LiDAR

Light **D**etection **A**nd **R**anging

collaboration with UMO and CFRU

Pilot Project to see how Single Photon LiDAR works for describing forest cover

SFMA, Holt, Howland, and PEF

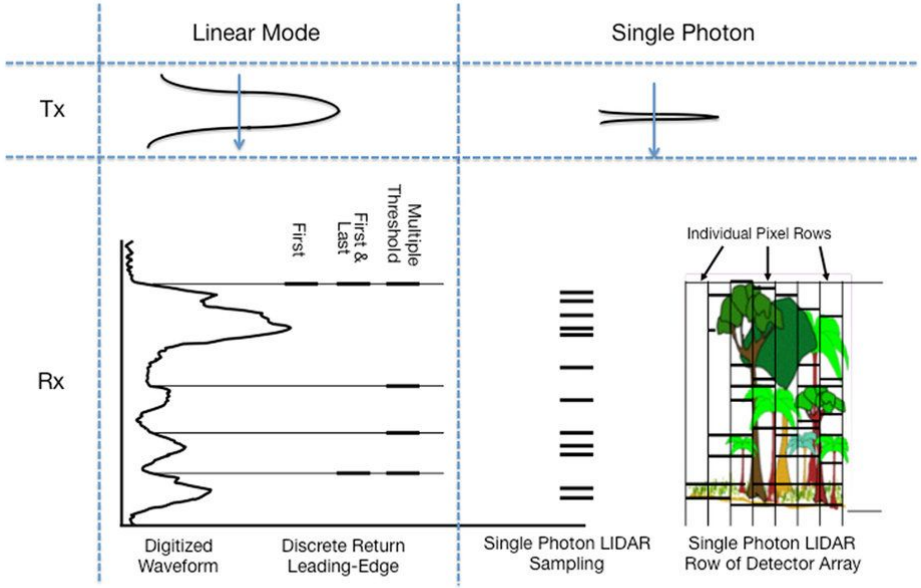
single photon vs discrete return

lidar pulse split into 10x10 array and all returned data captured

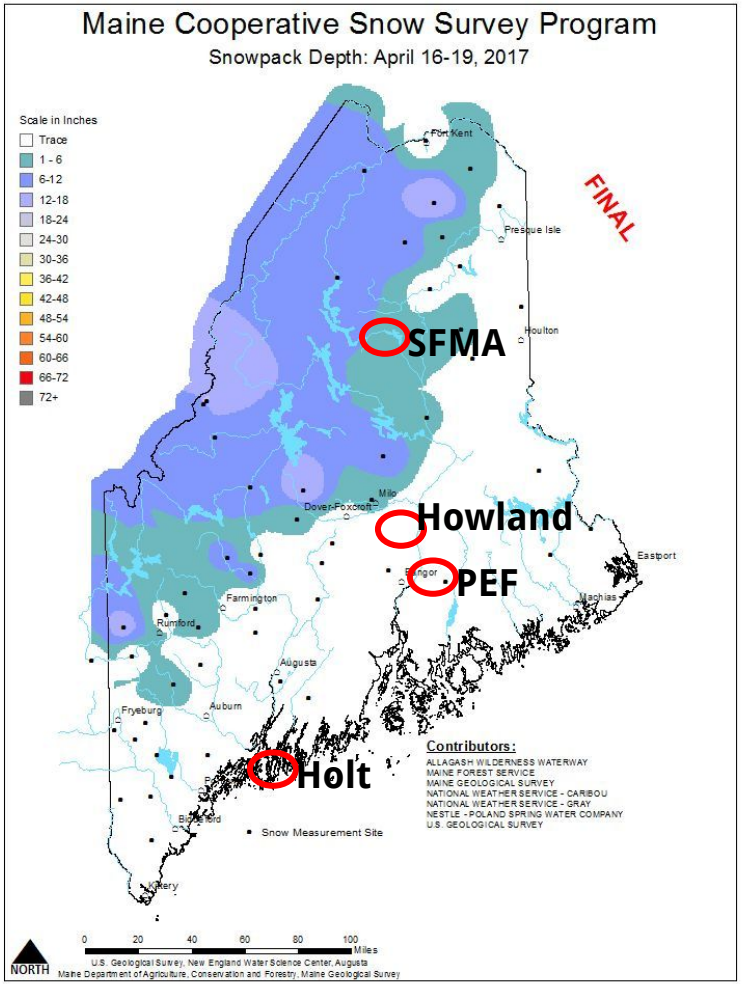
- one photon needed for single measurement, as opposed to hundreds or thousands
- fly higher and faster and achieve same or better point density
- ability to use for bathymetric data

Figure 1: Schematic diagram showing SPL and other lidar systems.

From: Rapid, High-Resolution Forest Structure and Terrain Mapping over Large Areas using Single Photon Lidar



Tx is the transmitted laser pulse and Rx is the returned energy. The SPL laser pulse has a shorter pulse width than other systems. The detector consists of a 10 × 10 array that records several returns per pulse.

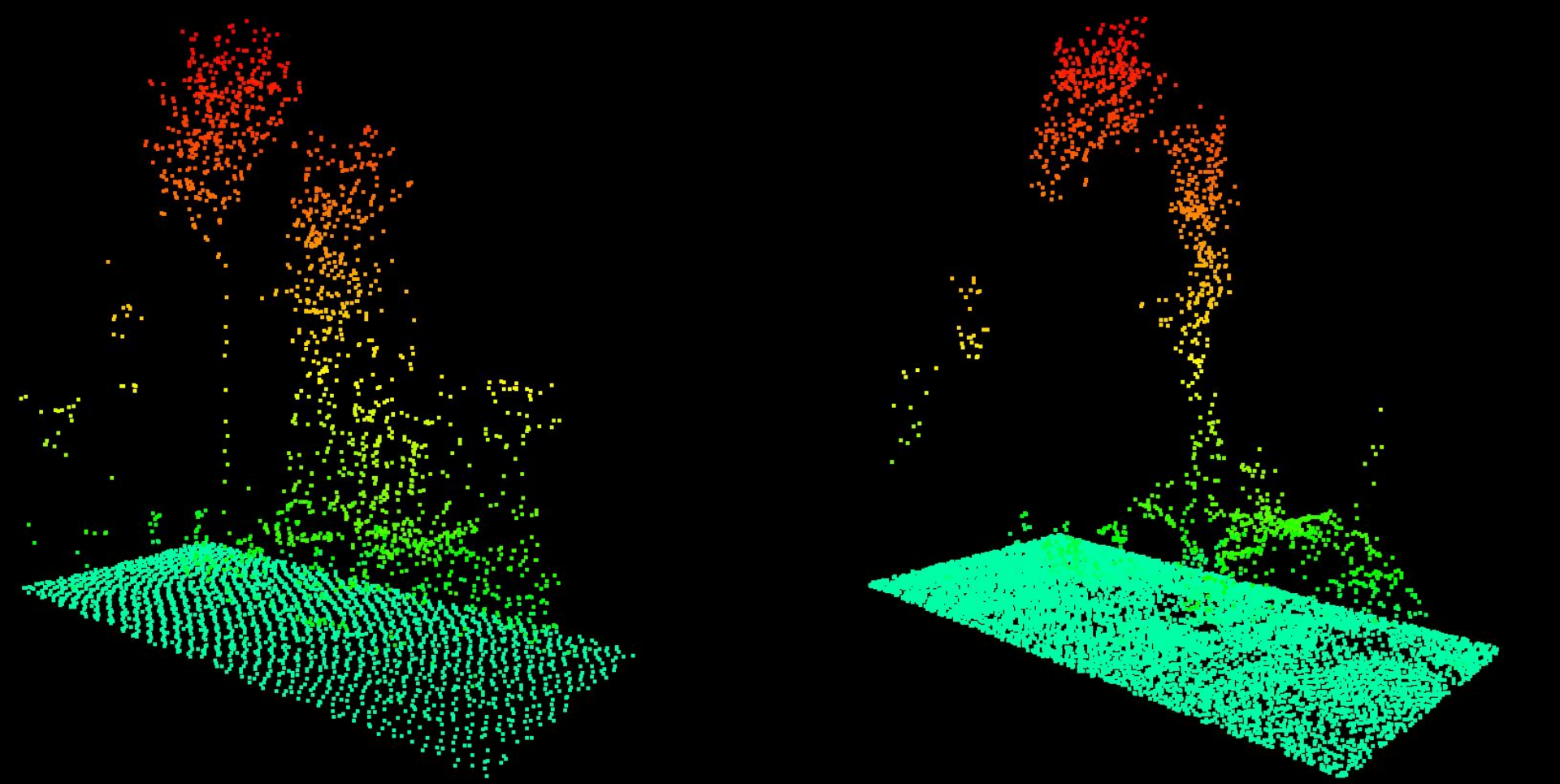


April 2016

snow cover remained in SFMA whilst Holt buds broke

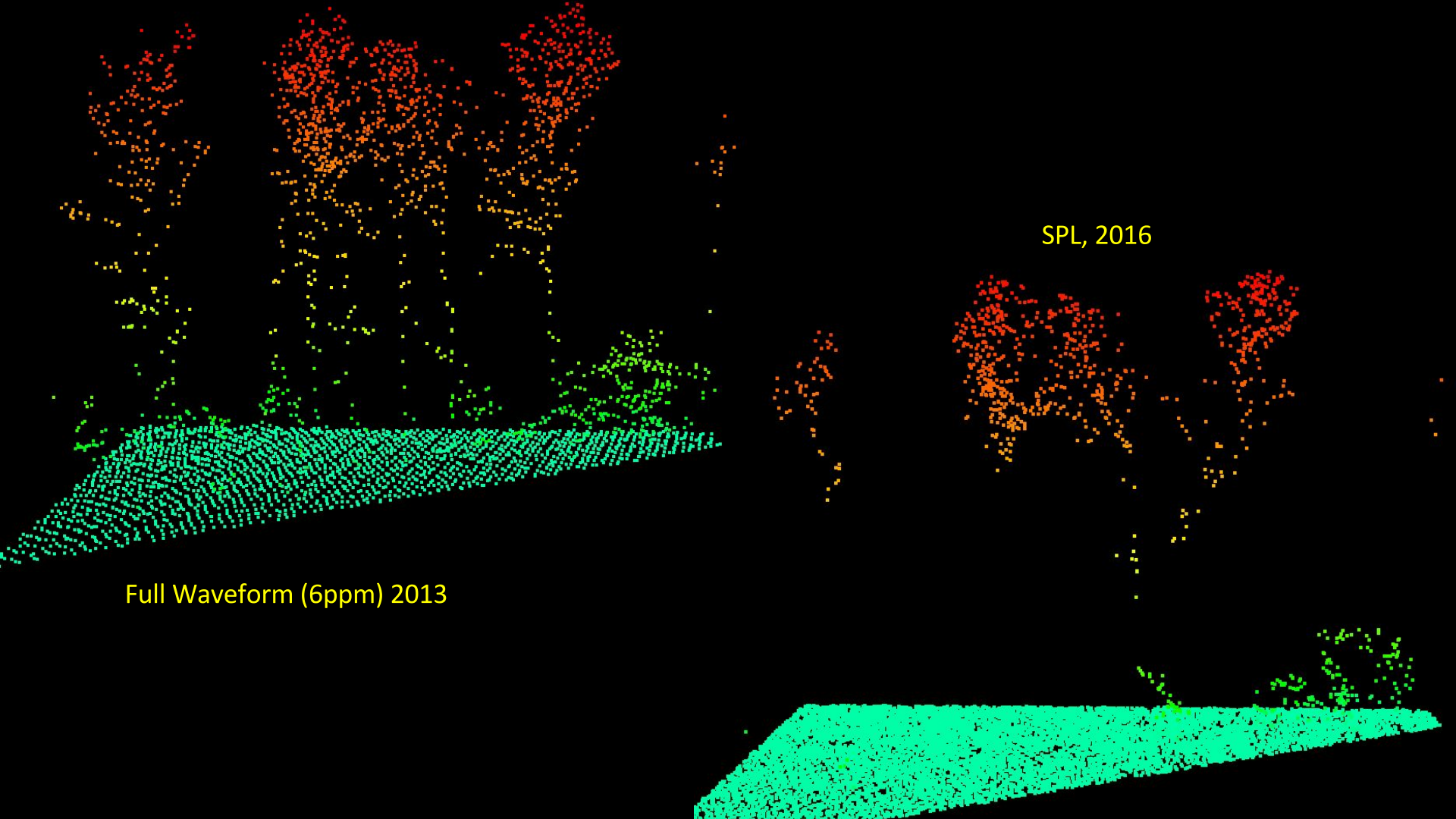
agreed to fly SPL if we could get a separate DEM
(snow does unknown bad things to LiDAR)

Quantum flew discrete return LiDAR @ 4ppsm
this also provided an interesting comparison



Full Waveform (6ppm) 2013

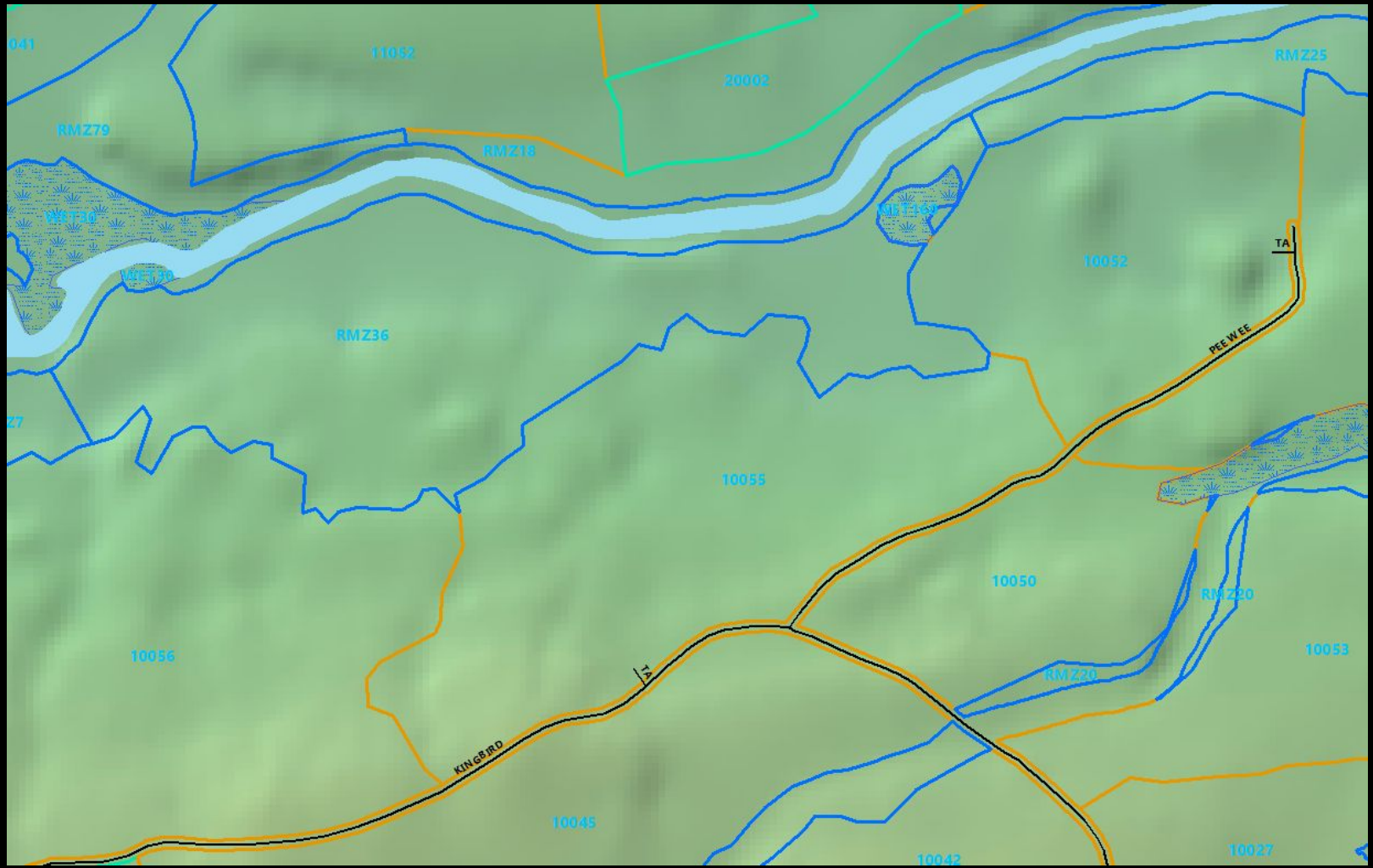
SPL, 2016


SPL, 2016
Full Waveform (6ppm) 2013

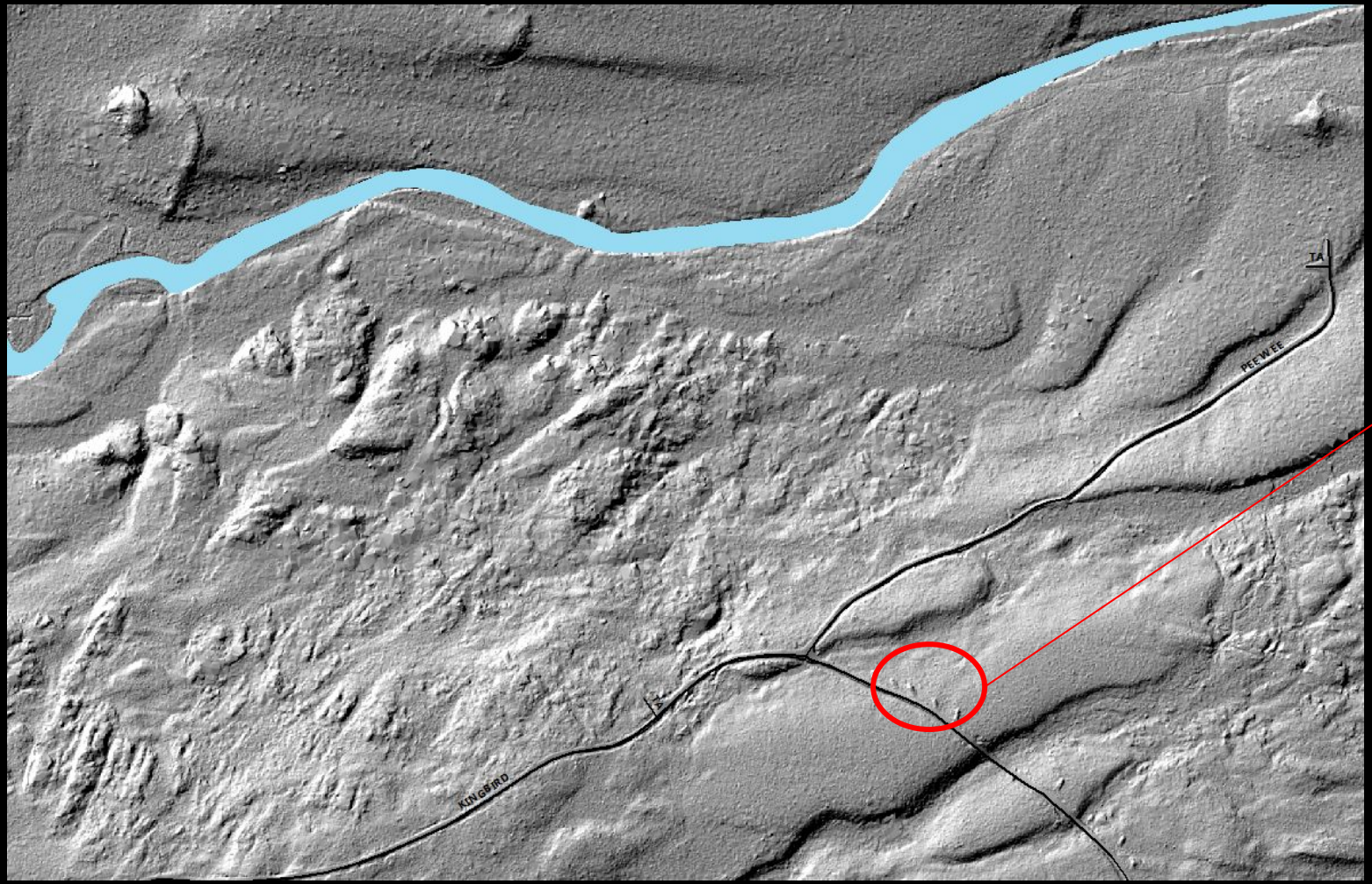
what happened?

(radio silence)

what did we get?

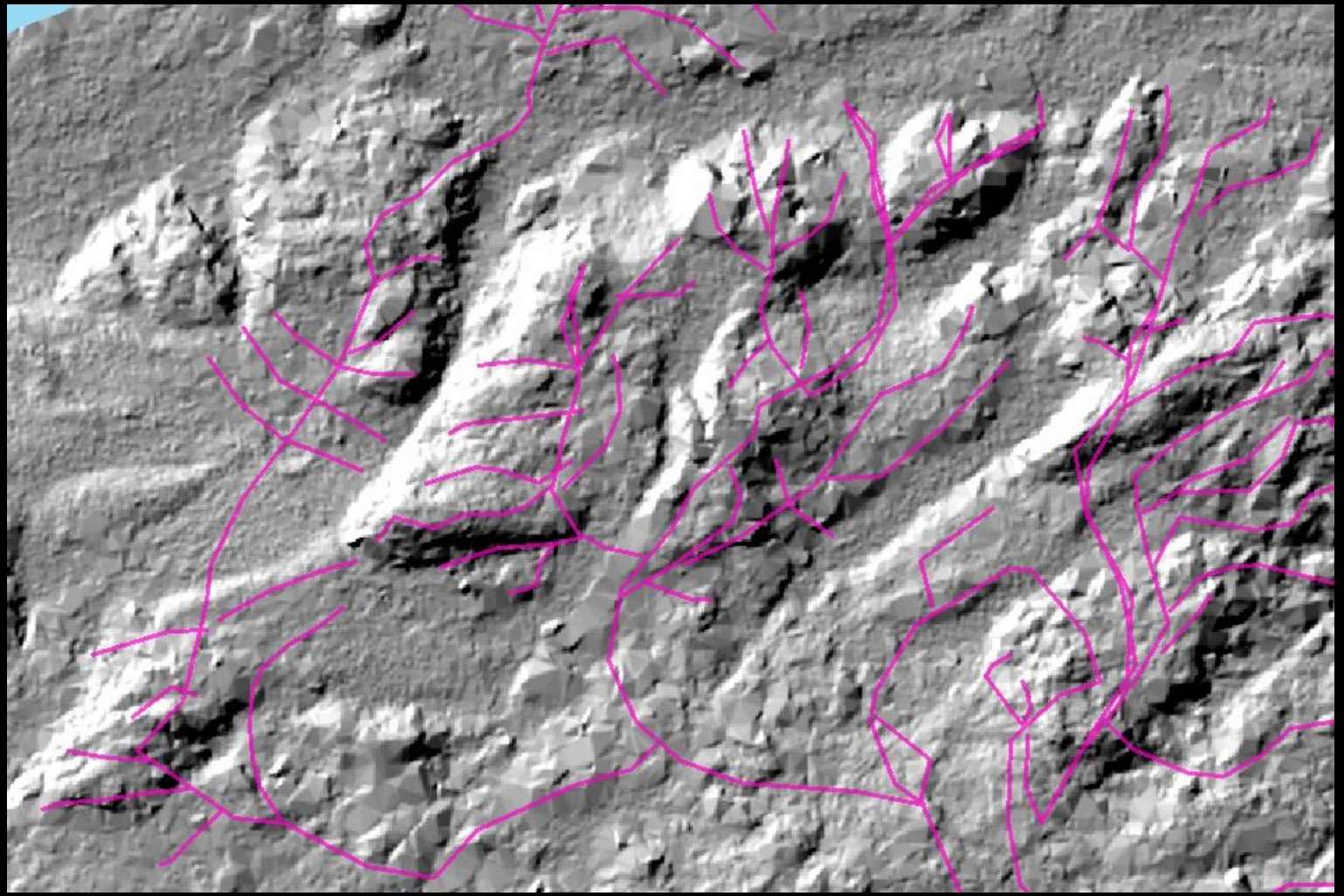

041
11052
20002
RMZ25
RMZ79
RMZ18
ME130
ME130
ME160
10052
TA
RMZ36
PEEWEE
Z7
10055
10050
RMZ20
10056
TA
RMZ20
10053
KINGBIRD
10045
10042
10027

what we had

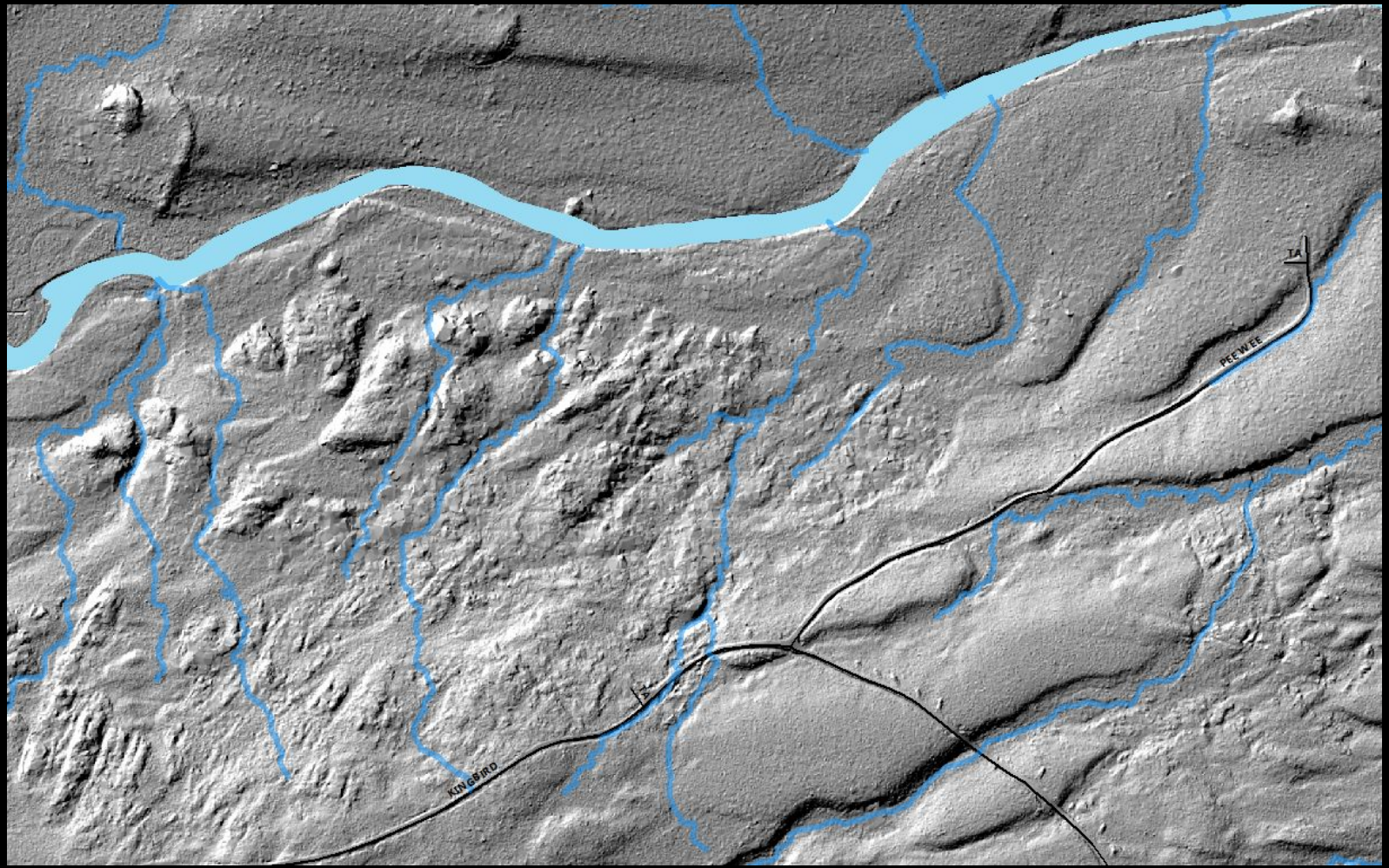


Digital Elevation Model 30m->1m

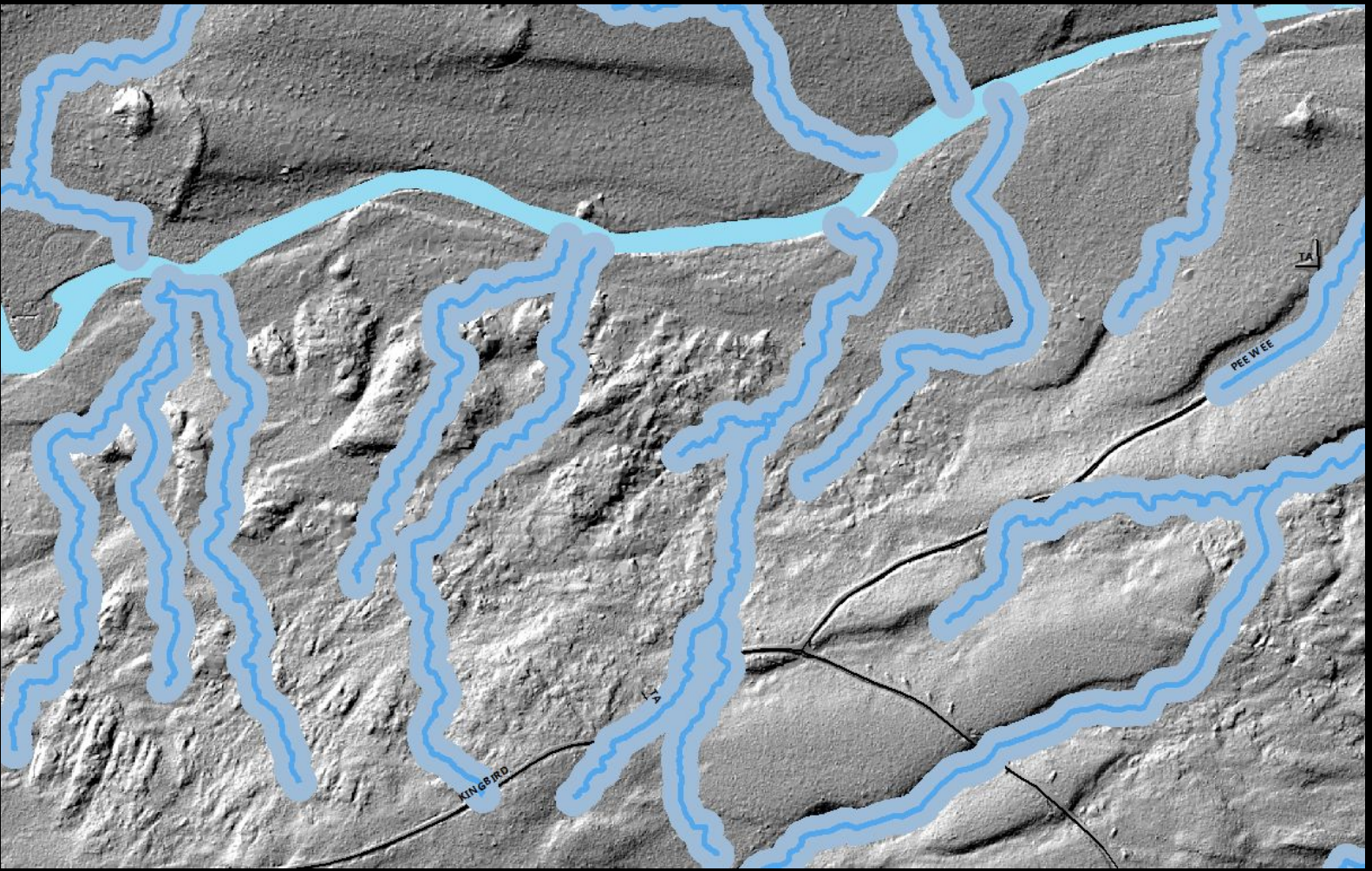
stump dumps



Digital
Elevation
Model
30m->1m



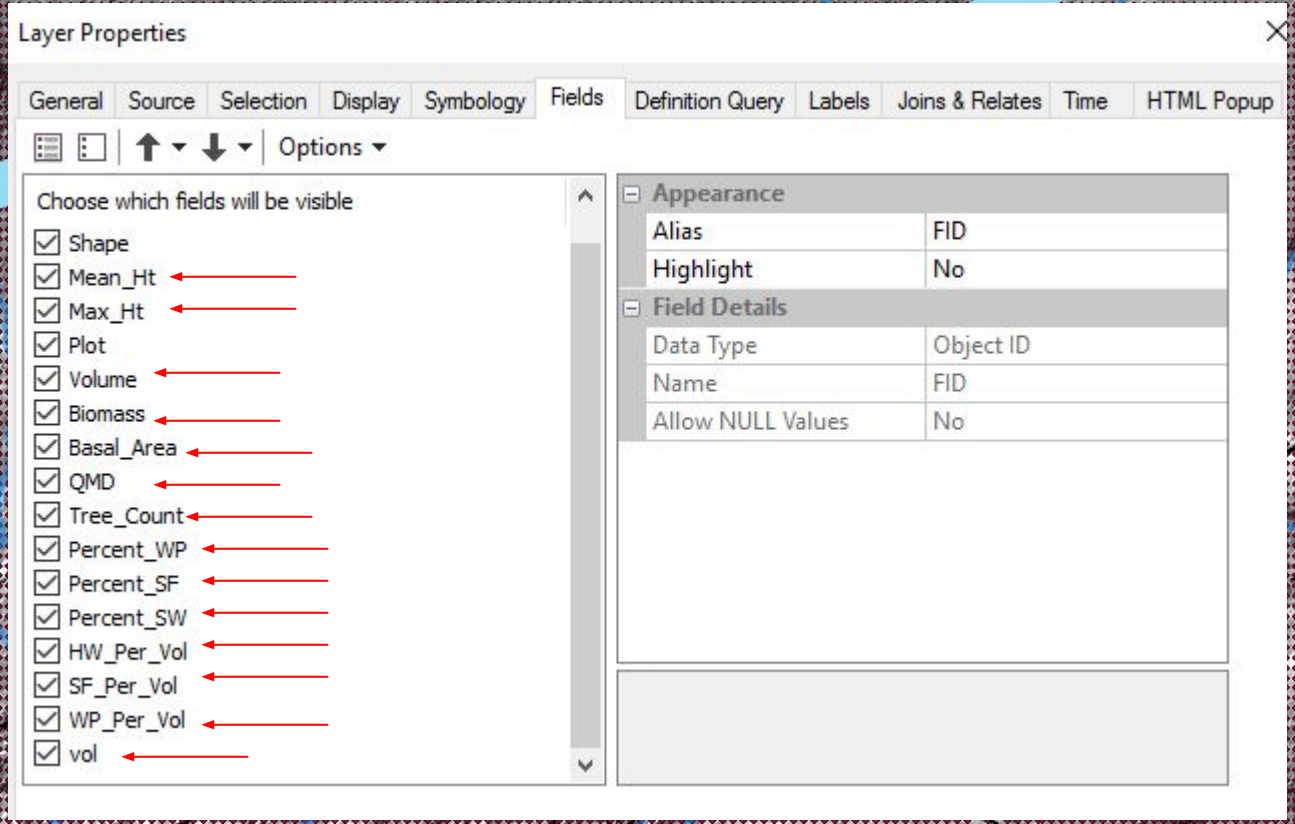
stream (over) detection

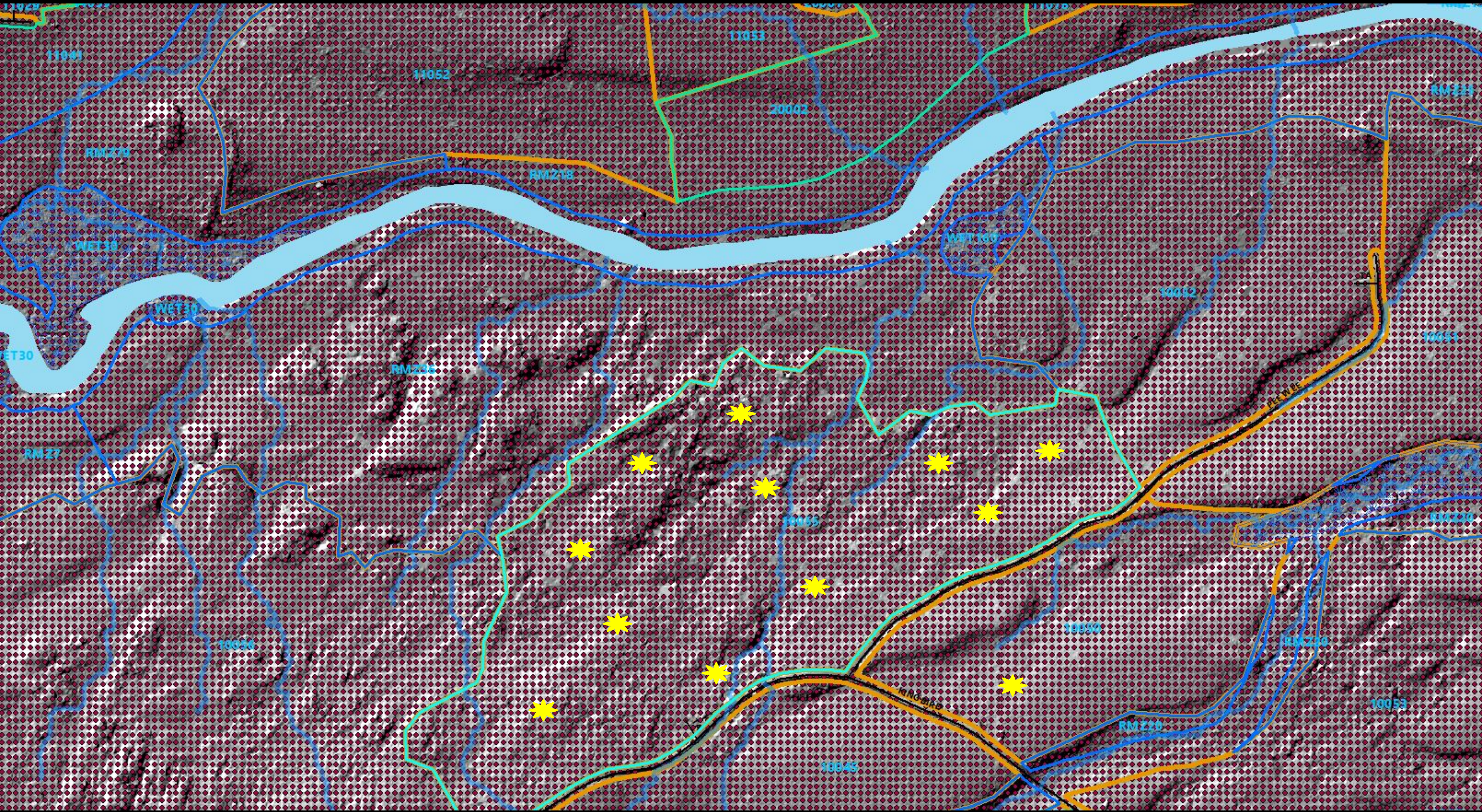


stream (over) detection

-enables stream buffer specificity in our riparian guidelines

Enhanced Forest Inventory





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RMZ79
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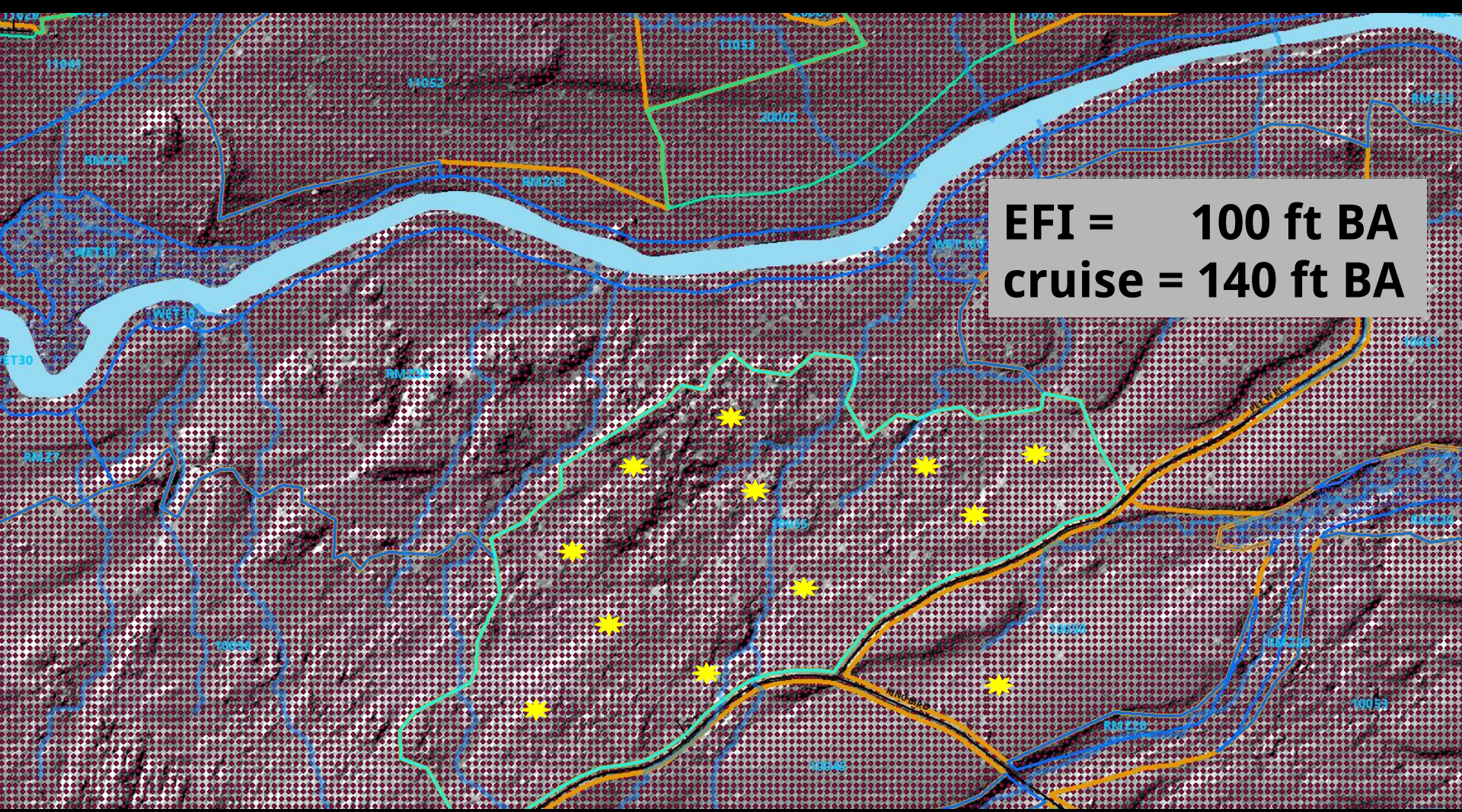
WET30
WET30
RMZ36
WET160
10092
10051
RMZ7
10056
10055
PEE WEE
KING BIRD
10050
RMZ20
RMZ20
RMZ20
10053
10045


EFI = 100 ft BA
cruise = 140 ft BA

a few different modeling attempts….

UMO

Model	R^2
Volume (m^3)	.64
Height (m)	.69
Biomass (kg)	.64
Basal Area (m^2)	.61
QMD (cm)	.54
Tree Count	.43
Percent Softwood (%)	.66
Percent Spruce/Fir (%)	.53
Percent White Pine (%)	.43
Hardwood Volume (m^3)	.65
Spruce/Fir Volume (m^3)	.66
White Pine Volume (m^3)	.39

Sewall

almost all below .33

tabled for now….

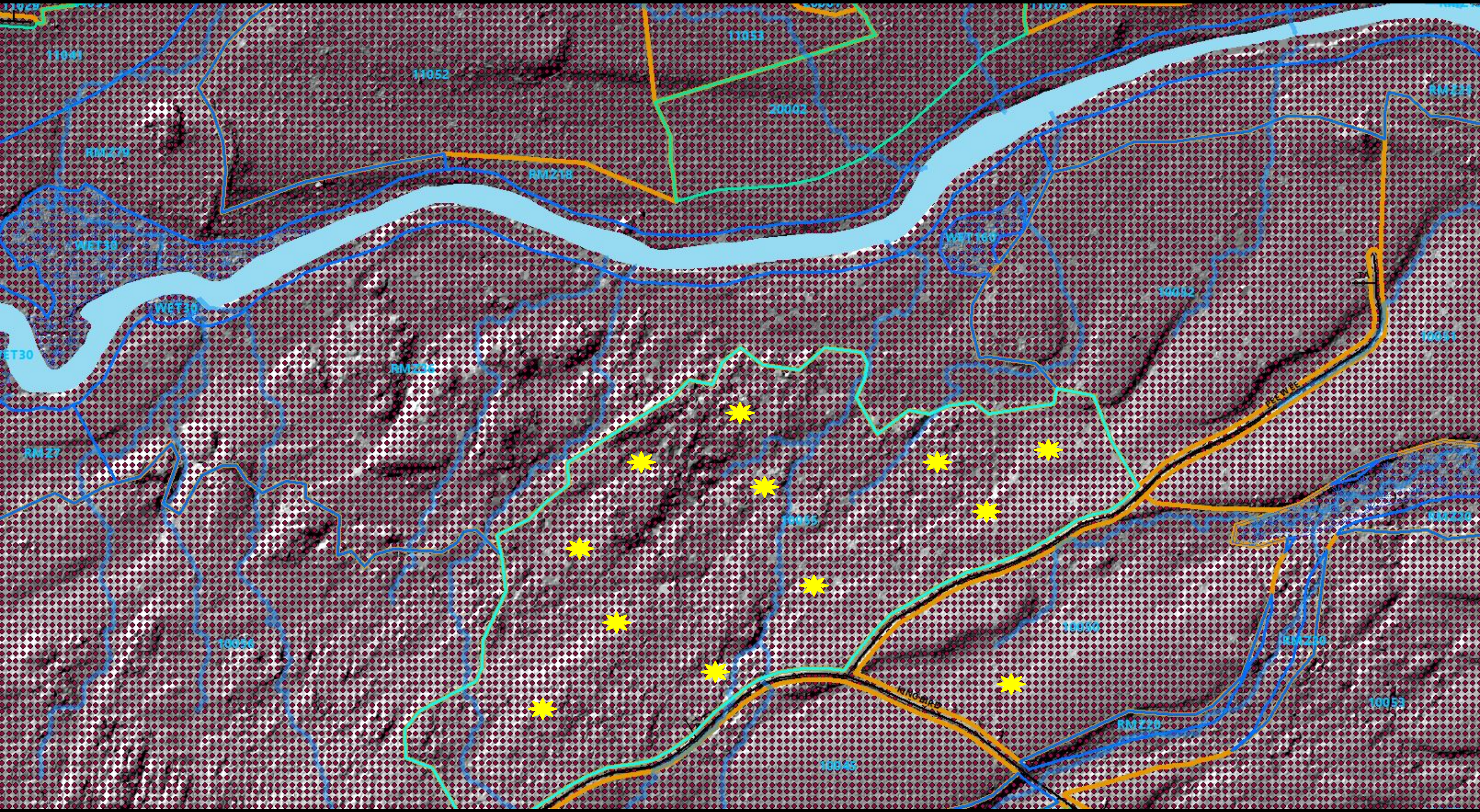
eventually

density

volume

regeneration height

wildlife structural charateristics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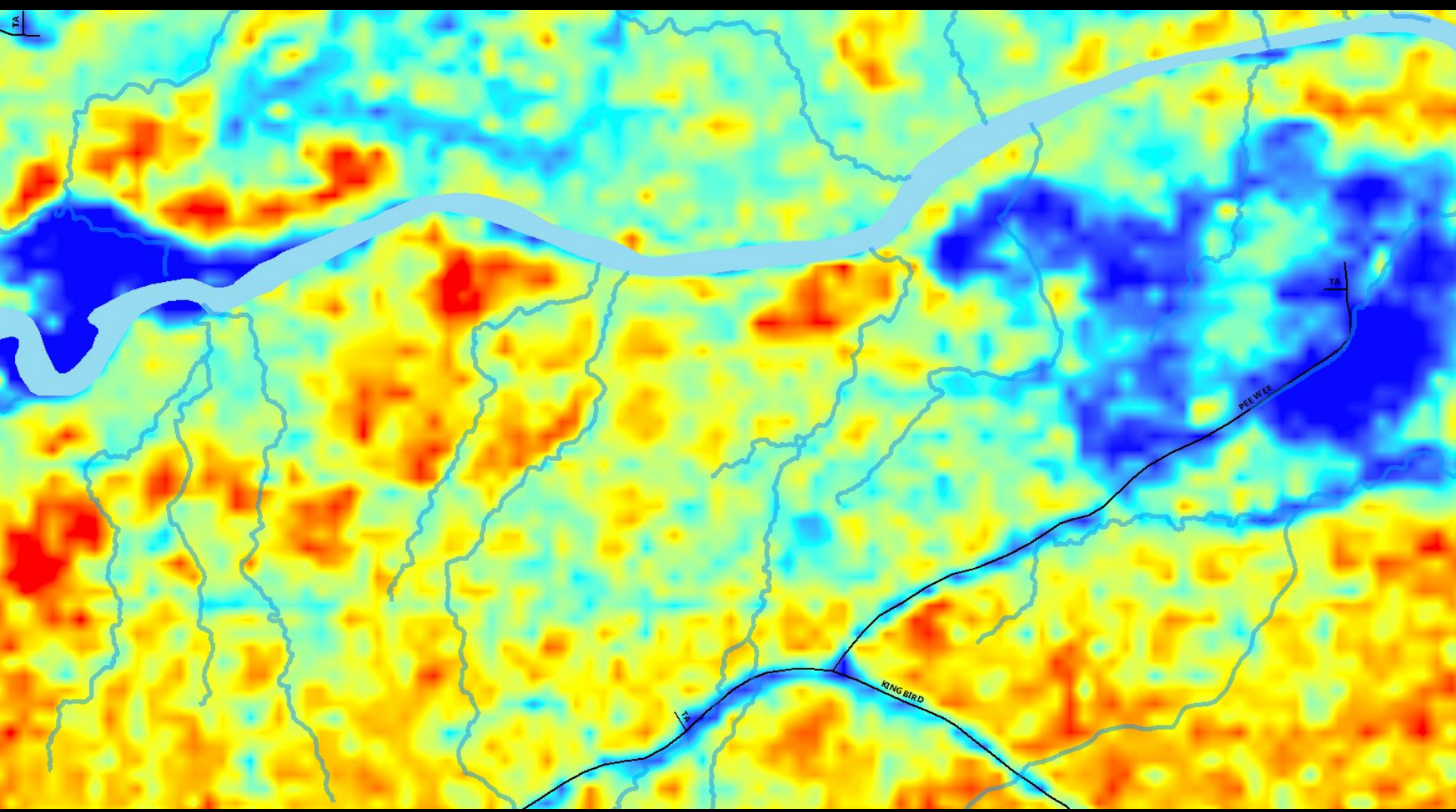
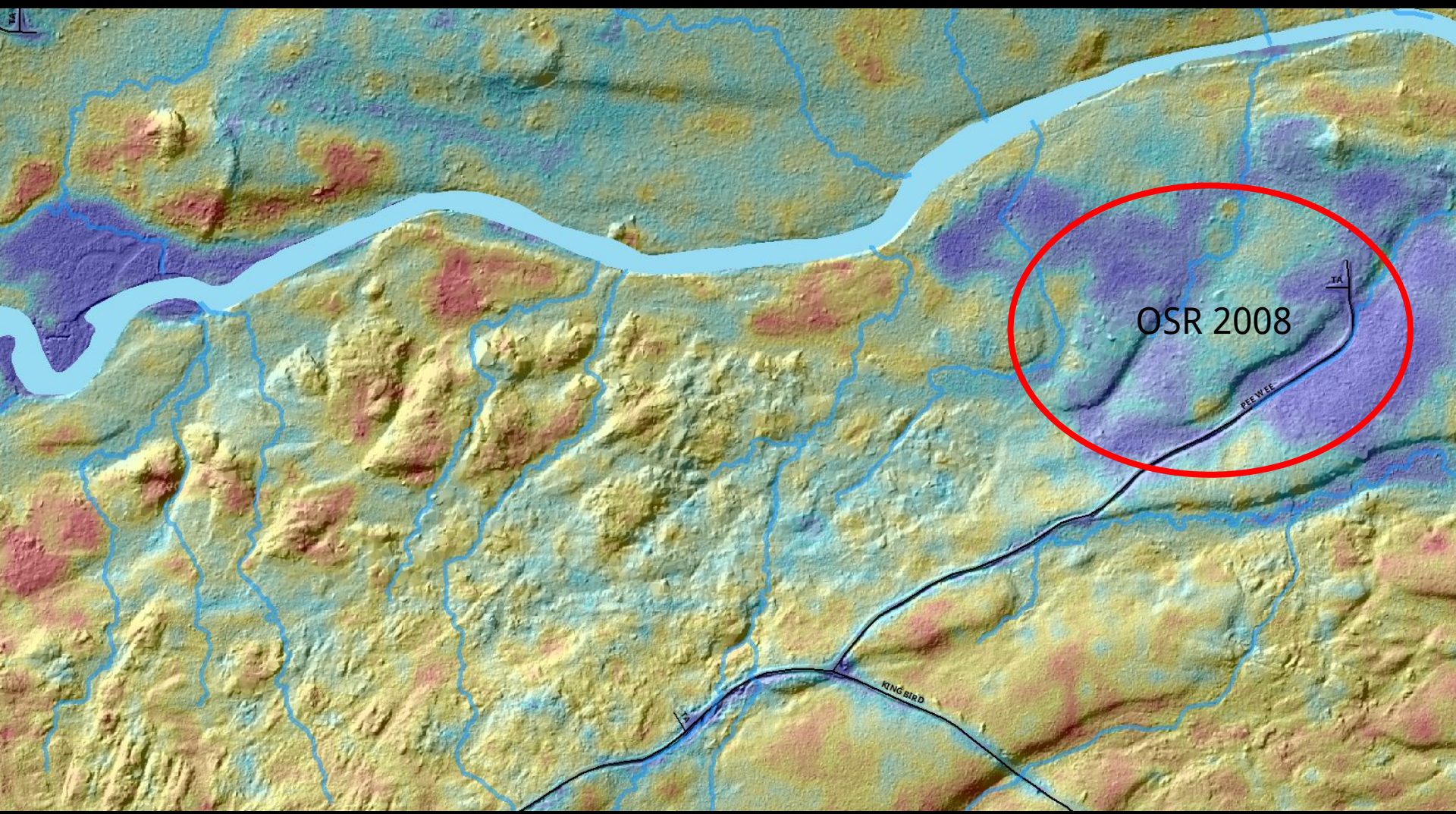
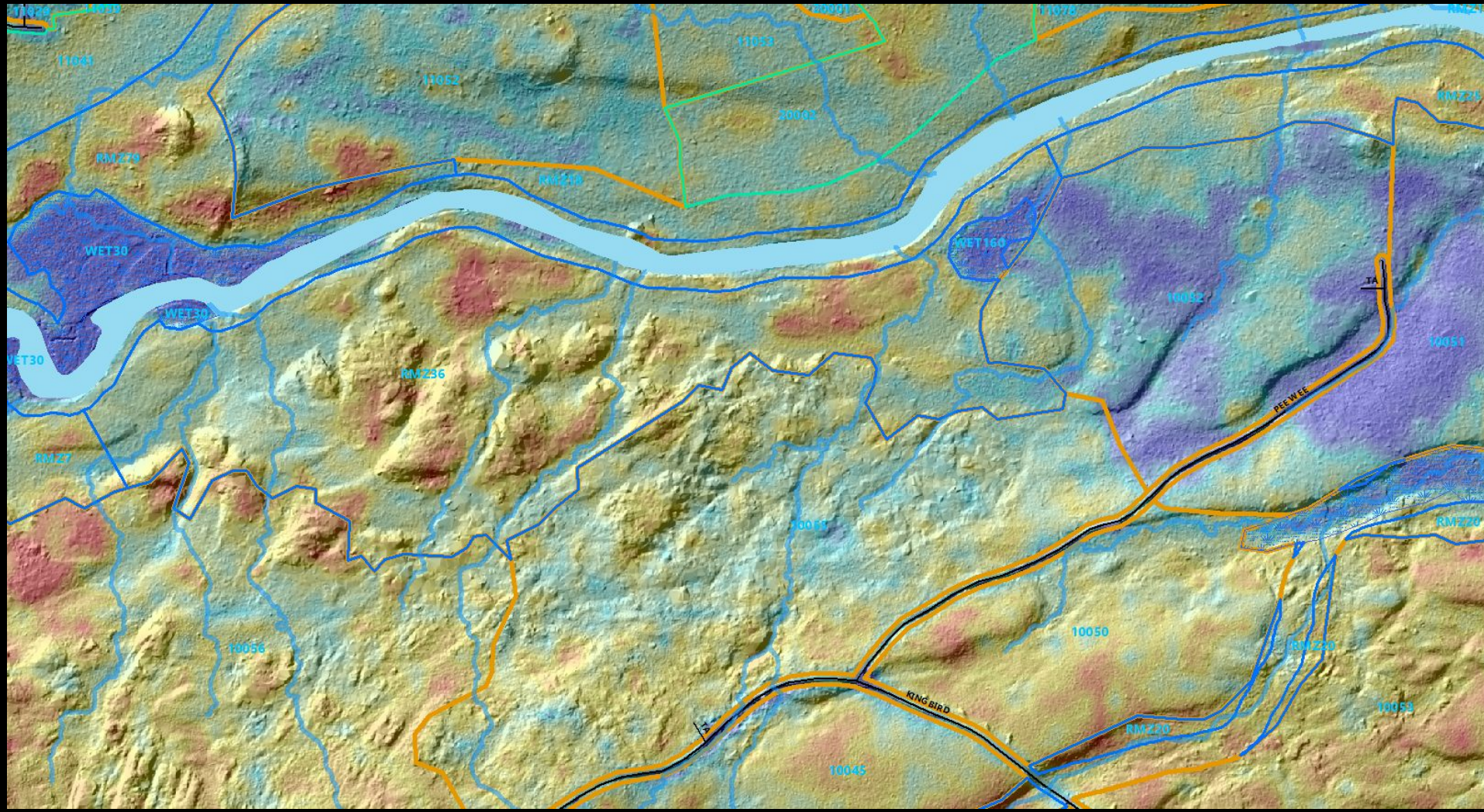
KING BIRD
RMZ20
RMZ20
10053
10045


TA
TA
PEEWEE
TA
KING BIRD


OSR 2008
TA
PEEWEE
KING BIRD
TA


11041
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RMZ30
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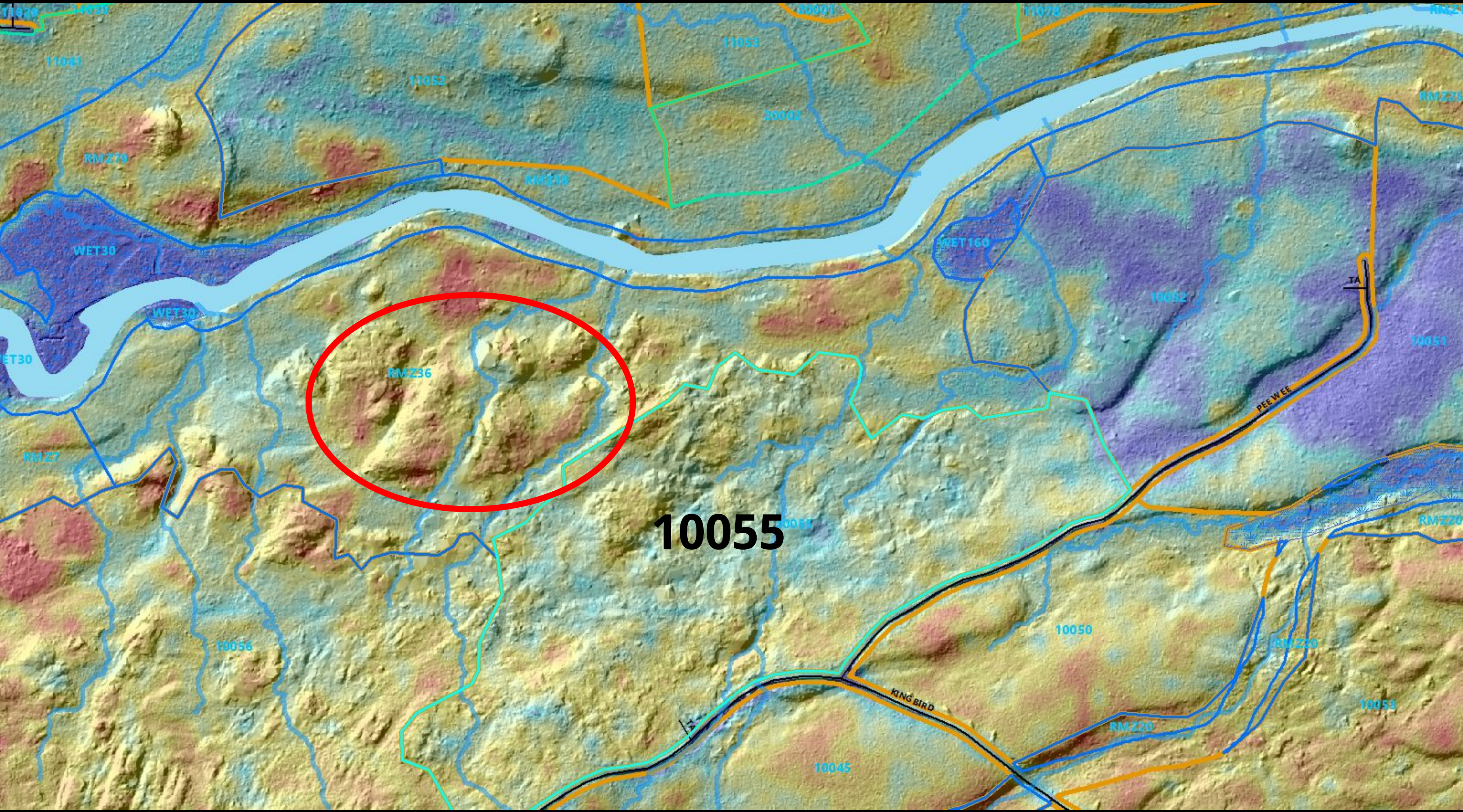

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11078
RMZ70
RMZ18
WET30
WET160
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RMZ36
RMZ7
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PEE WEE
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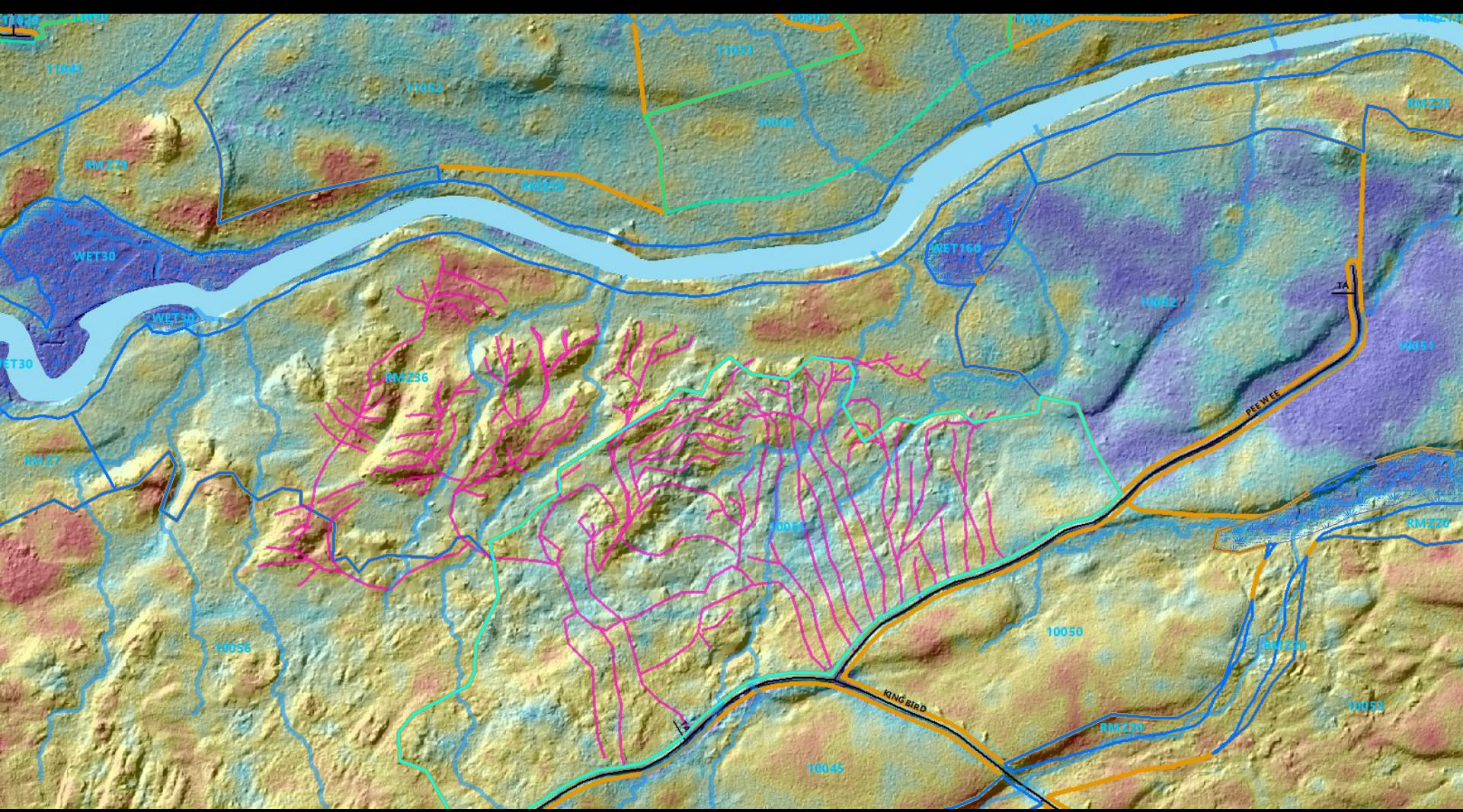
RMZ20
KING BIRD
10053
10045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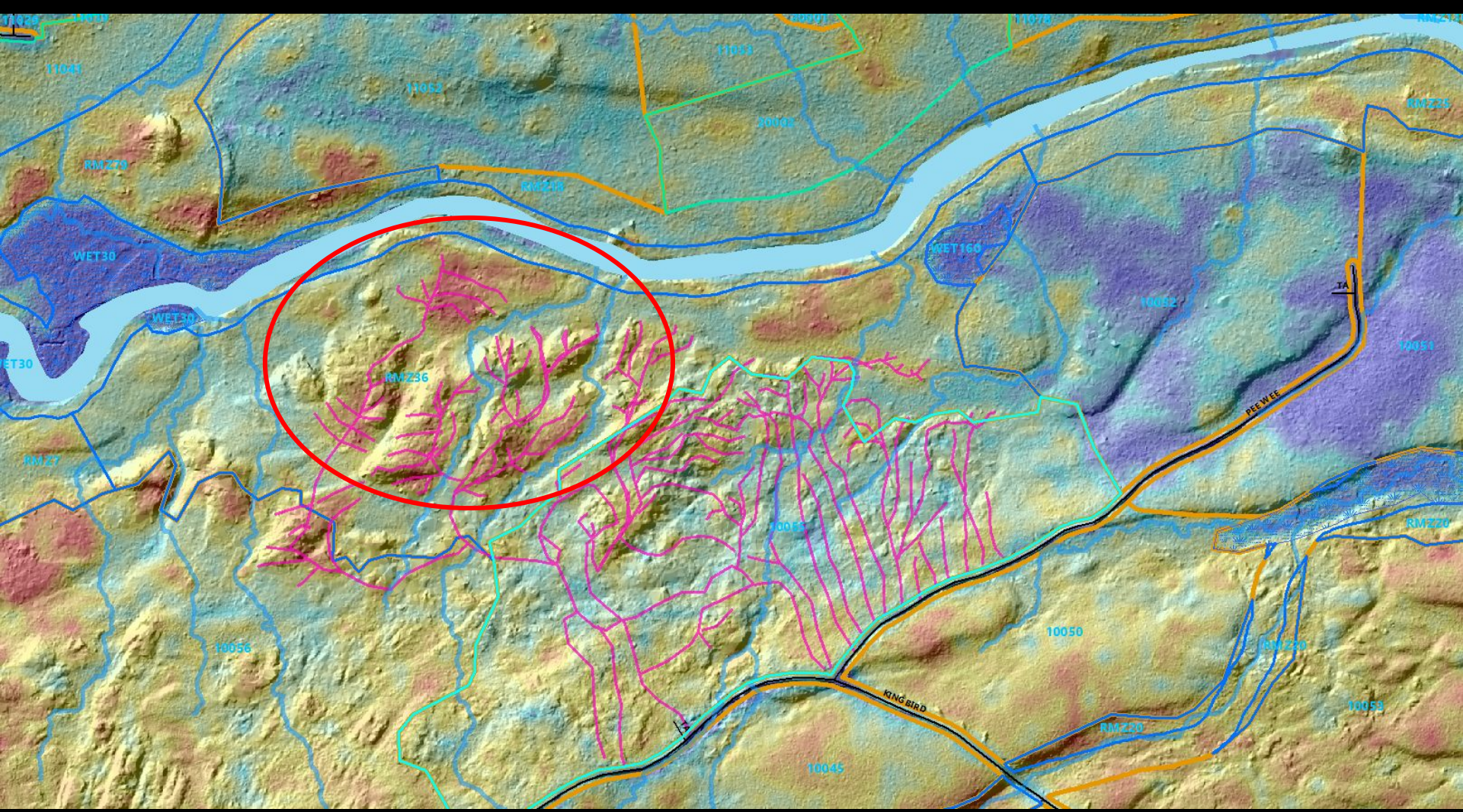
RMZ18
WET30
WET30
WET30
WET160
RMZ25
10052
10051
RMZ36
RMZ7
PEEWEE
10055
RMZ20
10050
10056
RMZ20
KINGBIRD
10053
RMZ20
10045

used this to find volume handy to the stand we were in.


11041
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RMZ29
RMZ18
WET30
WET160
RMZ25
10052
10051
RMZ36
PEE WEE
RMZ7
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RMZ20
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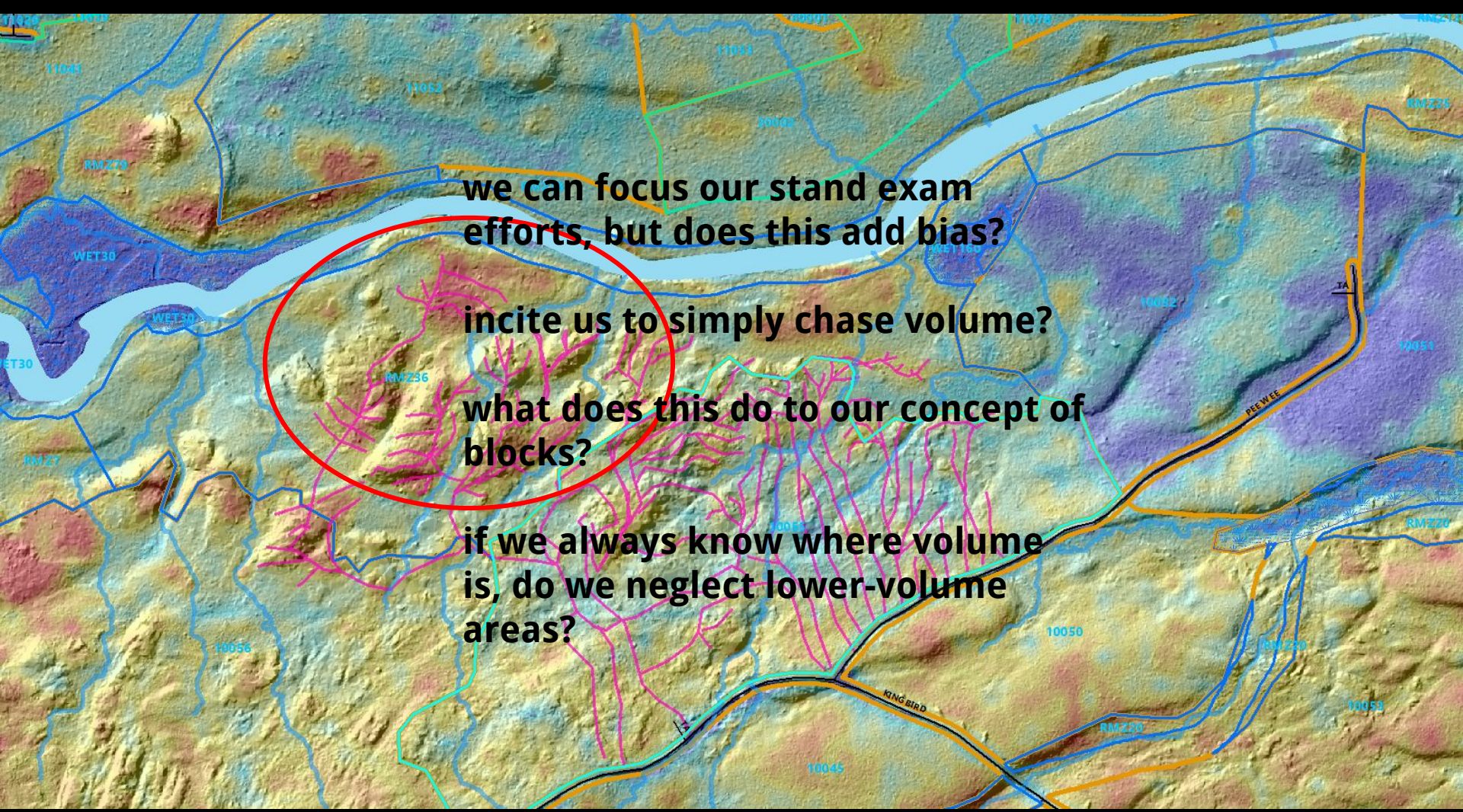
10056
KINGBIRD
10053
RMZ20
10045

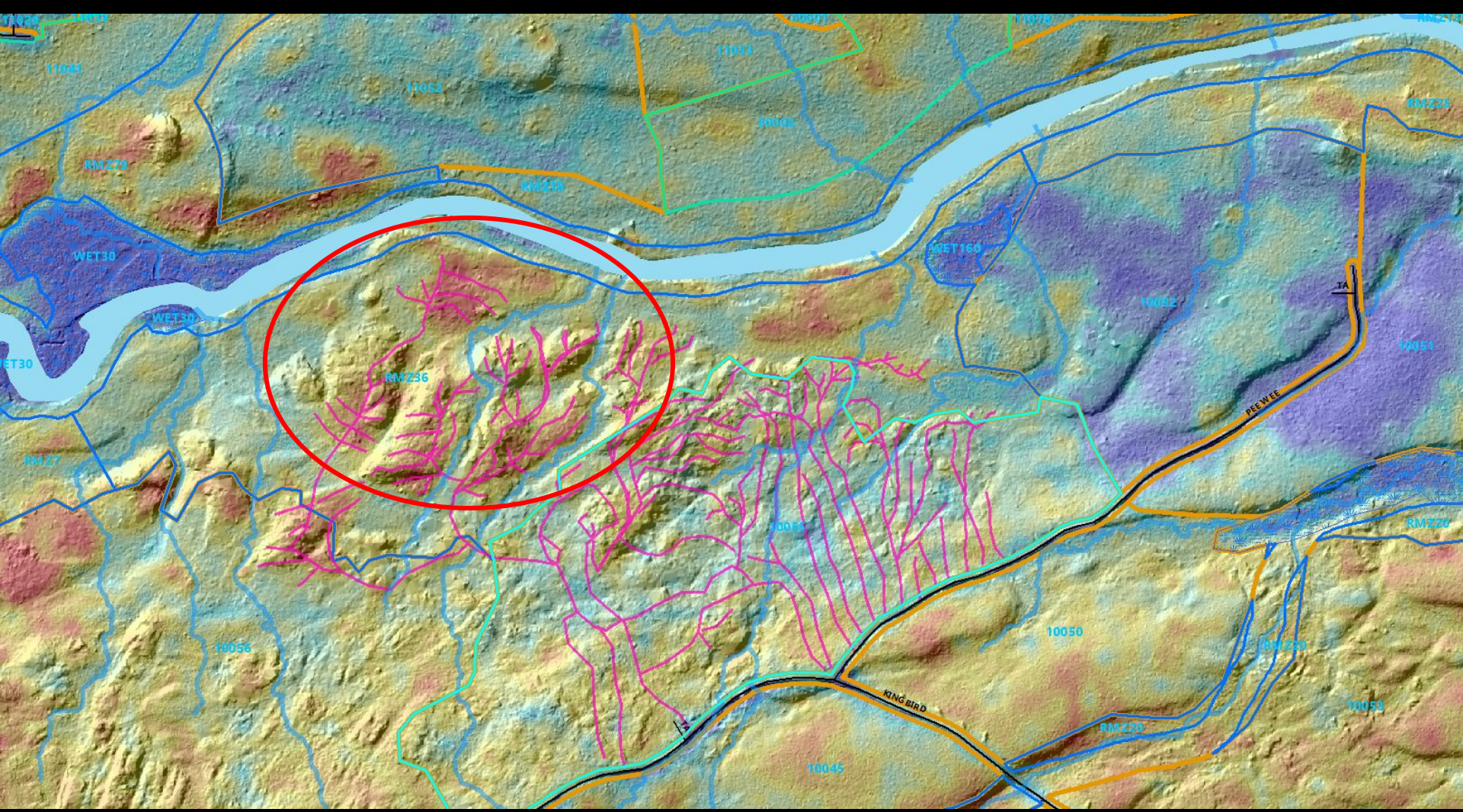
using this to identify areas of a stand to examine pre-harvest.

when particular chunks determined to be uniform
in composition, regen, and structure,
we have used this to reduce layout time by putting a trail into a microstand, and allowing the operator to create trail structure within microstand (with limits).

what are the unintended
consequences of using these
images to focus our

stand exams
harvest queue selection
layout
?


we can focus our stand exam efforts, but does this add bias?
incite us to simply chase volume?
what does this do to our concept of blocks?
if we always know where volume is, do we neglect lower-volume areas?
RMZ36
WET30
PEEWEE
KINGBIRD
10050
10045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RMZ20
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10056
KINGBIRD
10053
RMZ20
10045