Groundwater Models to Evaluate Changes in Irrigation Practices – Stevensville GWIP Area Ravalli County, Montana

Model objective:

Examine the impacts of major changes to irrigation practices to surface water and groundwater conditions

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Butte, MT

Bitterroot Water Symposium
Bitterroot College of the Univ. of Montana
Hamilton, MT
April 28, 2017

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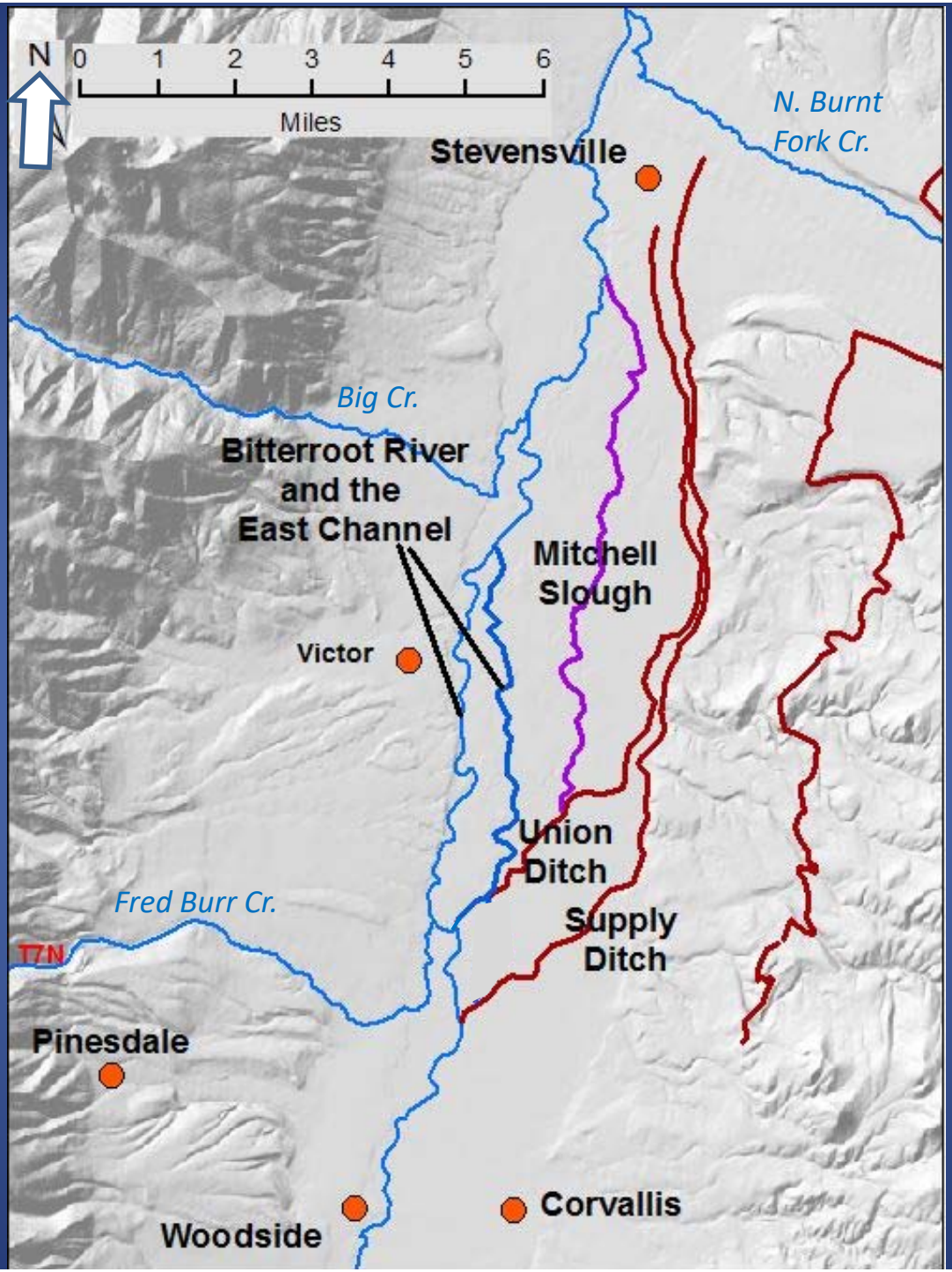
Project location and major water features



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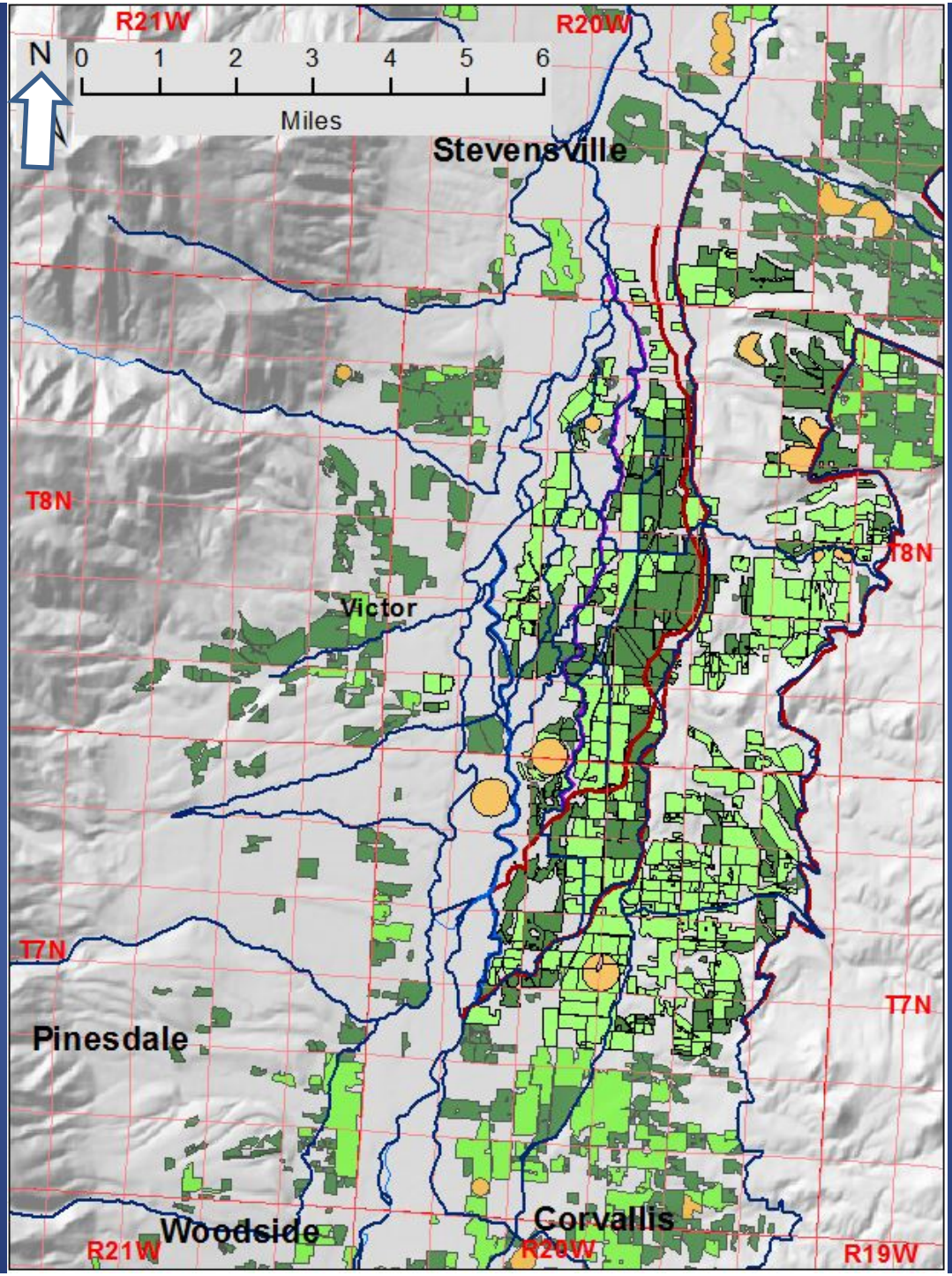
Irrigated lands



Flood
Sprinkler
Pivot

Coverage modified from MT Dept. of Revenue

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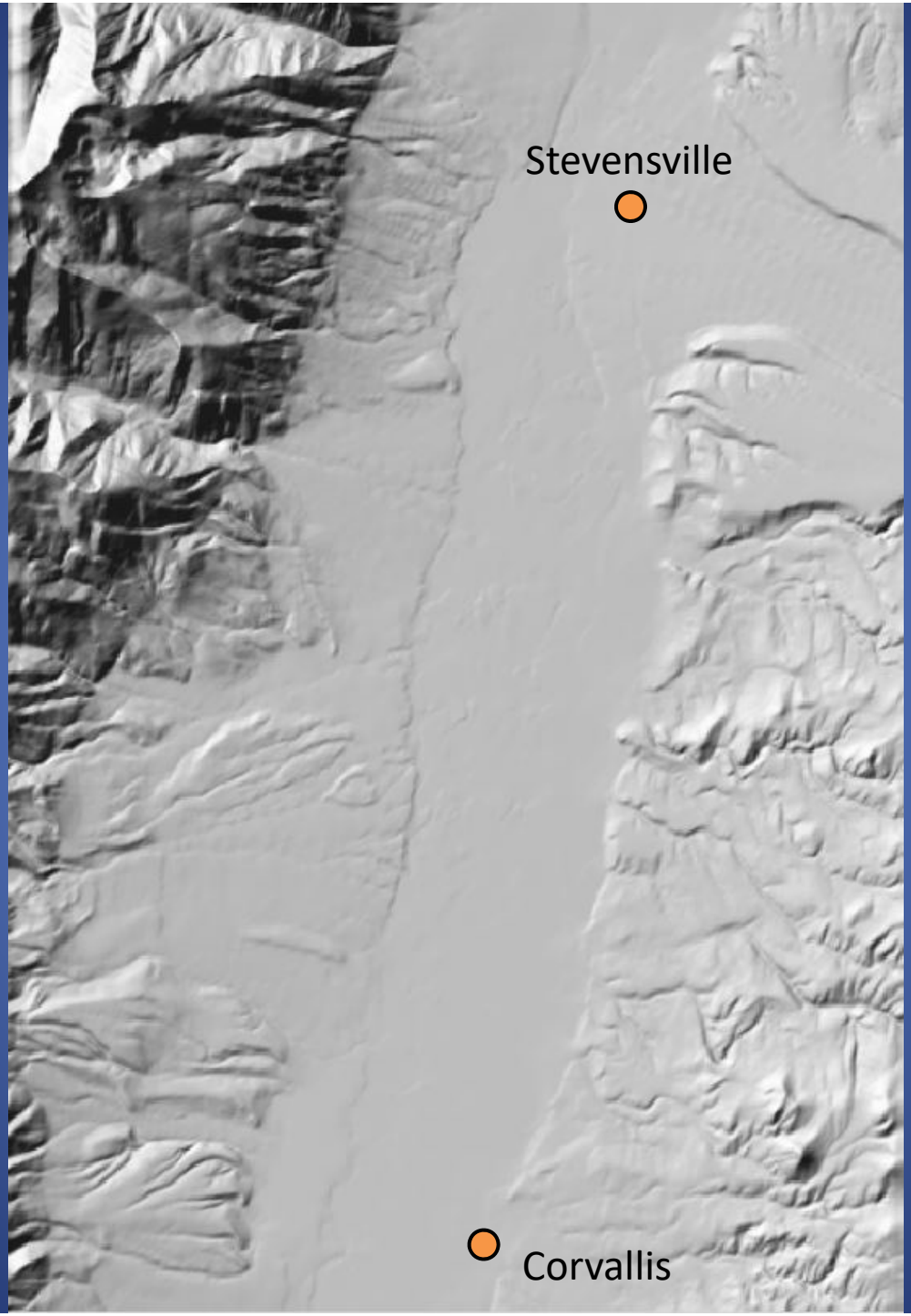
Shaded relief image

Digital Elevation data from US Geological Survey



Scale, miles
0 1 2 3 4

The flat valley floor is nicely visible in this image

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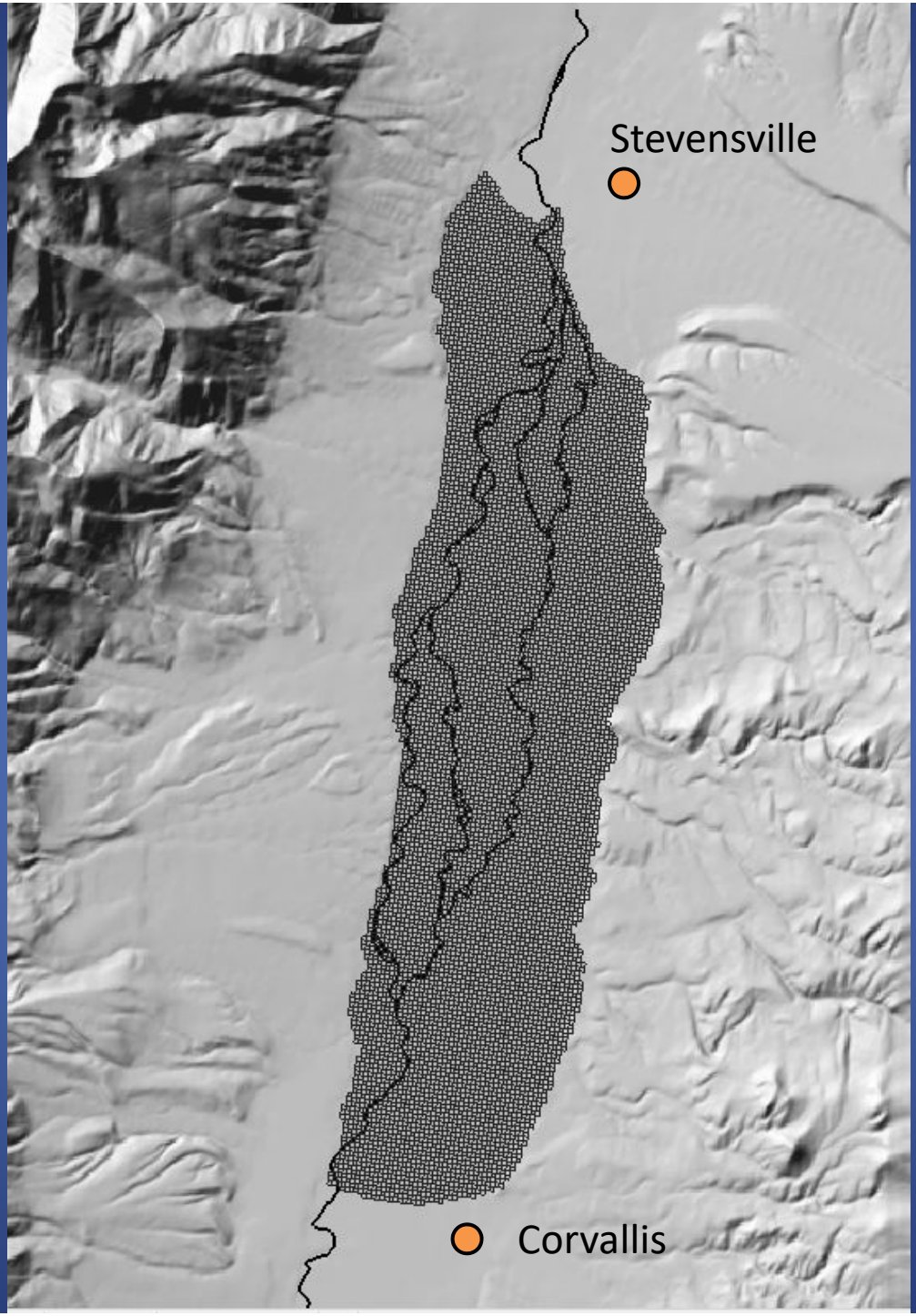
Groundwater model grid

Cells are
300 x 300 ft
In size in plan view

Scale, miles
0 1 2 3 4



Aquifer properties assigned to each layer

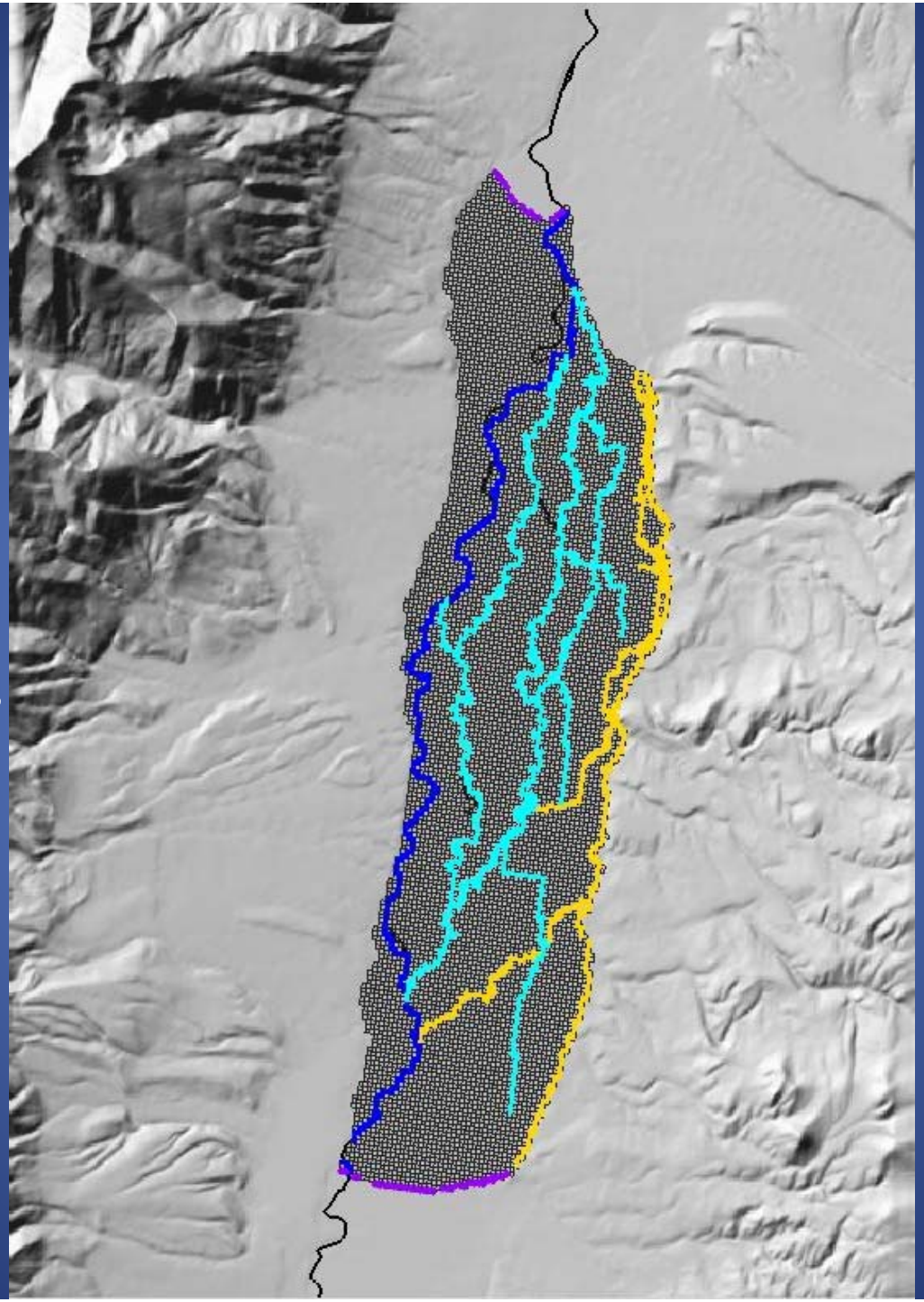
Top layer
S&G
Hydraulic conductivity (K)
2000 ft/d
S = 0.2

Middle layer
clay-silt
Hydraulic conductivity (K)
1 ft/d
S = 0.0005

Bottom layer
S&G, silt
Hydraulic conductivity (K)
50 ft/d
S = 0.0005

Major hydrologic features are added to the model:

Bitterroot River
East Channel
Mitchell Slough
Other major canals



Scale, miles
0 1 2 3 4

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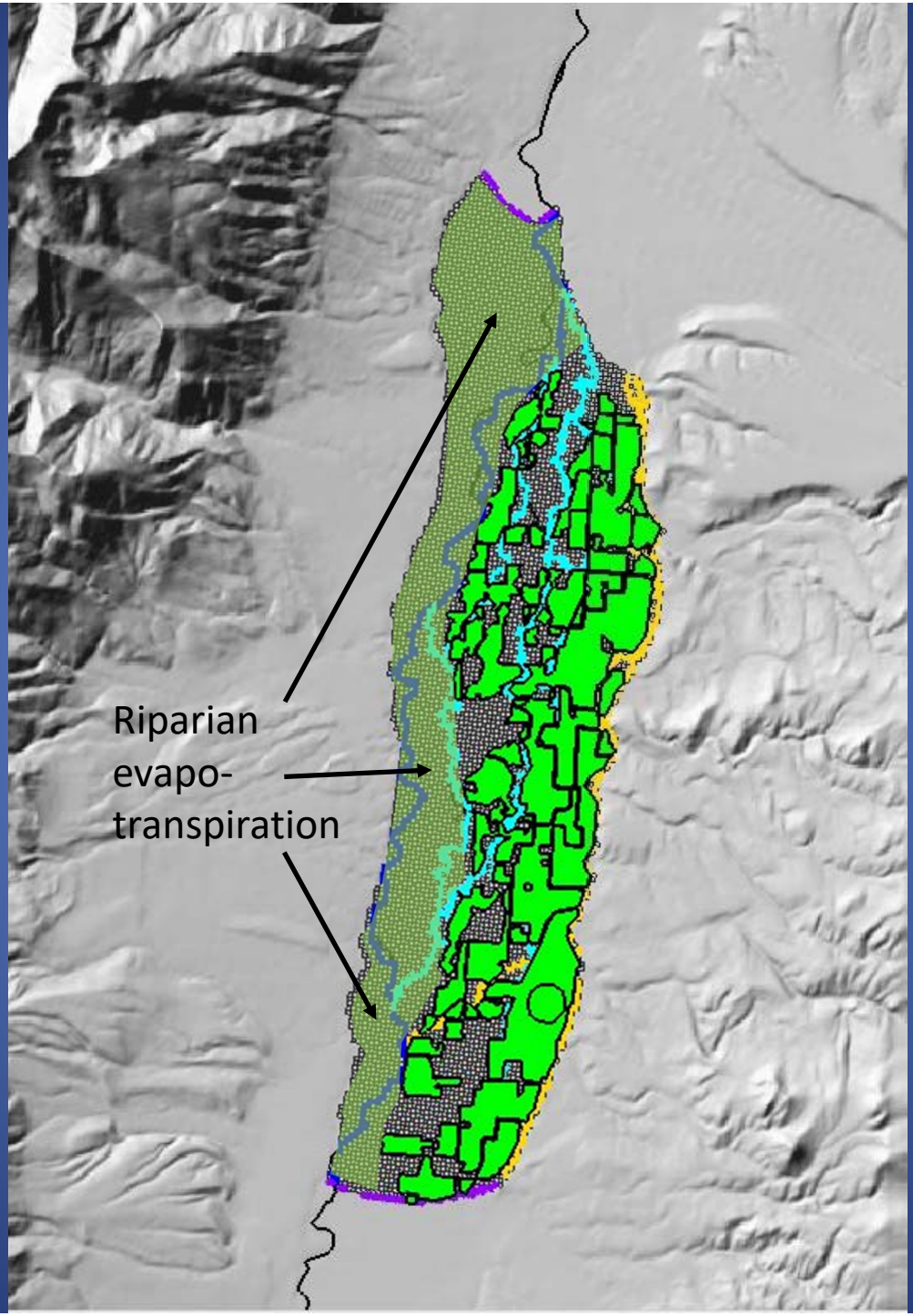
Groundwater recharge from irrigated fields

Riparian ET



Although all the irrigated fields appear in one color, recharge is assigned based on two basic types of irrigation:

Flood and sprinkler

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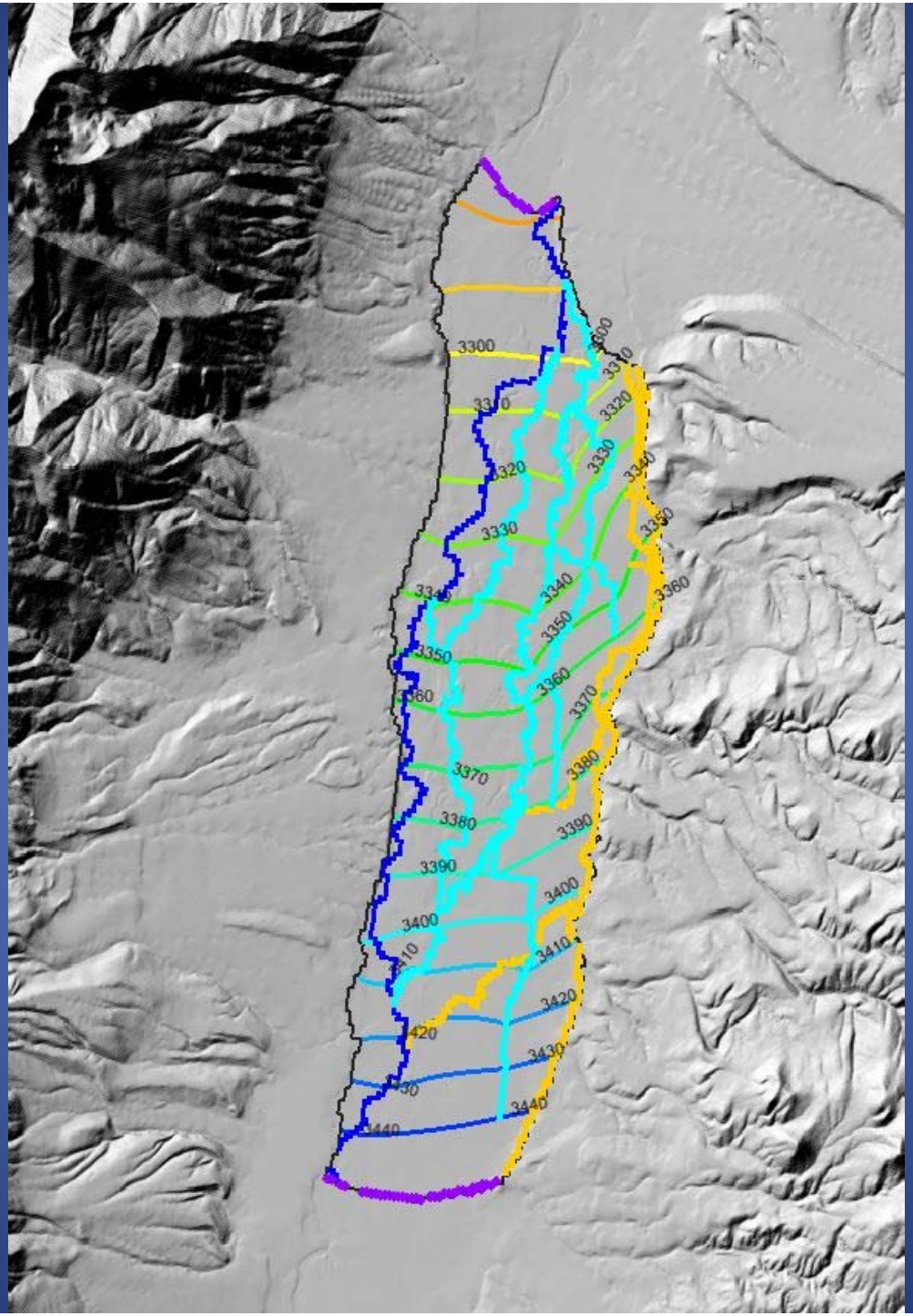
```
 HEAD WILL BE SAVED ON UNIT  730 AT END OF TIME STEP   1, STRESS PERIOD    1
1
  VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP  1 IN STRESS PERIOD   1
  ---------------------------------------------------------------------------

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

          IN:                                IN:
          ---                                ---
            STORAGE =          0.0000          STORAGE =          0.0000
     CONSTANT HEAD =     301428.2812   CONSTANT HEAD =     301428.2812
              WELLS =    2210541.0000           WELLS =    2210541.0000
      RIVER LEAKAGE =     704377.7500   RIVER LEAKAGE =     704377.7500
                 ET =          0.0000              ET =          0.0000
           RECHARGE =    1111354.2500        RECHARGE =    1111354.2500
     STREAM LEAKAGE =    1892217.0000  STREAM LEAKAGE =    1892217.0000

           TOTAL IN =    6219918.0000        TOTAL IN =    6219918.0000

         OUT:                               OUT:
         ----                               ----
            STORAGE =          0.0000          STORAGE =          0.0000
     CONSTANT HEAD =     360814.5312   CONSTANT HEAD =     360814.5312
              WELLS =          0.0000           WELLS =          0.0000
      RIVER LEAKAGE =    1135202.3750   RIVER LEAKAGE =    1135202.3750
                 ET =     344251.8438              ET =     344251.8438
           RECHARGE =          0.0000        RECHARGE =          0.0000
     STREAM LEAKAGE =    4379573.5000  STREAM LEAKAGE =    4379573.5000

           TOTAL OUT =    6219842.0000        TOTAL OUT =    6219842.0000

            IN - OUT =         76.0000         IN - OUT =         76.0000

 PERCENT DISCREPANCY =          0.00  PERCENT DISCREPANCY =          0.00
```

modeled water table elevations



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Video clip: 13-month transient model run

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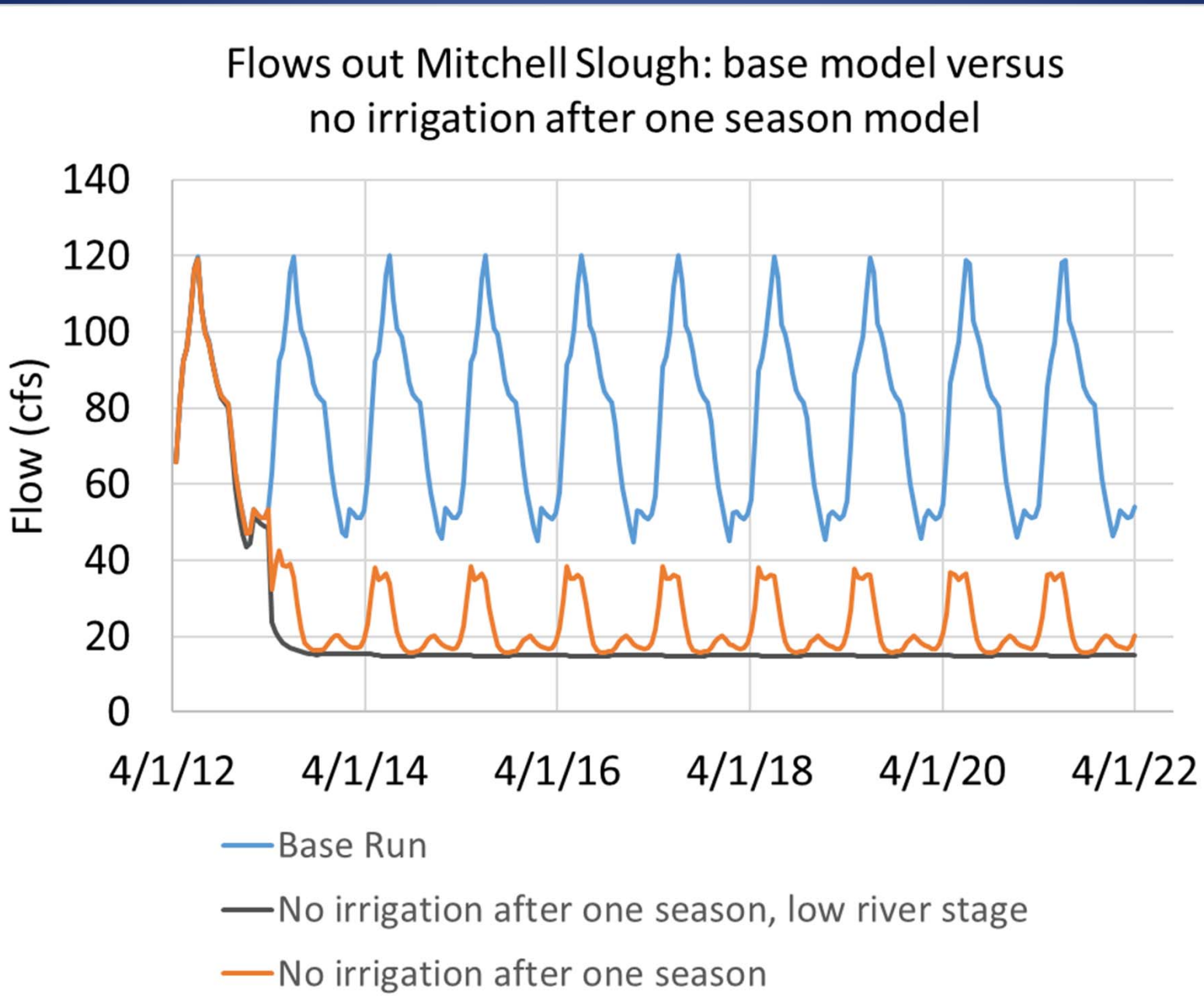
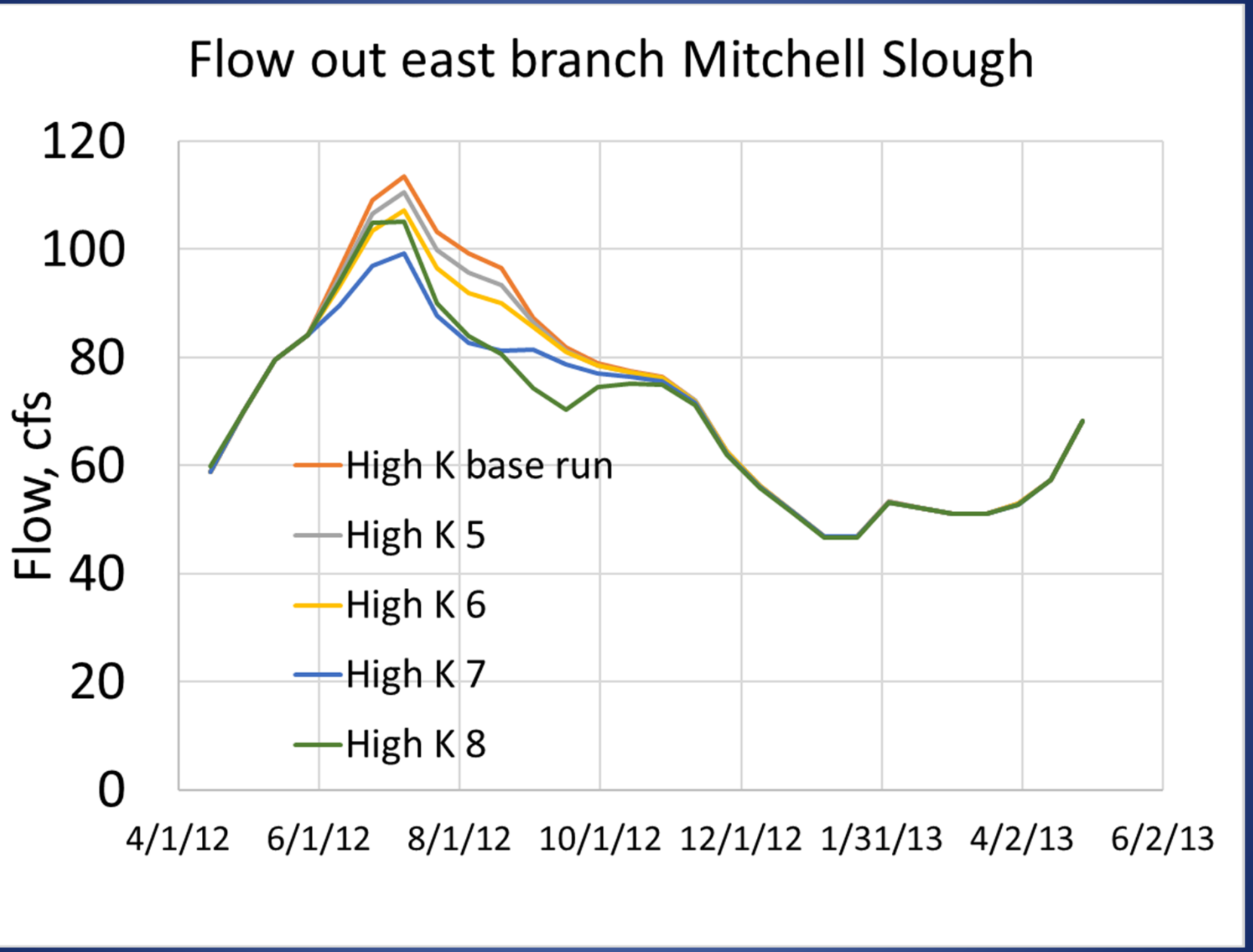
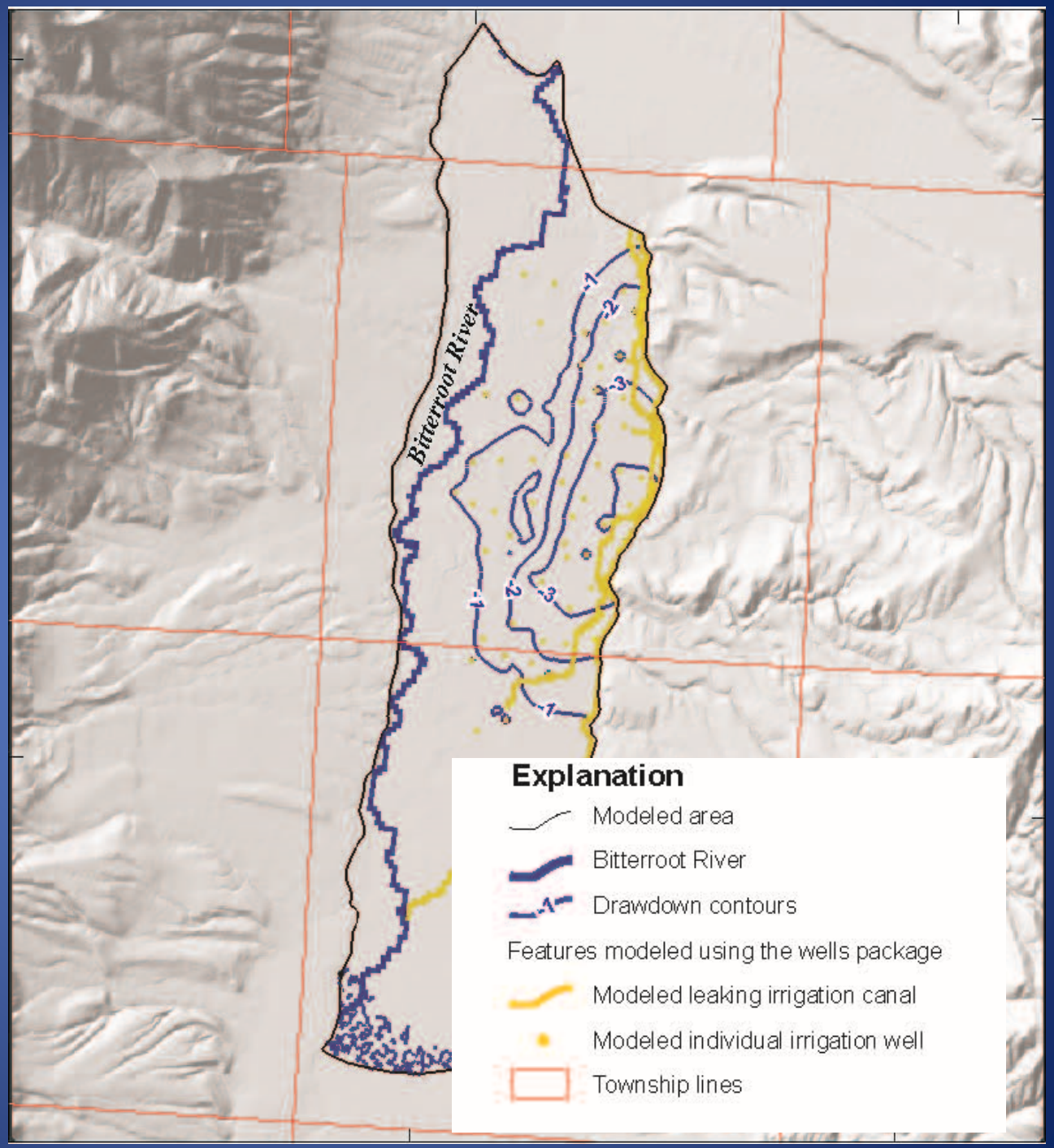
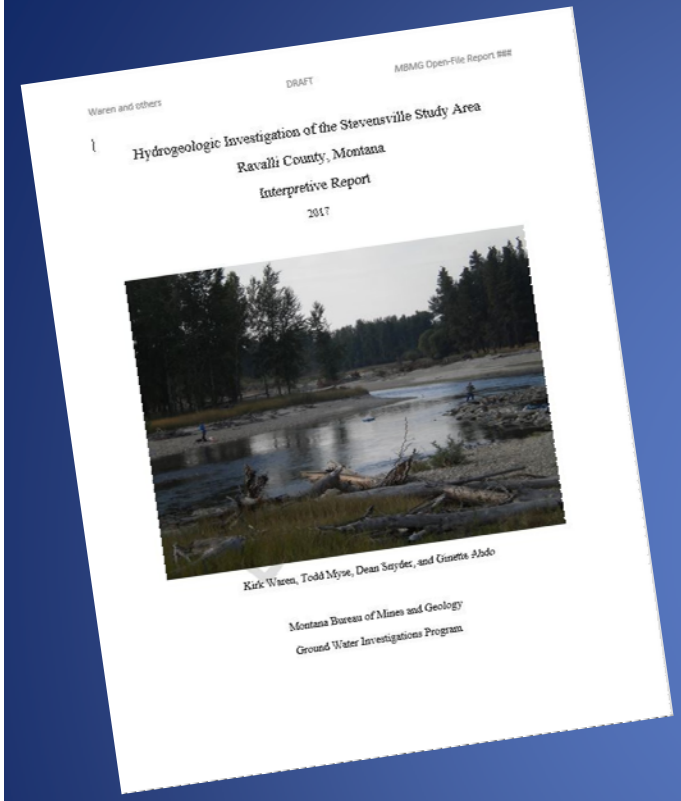

Flows out Mitchell Slough: base model versus no irrigation after one season model
Flow (cfs)
140
120
100
80
60
40
20
0
4/1/12
4/1/14
4/1/16
4/1/18
4/1/20
4/1/22
Base Run
No irrigation after one season, low river stage
No irrigation after one season


Flow out east branch Mitchell Slough
Flow, cfs
120
100
80
60
40
20
0
4/1/12
6/1/12
8/1/12
10/1/12
12/1/12
1/31/13
4/2/13
6/2/13
High K base run
High K 5
High K 6
High K 7
High K 8

Drawdown Map: modeled groundwater level declines caused by pumping irrigation wells



Products:



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Document Status Digital Data

Description Appendix B has directions for using the modeling files linked to this report.

Subject(s) STEADY-STATE TRANSIENT INVESTIGATION, PEDIMENT FOCUS MODEL, GROUNDWATER MODEL

Geographic Area/Counties LEWIS AND CLARK

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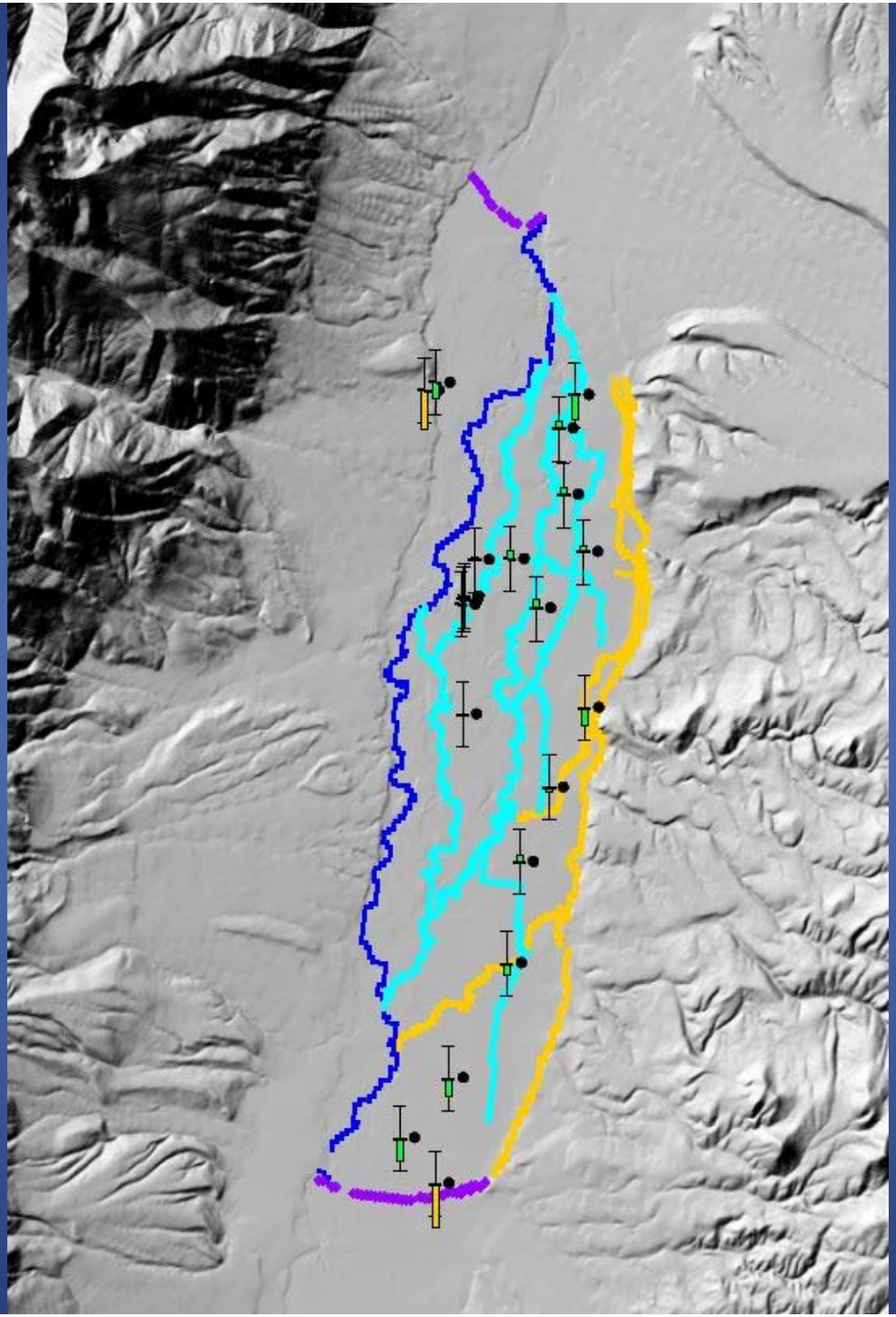
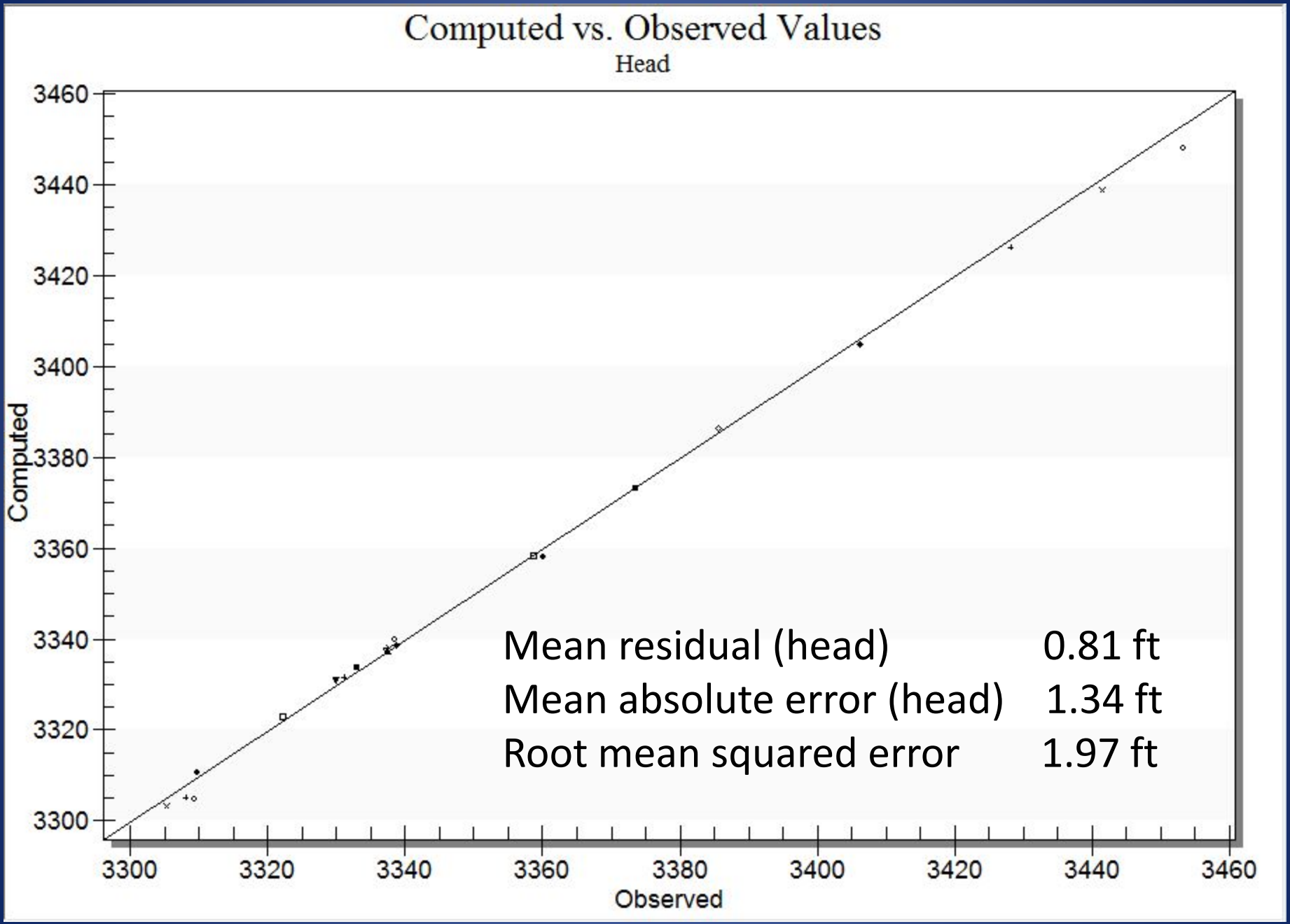
Report

Downloadable report and groundwater models

Extra slides




Computed vs. Observed Values
Head
Computed
Observed
3460
3440
3420
3400
3380
3360
3340
3320
3300
3300
3320
3340
3360
3380
3400
3420
3440
3460
Mean residual (head) 0.81 ft
Mean absolute error (head) 1.34 ft
Root mean squared error 1.97 ft