# Documentation of Conversion of the MODFLOW Multi-Node Well (MNW) Package To MODFLOW-2005

This documentation describes the changes to the MNW Package (Halford and Hanson, 2002) to convert it to work with MODFLOW-2005. See Chapter 9 of Harbaugh (2005) for further information about the MODFLOW-2005 program.

1. Fortran module GWFMNWMODULE was created to store the shared data for the MNW Package; GWFMNWMODULE incorporates the capability to support Local Grid Refinement. The following table describes the data.

| Variable Name | Size | Description |
|---|---|---|
| TWOPI | Scalar | Double-precision constant 2×3.1415926535897932 |
| ZERO25 | Scalar | Double-precision constant $1\times10^{-25}$ |
| ZERO20 | Scalar | Double-precision constant $1\times10^{-20}$ |
| ZERO8 | Scalar | Double-precision constant $1\times10^{-8}$ |
| BIG | Scalar | Double-precision constant $1\times10^{30}$ |
| MNWNAME | Scalar, LEN=200 | Prefix name of file for outputting time series data from MNW |
| NWELL2 | Scalar | Counter for the number of wells used in the current stress period |
| MXWEL2 | Scalar | Maximum number of well cells to be defined |
| IWL2CB | Scalar | Flag and unit number:<br>>0 – Unit number on which cell-by-cell flow terms are written<br>0 – Cell-by-cell flow terms will not be printed or recorded<br><0 – Write well recharge, water-levels, drawdown, and water quality. |
| KSPREF | Scalar | Reference stress period |
| IWELPT | Scalar | Flag: when nonzero indicates well information will be printed |
| NOMOITER | Scalar | Flow in MNW wells will not be calculated after NOMITER iterations |
| PLOSS | Scalar | Power term for calculating user-specified well loss:<br>0 – Skin<br>1 – Linear<br>>1 and <3.6 – Nonlinear |
| HDRY | Scalar | When a cell converts to dry, HNEW is set equal to HDRY. |
| SMALL | Scalar | Double-precision constant set according to solver head closure criteria. |
| HMAX | Scalar | Maximum absolute head in stress periods up to and including KSPREF |
| MNWSITE | MXWEL2, LEN=32 | Site label for identifying wells. |
| IOWEL2 | 3 | Flag and unit number :<br>(1) – Unit number for creating a WEL1 input file using MNW rates<br>(2) – Unit number for saving flow rate at each well node<br>(3) – Unit number for saving total flow rate for each multi-mode well |

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|---|---|---|
| WELL2 | 17,MXWEL2+1 | Data for each well (k is the well index):<br>(1,k) – Node index<br>(2,k) – Desired flow rate<br>(3,k) – Actual flow rate<br>(4,k) – Water quality attributes<br>(5,k) – Radius of wellbore<br>(6,k) – Skin associated with well completion<br>(7,k) – Minimum/maximum head or drawdown<br>(8,k) – Elevation of reference head<br>(9,k) – Water quality group identifier<br>(10,k) – Water level in wellbore<br>(11,k) – Update for HCOF / QWaverage, cel2wel conductance<br>(12,k) – Update for RHS<br>(13,k) – Lower limit flow rate to turn off<br>(14,k) – Lower limit flow rate to turn on<br>(15,k) – Reserve desired flow rate<br>(16,k) – Nonlinear loss term<br>(17,k) – Actual flow rate to individual nodes |
| HREF | NCOL,NROW,NLAY | Heads at the beginning of stress period KSPREF |

2. All subroutines were changed to designate 2 for the process version and 7 for the package version: GWF2MNW7.

3. Subroutines GWF1MNW1DF and GWF1MNW1AL were combined into GWF2MNW7AR.

4. GWF2MNW7AR was modified to use ALLOCATE statements to reserve memory for the data in GWFMNWMODULE rather than reserving space in the RX array used by MODFLOW-2000.

5. Subroutine arguments that are contained in Fortran modules were replaced with USE statements in all primary subroutines called from main.

6. The single CEL2WEL function was replaced by CEL2WELBCF, CEL2WELLPF, and CEL2WELHUF and these are used depending on which flow package is active.

7. Subroutine GWF2MNW7DA was created to deallocate memory.

8. To support the Local Grid Refinement capability, subroutine SGWF2MNW7PNT was created to set pointers to a grid, and subroutine SGWF2MNW7PSV was created to save the pointers for a grid. The grid number, IGRID, was added as a subroutine argument to all of the primary subroutines, and subroutines SGWF2MNW7PSV and SGWF2MNW7PNT are called as appropriate.

References

Halford, K.J. and Hanson, R.T., 2002, User guide for the drawdown- limited, multi-node well (MNW) package for the U.S. Geological Survey's modular three-dimensional finite-difference ground-water flow model, versions MODFLOW-96 and MODFLOW-2000: U.S. Geological Survey Open-File Report 02-293, 33 p.

Harbaugh, A.W., 2005, MODFLOW-2005,the U.S. Geological Survey modular ground-water model—the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16, variously p.