = pumping well
= Lidar target
Moss = Moss survey
Flux = GHG flux



SPRUCE – Sustained testing scheme

- Monitoring water levels inside the wells
- Continual pumping
- Pumps automatically switch on/off in response to well recovery
- Test function week of May 5 (Jeff R, Kenneth, Mel to travel)

Companion data

- Boise State U Lidar surveys – April (before) * August (after) (Josh)
- Elevation survey ahead of turn-on (Mark)
- GHG installations (Jon)
- Soil moisture sensors (2 hummock, 2 hollows) and Zentra ZL6 datalogger (install supports) to be installed
- Keith Olehauser piezometer measurements – clean up the wells and prepare to sample
- EM station nearby – water table level (& soil moisture?)

Companion data – Veg surveys (Jon + Dave + Modelers)

- Relative abundance community survey – do non-sphagnum mosses behave different from sphagnum?
  - Moss collars
  - Feather mosses input ?
- Tissue water content of sphagnum (need for moss PFT)
  - Drought related data to describe mortality…needed for modeling.
  - Tissue dehydration could also affect N fix'n and CH_4 ox'n also
  - Meeting w/ modelers and experimentalists for dev't of moss PFT ➔ Dave, Jon, Xiaoying, Dan
- N fixation? (decreases w/ warming, mic comm structure changes)
  - 8100 and 7810 domes ? Implement this year again and at test corral?
- CH_4 oxidation ?
  - (decreases w/ warming, but eCO_2 it is not as repressed as aCO_2)