# Instructions File for Content of 100-HR-3 (9-LAY) Groundwater Model

# 0\_Layer\_River\_Create Creation

**LayerCreation\_9Lay.xlsx** – Calculates the top and bottom of all layers, determines which cells are river cells, and assigns their associated bottom elevation for nine layer model.

**rivercells9laynew2020.xlsx** – Template file used to generate river csv files to be imported into GWV to create RIV package for nine layer model. Excel file contains stage info for 2006-2020; 2014 model begins at stress period 97. Was updated using the new convolution for 2020.

**River\_New2020\_GHBRIV.gwv** – The groundwater vistas file used to generate the DIS, BAS, RIV and GHB packages

## BottomCSV

Folder containing all the CSV files exported from LayerCreation\_9Lay.xls imported into GWV to create DIS package

## GHBCSV

Folder containing all the CSV files exported from GHBcellcreate.xlsx (Previously provided, did not change) imported into GWV to create GHB package. Conductance values are not calibrated values but were used to create PEST template files.

## RiverCSV

Folder containing all the CSV files exported from rivercells9laynew2020.xlsx imported into GWV to create River package. Conductance values are not calibrated values but were used to create PEST template files. (\_new2020 CSV files contain the stages using the updated river stage convolution for 2020)

# 1\_Model\_RUM-NOFLOW\_OLD2020RIV

PEST and MODFLOW files for 2014-2020 simulation with a no flow boundary under the river in layer 9. DHModelfinal.pst is the PEST control file with RUNMODEL.bat running the flow model and all post processors. This model uses the old convolution for the 2020 river stage to allow for a direct comparison to the “9\_Model\_RUM-NoFlow” model previously provided but with layer 5 split into 4 layers.

## Executables

Calcgradients.exe – Calculates three point gradients from calcgradients.in and produces gradients.out

Headtarg\_d.exe – Extracts simulated heads from the .hds file for a list of observed targets in headtarg2020.in and produces headtargs.out

mf2k-mst-chprc08dpv.exe – MODFLOW executable with minimum saturated thickness

pest.exe – Parameter ESTimation program

plproc64.exe – Krigs pilot points to produce hydraulic conductivity fields for the unconfined and RUM aquifers using DHMODEL.ctl control file and produces HKLAY1.ref and HKRUM.ref

transformGradients.exe – Transforms magnitudes (LN(1/magnitude) and azimuth (degree/30) for PEST targets in gradients.out to transformedGradients.out

## Python Scripts

03\_CreateGradInput.py – Creates calcgradients.in from Data\_Analysis.xlsx three-point gradient template file

CalculateMNW2.py – Reads the MNW2 and LIST file to produce observed and simulated flow rates for each system, DX - pts\_Q\_1.out, HX – pts\_Q\_7.out and for each well - AllWells\_Q.out

readheadtarg.py – Reads headtargs.out and writes the simulated heads to Data\_Analysis.xlsx, there is a script for each year (2014-2020) and for the 2020 RUM

readlist.py – Reads list file and outputs volumetric budgets to budget.csv (Not part of RUNMODEL.bat)

## Transport\_2014-2020P18\_CP

Folder containing files for hexavalent chromium transport (MT3D) run with RunMT3D.bat

### InitialPlume

Matrix files of initial plume concentrations for each layer

### ASCFiles

A folder of ASC files for the end of each year (2014-2020) for each layer and maximum created using ReadBIN\_WriteASC2.exe and ReadBIN\_WriteASC.in as input

# 2\_Model\_RUM-NOFLOW\_NEW2020

PEST and MODFLOW files for 2014-2020 simulation with a no flow boundary under the river in layer 9. DHModelfinal.pst is the PEST control file with RUNMODEL.bat running the flow model and all post processors. This model uses the new convolution for the 2020 river stage and is similar in boundary conditions as the “9\_Model\_RUM-NoFlow” model previously provided but with layer 5 split into 4 layers. See 1\_Model\_RUM-NOFLOW\_OLD2020RIV for list of executables and python scripts.

## Transport\_2014-2020P18\_CP

Folder containing files for hexavalent chromium transport (MT3D) run with RunMT3D.bat

### InitialPlume

Matrix files of initial plume concentrations for each layer

### ASCFiles

A folder of ASC files for the end of each year (2014-2020) for each layer and maximum created using ReadBIN\_WriteASC2.exe and ReadBIN\_WriteASC.in as input

# 3\_Model\_RUM-GHB\_NEW2020

PEST and MODFLOW files for 2014-2020 simulation with GHB (120’) under eastern river boundary in layer 9. DHModelfinal.pst is the PEST control file with RUNMODEL.bat running the flow model and all post processors. This model uses the new convolution for the 2020 river stage and is similar in boundary conditions as the “8\_Model\_RUM-GHB” model previously provided but with layer 5 split into 4 layers. See 1\_Model\_RUM-NOFLOW\_OLD2020RIV for list of executables and python scripts.

## Transport\_2014-2020P18\_CP

Folder containing files for hexavalent chromium transport (MT3D) run with RunMT3D.bat

### InitialPlume

Matrix files of initial plume concentrations for each layer

### ASCFiles

A folder of ASC files for the end of each year (2014-2020) for each layer and maximum created using ReadBIN\_WriteASC2.exe and ReadBIN\_WriteASC.in as input

# 4\_Figures

## Gradients

### 1\_RUM-NOFLOW\_OLD2020

PDFs of three-gradients by year (2014-2020) in the unconfined and 2020 in the RUM for 1\_Model\_RUM‑NOFLOW\_OLD2020RIV

### 2\_RUM-NOFLOW\_NEW2020

PDFs of three-gradients by year (2014-2020) in the unconfined and 2020 in the RUM for 2\_Model\_RUM‑NOFLOW\_NEW2020 simulation

### 3\_RUM-GHB\_NEW2020

PDFs of three-gradients by year (2014-2020) in the unconfined and 2020 in the RUM for 3\_Model\_RUM‑GHB\_NEW2020 simulation

## Hydrographs

RES2\_01\_RUMNOFLOW\_OLD2020.xlsx – Hydrographs by PEST group for 9 layer model 1\_Model\_RUM‑NOFLOW\_OLD2020RIV simulation and for 6 layer model 9\_Model\_RUM-NoFlow simulation

RES2\_02\_RUMNOFLOW\_NEW2020.xlsx – Hydrographs by PEST group for 9 layer model 2\_Model\_RUM‑NOFLOW\_NEW2020RIV simulation and for 6 layer model 9\_Model\_RUM-NoFlow simulation

RES2\_03\_RUMNOFLOW\_NEW2020.xlsx – Hydrographs by PEST group for 9 layer model 3\_Model\_RUM‑GHB\_NEW2020RIV simulation and for 6 layer model 8\_Model\_RUM-GHB simulation

## Pump Rates

PumpingRateComparison\_01\_RUMNOFLOW\_OLD2020.pdf – Observed verses simulated rates at each extraction/injection well for 1\_Model\_RUM‑NOFLOW\_OLD2020RIV simulation

\_DX\_01\_RUMNOFLOW\_OLD2020.png – Observed verses simulated total extraction and injection for 100-D area for 1\_Model\_RUM‑NOFLOW\_OLD2020RIV simulation

\_HX\_01\_RUMNOFLOW\_OLD2020.png – Observed verses simulated total extraction and injection for 100-H area for 1\_Model\_RUM‑NOFLOW\_OLD2020RIV simulation

PumpingRateComparison\_02\_RUMNOFLOW.pdf – Observed verses simulated rates at each extraction/injection well for 2\_Model\_RUM‑NOFLOW\_NEW2020RIV simulation

\_DX\_02\_RUMNOFLOW.png – Observed verses simulated total extraction and injection for 100-D area for 2\_Model\_RUM‑NOFLOW\_NEW2020RIV

\_HX\_02\_RUMNOFLOW.png – Observed verses simulated total extraction and injection for 100-H area for 2\_Model\_RUM‑NOFLOW\_NEW2020RIV

PumpingRateComparison\_03\_RUMGHB.pdf – Observed verses simulated rates at each extraction/injection well for 3\_Model\_RUM‑GHB\_NEW2020RIV simulation

\_DX\_03\_RUMGHB.png – Observed verses simulated total extraction and injection for 100-D area for 3\_Model\_RUM‑GHB\_NEW2020RIV simulation

\_HX\_03\_RUMGHB.png – Observed verses simulated total extraction and injection for 100-H area for 3\_Model\_RUM‑GHB\_NEW2020RIV simulation