Evaluating Floodplain Hydrologic Connectivity on the Yakima River

Cris Morton and Anthony Gabriel

Cultural and Environmental Resource Management, CWU

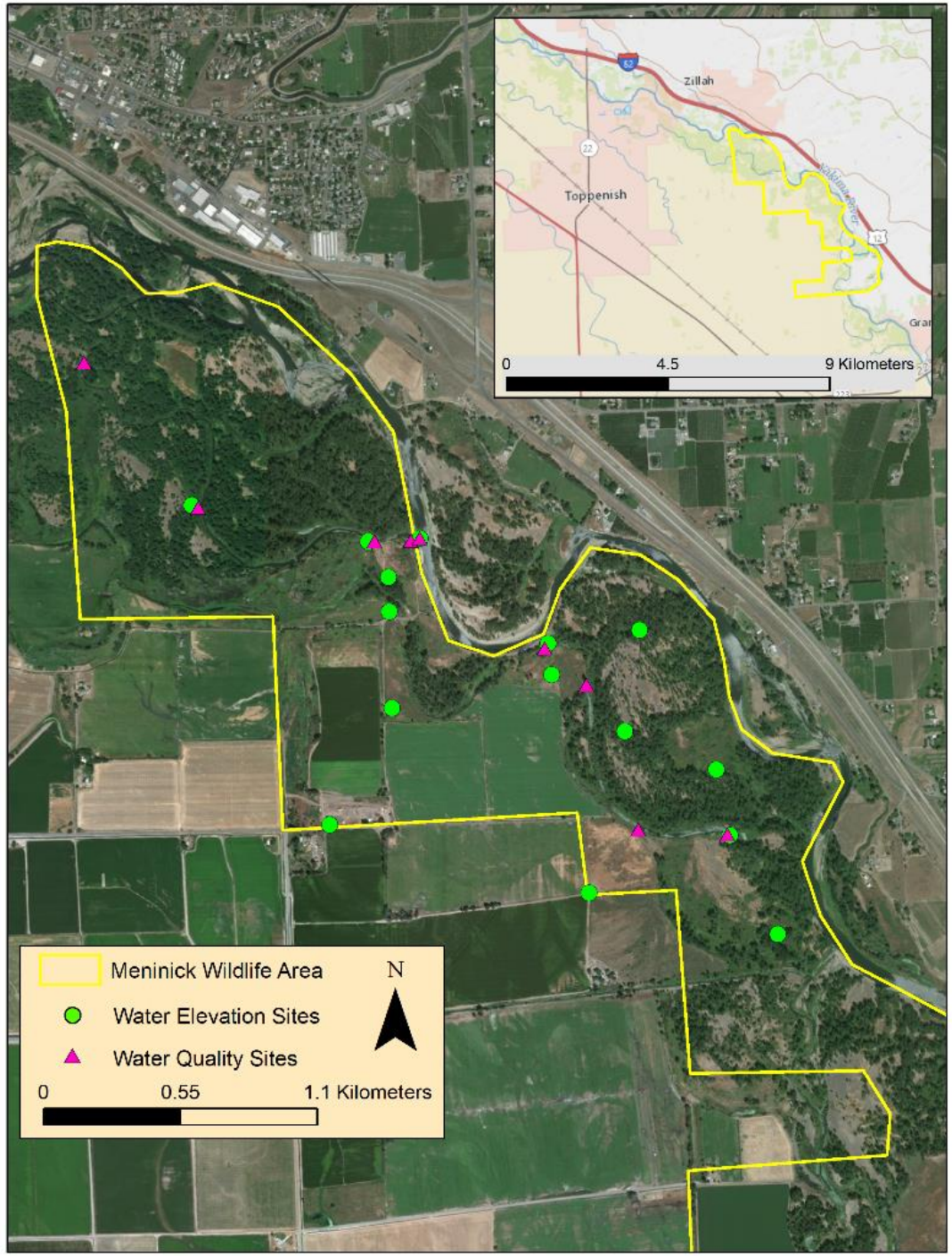
Research Goals

- Describe changes in groundwater (GW) movement through the floodplain
- Determine if and how surface water (SW) and GW movement influence each other's water quality parameters and water levels
- Determine how SW and GW contribute to water storage in the floodplain

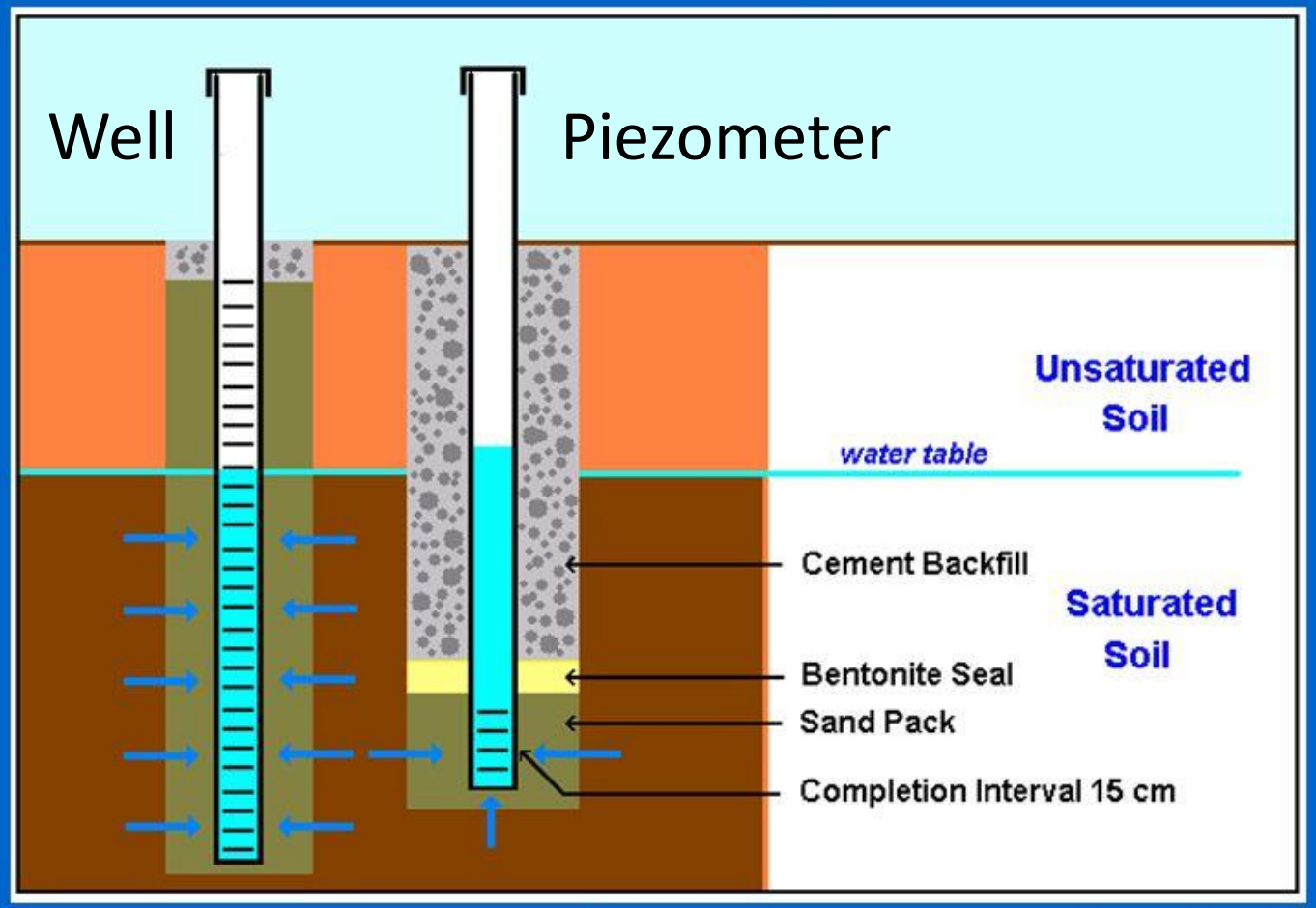
Research Objectives

- Collect side-channel water quality (dissolved oxygen, conductivity, pH, turbidity, and temperature) and flow (m3/second) data to determine differences between sites and seasons.
- Gather groundwater depth and side-channel water level data from groundwater monitoring wells and side-channel stage recorders.
- Use statistical analyses to investigate changes in water quality measures and water levels inside groundwater monitoring wells before check-dam installation and levee breach to determine changes in and relationships between surface and subsurface flow.

Study Area


Zillah
Toppenish
0
4.5
9 Kilometers
Meninick Wildlife Area
Water Elevation Sites
Water Quality Sites
N
0
0.55
1.1 Kilometers

Wells vs Piezometers



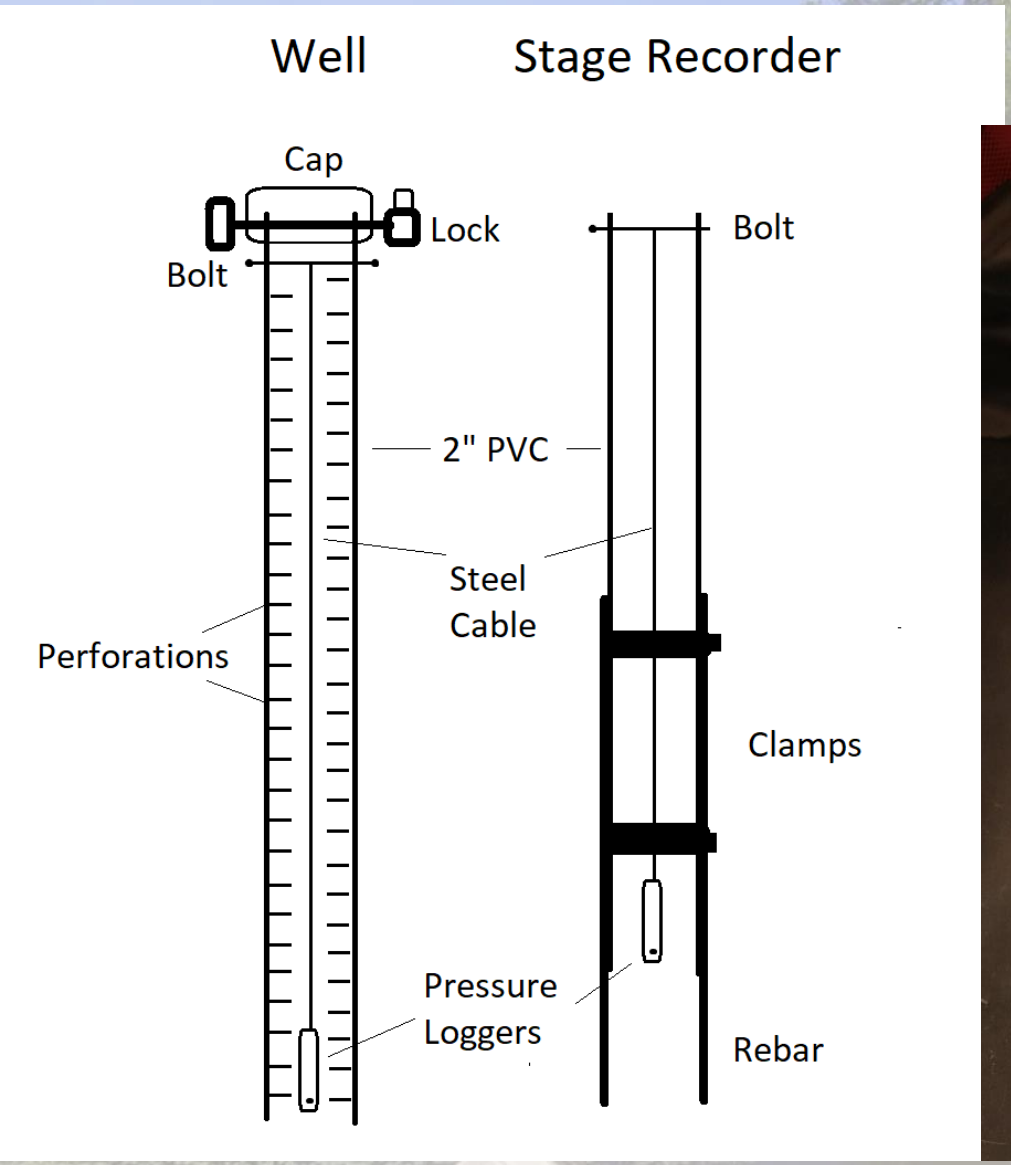
http://slideplayer.com/slide/6112633/18/images/6/Water+table+well+vs.+piezometer.jpg

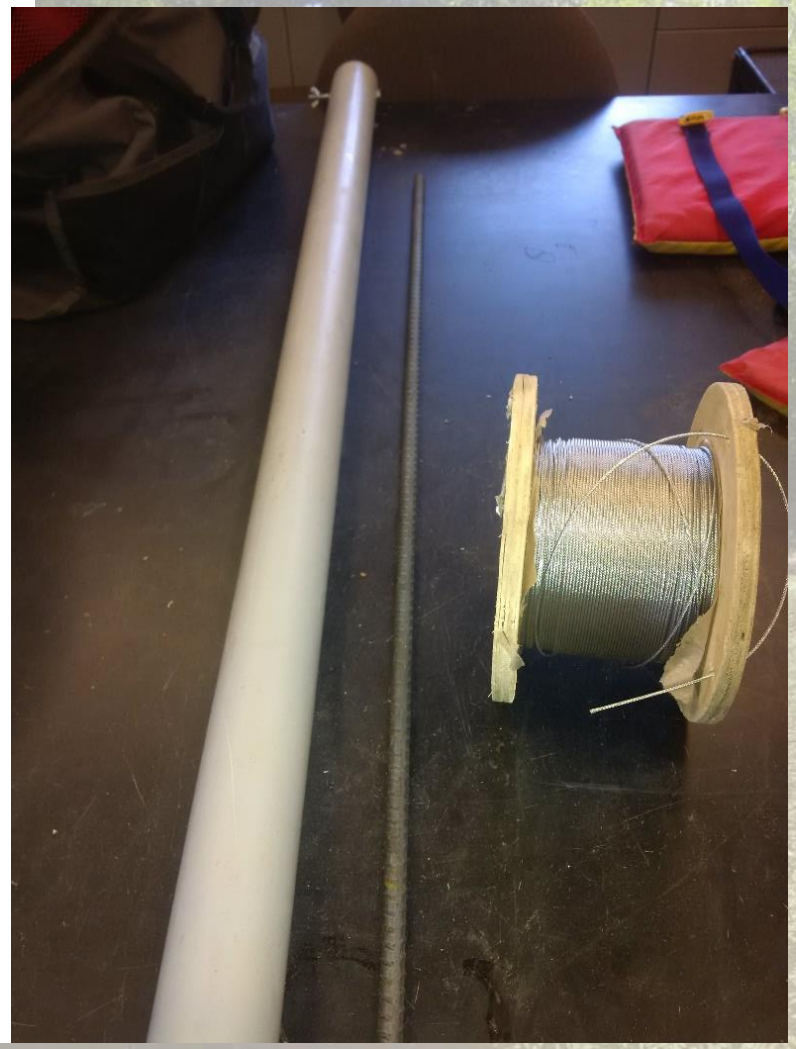
-Depends on research question
- Vertical or horizontal flow?

-Piezometers look at fluid pressure

-Wells look at water table elevation

Well Construction



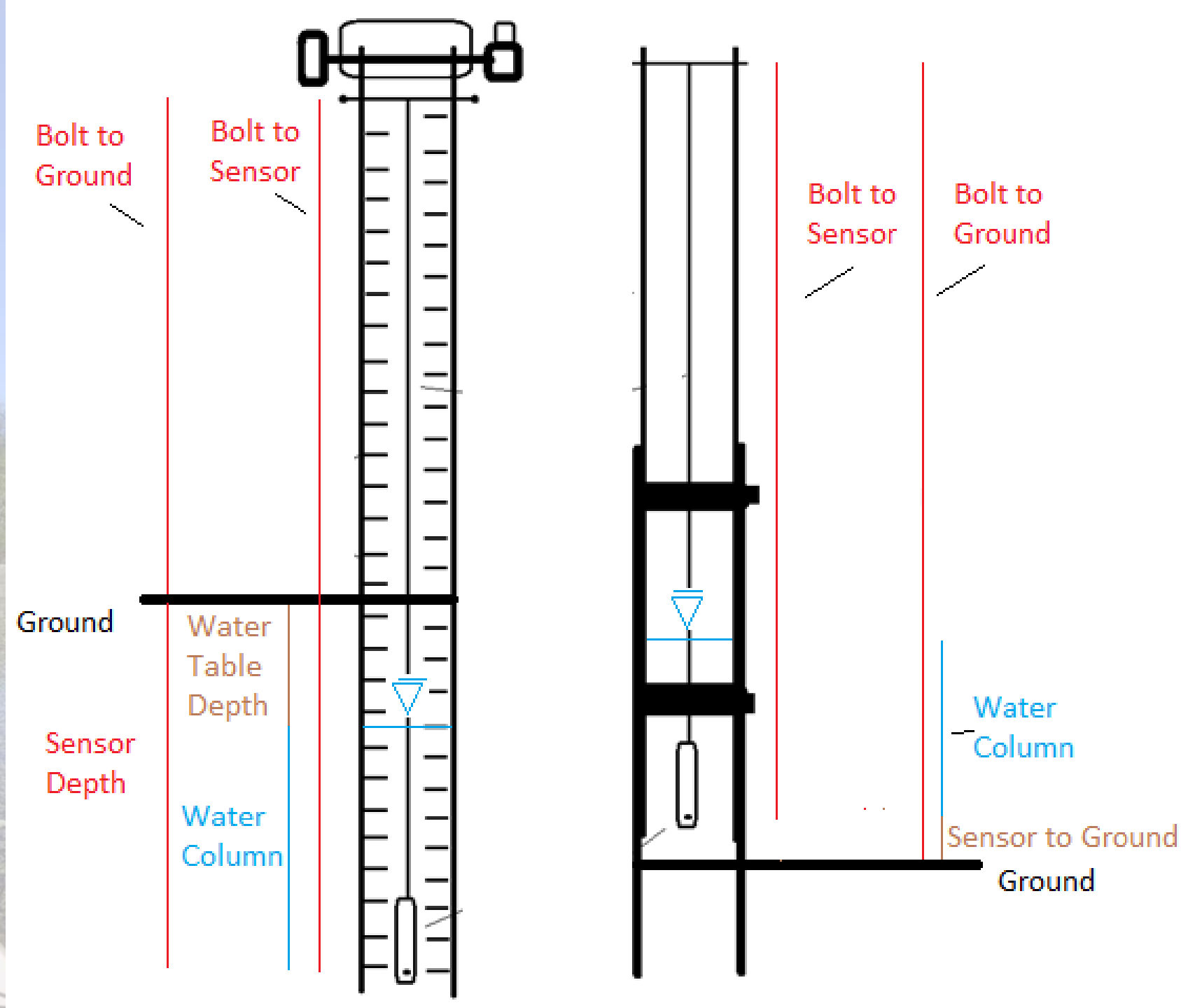


Installation

Monitoring


HOBO
Conductivity Logger
Low Range: 0 to 1000 uS/cm
Full Range: 0 to 10,000 uS/cm
P/N: U24-001
S/N: 20154301
4 Sensor
HOBO
Water Temp Pro v2
onset

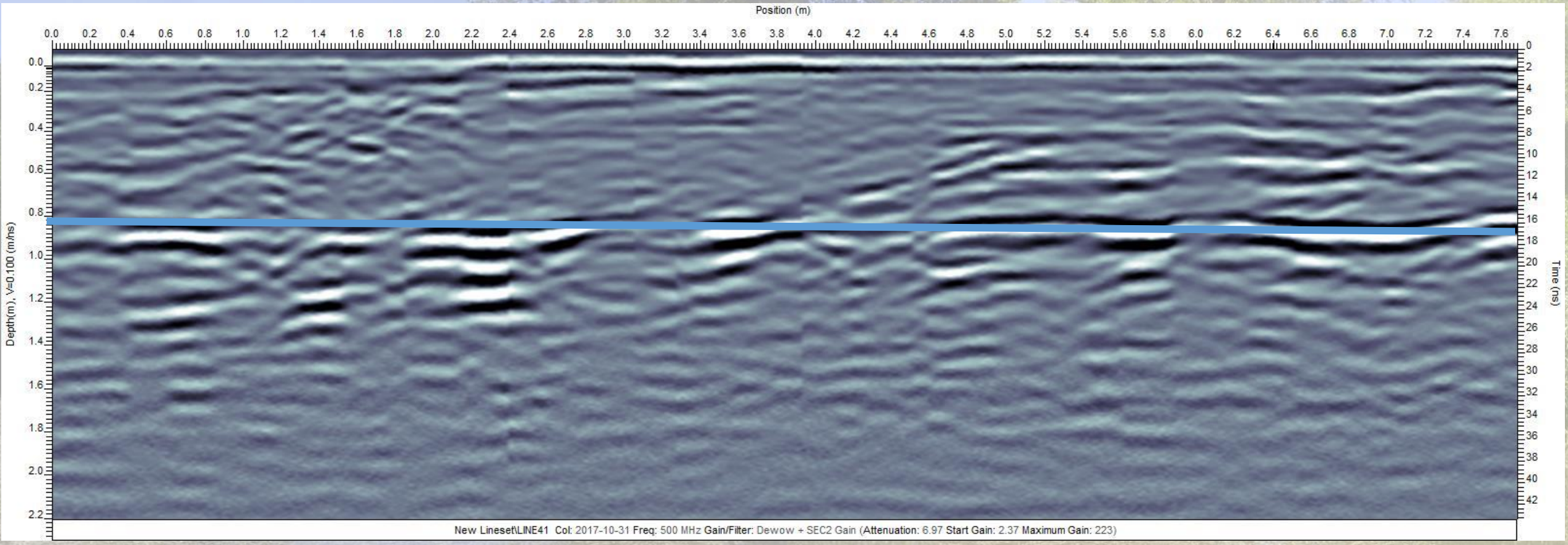
Calculating Water Elevations



Other Groundwater Monitoring Methods

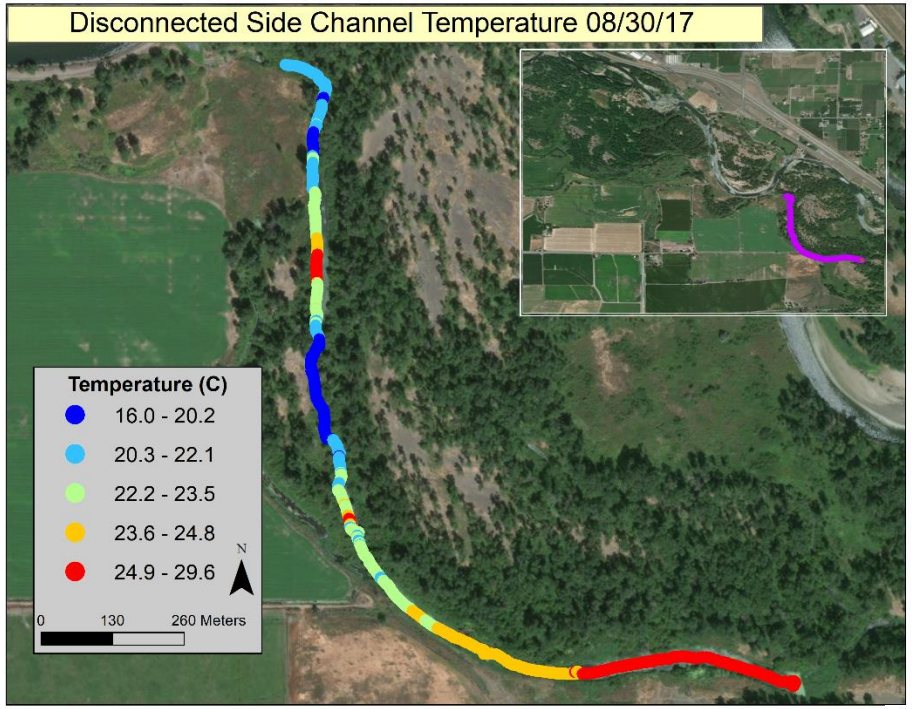
- Chemical concentrations (Mg, Na, Ca)
- Oxygen and hydrogen isotopes (compared to LMWL and GMWL)
- Ground-penetrating Radar
- Side-channel profiles

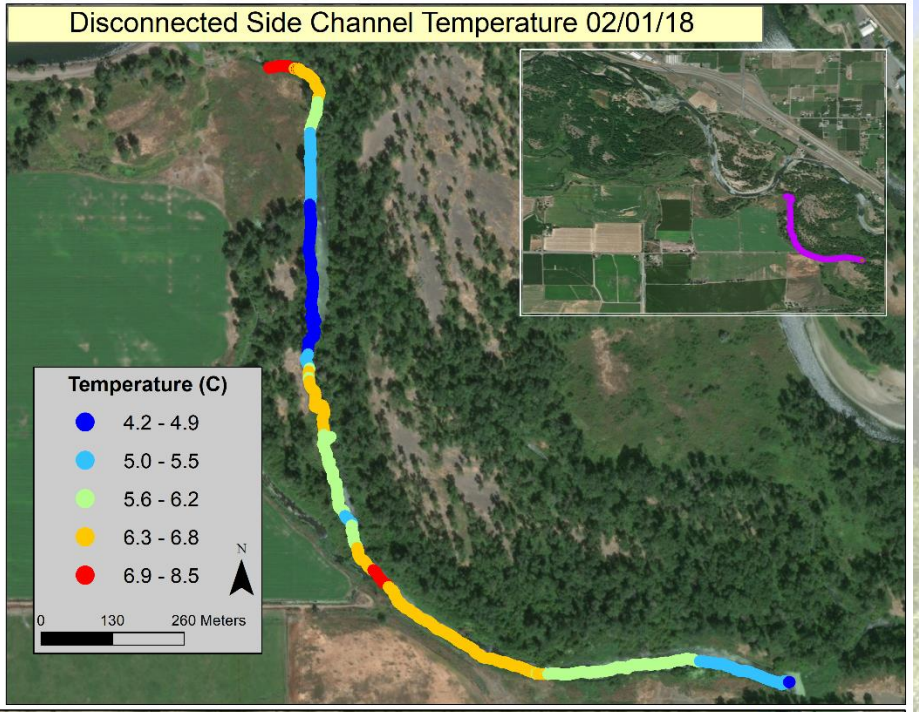
Ground-penetrating Radar

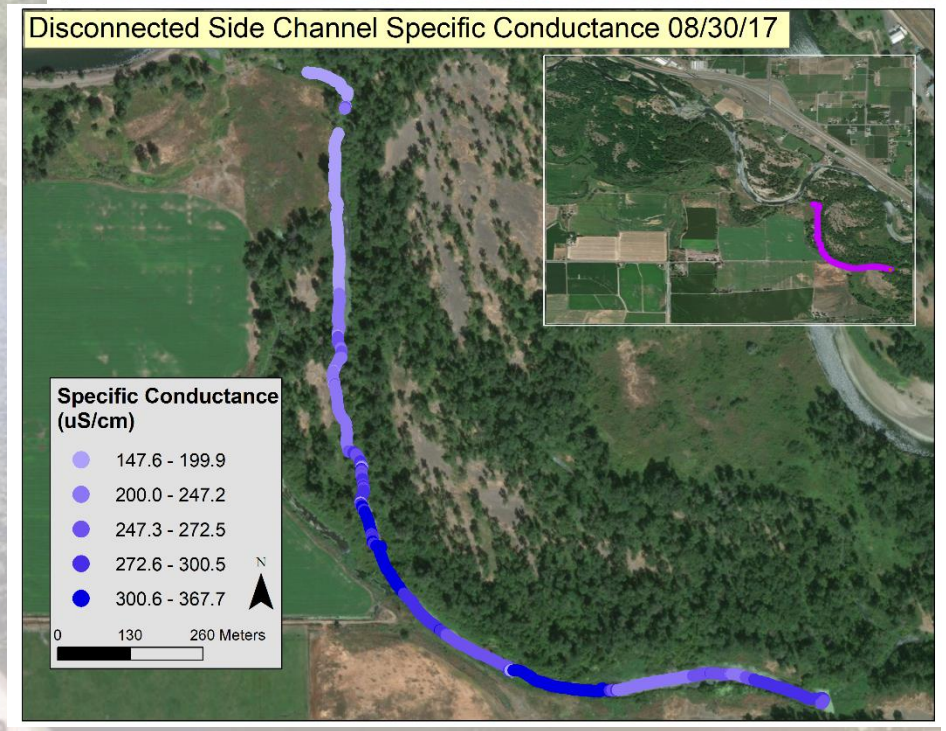


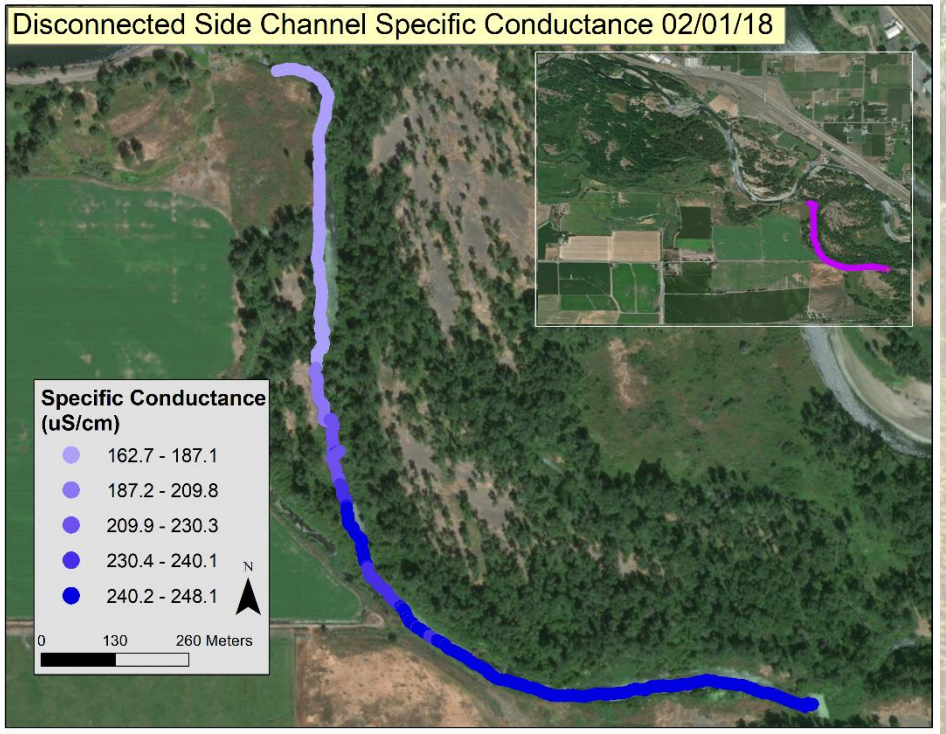
Measured water table depth at Well 5

Disconnected Side-Channel Temperature and Specific Conductance

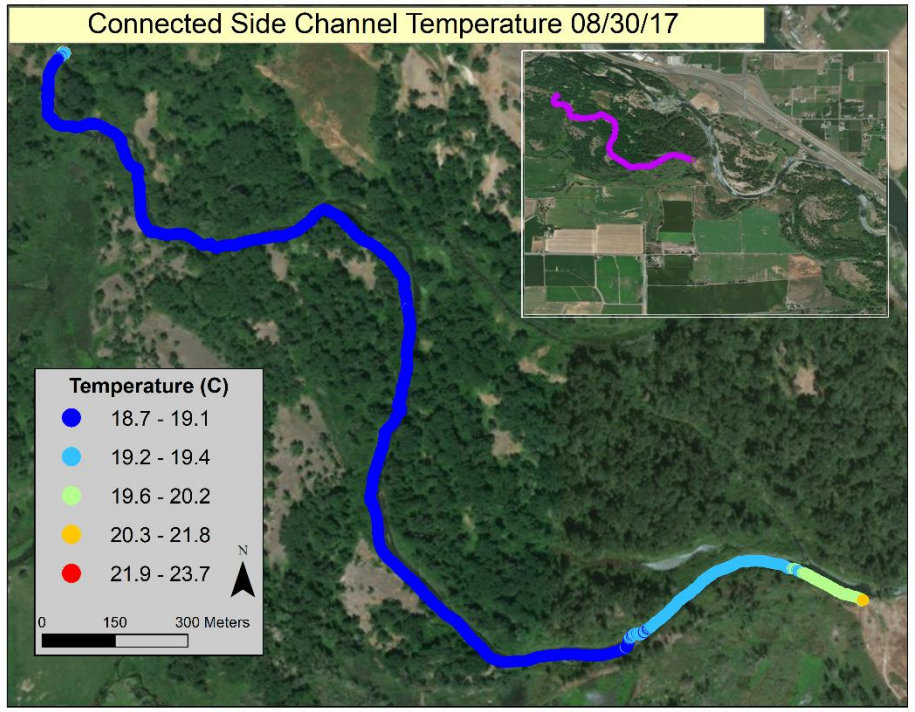


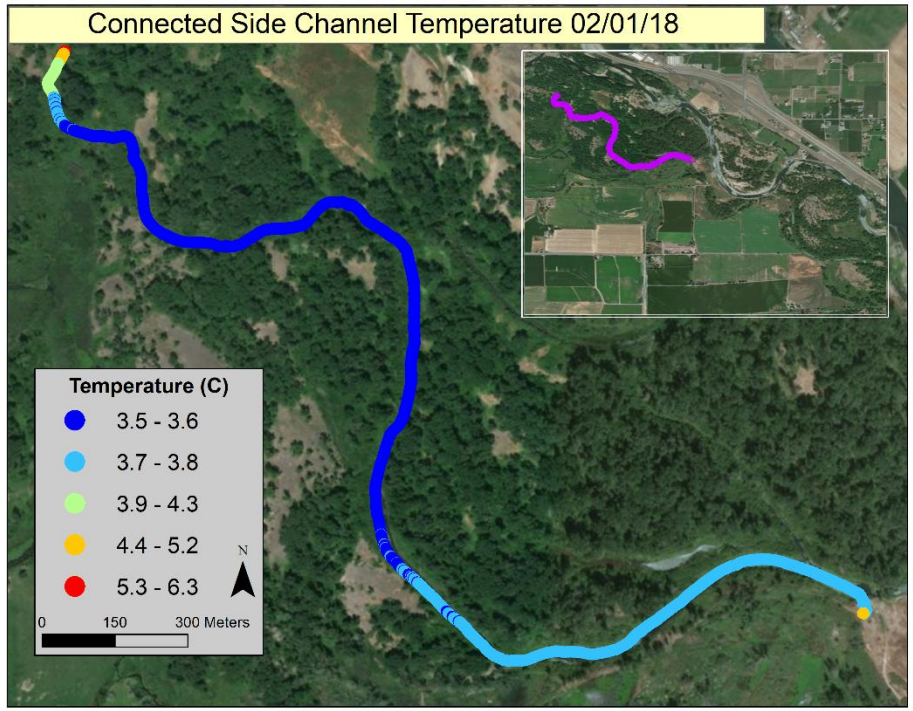


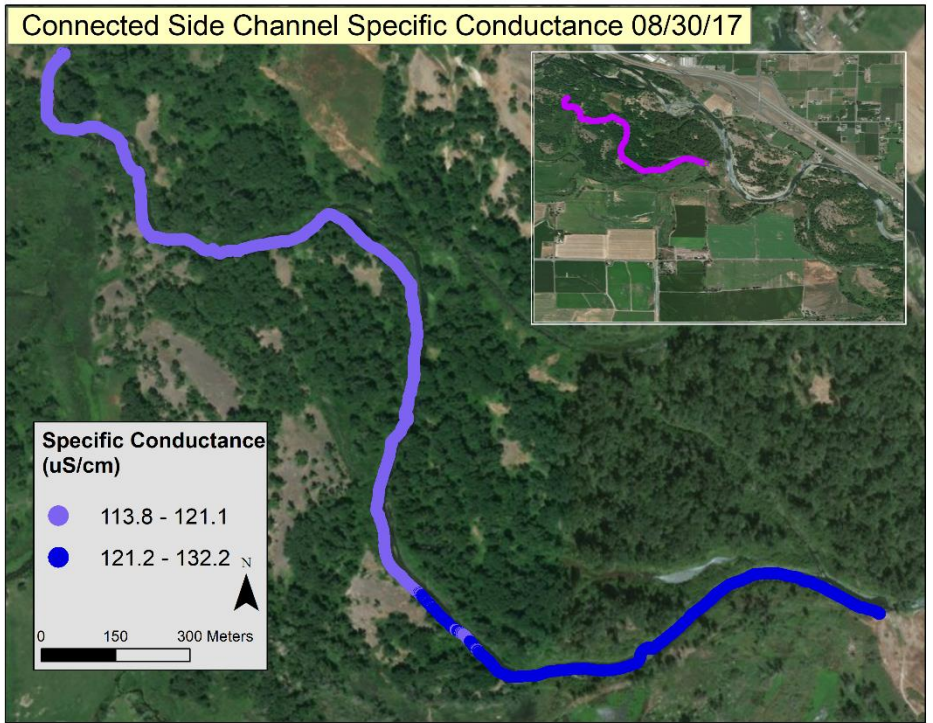


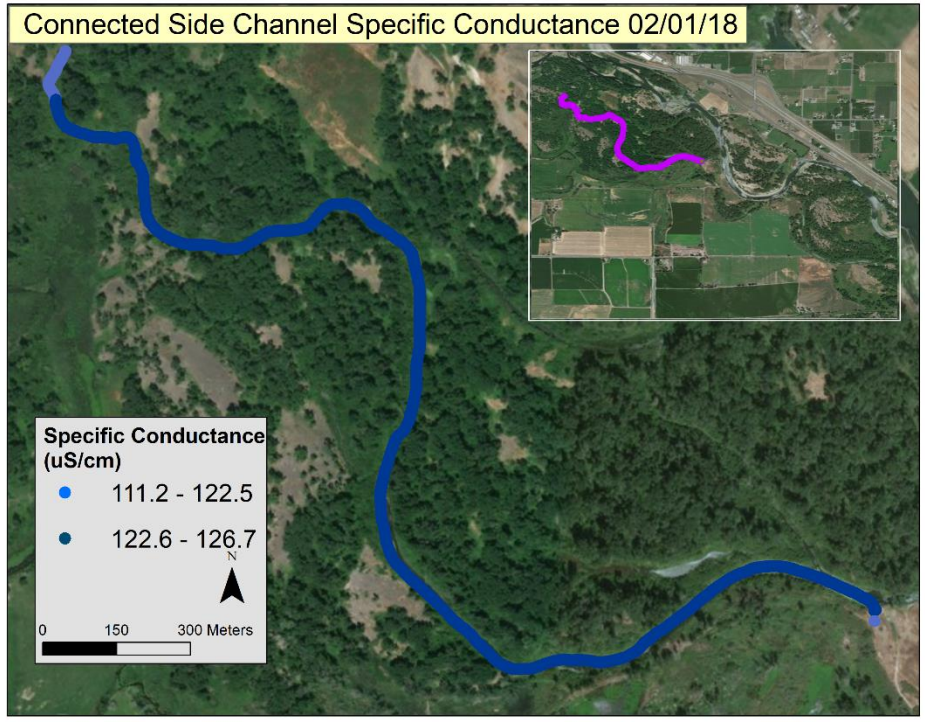


Connected Side-Channel Temperature and Specific Conductance

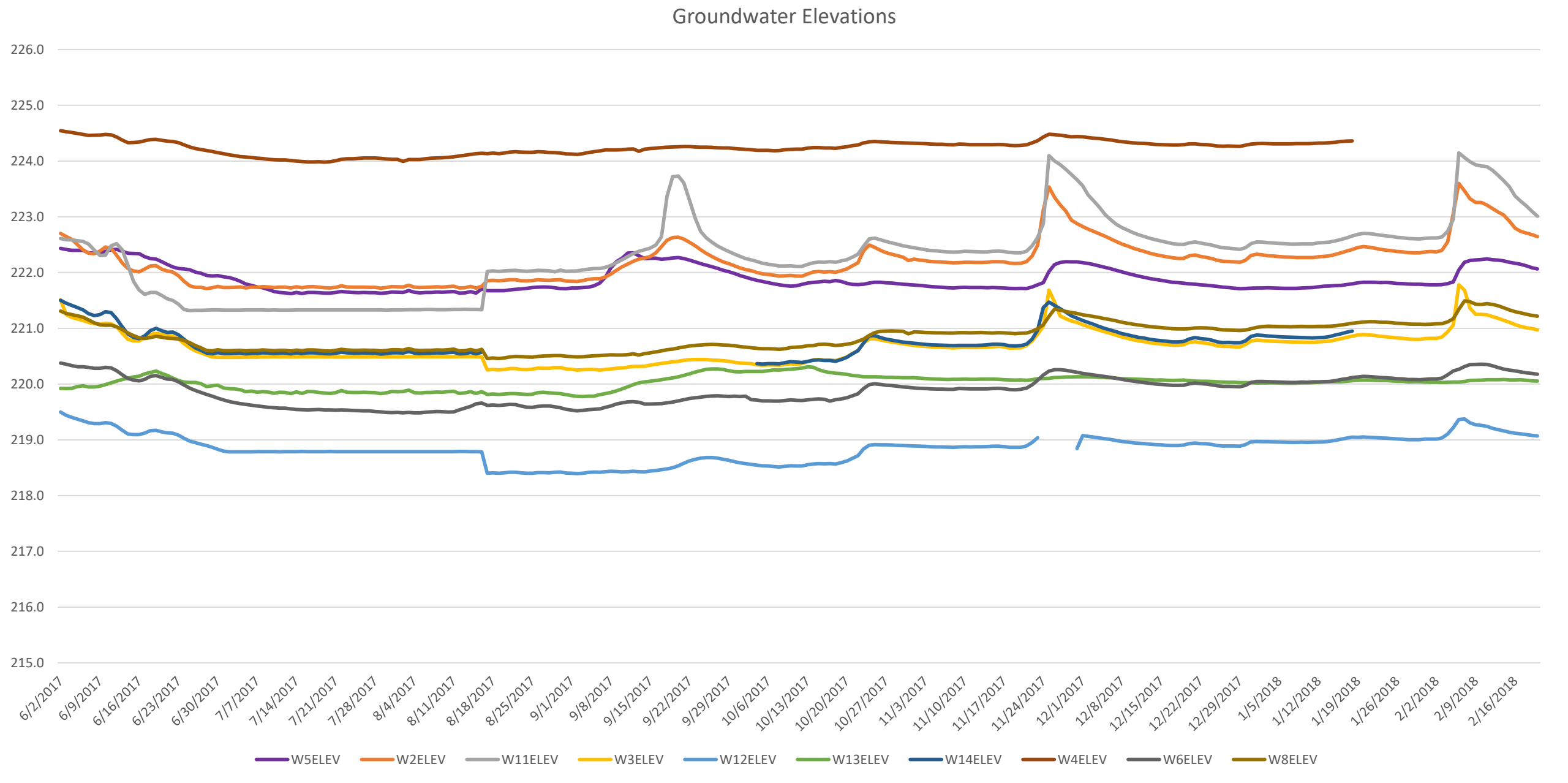




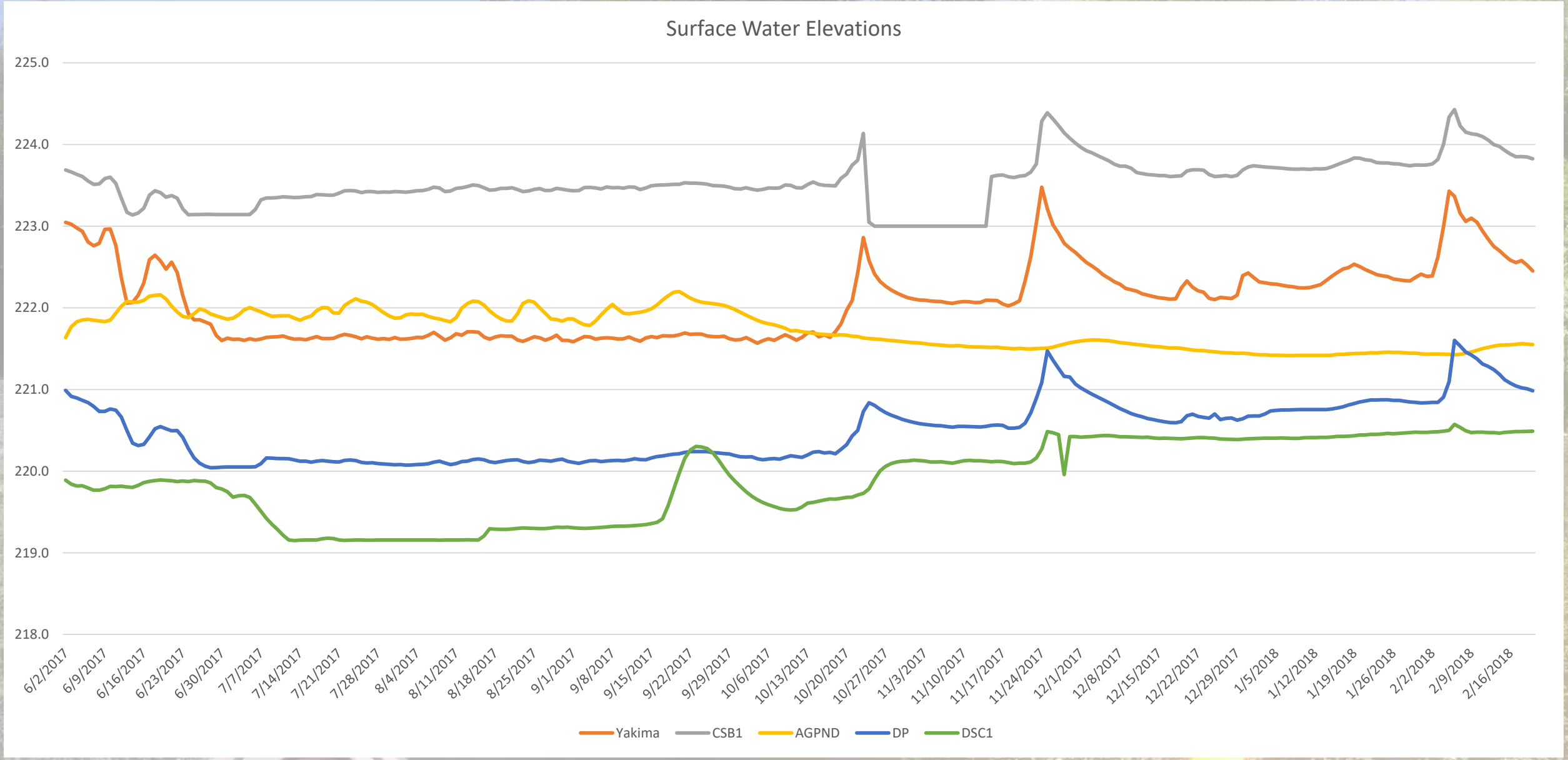




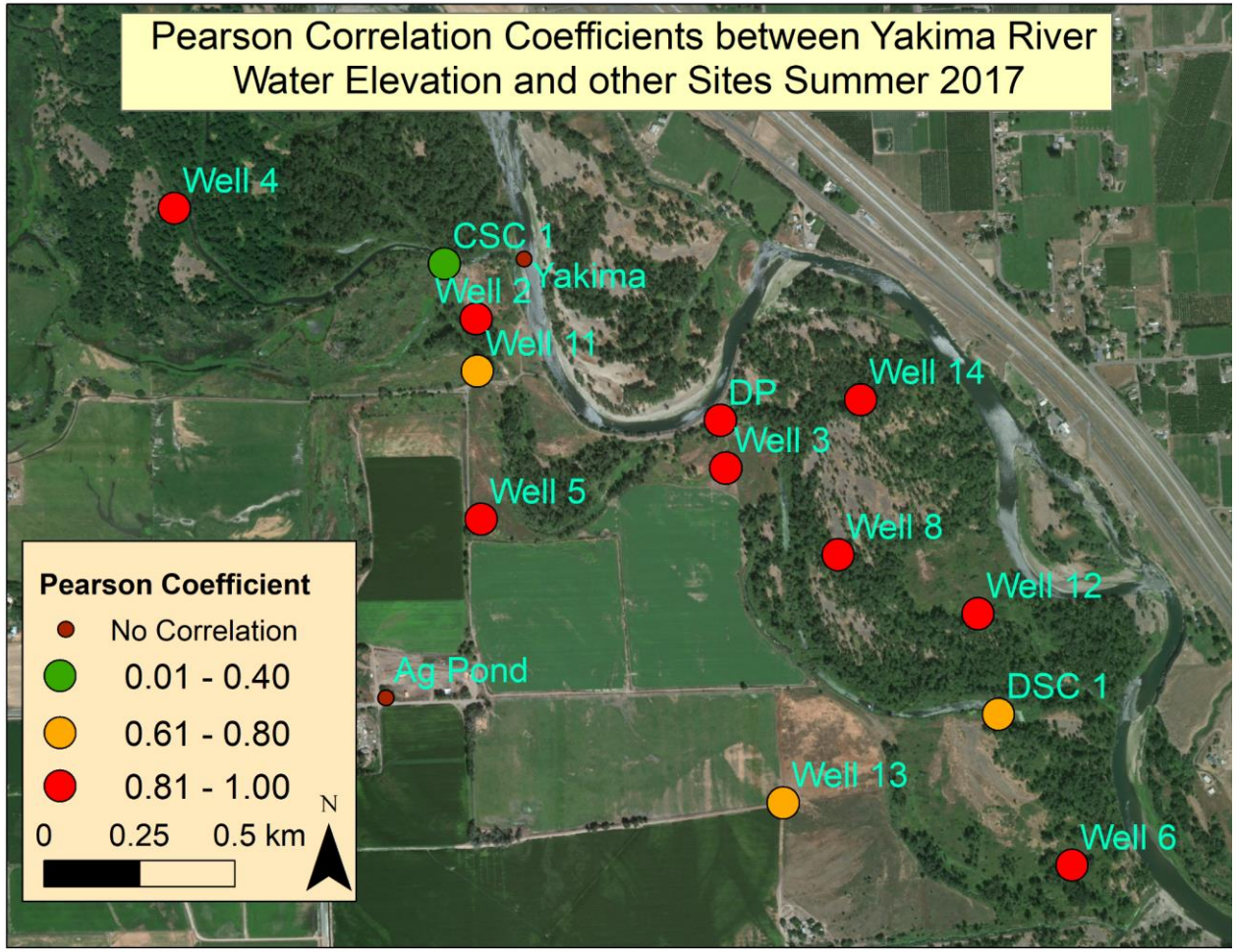
Analysis – Groundwater Elevations

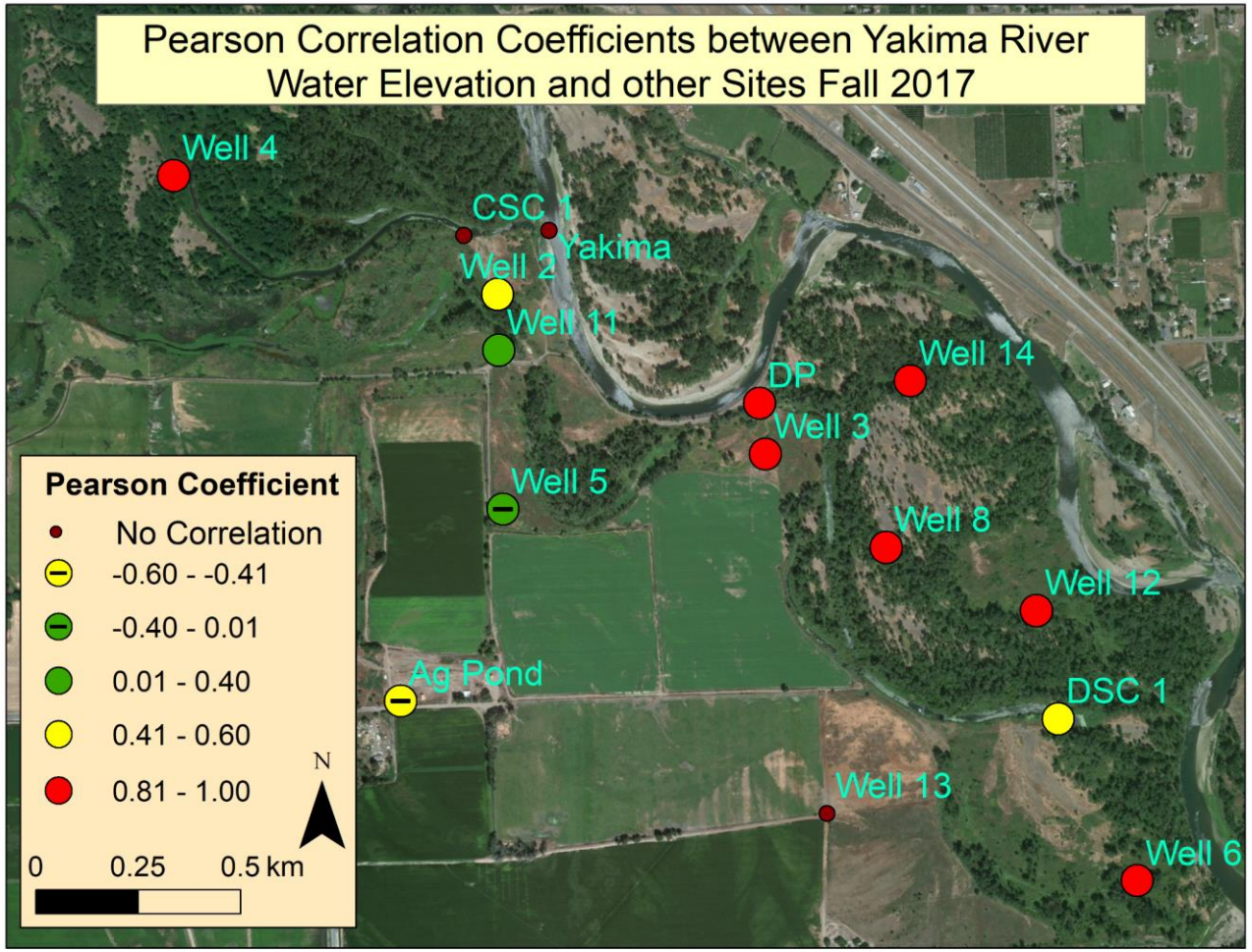


Analysis – Surface Water Elevations



Analysis – Groundwater Correlations





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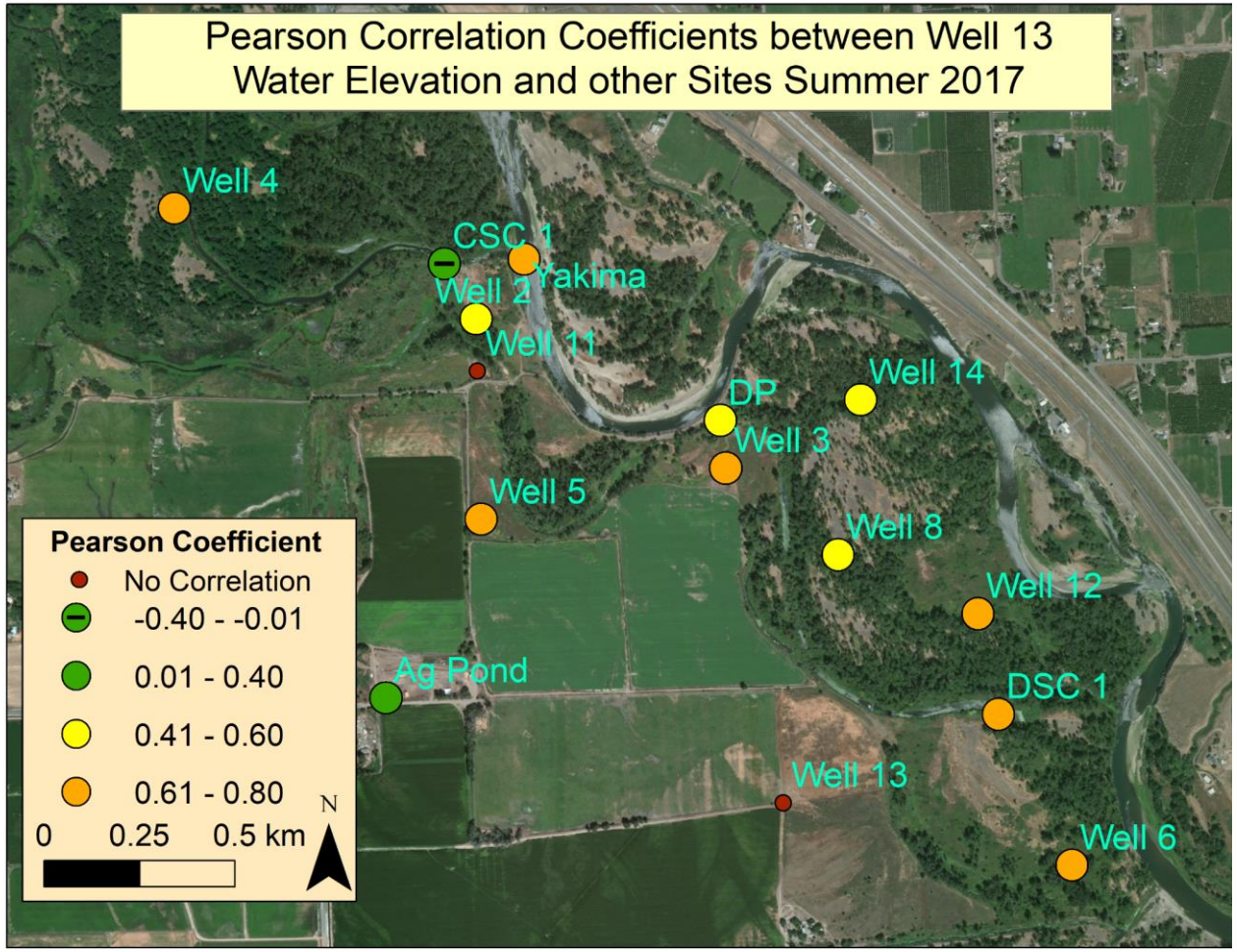
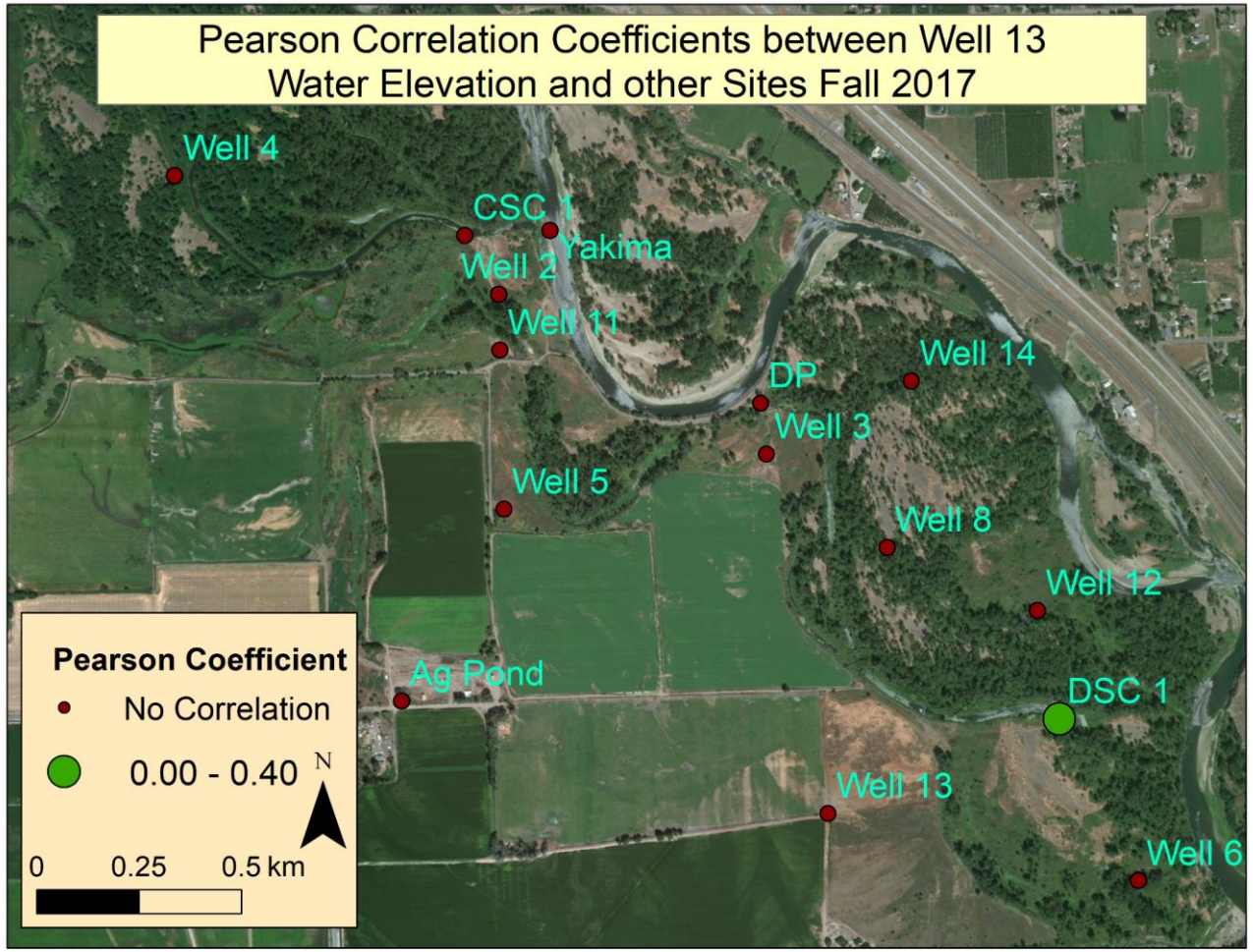
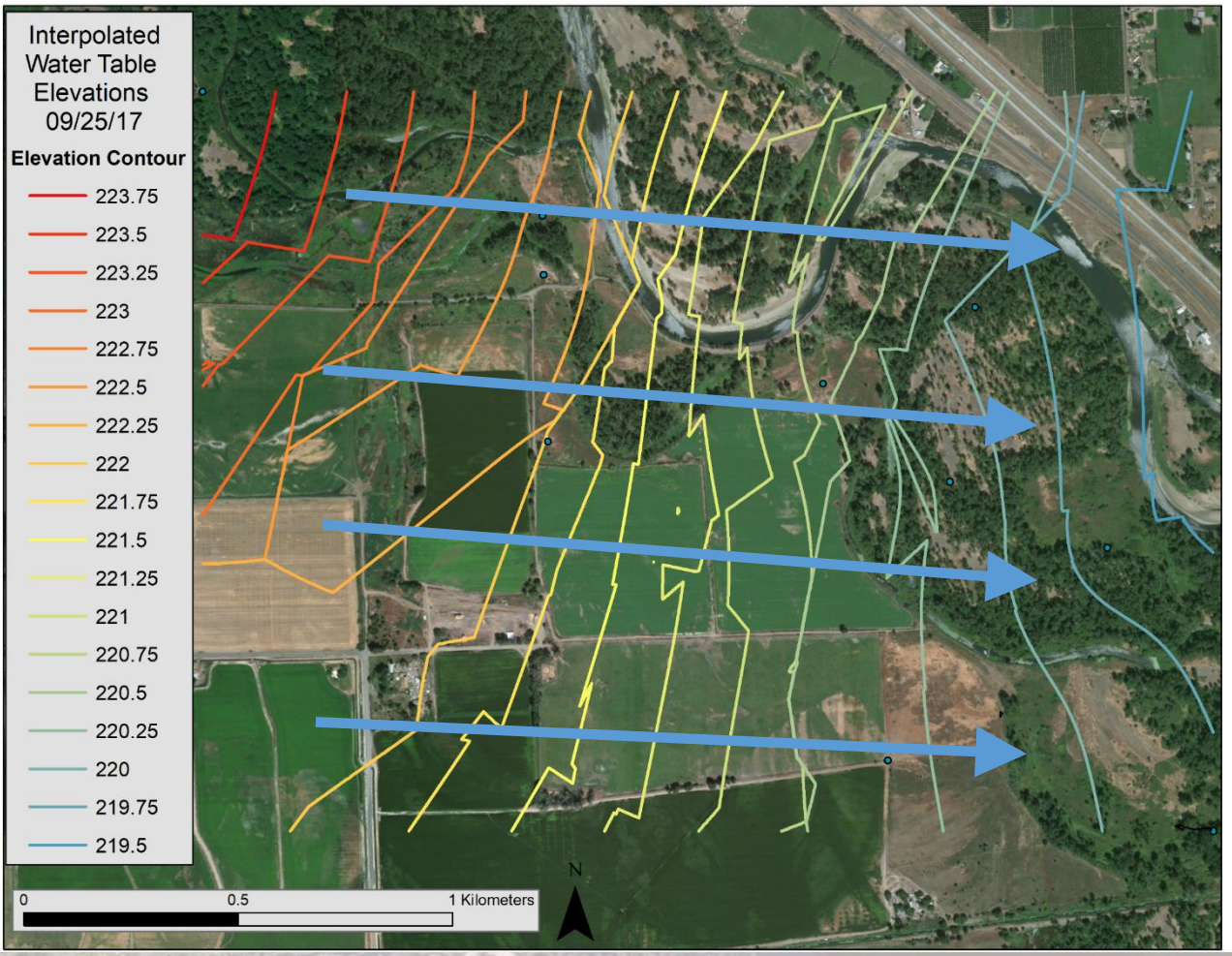
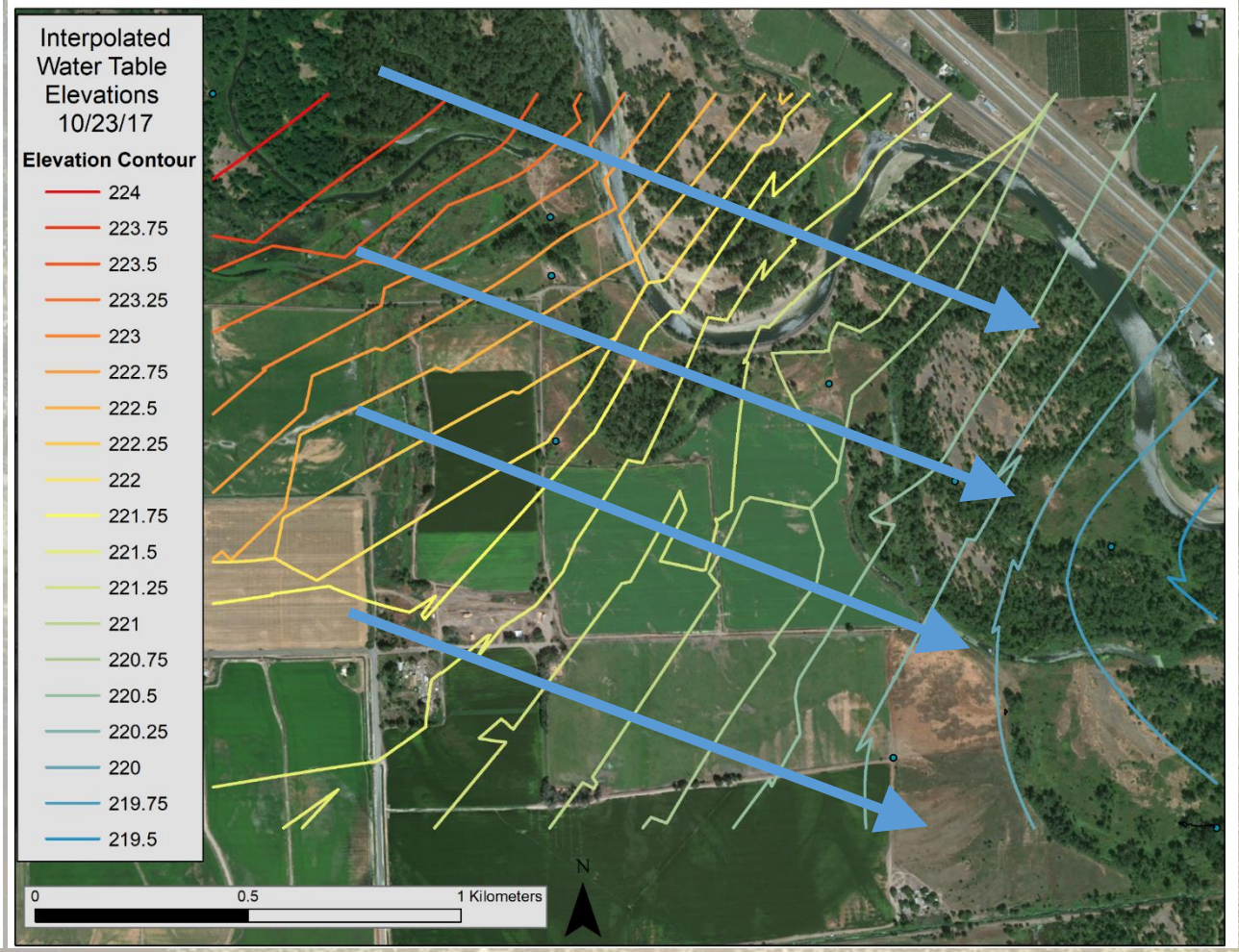


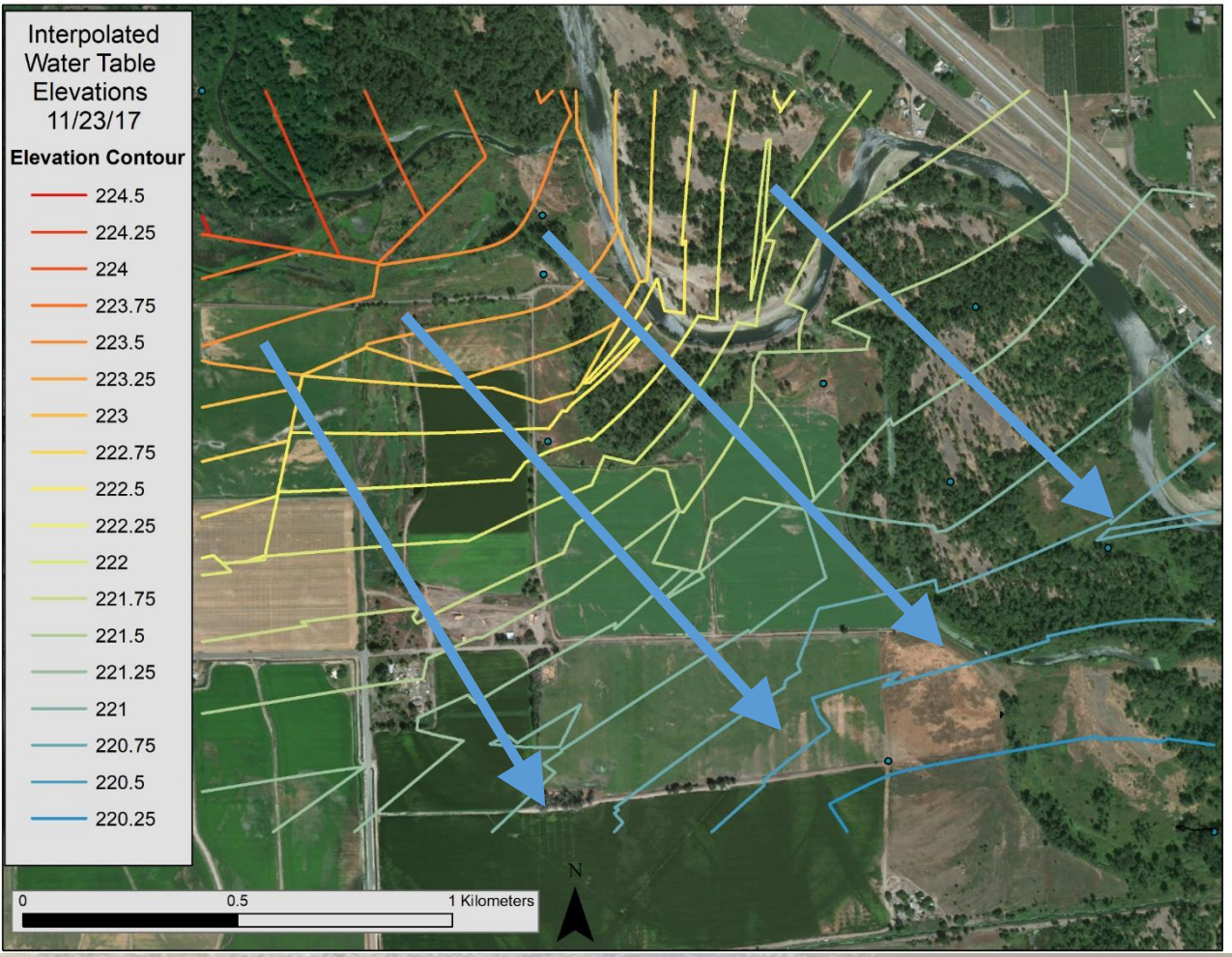


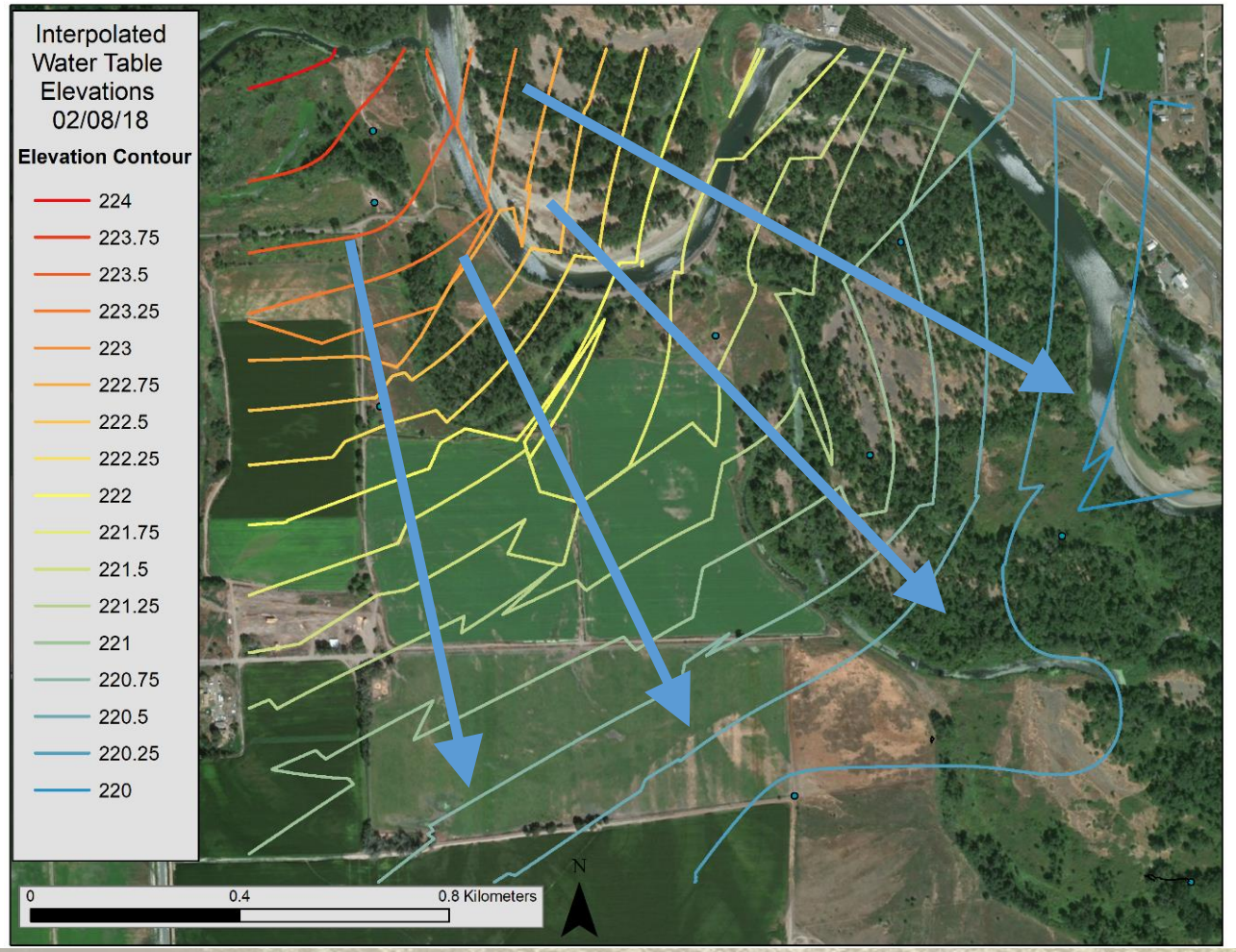
Analysis – Groundwater Interpolation





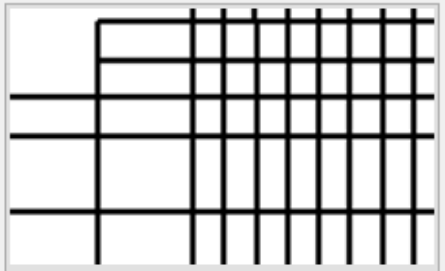
Analysis – Groundwater Interpolation



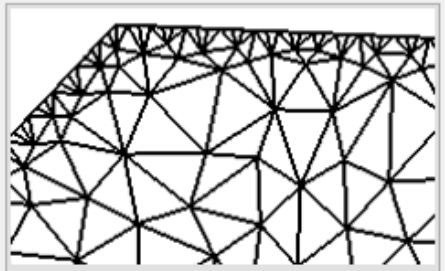


Analysis - Modeling

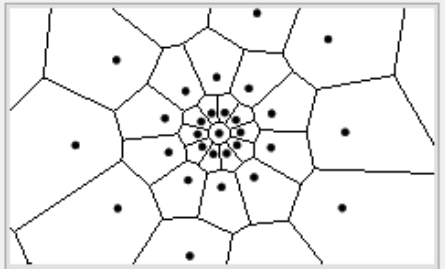
- Define Modeling Objectives
- Collect Data Objects
- Define Conceptual Model
- Define Model Structure
- Define Property Zones
- Select the Next Step
  - You have completed this step
    - Define Wall Boundary Condition
    - Define Pumping Wells
    - Define Boundary Conditions
- Select Grid Type
  - View Unstructured V-Grid
  - View Finite Element Mesh
  - View Finite Difference Grid
- Convert to MODFLOW-USG Model
- Translate to FEFLOW Model
- Convert to MODFLOW Model



Define Finite Difference Grid



Define Finite Element Mesh



Define Unstructured V-Grid

Run Stop

- Define Properties
- Define Boundary Conditions
- Define Observations
- Translate
- Run
- View Results
  - View Charts
  - View Maps

Run Log

```
PERCENT DISCREPANCY =           0.00     PERCENT DISCREPANCY =           0.00




         TIME SUMMARY AT END OF TIME STEP       10 IN STRESS PERIOD         6
                    SECONDS     MINUTES      HOURS       DAYS        YEARS
                    -----------------------------------------------------------
  TIME STEP LENGTH  17174.      286.23       4.7705      0.19877     5.44200E-04
STRESS PERIOD TIME  86400.      1440.0       24.000      1.0000      2.73785E-03
        TOTAL TIME 5.18400E+05  8640.0       144.00      6.0000      1.64271E-02

 VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP      10 IN STRESS PERIOD       7
 ---------------------------------------------------------------------------------------

    CUMULATIVE VOLUMES      L**3       RATES FOR THIS TIME STEP      L**3/T
    ------------------                 ------------------------

           IN:                                 IN:
           ---                                 ---
             STORAGE =         195.6147            STORAGE =          12.7650
      CONSTANT HEAD =           0.0000     CONSTANT HEAD =           0.0000
      RIVER LEAKAGE =    79673054.3559     RIVER LEAKAGE =     3951576.5000
                 ET =           0.0000                ET =           0.0000
           RECHARGE =       72011.2122          RECHARGE =       10287.3164

           TOTAL IN =    79745261.1828          TOTAL IN =     3961876.5814

          OUT:                                OUT:
          ----                                ----
             STORAGE =    79741375.9624            STORAGE =     3961256.6871
      CONSTANT HEAD =           0.0000     CONSTANT HEAD =           0.0000
      RIVER LEAKAGE =           0.0000     RIVER LEAKAGE =           0.0000
                 ET =        3884.7763                ET =         619.7957
           RECHARGE =           0.0000          RECHARGE =           0.0000

          TOTAL OUT =    79745260.7387          TOTAL OUT =     3961876.4828

           IN - OUT =           0.4441           IN - OUT =       9.8595E-02

PERCENT DISCREPANCY =           0.00     PERCENT DISCREPANCY =           0.00




         TIME SUMMARY AT END OF TIME STEP       10 IN STRESS PERIOD         7
                    SECONDS     MINUTES      HOURS       DAYS        YEARS
                    -----------------------------------------------------------
  TIME STEP LENGTH  17174.      286.23       4.7705      0.19877     5.44200E-04
STRESS PERIOD TIME  86400.      1440.0       24.000      1.0000      2.73785E-03
        TOTAL TIME 6.04800E+05  10080.       168.00      7.0000      1.91650E-02

***** The run was successful. *****
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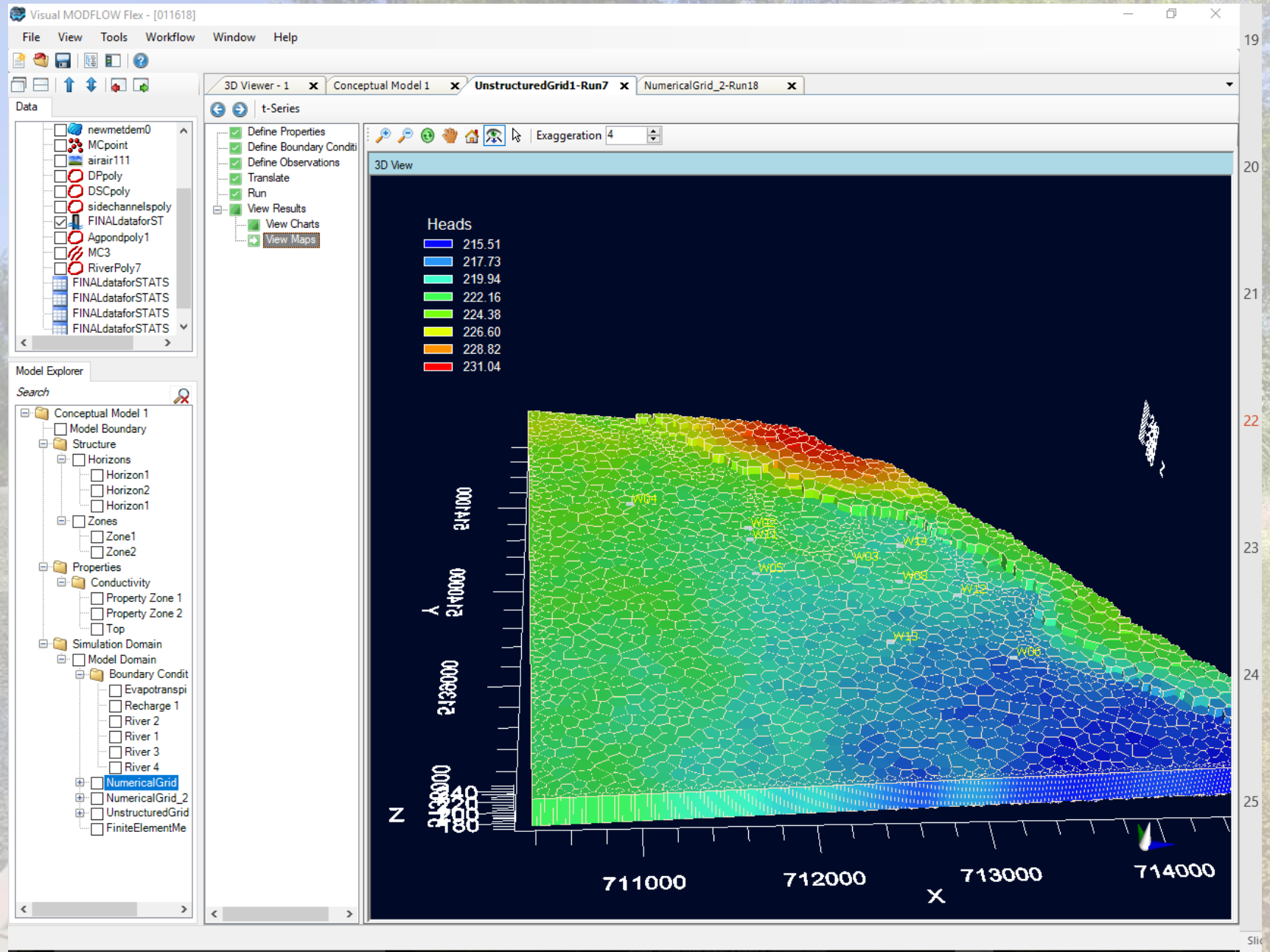
Analysis - Modeling



Problems and Issues

-Vandalism

-Weather

-Edge of models/interpolations

-Modeling learning curve

-Sensor deployment user error

-Well installation timing

What's Next

- Conduct dissolved oxygen longitudinal profiles
- Continue GW monitoring through project
- Post project monitoring
  - Determine changes in water quality
  - Determine changes in SW/GW interactions
- Use findings to inform future projects