Guide to the Watershed Model Programs and Files

Appendix 5-B. Guide to the Watershed Model Programs and Files

This appendix contains a list each of the programs included in the watershed model, a list of the files needed to run each program, a list of files developed by each program, a description of the contents of each file, and where to find the file in the current directory layout.

5-B.1.   General Input Files
The General Input Files contain parameters and characteristics used to calibrate and fine tune the model as well as control the inputs used to make a model run.

5-B.1.1.   Master Input File (Format _v28.1g)
Number of Files:
1

Location:
The Master Input File can be located practically anywhere, but for continuity it is usually stored in the Inputs Directory

Example:
MasterInput_v28.1g.txt

Purpose:
The Master Input file acts as a control file for the model run. It defines the model run, location of input files and where to write the results, contains a list of input files and input file descriptors, controls the use of optional model functions, defines the period of simulation, and layout of the model.

When building the Master Input File each of the following entries must be included. Furthermore, spaces should not be used in any file names, prefixes, or directories. Nor should commas be used as thousands separators in numbers.

Entries:
1. Header – Description line.

2. Run Designation (cRun[1]) – Name assigned to the model Run. This is a descriptor used to differentiate different scenarios, versions, and iterations of the model run. (String)

   The final iteration of the watershed model is Run028b2.

$$\underbrace{Run}_{Scenario} \quad \underbrace{028}_{Version} \quad \underbrace{b2}_{Iteration}$$

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[1] The length of this string is limited to 250 characters.

While the actual name does not have specific meaning within the confines of the model, **it's important when deciphering the difference between subsequent model runs**. The programs attach the run designation to the output files transferred to the surface water and groundwater models.

Other Examples:
    Graphical User Interface Development version 2 demand run: (GUI_002a)
    Dawson Area Canals Baseline version 1 supply run 6:   (DACb001f)
    Minimum Tillage Scenario version supply run 1:   (MinTill_001b)

*Note that an 'a' in the iteration number is frequently used to designate a 'demand run' and 'a', 'b', 'c', 'd', … is used to designate subsequent 'supply runs'.

3. Model Name (MODname[1]) – Name assigned to Model being run. This term is used to further distinguish between results files. (String)

    Examples
        Cooperative Hydrologic Study: (COHYST)
        Conjunctive Water Resources Management: (CWRM)
        Conservation Study: (ConSer)

4. Input Directory (INDIR[2]) – Directory location of the input files to be used in the model run. (String)

    Example:
        W:\COHYST\GUI\GUI_28b2\Inputs\

5. Output Directory (OUTDIR[2]) – Directory location to which the model results will be written. This folder needs to contain the COHYST output folder structure. (String)

    Example:
        W:\COHYST\GUI\GUI_28b2\Results\

6. Water Balance Parameter Directory (WBPDIR[2]) – Directory location containing the gridded water balance results from the soil water balance model (CropSim). (String)

    Example:
        W:\COHYST\COHYST\Gridded_CropSim\Run001\

7. Land Use Directory (LUDIR[2]) – Directory containing the land use data set. This location should contain the folders listed on lines 11-14 of the Master Input File. (String)

    Example:
        W:\COHYST\ModelPrep\LU_ext2\LU003ext\LUTest003\

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[2] The length of this string is limited to 1000 characters.

8. Canal Recharge Directory (CNLDIR[2]) – Directory containing the canal recharge data sets. Any canal recharge data set intended to be used in the model run should be located in this directory and listed in the Canal Master File (Master Input File line 29). (String)

   Example:
       W:\COHYST\GUI\GUI_28b2\Canal\

9. Miscellaneous Directory (MiscDIR[2]) – Directory containing the miscellaneous pumping and recharge data sets. Any miscellaneous pumping or recharge to be included in the modeling process should be located in this directory and listed in the Miscellaneous Master File (Master Input File lines 30-31). (String)

   Example:
       W:\COHYST\COHYST\Misc\

10. Municipal and Industrial Directory (MIDIR[2]) – Directory containing the municipal and industrial pumping and recharge data sets. Any municipal and industrial pumping or recharge to be included in the modeling process should be located in this directory and listed in the Municipal and Industrial Master files (Master Input File lines 32-33). (String)

    Example:
        W:\COHYST\COHYST\MI\

11. Groundwater Only Land Use Folder (GWLUfld[1]) – Name of the folder containing the groundwater only irrigated land use files. The folder needs to be located in the land use directory. (String)

    Example:
        GW004

12. Surface Water Only Land Use Folder (SWLUfld[1]) – Name of the folder containing the surface water only irrigated land use files. The folder needs to be located in the land use directory. (String)

    Example:
        SW004

13. Comingled Land Use Folder (COLUfld[1]) – Name of the folder containing the comingled land use files. The folder needs to be located in the land use directory. (String)

    Example:
        CO004

14. Dryland Land Use Folder (DryLUfld[1]) – Name of the folder containing the dryland land use files. The folder needs to be located in the land use directory. (String)

    Example:
        Dry004

15. Groundwater Only Land Use File Prefix (GWLU[1]) – This is the beginning of the groundwater only land use file which is then attached to the year identifier and file extension. Include only the prefix in the Master Input File. (String)

    Example:
        Prefix: GWLU

        File Name: $\underbrace{GWLU}_{Prefix} \underbrace{1985}_{Year} \underbrace{.txt}_{Extension}$

16. Surface Water Only Land Use File Prefix (SWLU[1]) – This is the beginning of the surface water only land use file which is then attached to the year identifier and file extension. Include only the prefix in the Master Input File. (String)

    Example:
        Prefix: SWLU

        File Name: $\underbrace{SWLU}_{Prefix} \underbrace{1985}_{Year} \underbrace{.txt}_{Extension}$

17. Comingled Land Use File Prefix (COLU[1]) – This is the beginning of the comingled land use file which is then attached to the year identifier and file extension. Include only the prefix in the Master Input File. (String)

    Example:
        Prefix: COLU

        File Name: $\underbrace{COLU}_{Prefix} \underbrace{1985}_{Year} \underbrace{.txt}_{Extension}$

18. Dryland Land Use File Prefix (DryLU[1]) – This is the beginning of the dryland land use file which is then attached to the year identifier and file extension. Include only the prefix in the Master Input File. (String)

    Example:
        Prefix: DryLU

        File Name: $\underbrace{DryLU}_{Prefix} \underbrace{1985}_{Year} \underbrace{.txt}_{Extension}$

19. Groundwater Concentration Folder (GWCfld[1]) – Name of the folder containing the groundwater concentration files. The folder needs to be located in the Inputs directory. (String)

    Example:

GWC

20. Groundwater Concentration File Prefix (GWCfile[1]) – This is the beginning of the groundwater concentration file which is then attached to the year identifier and file extension. Include only the prefix in the Master Input File. (String)

Example:
    Prefix: GWCLL

    File Name: $\underbrace{GWCLL}_{Prefix}\underbrace{1985}_{Year}\underbrace{.txt}_{Extension}$

21. Cell Location File (CellLoc[1]) – This is the name of the cell location file. The file needs to be located in the Inputs Directory. (String)

Example:
    CellLoc.csv

22. Coefficient Zone Coefficient File (Coeffile[1]) – This is the name of the coefficient zone coefficient file. The file needs to be located in the Inputs Directory. (String)

Example:
    CoefFile.csv

23. Application Efficiency File (AEfile[1]) – This is the name of the application efficiency file. The file needs to be located in the Inputs Directory. (String)

Example:
    AE.txt

24. Runoff Zone Coefficient File (ROZfile[1]) – This is the name of the runoff zone coefficient file. The file needs to be located in the Inputs Directory. (String)

Example:
    ROZCoef.txt

25. Percent to Recharge File (PctRchfile[1]) – This is the name of the percent to recharge file. The file needs to be located in the Inputs Directory. (String)

Example:
    Pctrch.txt

26. Surface Water Irrigation District Index File (SWidxfile[1]) – This is the name of the surface water index file. The file needs to be located in the Inputs directory. (String)

Example:
    SWindex2.txt

27. County ID File (CountID[1]) – This is the name of the county identification file. The file needs to be located in the Inputs Directory. (String)

Example:
   CountID.txt

28. County-Cell Relationship File (Cell_county[1]) – This is the name of the county-cell relationship file. The file needs to be located in the Inputs Directory. (String)

Example:
   Cell_County.txt

29. Canal Master File (CNLmastfile[1]) – This is the name of the Canal Master File containing the list of canal recharge data sets to be included in the model simulation. The inclusion of canal recharge is optional; controlled by the canal recharge flag (Master Input File line 44). If canal recharge is being included, this file needs to be located in the Inputs Directory, and include entries that are located in the Canal Recharge Directory. Otherwise, it is acceptable form to use the term 'None'. (String)

Examples:
   Canal_Master.txt
   None   for when no canal recharge is included

30. Miscellaneous Master Recharge File (MISCrmastfile[1]) – This is the name of the Miscellaneous Master Recharge File containing the list of miscellaneous recharge data sets to be included in the model simulation. The inclusion of miscellaneous recharge is optional; controlled by the miscellaneous recharge flag (Master Input File line 45). If miscellaneous recharge is being included, this file needs to be located in the Inputs Directory, and include entries that are located in the Miscellaneous Directory. Otherwise, it is acceptable form to use the term 'None'. (String)

Example:
   MiscR_Master.txt
   None   for when no miscellaneous recharge is included

31. Miscellaneous Master Pumping File (MISCpmastfile[1]) – This is the name of the Miscellaneous Master Pumping File containing the list of miscellaneous pumping data sets to be included in the model simulation. The inclusion of miscellaneous pumping is optional; controlled by the miscellaneous pumping flag (Master Input File line 46). If miscellaneous pumping is being included, this file needs to be located in the Inputs Directory, and include entries that are located in the Miscellaneous Directory. Otherwise, it is acceptable form to use the term 'None'. (String)

Example:
   MiscP_Master.txt
   None   for when no miscellaneous pumping is included

32. Municipal and Industrial Master Recharge File (MIrmastfile[1]) – This is the name of the M&I Master Recharge File containing the list of M&I recharge data sets to be included in the model simulation. The inclusion of M&I recharge is optional; controlled by the M&I recharge flag (Master Input File line 47). If M&I recharge is being included, this file needs to be located in the Inputs Directory, and include entries that are located in the Municipal and Industrial Directory. Otherwise, it is acceptable form to use the term 'None'. (String)

    Example:
       MIr_Master.txt
       None   for when no Municipal and Industrial recharge is included

33. Municipal and Industrial Master Pumping File (MIpmastfile[1]) – This is the name of the M&I Master Pumping File containing the list of M&I pumping data sets to be included in the model simulation. The inclusion of M&I pumping is optional; controlled by the M&I pumping flag (Master Input File line 48). If M&I pumping is being included, this file needs to be located in the Inputs Directory, and include entries that are located in the Municipal and Industrial Directory. Otherwise, it is acceptable form to use the term 'None'. (String)

    Example:
       MIp_Master.txt
       None   for when no Municipal and Industrial recharge is included

34. Active Cells File (ActCellfile[1]) – This is the name of the Active Cells File. This file needs to be located in the Inputs Directory. (String)

    Example:
       Active_cells.txt

35. Call Year File (CallYrfile[1]) – This is the name of the Call Year File. This file needs to be located in the Inputs Directory. (String)

    Example:
       Callyr.csv

36. Number of Cells (ncells) – This value indicates the total number of cells in the complete model grid. (Integer)

    Example:
       138600
       ~~138,600~~   Using a comma to separate thousand places is unacceptable

37. Simulation Starting Month (startmon) – This value indicates the starting month of the simulation. The watershed model is based upon a calendar year. (January = 1, February =2, …) (Integer)

    Example:
       10

38. Simulation Starting Year (startyr) – This value indicates the year the simulation will start. (Integer)

    Example:
       1984

39. Simulation Ending Month (endmon) – This value indicates the ending month of the simulation. The watershed model is based upon a calendar year. (January = 1, February =2, …) (Integer)

    Example:
       12

40. Simulation Ending Year (endyr) – This value indicates the year the simulation will end. (Integer)

    Example:
       2010

41. Use RCH Zeroed Cells Flag (RCH0flg) – This a flag to eliminate inclusion of the Lake McConaughy area from the watershed model. Recharge and pumping estimates in this area are then controlled by the surface water operations model and the groundwater model. The cell controlled by this flag are identified in field three of the *Active Cells* file (Master Input File line 34). (Integer)

    0   - estimate the water balance
    1   - restrict estimation in the define area

42. Dryland Only Flag (DPonly) – This is a flag to limit the application of irrigation water on all irrigated lands. (Integer)

    0   - all irrigation included
    1   - all irrigation restricted

43. Surface Water Only Flag (SWonly) – This is a flag to limit the application of ground water pumping on both groundwater only lands and comingled lands. (Integer)

    0   - all irrigation included
    1   - no groundwater pumping applied

44. Canal Recharge Flag (cnlrflg) – Flag indicating the inclusion of canal recharge. If canal recharge is to be included the name of the Canal Master File must be included in Master Input File (line 29), be located in the Inputs Directory, and all data sets listed in the Canal Master File must be located in the Canal Directory. (Integer)

    0   - no canal recharge
    1   - include canal recharge

45. Miscellaneous Recharge Flag (miscrflg) – Flag indicating the inclusion of miscellaneous recharge. If miscellaneous recharge is to be included the name of the Miscellaneous Master Recharge File must be included in the Master Input File (line 30), be located in the Inputs Directory, and all data sets listed in the Miscellaneous Master Recharge File must be located in the Miscellaneous Directory. (Integer)

   0   - no miscellaneous recharge
   1   - include miscellaneous recharge

46. Miscellaneous Pumping Flag (miscpflg) – Flag indicating the inclusion of miscellaneous pumping. If miscellaneous pumping is to be included the name of the Miscellaneous Master Pumping File must be included in the Master Input File (line 31), be located in the Inputs Directory, and all data sets listed in the Miscellaneous Master Pumping File must be located in the Miscellaneous Directory. (Integer)

   0   - no miscellaneous recharge
   1   - include miscellaneous pumping

47. Municipal and Industrial Recharge Flag (MIrflg) – Flag indicating the inclusion of M&I recharge. If M&I recharge is to be included the name of the M&I Master Recharge File must be included in the Master Input File (line 32), be located in the Inputs Directory, and all data sets listed in the M&I Master Recharge File must be located in the Municipal and Industrial Directory. (Integer)

   0   - no M&I recharge
   1   - include M&I recharge

48. Municipal and Industrial Pumping Flag (MIpflg) – Flag indicating the inclusion of M&I pumping. If M&I pumping is to be included the name of the M&I Master Pumping File must be included in the Master Input File (line 33), be located in the Inputs Directory, and all data sets listed in the M&I Master Pumping File must be located in the Municipal and Industrial Directory. (Integer)

   0   - no M&I pumping
   1   - include M&I pumping

49. Number of Control Year Variables (ctrlyrs) – This parameter controls the number of control years. This number needs to match the number of control variables located in the Call Year File. The control year routines have several embedded algorithms hardcoded in the model. **It is not recommended that changes be made to this parameter without complete knowledge of the model code.** (Integer)

   Example:
       6

50. Number of Coefficient Zones (nczones) – This parameter indicates the number of coefficient zones identified within the model. (Integer)

Example:
   18

51. Number of Runoff Zones (nrzones) – This parameter indicates the number of runoff zones identified within the model. (Integer)

    Example:
       37

52. Number of Soil Classes (nsoils) – This parameter indicates the number of soil classes included within the model. (Integer)

    Example:
       20

53. Number of Irrigation Districts (nirrdist) – This parameter indicates the number of irrigation districts identified within the model domain. This includes all identified districts not just the irrigation districts married to the surface water operations model. (Integer)

    Example
       26

54. Size of the Model Grid Cell (csize) – This parameter indicates the size of the cell in acres. This value is a real or floating value and needs to include a decimal point at the end. (Real)

    Example:
       160.

55. Number of Columns in the Entire Model Grid (ncols) – This parameter indicates the number columns in the model grid. (Integer)

    Example:
       504

56. Number of rows in the Entire Model Grid (nrows) – This parameter indicates the number of rows in the model grid. (Integer)

    Example:
       275

57. Number of Crops (ncrops) – This parameter indicates the number of crops being simulated in the model. (Integer)

    Example
       8

58. List of Crops (Crops[3](:)) – This is a set of names for crops being simulated designated by the number of crops (Master Input File line 57). For each crop there is one line in the Master Input file. The crops need to be listed in the order they appear in the land use files. Finally, the final three crops need to be 'Past', 'Fallow', and 'Misc' in that order. (String)

Example:
   Corn
   Soybeans
   Milo
   Alfalfa
   WinterWheat
   Past
   Fallow

5-B.1.2.   Call Year
<u>Number of Files:</u>
1

<u>Location:</u>
Input Directory

<u>Example File:</u>
Callyr.csv

<u>Purpose:</u>
The Call Year File acts as a control vessel for the input data employed to create the simulation year results. The call year file contains control year variables for land use, climate, comingled irrigation split, canal recharge, miscellaneous pumping and recharge, and Municipal and Industrial Pumping and Recharge. This becomes useful when trying to examine scenarios different from the historical data set or project into the future where there is no available data.

Normally for a historical simulation, the model uses the data associated with the simulation year. However, this is not always the case. Suppose the user wished to examine how the system would respond historically to the current level of development? Or, what if the user would like to look at what would have happened if weather patterns of a specific period were repeated multiple times? These scenarios can be addressed within the Call Year File by changing the control year for the simulation year. This also precludes the user from needing to create a series of repetitive input file copies.

<u>Examples:</u>
Use the current level of development (2010) over the historical climate 1984-2010.
The user would change the value of each line in the second column (Land Use or LU) to 2010. Then as the model progresses through the simulation period, it will apply the simulation year climate to the 2010 land use.

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[3] The length of the crop name is limited to 12 characters.

What if the next 40 years were subject to drought conditions similar to those experienced from 2001-2005?

For this scenario, the user would like to simulate the period 1985-2010 as normal then for the years 2011 through 2050 repeat the 2001-2005 climate. The call year file needs to be adapted so there is one line for each year in the simulation period. For the years 1984-2010 the values for each control year will be equal to the simulation year (For year = 1984; LU = 1984, WBP = 1984, …).

For the years 2011-2050 the control values would be adjusted as follows:
The climate values would start to repeat 2001 through 2005 such that $WBP_{2011}=2001$, $WBP_{2012}=2002$, $WBP_{2013}=2003$, $WBP_{2014}=2004$, and $WBP_{2015}=2005$. The cycle would then repeat ($WBP_{2016}=2001$, $WBP_{2017}=2002$, …, $WBP_{2050}=2005$) through the rest of the simulation period.

However, climate is not the only variable that needs to be projected. For this scenario land use would be kept at 2010 ($LU_{2011} = 2010$, $LU_{2012}=2010$, …). As this is projecting into the future, for this scenario we do not want to regress our development back to 2001 levels. A similar approach would be taken for the groundwater concentration factor, and municipal and industrial pumping.

The representation of the canal recharge presents a more fluid challenge. If the run is a supply run or the canal recharge passing through the watershed model is limited to the Republican River canals, it would be recommended to cycle the historical canal recharge 2001-2005 like the climate values described above. In the event that the user is including the canal recharge in the .RCH through the watershed model the values in the Canal Year Control variable should match the simulation year to use the data coming out of the surface water operations model.

*Note the control year variable controls all data sets listed in the Master Canal file. In the case where the Canal Recharge from the surface water operations model is used, new files will need to be created for the canal recharge in the Republican River with the appropriate year suffix.

The M&I control years would be held constant at 2010 levels. This approach is taken for the current set of M&I data sets developed using per capita (municipal) and per capacity (industrial) estimates of pumping. If the pumping estimate was weather driven rather than population or capacity, a different approach may be more suitable.

Currently there is no Miscellaneous data sets included in the COHYST model. Therefore, the method for assigning values to the Miscellaneous control year is optional; it could repeat the current level, cycle with the scenario, or maintain the simulation year value. Any future implementation of miscellaneous data sets would need to be assessed before choosing how to proceed.

Fields (1 + Number of control years {Master Input File line 49}):
Simulation Year (Year) (Integer)
Control Years For:
- Land Use (LU) (Integer)
- Climate (WBP) (Integer)
- Groundwater Concentration Factor (GWC) (Integer)

- Canal Recharge (Canal) (Integer)
- Miscellaneous Pumping and Recharge (Misc) (Integer)
- Municipal and Industrial Pumping and Recharge (MI) (Integer)

Entries:
A header followed by one entry per year in the simulation period.

5-B.1.3.   Active Cell File
Number of files:
1

Location:
Input Directory

Example:
Active_cells.txt

Purpose:
The active cell contains a list of cells within the model grid. For each cell the file indicates if the cell is active in the watershed model, and if the cell belongs to the zero-recharge set. The zero-recharge set indicates an area of the active model domain in which the estimation of pumping and recharge are ceded to the surface water operations model and the groundwater model. This set is colloquially known as the 'Mahesh Zeros'. The watershed model further restricts estimation of the remaining water balance to maintain conservation of mass.

Fields (3):
Cell   (Integer)
Active   1-Active, 0-Inactive (Integer)
Zero Recharge   1-zero-recharge, 0-normal (Integer)

Entries:
A header followed by one entry for each cell in the model.

5-B.1.4.   Application Efficiency File
Number of files:
1

Location:
Input Directory

Example:
AE.txt

The Application Efficiency file controls the magnitude and trends of the application efficiency for groundwater irrigation and surface water irrigation within each coefficient zone. Application efficiency within a coefficient zone is defined by an initial value, a final value, and two years defining the period over which the application efficiency trends (using linear interpolation) from the initial value to the final value.

Fields (9):
Zone
Groundwater Irrigation
- Initial AE   (real)
- Final AE   (real)
- Beginning AE Trend Year   (Integer)
- Ending AE Trend Year   (Integer)
Surface Water Irrigation
- Initial AE   (real)
- Final AE   (real)
- Beginning AE Trend Year   (Integer)
- Ending AE Trend Year   (Integer)

Entries:
A header followed by one entry for each coefficient zone.

5-B.1.5.   Cell Location File
Number of files:
1

Location:
Input Directory

Example:
CellLoc.csv

Purpose:
The cell location file contains the properties of the cell used to link to the appropriate coefficients during the modeling process. The cell location file defines the soil class, coefficient zone, and runoff zone to which the cell belongs. Furthermore, the distance between the cell and the gauge at the collection point for the runoff zone is included. In the event that the cell is not assigned to a runoff zone (ROZ = 0), the distance to gauge will be defined as 0.0 miles.

Fields:
Cell	(Integer)	
Soil Class	(Integer)	
Coefficient Zone	(Integer)	
Runoff Zone	(Integer)	
Miles to Gauge	(real)	miles

A header followed by one entry for each cell.

5-B.1.6.   Coefficient Zone Coefficient File
Number of files:
1

Location:
Input Directory

Example:
CoefFile.csv

Purpose:
The coefficient zone file contains the control variable used to calibrate the model. The coefficient zone is further divvied up by crop and soil with a set of coefficients for each combination.

Fields (16):
Zone	(Integer)	
Crop	(Integer)	
Soil	(Integer)	
NIR Target	(real)	
Dry ET Adjustment Factor	(real)	
Irrigated ET Adjustment Factor	(real)	
Surface Loss Fraction – GW	(real)	
Surface Loss Fraction – SW	(real)	
Dryland ET to Runoff	(real)	
Deep Percolation Adjustment Factor	(real)	
Runoff Adjustment Factor	(real)	
Maximum Partitioning Factor	(real)	
Minimum Partitioning Factor	(real)	
Deep Percolation Lower Threshold	(real)	(in)
Deep Percolation Cap	(real)	(in)
Runoff Weighting Factor	(real)	

Entries:
A header followed by one entry for each combination of coefficient zone, crop, and soil.

5-B.1.7.   Percent to Recharge File
Number of files:
1

Location:
Input Directory

Example:
ptcrch.txt

Purpose:
The percent to recharge file contains the calibration parameter used to split the runoff transmission losses between edge of field recharge and evapotranspiration.

Fields (2):
Coefficient Zone   (Integer)
Percent to recharge   (real)

Entries:
A header followed by one entry for each coefficient zone.

5-B.1.8.   Runoff Zone Coefficients
Number of files:
1

Location:
Input Directory

Example:
ROZcoef.txt

Purpose:
The Runoff Zone Coefficient file contains the rate of transmission loss for runoff between the field's edge and the stream gauge.

Fields (2):
Runoff Zone   (Integer)
Loss Per Mile   (real)   (%/mile)

Entries:
A header followed by one entry for each runoff zone in the model.

5-B.1.9.   Surface Water Irrigation District Index
Number of files:
1

Location:
Input Directory

Example:
SWindex2.txt

Purpose:
The surface water irrigation district index file contains links to the surface water irrigation district index with the old COHYST surface water district ID and the irrigation district name.

Fields (3):
Surface Water Irrigation District Index   (Integer)
COHYST Irrigation District ID   (Integer)
Irrigation District' Canal Name   (String)

Entries:
A header followed by one entry for each irrigation district.

5-B.1.10.   Pumping and Recharge Master Files
Number of files:
Between 0 and 5. There needs to be one master file for each type of external pumping and
recharge file (canal, miscellaneous, and M&I) included in the simulation.

Location:
Input Directory

Example:
Canal_Master.txt
MIp_Master.txt

Purpose:
The master files are used to control exogenous pumping and recharge data sets that are desired
to be included in the .RCH and .WEL files. The master files contain the data set folder and
filename prefix.

Fields (2 or 3):
Index (Canal Master File Only)   (Integer)
Folder   (String)
Filename Prefix   (String)

Entries:
A header followed by one entry for each exogenous data set the user wished to include in the
.WEL and .RCH files.

5-B.1.11.   Zone Definition Files
Number of files:
2+

Location:
Input Directory

Example:
Subdist_cell.txt   Sub-divides the CNPPID service area by the local canals (Phelps, Loomis)
Uareas.txt   Defines U-area service area

Purpose:
The Zone definition files are used to further subdivide the model into localized regions for
analysis of the results. Multiple zones can be defined within the zone.

Fields (2+):
Cell   (Integer)
Zone   (Integer)

Entries:
A header followed by one entry for each cell defined to be part of the zone.
-or-
A header followed by one entry for each cell, where cells not assigned to a zone have a '0' value in the zone field.

5-B.1.12.   Index Files
Number of files:
Multiple

Location:
Input Directory

Example:
Soil_Index.txt
SubDist_idx.txt

Purpose:
The Index files are used as references to help the user understand the meaning of various groups, zones, or properties. While the use of an index number is simple for computational purposes, the index is then used to look up the meaning. The majority of index files are not currently used within the constructs of the programming code, but rather beneficial when analyzing the results.

Fields (Typically 2):
Index Number   (Integer)
Index Value   (Variable)

Entries:
The size, shape, and number of field in the index files can vary from index folder to index folder. As will the order in which the fields are arranged.

5-B.2.   Static Input Files
Static Input files tend to be larger set of files that will stay relatively consistent from run to run. However, as the user begins to make scenario simulation, changes to the static input files becomes more common.

5-B.2.1.   Gridded Water Balance Parameter Files
<u>Number of files:</u>
The gridded water balance parameter data is divided into 5 categories; precipitation, net irrigation requirement, evapotranspiration, runoff, and deep percolation.
- There is one precipitation file for each climate year of the simulation reference in the call year file.
- There is one net irrigation requirement file for each crop[4] for each climate year of the simulation referenced in the call year file.
- There are two files for each crop[4] of the evapotranspiration, runoff, and deep percolation parameters representing irrigated and non-irrigated conditions for each climate year of the simulation referenced in the call year file.

<u>Location:</u>
Gridded Water Balance Parameter Directory

<u>Example:</u>
PRECIP1985.txt
Alfalfa-NIR1957.txt
Corn-IrrET2013.txt

*Note: it is important that the crop name and an entry in the crop list located in the Master Input File match.

<u>Purpose:</u>
The gridded water balance parameter files contain the initial estimate of the monthly water balance for each cropping scenario across the entire model domain.

<u>Fields (16):</u>
Cell	(Integer)	
Year	(Integer)	
Crop[5]	(Integer)	
Annual Value	(real)	(in)
Monthly Values (12)	(real)	(in)

<u>Entries:</u>
A Header followed by one entry for each cell in the entire model grid.

5-B.2.2.   Land Use Files

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[4] Fallow does not have an irrigated condition represented in the model. The miscellaneous land use is represented by pasture.
[5] There is a crop field in all files, including the precipitation file. The precipitation is defined for the cell independent of growing vegetation.

Number of files:
There are four files for each Land Use year of the simulation referenced in the call year file. One containing each the dryland land use, groundwater only land use, surface water only land use, and comingled land use.

Location:
Land Use Directory

Example:
DryLU1999.txt
SWLU2005.txt

Purpose:
The land use files control the cells included in the simulation, what type of vegetation is being grown within the cell, if the cells are being irrigated and from which sources. If the cell is receiving surface water, the land use files define which canal is delivering the water.

Fields (3 + ncrops -or- 5 + ncrops):
For dryland and groundwater only irrigated land use:

Cell	(Integer)	
Year	(Integer)	
Total acres	(real)	(acres)
Crop acres (ncrops)	(real)	(acres)

For surface water only and comingled irrigated land use:

Cell	(Integer)	
Year	(Integer)	
Old COHYST Irrigation District Identifier	(Integer)	
Surface water district index ID	(Integer)	
Total acres	(real)	(acres)
Crop acres (ncrops)	(real)	(acres)

Entries:
For dryland groundwater only irrigated land use files:
A header followed by one entry for each cell containing relevant land use

For surface water only and comingled irrigated land use:
A header followed by one entry for each surface water irrigation district within each cell containing relevant land use. Multiple irrigation districts can service fields within a single cell, however, each acre is serviced by only one district.

*Note: Across all four land use files the total number of acres within a cell should sum to the size of the cell (160 acs)

5-B.2.3.   Canal Recharge Files
Number of files:
There is one set of files for each entry in the Canal Master Input File. Each set of files contains one file for each canal recharge year of the simulation period as defined within the call year file.

*At this time, all canal recharge sets are subject to the same definition within the call year file.

Location:
Canal Directory

Example:
RR_cnlrch2003.txt
Stella_cnlrch1991.txt

Purpose:
The canal recharge files contain recharge information developed outside the watershed model, but necessary for inclusion into the '.RCH' file.

Fields (15):
Cell   (Integer)
Year   (Integer)
Annual Value   (real)   (AF)
Monthly Value (12)   (real)   (AF)

Entries:
A header followed by one entry for each cell where the canal recharge is not equal to zero.

5-B.2.4.   Municipal and Industrial Pumping and Recharge Files
Number of files:
There is one set of files for each entry in the M&I Master Recharge or Pumping files. Each set of files contains one file for each M&I year of the simulation period as defined within the call year file. Pumping and Recharge are considered separately.

Location:
Municipal and Industrial Directory

Example:
COHYST_MI1999.txt

Purpose:
The M&I pumping and recharge files contain the pumping and recharge data directly related to a municipal or industrial concern which need to be represented in either the '.WEL' or '.RCH' file.

Fields (15):
Cell   (Integer)
Year   (Integer)
Annual Value   (real)   (AF)
Monthly Value (12)   (real)   (AF)

Entries:
A header followed by one entry for each cell where the M&I pumping or recharge is not zero.

5-B.2.5.   Miscellaneous Pumping and Recharge Files
Number of files:
There is one set of files for each entry in the Miscellaneous pumping or recharge files. Each set of files contains one file for each Miscellaneous year of the simulation period as defined within the call year file. Pumping and Recharge are considered separately.

Location:
Miscellaneous Directory

Example:
MiscRch2007.txt

Purpose:
The miscellaneous pumping and recharge files contain pumping and recharge data that was developed outside of the watershed model but deemed significant to include in either the '.WEL' or '.RCH' file.

Fields (15):
Cell   (Integer)
Year   (Integer)
Annual Value   (real)   (AF)
Monthly Value (12)   (real)   (AF)

Entries:
A header followed by one entry for each cell where the miscellaneous pumping or recharge is not zero.

5-B.2.6.   Groundwater Concentration and Lateral Loss Files
Number of files:
There is one file for each GWC year of the simulation period as defined within the call year file.

Location:
Input Directory \ Ground Water Concentration folder

Example:
GWCLL1995.txt

Purpose:
The GWC file contains parameters defining irrigation demand split for comingled lands between surface water deliveries and ground water pumping. It further defines if the surface water irrigated lands need to account for additional transmission losses from the canal laterals in the irrigation demands and supplies.

Fields (4):
Year   (Integer)
Old COHYST Irrigation District Identifier   (Integer)
Groundwater Concentration Factor   (real)
Lateral Loss Factor   (real)

A header followed by one entry for each canal in the surface water operations model (including Kearney canal).

5-B.3.   Irrigation Demand (Irr_Demand_v28.1g.f90)

Purpose:
The Irrigation Demand program estimates the irrigation necessary to meet irrigation targets within the model.

Input Files:
Master Input File	(General Input File)
Cell Location	(General Input File)
Coefficient Zone Coefficients	(General Input File)
Application Efficiencies	(General Input File)
Surface Water Index	(General Input File)
Call Year	(General Input File)
Ground Water Concentration	(Static Input File)
Gridded Water Balance Parameter: Precipitation	(Static Input File)
Gridded Water Balance Parameter: Net Irrigation Requirement	(Static Input File)
Land Use: Groundwater Only	(Static Input File)
Land Use: Surface Water Only	(Static Input File)
Land Use: Comingled	(Static Input File)

Output Files:
5-B.3.1.   Irrigation Demand Summary
Number of files:
There is one Irrigation Demand Summary file created.

Location:
OUTDIR

Example:
Demand_sum.txt

Purpose:
The file provides a model-wide overview of the estimated irrigation demands for groundwater only pumping, surface water only deliveries, comingled pumping, and comingled deliveries.

Fields (5):
Year
Groundwater Only Pumping
Surface Water Only Deliveries
Comingled Pumping
Comingled Deliveries

Entries:
A header followed by one entry for each year in the simulated period.

5-B.3.2.   Irrigation Demands

Number of files:
There are four files for each year in the simulation. One for each ground water only demand, surface water only demand, comingled pumping demands, and comingled surface water delivery demands.

Location:
OUTDIR\DemIrr\GWP
OUTDIR\DemIrr\SWD
OUTDIR\DemIrr\COP
OUTDIR\DemIrr\COD

Example:
GWP1999.txt
SWD1999.txt
COP1999.txt
COD1999.txt

Purpose:
These files contain the irrigation format for the WSPP program if the demands are used for applied irrigation estimates.

Fields (17 or 19):
For ground water pumping only:

Entry Index	(Integer)	
Cell	(Integer)	
Year	(Integer)	
Crop	(Integer)	
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

For surface water only, comingled pumping, and comingled deliveries

Entry Index	(Integer)	
Cell	(Integer)	
Year	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Surface water district index ID	(Integer)	
Crop	(Integer)	
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

Entries:
Groundwater only Pumping
        A header followed by one entry for each combination of crop and cell in which pumping was applied.

For surface water only, comingled pumping, and comingled deliveries

A header followed by one entry for each combination of crop, cell, and irrigation district in which irrigation water was applied. If either ground water or surface water irrigation is applied to comingled lands an entry is written to both the comingled pumping and comingled deliveries files.

5-B.3.3.　　Irrigation Demands: Surface Water Irrigation District

Number of files:
There is one file for each year in the simulation.

Location:
OUTDIR\DemIrr\HDRSW

Example:
SWdist1995.txt

Purpose:
This file contains the total surface water irrigation demand for each cell within each irrigation district.

Fields (18):
Cell	(Integer)	
Year	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Surface water district index ID	(Integer)	
Irrigation Source	(Integer)	
Annual Value	(real)	(AF)
Monthly Values (12)	(real)	(AF)

Entries:
A header followed by one entry for each combination of surface water irrigation district and cell which had an irrigation demand greater than zero.

5-B.3.4.　　Surface Water Irrigation District Demand Summary

Number of files:
There is one file for each year in the simulation.

Location:
OUTDIR\SWIDsum\

Example:
SWIDsum1995.txt

Purpose:
This file contains a summary of the irrigation demands within irrigation districts. This file is specifically formatted for entry into a data base tool developed for analyzing the irrigation supply and demand.

Cell	(Integer)	
Year	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Surface water district index ID	(Integer)	
Zone	(Integer)	
Crop	(Integer)	
Soil	(Integer)	
Surface water only acres	(real)	(acres)
Comingled acres	(real)	(acres)
Annual precipitation	(real)	(in)
Annual irrigation demand	(real)	(in)
Annual irrigation demand	(real)	(AF)
Lateral loss percentage	(real)	
Annual comingled deliveries demand	(real)	(AF)
Groundwater concentration factor	(real)	

Entries:
A header followed by one entry for each combination of crop, irrigation district, and cell where either the surface water only or comingled surface water demands are greater than zero.

5-B.3.5.   Irrigation Transactions
Number of files:
There is one irrigation transaction file for each year of the simulation.

Location:
OUTDIR\DemIrr\Trans

Example:
Irrtrans2001.txt

Purpose:
This file contains the number of irrigation transactions from each irrigation source created by the irrigation demand program. This value is used to size the irrigation arrays in the WSPP program.

Fields (4):

Year	(Integer)
Groundwater only transactions	(Integer)
Surface water only transactions	(Integer)
Comingled transactions	(Integer)

Entries:
A header followed by one entry for the relevant simulation year.

5-B.4.   District Demand (District_Demand_v28.1g.f90)

<u>Purpose:</u>
The District Demand program compiles the surface water irrigation demands for each irrigation district across the entire simulated period into a properly formatted file for delivery to the surface water operation model.

<u>Input Files:</u>
Master Input File	(General Input File)
Surface Water Index	(General Input File)
Active Cell File	(General Input File)
Irrigation Demands: Surface Water Irrigation District	(Irrigation Demand)

<u>Output Files:</u>
5-B.4.1.   District Demand
<u>Number of files:</u>
1

<u>Location:</u>
OUTDIR\DemIrr\HDRSW

<u>Example:</u>
Distdemand.txt

<u>Purpose:</u>
Contains an annual summary of the irrigation demands within each irrigation district formatted for input into the surface water operations model.

<u>Fields (18):</u>
Year	(Integer)	
Surface water district index ID	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Annual Value	(real)	(AF)
Monthly Value (12)	(real)	(AF)
Irrigation Season Demand (months 6-9)	(real)	(AF)
Irrigation District Name	(String)	

<u>Entries:</u>
A header followed by one entry for each irrigation district included in the model every year of the simulated period.

5-B.5.   Irrigation Supply (Irr_Supply_v28.1g.f90)

<u>Purpose:</u>
The Irrigation Demand program estimates the irrigation necessary to meet irrigation targets within the model.

Input Files:

Master Input File	(General Input File)
Cell Location	(General Input File)
Coefficient Zone Coefficients	(General Input File)
Application Efficiencies	(General Input File)
Surface Water Index	(General Input File)
Call Year	(General Input File)
Ground Water Concentration	(Static Input File)
Gridded Water Balance Parameter: Precipitation	(Static Input File)
Gridded Water Balance Parameter: Net Irrigation Requirement	(Static Input File)
Land Use: Groundwater Only	(Static Input File)
Land Use: Surface Water Only	(Static Input File)
Land Use: Comingled	(Static Input File)

5-B.5.1.   District Deliveries   (Model Exchange File)

Number of files:
1

Location:
OUTDIR\AppIrr

Example:
DistDel.txt

Purpose:
The district delivery file contains the volume of surface water deliveries from the surface water operations model along with estimates of deliveries (supply is assumed to meet demand) for the irrigation districts not included in the surface water operations model.

Fields (16):

Year		
Surface water district index ID	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Annual Value	(real)	(AF)
Monthly Values (12)	(real)	(AF)

Entries:
A header followed by one entry for each irrigation district included in the model for every year of the simulation period.

Output Files:
5-B.5.2.   Irrigation Supply Summary

Number of files:
1

Location:
OUTDIR

Example:
Supply_Sum.txt

Purpose:
The file provides a model-wide overview of the irrigation supplies for groundwater only pumping, surface water only deliveries, comingled pumping, and comingled deliveries.

Fields (5):

Year	(Integer)	
Groundwater only pumping	(real)	(AF)
Surface water only deliveries	(real)	(AF)
Comingled pumping	(real)	(AF)
Comingled deliveries	(real)	(AF)

Entries:
A header followed by one entry for each year in the simulation.

5-B.5.3.   Irrigation Supplies
Number of files:
There are four files for each year in the simulation. One file for each ground water only supplies, surface water only supplies, comingled pumping supplies, and comingled surface water delivery supplies

Location:
OUTDIT\AppIrr\GWP
OUTDIT\AppIrr\SWD
OUTDIT\AppIrr\COP
OUTDIT\AppIrr\COD

Example:
GWP2000.txt
SWD2000.txt
COP2000.txt
COD2000.txt

Purpose:
These files contain the supplied irrigation volumes formatted for use in the WSPP program.

Fields (17 or 19):
For ground water pumping only:

Entry Index	(Integer)	
Cell	(Integer)	
Year	(Integer)	
Crop	(Integer)	
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

For surface water only, comingled pumping, and comingled deliveries

Entry Index	(Integer)
Cell	(Integer)
Year	(Integer)
Old COHYST irrigation district identifier	(Integer)
Surface water district index ID	(Integer)
Crop	(Integer)
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

Entries:

Groundwater only Pumping

A header followed by one entry for each combination of crop and cell in which pumping was applied.

For surface water only, comingled pumping, and comingled deliveries

A header followed by one entry for each combination of crop, cell, and irrigation district in which irrigation water was applied. If either ground water or surface water irrigation is applied to comingled lands an entry is written to both the comingled pumping and comingled deliveries files.

5-B.5.4.   Surface Water Irrigation District Supply Summary

Number of files:

There is one file for each year of the simulation.

Location:

OUTDIR\AppIrr\

Example:

SWISsum1995.txt

Purpose:

This file contains a summary of the irrigation demands within irrigation districts. This file is specifically formatted for entry into a data base tool developed for analyzing the irrigation supply and demand.

Fields (15):

Cell	(Integer)	
Year	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Surface water district index ID	(Integer)	
Zone	(Integer)	
Crop	(Integer)	
Soil	(Integer)	
Surface water only acres	(real)	(acres)
Comingled acres	(real)	(acres)
Annual precipitation	(real)	(in)

Annual irrigation demand	(real)	(in)
Annual irrigation demand	(real)	(AF)
Lateral loss percentage	(real)	
Annual comingled deliveries demand	(real)	(AF)
Groundwater concentration factor	(real)	

Entries:
A header followed by one entry for each combination of crop, irrigation district, and cell where either the surface water only or comingled surface water demands are greater than zero.

5-B.5.5.   Irrigation Transactions
Number of files:
There is one irrigation transaction file for each year of the simulation.

Location:
OUTDIR\AppIrr\Trans

Example:
Irrtrans2001.txt

Purpose:
This file contains the number of irrigation transaction from each irrigation source created by the irrigation supply program. This value is used to size the irrigation arrays in the WSPP program.

Fields (4):
Year	(Integer)
Groundwater only transactions	(Integer)
Surface water only transactions	(Integer)
Comingled transactions	(Integer)

Entries:
A header followed by one entry for the relevant simulation year.

5-B.6.   Water Supply Partitioning Program (WSPP_v28.1g.f90)
Purpose:
The water supply partitioning program applies precipitation and irrigation to the field, adjusts for deficit irrigation volumes, adjusts for non-idealized conditions, and estimates evapotranspiration, recharge, and runoff while maintain the water balance.

Input Files:
Master Input File	(General Input File)
Cell Location	(General Input File)
Coefficient Zone Coefficients	(General Input File)
Application Efficiencies	(General Input File)
Surface Water Index	(General Input File)
Irrigation Transactions	(Irrigation Supply {or Irrigation Demand})
Ground Water Concentration	(Static Input File)

Irrigation Supplies (or Demands)	(Irrigation Supply {or Irrigation Demand})
Land Use: Groundwater Only	(Static Input File)
Land Use: Surface Water Only	(Static Input File)
Land Use: Comingled	(Static Input File)
Land Use: Dryland	(Static Input File)
Gridded Water Balance Parameter: Net Irrigation Requirement	(Static Input File)
Gridded Water Balance Parameter: Evapotranspiration	(Static Input File)
Gridded Water Balance Parameter: Runoff	(Static Input File)
Gridded Water Balance Parameter: Deep Percolation	(Static Input File)

<u>Output Files:</u>

5-B.6.1.   WSPP Deep Percolation

<u>Number of files:</u>

There is one WSPP Deep Percolation file for each year in the simulation period.

<u>Location:</u>

OUTDIR\WSPP_OUT

<u>Example:</u>

WSPPDP2005.txt

<u>Purpose:</u>

This file is used to hold the direct field recharge until it is added to the .RCH file.

<u>Fields (17):</u>

Cell	(Integer)	
Year	(Integer)	
Irrigation Source	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

<u>Entries:</u>

A header followed by one entry for every combination of cell and irrigation source present in the land use files.

5-B.6.2.   WSPP Runoff

<u>Number of files:</u>

There is one WSPP Runoff file for each year in the simulation period

<u>Location:</u>

OUTDIR\WSPP_OUT

<u>Example:</u>

WSPPRO2005.txt

Purpose:
This file is used to hold the direct field runoff until it can be further partitioned.

Fields (17):
Cell	(Integer)	
Year	(Integer)	
Irrigation Source	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

Entries:
A header followed by one entry for every combination of cell and irrigation source present in the land use files.

5-B.6.3.   WSPP Pumping
Number of files:
There is one WSPP Pumping file for each year in the simulation period.

Location:
OUTDIR\Pump

Example:
Pump1994.txt

Purpose:
This file is used to hold the irrigation pumping until it is added to the .WEL file.

Fields (17):
Cell	(Integer)	
Year	(Integer)	
Irrigation Source	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

Entries:
A header followed by one entry for every combination of cell and irrigation source which applies groundwater pumping.

5-B.6.4.   Lateral Losses
Number of files:
There is one Lateral Losses file for each year in the simulation period.

Location:
OUTDIR\LatLoss

Example:
LatLoss1988.txt

Purpose:
This file is used to hold the transportation losses which occur between the main canal and the field until they can be added to the .RCH file. The location of the laterals is assumed to be in the same cell the water is being applied.

Fields (17):

Cell	(Integer)	
Year	(Integer)	
Irrigation Source	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Annual Values	(real)	(AF)
Monthly Values (12)	(real)	(AF)

Entries:
A header followed by one entry for each cell and irrigation combination in which surface water deliveries are applied.

5-B.6.5.   RAW File
Number of files:
There is one RAW File for each year in the simulation period.

Location:
OUTDIR\RAW

Example:
RAW_WSPP1994.txt

Purpose:
The RAW file contains a record of the water balance for each of the simulations made in the WSPP program. These files can then be queried to develop localized and regional summaries.

Fields (30):

Cell	(Integer)	
Year	(Integer)	
Month	(Integer)	
Crop	(Integer)	
Old COHYST irrigation district identifier	(Integer)	
Surface water district index ID	(Integer)	
Irrigation source	(Integer)	
Soil	(Integer)	
Coefficient zone	(Integer)	
Runoff zone	(Integer)	
Acres	(real)	(acres)
Groundwater pumping	(real)	(AF)
Surface water deliveries	(real)	(AF)

Direct evapotranspiration	(real)	(AF)
Direct runoff	(real)	(AF)
Direct deep percolation	(real)	(AF)
Irrigation Surface Losses	(real)	(AF)
ET gain	(real)	(AF)
ET base	(real)	(AF)
Change in ET 1	(real)	(AF)
Change in ET 2	(real)	(AF)
Deep Percolation 1	(real)	(AF)
Deep Percolation 2	(real)	(AF)
Runoff 1	(real)	(AF)
Runoff 2	(real)	(AF)
Deep Percolation converted to Runoff	(real)	(AF)
Excess Water	(real)	(AF)
Runoff and deep percolation converted to evapotranspiration	(real)	(AF)
Net irrigation requirement minus Evapotranspiration	(real)	(AF)
Lateral losses	(real)	(AF)

Entries:

A header followed by one entry for each combination of crop, irrigation source, cell, month, and irrigation district. This is a massive file.

5-B.7.   WSPP Report (WSPP_Report_v28.1g.f90)

Purpose:

The WSPP Report is used to sort through the RAW file and develop a set of predefined report summaries of the COHYST water balance.

Input Files:

Master Input File	(General Input File)
Cell Location File	(General Input File)
Surface Water Irrigation District Index	(General Input File)
Percent to Recharge File	(General Input File)
Runoff Zone Coefficients	(General Input File)
Active Cell File	(General Input File)
Call Year File	(General Input File)
Zone Definition File: Cell County	(General Input File)
Zone Definition File: CNPPID Sub-districts	(General Input File)
Zone Definition File: U-areas	(General Input File)
Index File: County ID	(General Input File)
Master File: Canal Recharge	(General Input File; optional)
Master File: Miscellaneous Recharge	(General Input File; optional)
Master File: M&I Recharge	(General Input File; optional)
Master File: Miscellaneous Pumping	(General Input File; optional)
Master File: M&I pumping	(General Input File; optional)
Gridded Water Balance Parameter: Precipitation	(Static Input File)
Canal Recharge (multiple)	(Static Input File; optional)

Miscellaneous Recharge (multiple)	(Static Input File; optional)
M&I Recharge (multiple)	(Static Input File; optional)
Miscellaneous Pumping (multiple)	(Static Input File; optional)
M&I Pumping (multiple)	(Static Input File; optional)
RAW File	(Water Supply Partitioning Program)

Output Files:

5-B.7.1.   Report Summaries

Number of files:

~112 files are created describing the COHYST water balance for the region, by county, coefficient zone, runoff zone, surface water irrigation district, and U-area. Summaries are further created on annual and monthly time steps separated by combinations of crop, soil, and irrigation source.

Location:

OUTDIR\Report\...

Examples:

Reg_Tot_Ann.txt
ROZ_CSI_Mon.txt
Uarea_IrrS_Ann.txt

Purpose:

The report summaries are used to characterize the results of the watershed model and allow the user to investigate how the model is functioning at different scales.

Fields (24+):

The number of fields in the file depends upon the specific report. The more specific the characterization of the report, the greater the number of fields. Furthermore, a summary of the recharge and pumping data sets created outside of the watershed model is developed but these sets cannot be sub-divided by soil, crop, or irrigation source.

Year	(Integer)	
Month	(Integer)	
Crop	(Integer; optional)	
Soil	(Integer; optional)	
Irrigation Source	(Integer; optional)	
Acres	(real)	(acres)
Precipitation	(real)	(AF)
Groundwater Pumping	(real)	(AF)
Surface Water Deliveries	(real)	(AF)
Direct Evapotranspiration	(real)	(AF)
Direct Runoff	(real)	(AF)
Direct Deep Percolation	(real)	(AF)
Irrigation Surface Losses	(real)	(AF)
ET Gain	(real)	(AF)
ET Base	(real)	(AF)
Change in ET 1	(real)	(AF)

Change in ET 2	(real)	(AF)
Deep Percolation 1	(real)	(AF)
Deep Percolation 2	(real)	(AF)
Runoff 1	(real)	(AF)
Runoff 2	(real)	(AF)
Deep Percolation Transferred to Runoff	(real)	(AF)
Deep Percolation and Runoff Transferred to Evapotranspiration	(real)	(AF)
Lateral Losses	(real)	(AF)
Runoff Contributions to Streamflow	(real)	(AF)
Runoff Transmission Losses to Recharge	(real)	(AF)
Runoff Transmission Losses to Evapotranspiration	(real)	(AF)
Canal Recharge (multiple)	(real; optional)	(AF)
Miscellaneous Recharge (multiple)	(real; optional)	(AF)
M&I Recharge (multiple)	(real; optional)	(AF)
Miscellaneous Pumping (multiple)	(real; optional)	(AF)
M&I Pumping (multiple)	(real; optional)	(AF)

Entries:
A header followed by one entry for each desired combination each time period.

5-B.8.   Make Recharge (Make_Rch_v28.1g.f90)
Purpose:
The Make Recharge program partitions edge of field runoff between contributions to stream flow, transmission losses to recharge, and transmission losses to evapotranspiration. The program next compiles all sources of recharge and converts them to a '.RCH' file format.

Input Files:
Master Input File	(General Input File)
Cell Location	(General Input File)
Runoff Zone Coefficients	(General Input File)
Percent to Recharge File	(General Input File)
Active Cells	(General Input File)
Call Year	(General Input File)
WSPP Deep Percolation	(Water Supply Partitioning Program)
WSPP Runoff	(Water Supply Partitioning Program)
Lateral Losses	(Water Supply Partitioning Program)
Master File: Canal Recharge	(General Input File; optional)
Master File: Miscellaneous Recharge	(General Input File; optional)
Master File: M&I Recharge	(General Input File; optional)
Canal Recharge	(Static Input File; optional)
Miscellaneous Recharge	(Static Input File; optional)
M&I Recharge	(Static Input File; optional)

Output Files:
5-B.8.1.   Recharge Values
Number of files:
1

OUTDIR

Example:
Rch_values.txt

Purpose:
The Recharge Values file contains the annual recharge rates for each cell during each year of the simulation. This file is used to create spatial maps.

Fields (3):
Cell	(Integer)	
Year	(Integer)	
Recharge	(real)	(in)

Entries:
A header followed by one entry for each cell each year of the simulation.

5-B.8.2.   Runoff Contributions to Stream Flow
Number of files:
1

Location:
OUTDIR

Example:
COHYST_GUI_GUI_28b2SF.txt

Purpose:
The runoff contributions to stream flow contains the monthly estimate of the portion of runoff which contributes to the stream flow at the gauge within each of the defined runoff zones. This file is then transferred to the surface water operation model and groundwater model.

Fields (4):
Year	(Integer)	
Month	(Integer)	
Runoff zone	(Integer)	
Runoff contributions to stream flow	(real)	(AF)

Entries:
A header followed by one entry for each runoff zone for each month and year in the simulation period.

5-B.8.3.   Annual '.RCH' File
Number of files:
There is one annual '.RCH' File for each partial calendar year in the simulation period.

<u>Location:</u>
OUTDIR\RCH

<u>Example:</u>
COHYST_GUI1998.RCH

<u>Purpose:</u>
This file creates a properly formatted portion of the fully formatted '.RCH' file for the relevant year.

<u>Fields (NA):</u>

<u>Entries:</u>
The '.RCH' file organization can be broken down into parts.
1. File Headers – See the MODFLOW documentation for information on the header. This is not included in the Annual '.RCH' files
2. Stress Period Headers - See the MODFLOW documentation for information on the stress period header. This consists of two lines written at the beginning of each stress period in the model simulation
3. Data Bloc – Each row of the model grid comprises a bloc of entries. There is one bloc for each row in the complete model grid.
4. Entry Lines – Within each bloc there are two types of entry lines complete and incomplete
    a. Complete entry lines contain 10 unit entries.
    b. Incomplete entry lines contain the remainder entries when a complete entry line cannot be created.
    c. Within the current COHYST model (number of columns = 504) there are 50 complete entry lines and 1 partial entry line with 4 entries.
5. Entry – The recharge experienced by a cell in a stress period.

5-B.8.4.   Stream Flow File
<u>Number of files:</u>
One stream flow file for each year in the simulation period.

<u>Location:</u>
OUTDIR\SF

<u>Example:</u>
SF1995.txt
<u>Purpose:</u>
This is a quality assurance file created to check the calculations related to estimating the runoff contributions to streamflow.

<u>Fields (12):</u>

Cell	(Integer)
Runoff zone	(Integer)
Row	(Integer)
Column	(Integer)

Year	(Integer)	
Month	(Integer)	
Number of days in the month	(Integer)	
Runoff contributions to stream flow	(real)	(AF)
Field runoff	(real)	(AF)
Loss per mile	(real)	(%/mile)
Miles to gauge	(real)	(miles)
Runoff contributions to stream flow	(real)	(AF/day)

Entries:
A header followed by one entry for each cell where the runoff is greater than 0.

5-B.8.5.   Runoff Balance Check
Number of files:
There is one runoff balance check file for each year of the simulation period.

Location:
OUTDIR\RObal

Example:
RObal2001.txt

Purpose:
The runoff balance check file is a quality control file used to ensure that the runoff water balance is being maintained.

Fields (7):
Cell	(Integer)	
Year	(Integer)	
Month	(Integer)	
Field runoff	(real)	(AF)
Runoff transmission losses to recharge	(real)	(AF)
Runoff contributions to stream flow	(real)	(AF)
Runoff transmission losses to evapotranspiration	(real)	(AF)

Entries:
A header followed by one entry for each cell in which the field runoff was greater than 0.

5-B.8.6.   Recharge Summary
Number of files:
There are two files for each year in the simulation period. One file contains an annual summary,the second contains a monthly summary of the same data.

Location:
OUTDIR\AnnRCH

<u>Example:</u>
AnnRch2001.txt
MonRch2001.txt

<u>Purpose:</u>
The recharge summary file contains an overview of the recharge, runoff, and runoff balance for each cell.

<u>Fields (~14):</u>

Cell	(Integer)	
Year	(Integer)	
Month	(Integer)	
Total recharge	(real)	(AF)
Direct recharge	(real)	(AF)
Direct runoff	(real)	(AF)
Canal recharge (multiple)	(real; optional)	(AF)
Later seepage	(real)	(AF)
Miscellaneous recharge (multiple)	(real; optional)	(AF)
M&I recharge (multiple)	(real; optional)	(AF)
Runoff transmission losses to recharge	(real)	(AF)
Runoff transmission losses to evapotranspiration	(real)	(AF)
Runoff contributions to stream flow	(real)	(AF)

<u>Entries:</u>
A header followed by one entry for each active cell where the total recharge is greater than zero for the relevant time period.

5-B.8.7.   Canal Recharge Check
<u>Number of files:</u>
There is one canal recharge check file for each year in the simulation period.

<u>Location:</u>
OUTDIR\Cnlchk

<u>Example:</u>
Cnlchk1999.txt

<u>Purpose:</u>
The canal check file contains a summary of the canal recharge within each cell each month as compared to the total amount of recharge in the cell.

<u>Fields (~6):</u>

Cell	(Integer)	
Year	(Integer)	
Month	(Integer)	
Total recharge	(real)	(AF)
Canal recharge (multiple)	(real; optional)	(AF)

A header followed by one entry for each cell each month where the canal recharge is not equal to zero.

5-B.9.   Make Well (Make_Wel_v28.1g.f90)

Purpose:
The Make Well program compiles all sources of pumping and converts them into a '.WEL' file format.

Input Files:

Mater Input File	(General Input File)
Active Cell	(General Input File)
Call Year	(General Input File)
Master File: Miscellaneous Pumping	(General Input File; optional)
Master File: M&I pumping	(General Input File; optional)
Miscellaneous Pumping (multiple)	(Static Input File; optional)
M&I Pumping (multiple)	(Static Input File; optional)
WSPP Pumping	(Water Supply Partitioning Program)

Output Files:
5-B.9.1.   Annual '.WEL' File
Number of files:
There is one annual '.WEL' file for each year in the simulation period.

Location:
OUTDIR\WEL

Example:
COHYST_GUI1985.WEL

Purpose:
This file creates a properly formatted portion of the fully formatted '.WEL' file for the relevant year.

Fields (NA):

Entries:
The first entry of the annual '.WEL' file is the maximum lines within any stress period in the relevant year. The maximum value across all years is needed to create the file header, otherwise, the remainder of the file is formatted like the '.WEL' file.
The '.WEL' file organization can be broken down into parts.
1. File Headers – See the MODFLOW documentation for information on the header. This is not included in the annual '.WEL' files.
2. Stress Period Header – This contains the number of well entries for the stress period.
3. Well Entries – There is one entry for each well as listed in the stress period header. Each entry has:
    a. Layer the water is being extracted from

b. Model grid row
c. Model grid column
d. Pumping rate (ft^3/day)

5-B.9.2.   Well Check File
<u>Number of files:</u>
There is one well check file per year in the simulation.

<u>Location:</u>
OUTDIR\Wellchk

<u>Example:</u>
Wellchk1996.txt

<u>Purpose:</u>
This is a quality control file used to ensure that the pumping data is being correctly convey to the '.WEL' file.

<u>Fields (9):</u>
Cell	(Integer)	
Layer	(Integer)	
Row	(Integer)	
Column	(Integer)	
Year	(Integer)	
Month	(Integer)	
Day in month	(Integer)	
Pumping	(real)	(AF/day)
Pumping	(real)	(ft^3/day)

<u>Entries:</u>
A header followed by one entry for each cell each month the volume of pumping is greater than zero.

5-B.10.   Compile Recharge (Compile_Rch_v28.1g.f90)
<u>Purpose:</u>
The Compile Recharge program combines the individual annual '.RCH' files into a single properly formatted '.RCH' file for the entire simulation period.

<u>Input Files:</u>
Master Input File	(General Input File)
Annual '.RCH' File	(Make Recharge)

<u>Output Files:</u>
5-B.10.1.   '.RCH' File
<u>Number of files:</u>
There is one '.RCH' File

<u>Location:</u>

OUTDIR

Example:
COHYST_GUI_GUI_28b2.RCH

Purpose:
This file is a properly formatted '.RCH' file for the simulation period.

Fields (NA):

Entries:
The '.RCH' file organization can be broken down into parts.
1. File Headers – See the MODFLOW documentation for information on the header.
2. Stress Period Headers - See the MODFLOW documentation for information on the stress period header. This consists of two lines written at the beginning of each stress period in the model simulation
3. Data Bloc – Each row of the model grid comprises a bloc of entries. There is one bloc for each row in the complete model grid.
4. Entry Lines – Within each bloc there are two types of entry lines complete and incomplete
   a. Complete entry lines contain 10 unit entries.
   b. Incomplete entry lines contain the remainder entries when a complete entry line cannot be created.
   c. Within the current COHYST model (number of columns = 504) there are 50 complete entry lines and 1 partial entry line with 4 entries.
5. Entry – The recharge experienced by a cell in a stress period.

5-B.11.   Compile Well
Purpose:
The Compile Well program combines the individual annual '.WEL' files into a single properly formatted '.WEL' file for the entire simulation period.

Input Files:
Master Input File   (General Input File)
Annual '.WEL' File   (Make Well)

Output Files:
5-B.11.1.   '.WEL' File
Number of files:
There is one '.WEL' file.

Location:
OUTDIR\WEL

Example:
COHYST_GUI_GUI_28b2.WEL

<u>Purpose:</u>
This file creates a properly formatted '.WEL' file for the simulation period.

<u>Fields (NA):</u>

<u>Entries:</u>
The '.WEL' file organization can be broken down into parts.
1. File Headers – See the MODFLOW documentation for information on the header.
2. Stress Period Header – This contains the number of well entries for the stress period.
3. Well Entries – There is one entry for each well as listed in the stress period header. Each entry has:
    a. Layer the water is being extracted from
    b. Model grid row
    c. Model grid column
    d. Pumping rate (ft^3/day)