Wood River Valley
Model Construction Update

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These slides were presented at the Wood River Valley Modeling Technical Advisory Committee meeting Thursday, 6/5/2014, 10am-3pm at the Community Campus, Bullion Room, in Hailey. Taken outside the context of the original presentation, these slides may not provide a complete or accurate representation of the speaker’s intent.

Install

If R is not already installed on your computer, download and install the latest binary distribution from CRAN.

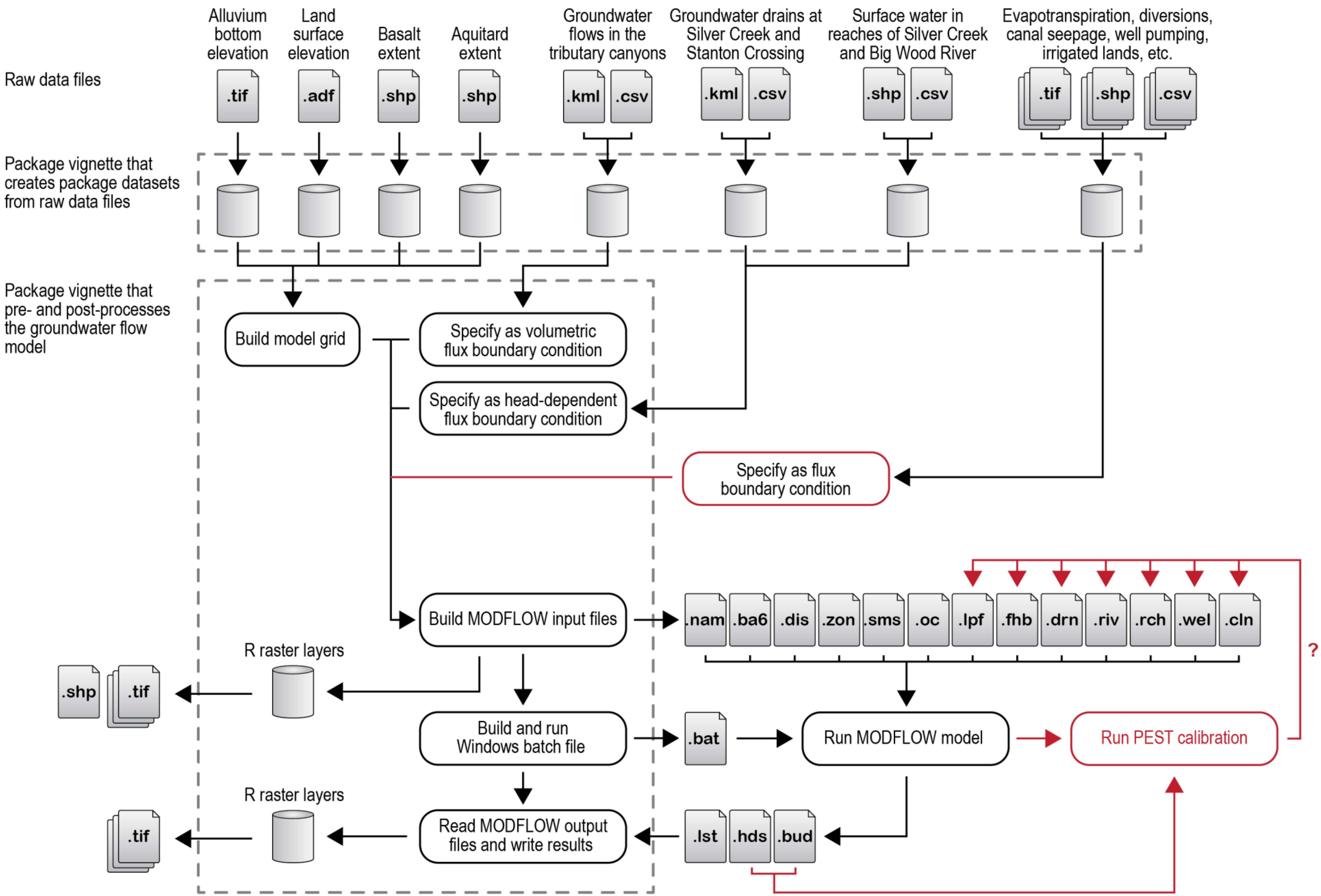
Open an R session and install the following packages from CRAN:

```
> install.packages(c("sp", "rgdal", "raster", "igraph", "rgeos", "RCurl", "png", "xtable", "gstat"))
```

Install the **wrv** package:

```
> install.packages("wrv", repos = "<WILL BE SPECIFIED WHEN REPORT IS PUBLISHED>")
```

System requirements include the latest version of MODFLOW-USG. Windows users can download and decompress the file archive in the default search path `C:/WRDAPP`.


Alluvium bottom elevation
Land surface elevation
Basalt extent
Aquitard extent
Groundwater flows in the tributary canyons
Groundwater drains at Silver Creek and Stanton Crossing
Surface water in reaches of Silver Creek and Big Wood River
Evapotranspiration, diversions, canal seepage, well pumping, irrigated lands, etc.
Raw data files
.tif
.adf
.shp
.shp
.kml
.csv
.kml
.csv
.shp
.csv
.tif
.shp
.csv
Package vignette that creates package datasets from raw data files
Package vignette that pre- and post-processes the groundwater flow model
Build model grid
Specify as volumetric flux boundary condition
Specify as head-dependent flux boundary condition
Specify as flux boundary condition
Build MODFLOW input files
.nam
.ba6
.dis
.zon
.sms
.oc
.lpf
.fhb
.drn
.riv
.rch
.wel
.cln
?
R raster layers
.shp
.tif
Build and run Windows batch file
.bat
Run MODFLOW model
Run PEST calibration
R raster layers
.tif
Read MODFLOW output files and write results
.lst
.hds
.bud

Create Package Data Sets from Raw Data Files

By Jason C. Fisher

Contents

Processing Instructions for the Groundwater Flow Model of the Wood River Valley, Idaho

By Jason C. Fisher

Contents

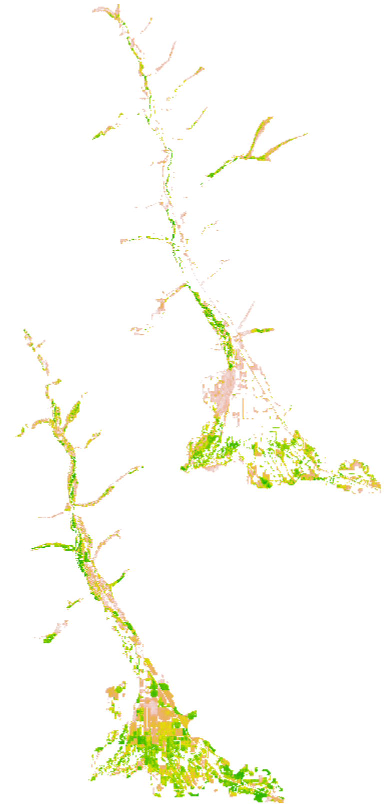
Figures

Recharge on Non-Irrigated Lands

- Precipitation minus evapotranspiration
- Model layer 1 cells in all stress periods
- Recharge Package

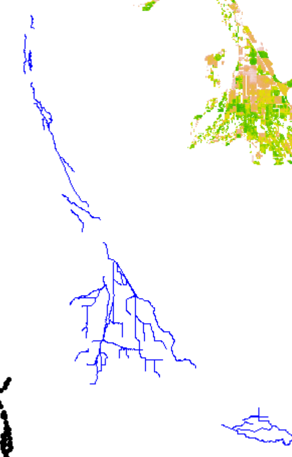
Recharge on Irrigation Entities

- Complex calculation (dependent on diversions, etc.)
- Model layer 1 cells, all stress periods
- Recharge Package



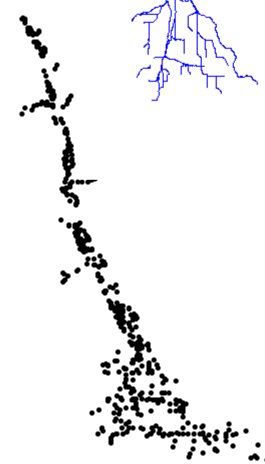
Seepage along Canals

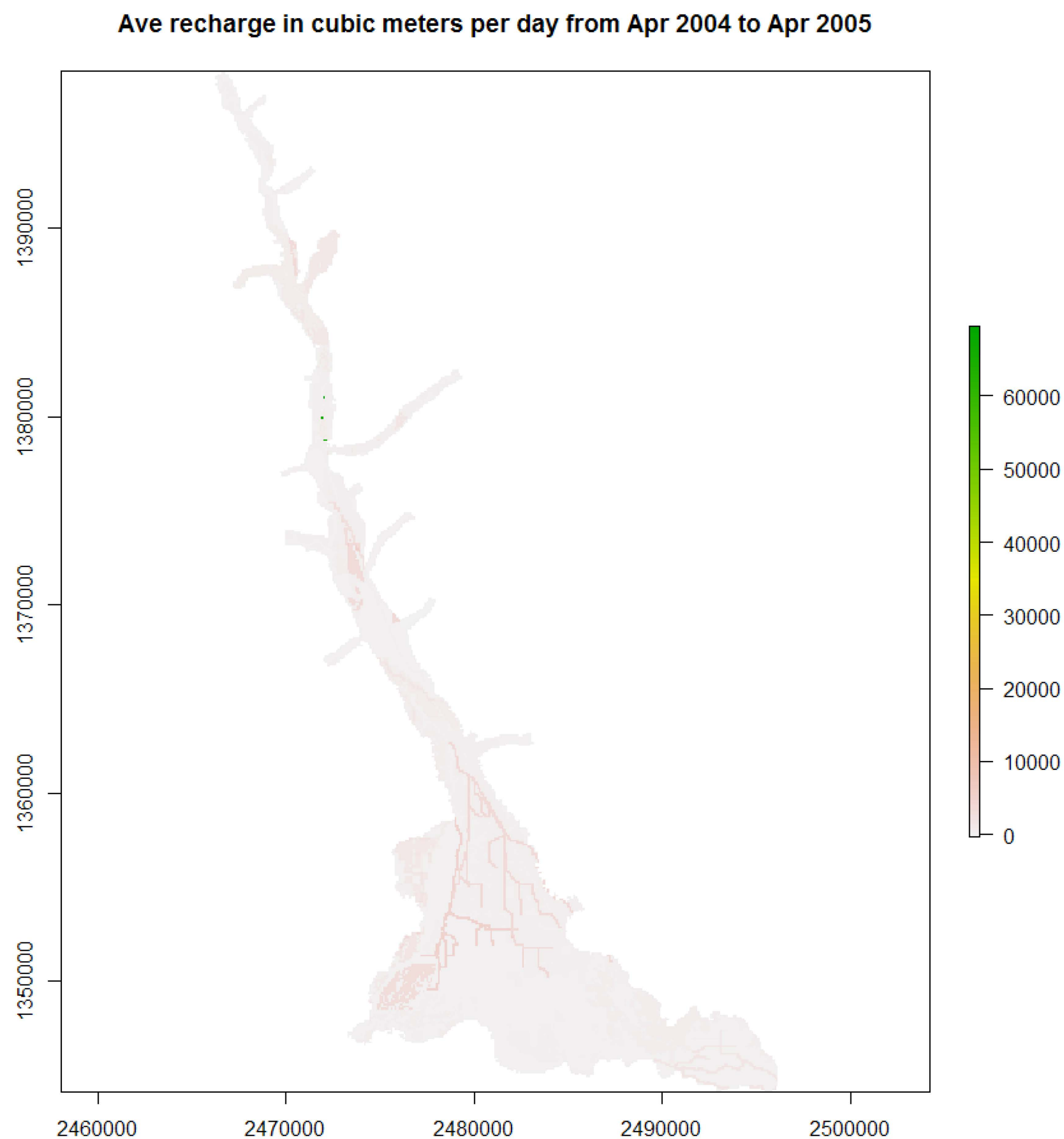
- Fraction of diversions for irrigation entities
- Model layer 1 cells, all stress periods
- Recharge Package



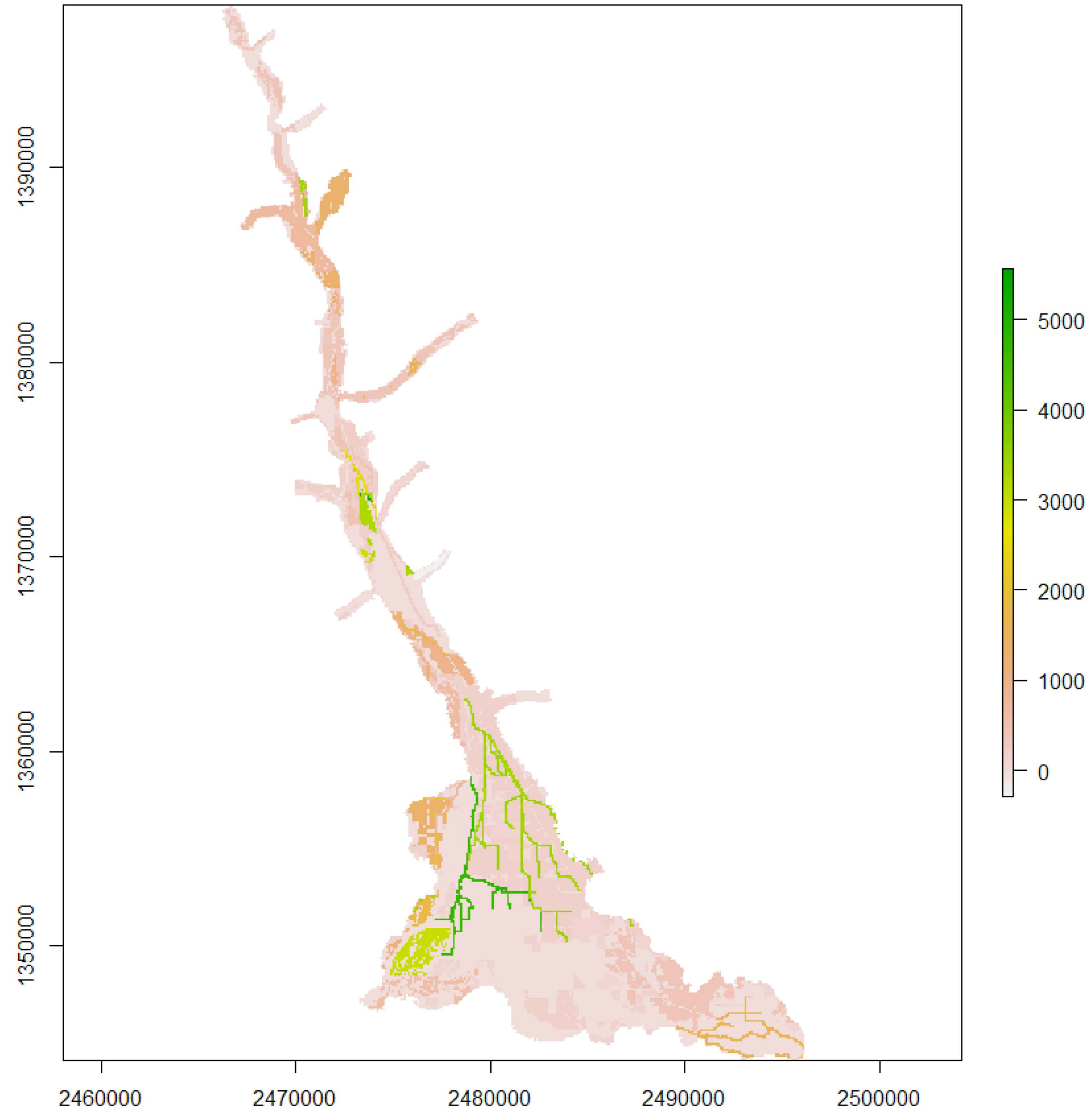
Pumping at Well Sites

- Observed and estimated values of pumping
- Model layer(s) 1, 2, 3 cells, all stress periods
- Connected Linear Network and Well Packages

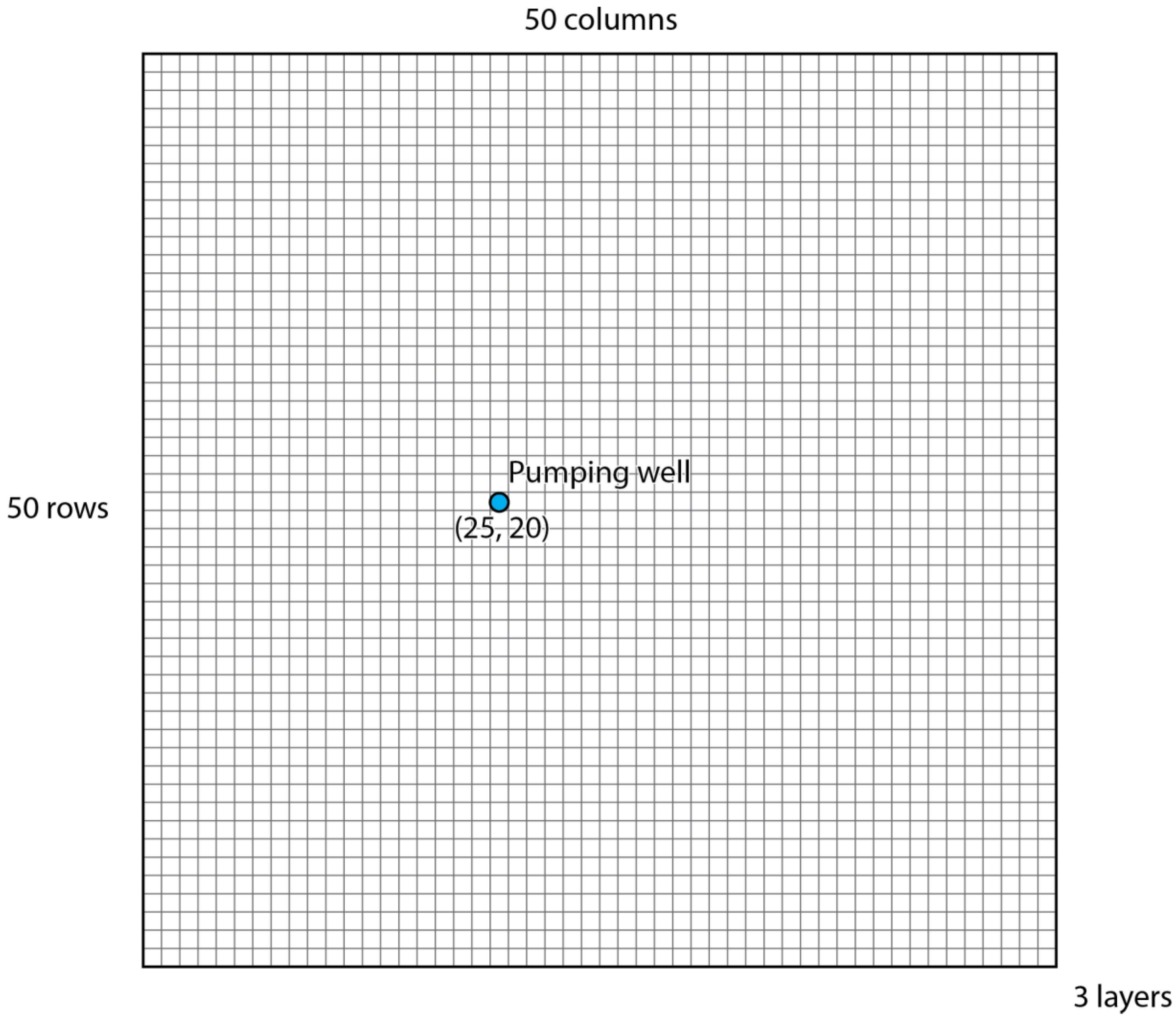



Ave recharge in cubic meters per day from Apr 2004 to Apr 2005
1390000
1380000
1370000
1360000
1350000
2460000
2470000
2480000
2490000
2500000
60000
50000
40000
30000
20000
10000
0

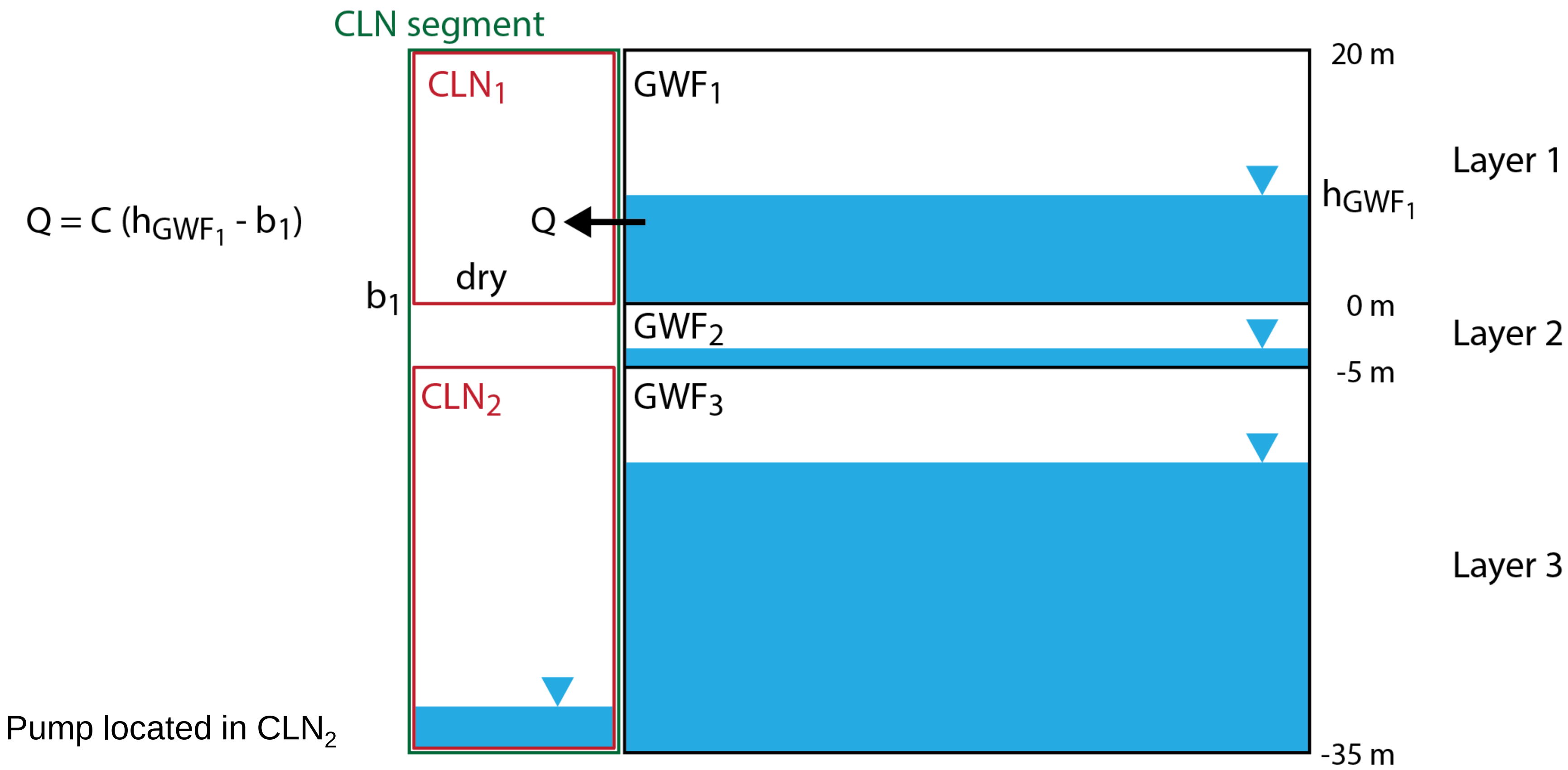
Ave recharge in cubic meters per day from Apr 2004 to Apr 2005 without Outliers



Example problem demonstrating use of the Connected Linear Network (CLN) process with a structured grid and pumping from a single well



- A single CLN is known as a *CLN segment*
- CLN_i is a *CLN cell* at location i
- GWF_j is a groundwater flow cell (*GWF cell*) at location j
- Q is the volumetric discharge/recharge
- b_1 is the bottom elevation of model layer 1
- h_{GWF1} is the hydraulic head in GWF_1
- C is the conductance between cells



Connected Linear Network (CLN) Package file (*.cln)

No. of CLN segments Output file unit numbers No. of conduit-geometry types

```
1 -1 35 36 0 0 2 1        # NCLN ICLNNDS ICLNCB ICLNHD ICLNDD ICLNIB NCLNGWC NCONDUITYP
```

Linear segments No. of connections to GWF cells

```
constant 2                # NNDCLN(NCLN)
```

No. of CLN cells per CLN segment

CLN cell index CLN segment orientation

```
1 1 0 20.0   0.0 0 0 0    # IFNO IFTYP IFDIR FLENG FELEV FANGLE IFLIN ICCWADI
```

Conduit type CLN cell vert. length

CLN cell bottom elev.

```
2 1 0 30.0 -35.0 0 0 0    # IFNO IFTYP IFDIR FLENG FELEV FANGLE IFLIN ICCWADI
```

CLN cell index Row Thiem equation options

```
1 1 25 20 0 0 20.0 1.0 0  # IFNOD IGWLAY IGWROW IGWFCOL IFCON FSKIN FLENGW FANISO ICGWADI
```

Layer Column Horiz. anisotropy

Leakage across skin

```
2 3 25 20 0 0 30.0 1.0 0  # IFNOD IGWLAY IGWROW IGWFCOL IFCON FSKIN FLENGW FANISO ICGWADI
```

Conduit type "cylindrical" Hydraulic conductivity factor Length of CLN segment connected to GWF cell

```
1 0.5 3.23e10             # ICONDUITYP FRAD CONDUITK
```

Conduit radius

```
constant 1                # IBOUND(NCLNNDS)

internal 1.0 (Free) -1    # STRT(NCLNNDS)
```

Initial head in CLN cells

```
10.0 30.0
```

Well (WEL) Package file (*.wel)

Max. no. of wells in use during a stress period

```
1 54 1       # MXACTW IWELCB IWELQV
```

Output file unit number

```
0 0 1        # ITMP NP ITMPCLN
```

No. of parameters in use

No. of non-parameter wells read for current stress period for CLN cells

```
2 -62840.0   # Node Q
```

Volumetric recharge rate (+ recharge and – discharge)

CLN cell index no.

TODO List

1. ~~Validate R code pertaining to processing of recharge on irrigated lands, canal seepage, and well pumping~~
2. ~~Create and document new R datasets: precipitation, diversions, evapotranspiration, canal seepage, etc.~~
3. Integrate new processing instructions into package vignettes
4. ~~Develop input files for the Recharge, Well, and Connected Linear Network Packages~~
5. Construct transient model run
6. Decrease run time for a MODFLOW simulation (currently at about 1 minute)
7. Collaborate on model calibration…

Questions