Summary Page Documentation

The following was taken from the Cedar area printout. An explanation of the data source for each line will be contained here. The explanation for the line follows the line. Data represent a summary for the entire area modeled, regardless of subarea boundaries.

OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP ANN

CLIMATOLOGICAL DATA

1. Temperature represents the average temperature of the cropland area:

TEMPERATURE (DEG F.) 51.3 39.1 30.2 30.3 34.2 41.5 47.6 57.2 66.3 74.0 71.9 63.3 50.6

1. Cropland precipitation is precipitation falling specifically on the cropland area:

CROPLAND PRECIPITATION (INCHES) 1.40 0.82 0.84 0.98 1.13 1.06 0.93 0.71 0.53 0.83 0.82 0.71 10.77

1. Average area precipitation is an average of the precipitation falling on all parts of the subarea:

AVERAGE AREA PRECIPITATION (INCHES) 1.63 1.16 1.25 1.55 1.66 1.67 1.29 0.97 0.70 1.06 1.28 0.97 15.20

1. This is the average monthly and annual inflow from an upstream subarea, Coal Creek in this case:

RIVER INFLOW

Coal Creek 846 748 671 662 674 1302 3122 8837 4339 1395 946 804 24348

SUBTOTAL 846 748 671 662 674 1302 3122 8837 4339 1395 946 804 24348

1. These represent the average monthly and annual flow for each of the tributaries listed. Tributary flows can come from USGS gauges correlated with another gauge, pour points linked to a USGS stream station and a factor derived from streamstats or area-altitude or from a file in Division format.

TRIBUTARY FLOWS

Braffits Creek 23 20 18 18 18 36 85 241 119 38 26 22 665

Shirtz Creek 9 8 7 7 7 14 34 97 48 15 10 9 268

Murie Creek 114 101 90 89 91 175 420 1189 584 188 127 108 3276

SUBTOTAL 146 129 116 114 117 225 540 1528 750 241 163 139 4209

1. The figure below represents the net supply to the land area for the period of record and includes reservoir storage and evaporation:

TOTAL SUBAREA SUPPLY 993 878 787 777 790 1528 3662 10365 5090 1637 1109 943 28558

AGRICULTURE LAND BUDGET

1. Average cropland precipitation is an average of 80% of the precipitation falling on crop areas only. Effective precipitation in acre-feet is read from the AreaET table in modeldata.mdb. It is calculated by the python script O:\database\watbudg\gis\python\AreaET.py.

CROPLAND EFFECTIVE PRECIPITATION 1247 720 741 860 993 939 824 621 465 725 723 621 9479

1. All landarea QX diversions (other than groundwater) are summarized here. QX values area calculated in the budget model in the LNDCLC subroutine (uniquely programmed for each water budget model). QX numbers are defined in the input data to the model.

SURFACE DIVERSION TO CROPLAND 530 110 0 0 0 253 3235 3345 1990 1230 1070 943 12706

1. All groundwater diversions are summarized here. The amount of groundwater per year to allocate to each land area is calculated by the python script O:\database\watbudg\gis\python\ allocategwAreas.py.

GROUNDWATER PUMPING TO CROPLAND 305 0 0 0 0 1 968 5332 5465 6061 5248 2965 26344

1. This is the amount of water calculated to be used by wet pasture. It will be zero if there is no sub-irrigated non-irrigated land that receives its water from groundwater originating either from the stream or return flow from the agricultural area.

RIVER USE BY WET PASTURE 0 0 0 0 0 0 0 1 0 0 0 0 3

1. This is the average amount of water available to the crop for consumptive use. Because it does not always occur at the time needed, there are shortages.

AMOUNT TO ROOTZONE 1122 777 741 860 993 1063 2420 5725 5124 5180 4572 2777 31355

1. This is the average amount of water available for return flow (rflo). RFLO is averaged from RETFL(L)\*(1.-RETI(L)), where RETFL is defined as RETFL(ILND)= +MAX(MOIST(ILND) -SOIL(ILND),0.0) + DIV\*(1.0-TEF(ILND))+ Pumped(ILND)\*(1.0-IEFF(ILND)) + MAX(WMOIS(ILND)- WSOIL(ILND),0.0).

UNROUTED RETURN FLOW 443 102 20 55 97 3181 2116 4629 4046 4014 3478 2129 24310

1. Cropland potential consumptive use is calculated from CONUSE(K,J,L)+ WCUSE(L,J,K)+ MAX(0.0, EffPRE(L,J,K) -PERCO(K,J,L) -WPERC(K,J,L)). This includes potential consumptive use from irrigated and sub-irrigated cropland plus effective precipitation on cropland and sub-irrigated cropland minus the excess precipitation which flows into the soil moisture (mostly during winter and fall). The effective precipitation added to potential consumptive use is less than that printed on the line CROPLAND EFFECTIVE PRECIPITATION since the excess precipitation is subtracted.

CROPLAND POTENTIAL CONSUMPTIVE USE 968 0 0 0 0 8 1923 6761 6762 7671 6590 3966 34650

1. This is effective precipitation which falls during the months when there is potential consumptive use. The period varies according to the climate of the area.

IRRIGATION SEASON EFFECTIVE PRECIP. 626 0 0 0 0 7 796 619 465 725 639 554 4431

1. RZSUP printed here is an average of RETUSE. Retuse is calculated by MAX(MIN(SUBSHRT,QRTF(ILND)),0.0). In other words if after diverting demand from the river to supply sub-irrigated agriculture, sub-irrigated lands have not had a full supply, return flow is used and the average amount is printed here.

CROP CONSUMPTIVE USE FROM RETURN FLOW 0 0 0 0 0 0 0 0 1 1 1 1 5

1. SMSPL is the average of SPILL. Spill is calculated SPILL(ILND)=SPILL(ILND)+SoilLoss + SoilLossW in that month where winter carryover soil moisture is depleted to 65% of what was added during the winter. Spill is then augmented by SPILL(ILND)= SPILL(ILND)+ MAX(MOIST(ILND)- SOIL(ILND),0.0)+ MAX(WMOIS(ILND)- WSOIL(ILND),0.0) which means that when soil moisture exceeds capacity in any one month, it is returned to the system as return flow. In March, 45 percent of the winter precipitation stored in the soil column is released to the system.

SPILLS FROM SOIL MOISTURE RESERVOIR 0 0 0 0 0 2540 0 0 0 0 0 0 2540

1. This is the average crop soil moisture in acre-feet for each month.

ACCUMULATED CROP SOIL MOISTURE 1714 2454 3175 3987 4883 3198 4605 3906 2753 1511 1032 909 2844

1. This is the average sub-irrigated soil moisture in acre-feet for each month.

ACCUMULATED WET PAST. SOIL MOISTURE 1 1 2 2 2 1 1 1 1 1 1 1 1

1. This is the average change in crop soil moisture in acre-feet for each month.

CHANGE IN CROP SOIL MOISTURE -770 -727 -721 -805 -896 1996 -1292 418 992 1228 454 124 0

1. This is the average change in sub-irrigated soil moisture in acre-feet for each month.

CHANGE IN WET PAST. SOIL MOISTURE 0 -1 0 0 0 1 0 0 0 0 0 0 0

1. For cropland this is the amount of water that would have to be diverted from a river to give the cropland a full supply PLUS the amount of consumptive use shortage from sub-irrigated crops.

SHORTAGES (DIVERSION) 12 0 0 0 0 0 0 2 459 1554 2212 1227 5467

1. This is the consumptive use of crop (with rainfall included) that the crop was able to achieve with its water supply.

CROPLAND ACTUAL CONSUMPTIVE USE 962 0 0 0 0 8 1923 6760 6526 6871 5452 3335 31837

1. CPDEP is the depletion to the system. CPDEP(I)=TDIVR(I)+ AGPUMP(I)+ RIVGW(I)- TOTRF(I) plus the monthly average of PERCO(K,J,L) + WPERC(K,J,L). TDIVR is printed above as the surface diversion to cropland. AGPUMP is printed above as the total agricultural groundwater pumped to the area. RIVGW is printed above as the river use by wet pasture. TOTRF is printed below as the total return flow from each area or the sum of QXs from each land area.

CROPLAND ACTUAL DEPLETION 449 386 622 809 926 -270 2663 5925 4896 4693 4121 2187 27406

1. TOTRF as printed below is the total return flow from each area or the sum of QX flows from each land area.

TOTAL RETURN FLOW 1082 460 119 51 67 1492 1911 2868 2814 2811 2468 1923 18065

1. DDIV and DPUM as printed below is sum of QX inflows to each municipal provider from surface and groundwater supplies. The total use is read from the M&I database and proportioned to surface and groundwater demands according to the proportions shown in the municipal supply. This explanation also applies to the M&I GROUNDWATER PUMPED line as well. DDIV is an average of DMDEL(L) which is the surface supply to municipal area L in month K and year J. Any deficit in DMDEL(L) relative to how much the database indicates should be included in surface diversions appears in DMPUM(L), or the groundwater pumping for M&I area L. In other words, municipal areas do not experience shortages. Surface diversions often refer to secondary irrigation water delivered to residential areas.

MUNICIPAL AND INDUSTRIAL USE

M&I SURFACE DIVERSIONS 8.8 0.0 0.0 0.0 0.0 0.0 24.1 78.4 104.2 102.1 78.2 61.5 457.4

M&I GROUNDWATER PUMPED 321.9 256.7 256.7 256.7 256.7 256.7 435.7 839.1 1030.2 1015.1 837.6 713.2 6476.5

1. DSUP as printed below is the total deliveries the all municipal providers in the current model:

TOTAL M&I DEMAND 330.7 256.7 256.7 256.7 256.7 256.7 459.8 917.6 1134.4 1117.2 915.9 774.7 6933.9

1. DemIn as printed below is the indoor demand for all municipal providers. Indoor demand consists of residential indoor, 80% of commercial use, 20% of institutional use, and industrial use as read from the CorrelatedPotable the table in the M&I.mdb database. This value is stored in the FORTRAN variable MunDemIn(L,J,K).

INDOOR DEMAND 256.7 256.7 256.7 256.7 256.7 256.7 256.7 256.7 256.7 256.7 256.7 256.7 3080.6

1. DemOut as printed below is the outdoor demand for all municipal providers. Outdoor demand consists of residential outdoor, 20% of commercial use, 80% of institutional use, and secondary water use as read from the CorrelatedPotable, CorrelatedSecondary and SSI tables in the M&I.mdb database. This value is stored in the FORTRAN variable MunDemOut(L,J,K).

OUTDOOR DEMAND 74.0 0.0 0.0 0.0 0.0 0.0 203.1 660.9 877.7 860.5 659.1 518.0 3853.3

1. DMUSE as printed below is the sum of indoor use depletion for all municipal providers in the model. Indoor depletion is calculated from the ResReturn factor as read from the ReturnFlows datatable, times a factor representing losses from the type of sewage treatment as read in the Treatment table and the associated factor in the ReturnFlows datatable with consideration for the evaporative losses from sewage ponds found in the ponds datatable for each municipal provider. The values calculated for each municipal provider are stored in the FORTRAN variable DepIndoor(L,J,K).

INDOOR DEPLETION 42.0 20.0 20.0 20.0 20.0 20.0 80.2 204.9 231.2 229.5 204.7 173.0 1265.4

1. LGOUT as printed below is the total of outdoor use depletion for all municipal providers in the model. Outdoor depletion is calculated from the residential outdoor demand, commercial outdoor demand, institutional outdoor demand and secondary water use times (1 – OutDoor), OutDoor being a factor read from the ReturnFlows table.

OUTDOOR DEPLETION 37.0 0.0 0.0 0.0 0.0 0.0 101.5 330.4 438.9 430.2 329.6 259.0 1926.6

1. DMACU as printed below is the total M&I depletion for each provider in the model and is also the sum of DMUSE and LGOUT.

TOTAL M&I DEPLETION 79.0 20.0 20.0 20.0 20.0 20.0 181.7 535.3 670.0 659.7 534.2 432.0 3192.1

1. DRET as printed below is return flow from all M&I providers within the model. This value is the average of QX(MunQXRet(L),J,K) for all municipal areas 1 through L.

RETURN FLOW 251.7 236.7 236.7 236.7 236.7 236.7 278.0 382.2 464.4 457.5 381.6 342.7 3741.8

1. WCONS printed below is the average wetland consumptive use for Cottonwoods (an assumed riparian plant) considering rainfall and temperature for the area in which they are found. WTDEP is the average of QX(NQXPH,J,K).

WET/OPEN WATER AREA BUDGET

WET/OPEN WATER DEPLETION 158 0 0 0 0 0 335 941 1480 1901 1600 1001 7416

SUBAREA CONSUMPTIVE USE/DEPLETIONS

1. Printed below are the total depletions for the model from agriculture, M&I, and riparian water uses. This value is the sum of CPDEP + DMACU + WCONS as defined above.

TOTAL CONSUMPTIVE USE 1100 20 20 20 20 28 2220 7625 7699 8174 6532 4102 37562

1. Printed below are the consumptive use totals from agricultural, M&I, wetlands.

TOTAL DEPLETIONS 587 406 642 829 946 -250 2959 6791 6070 5996 5201 2955 33131

OUTFLOW AND/OR GROUNDWATER CHANGE

1. CHGW printed below is the average difference between calculate agricultural return flow and the routed return flow.

CHANGE IN GROUND WATER STORAGE 1113 508 109 -1 -28 -1551 -84 -1045 -212 132 273 781 -6

1. Printed below is the average of all the QX flows which are identified as basin outflows.

BUDGET OUTFLOW Basin Outflow 0 0 0 0 0 0 0 0 0 0 0 0 0

1. Printed below is the average basin yield. Yield = basin outflows - mainstem inflow – basin imports + basin exports + diversions to agricultural land areas (including sub-irrigation diversions) + agricultural groundwater deliveries + excess precipitation (above ET requirements) - agricultural return flows + change in reservoir storage + reservoir evaporation + man-influenced riparian use + surface diversions to M&I areas + M&I groundwater diversions – M&I return flow.

SUBAREA YIELD

SUMMATION OF YIELD 587 406 642 829 946 -250 2959 6791 6070 5996 5201 2955 33131

1. AvNatUse printed below is natural system use for the subarea. Natural system use is defined as the volume of rainfall over the entire subarea plus yield.

NATURAL SYSTEM USE 47098 33334 35895 44487 47407 49082 34594 21569 14474 24965 32182 25315 410402

NATURAL SYSTEM USE 46913 33354 36164 44944 47980 48349 35609 20660 13298 23644 31134 24453 406503

1. AvRainAF printed below is the average precipitation falling on the subarea during the model period in acre feet:

SUMMARY

TOTAL PRECIPITATION 47686 33740 36537 45315 48353 48832 37553 28359 20544 30960 37383 28270 443533

1. AvNatUse is as defined above in 39.

NATURAL SYSTEM USE 47098 33334 35895 44487 47407 49082 34594 21569 14474 24965 32182 25315 410402

1. QXTOT as defined above in 6.

TOTAL SURFACE DIVERSIONS 614 126 0 0 0 289 3601 3538 2349 1545 1335 1139 14536

1. Agricultural and municipal groundwater deliveries, AGPUM + DPUM.

TOTAL GROUNDWATER USE 626 257 257 257 257 258 1404 6171 6495 7076 6086 3678 32821

1. TotInflow is the negative of the amount of inflow into the subarea as above in 4 above.

INFLOW -846 -748 -671 -662 -674 -1302 -3122 -8837 -4339 -1395 -946 -804 -24348

1. BasOut is the basin outflow as above in 37 above.

OUTFLOW 0 0 0 0 0 0 0 0 0 0 0 0 0

1. TDIVR is the average monthly diversion to agricultural land areas as in 8 above.

AGRICULTURAL SURFACE DIVERSIONS 605 125 0 0 0 289 3577 3458 2245 1442 1256 1078 14075

1. AGPUMP+RIVGW is the sum of average monthly ground water and sub-irrigated diversions from river flows as in 9 and 10 above.

AGRICULTURAL GROUNDWATER DIVERSION 305 0 0 0 0 1 968 5334 5466 6061 5248 2965 26348

1. The sum of items 46 and 47 above.

AGRICULTURAL TOTAL DIVERSIONS 910 126 0 0 0 290 4545 8791 7710 7503 6504 4042 40423

1. Crop consumptive use as in item 22 above.

AGRICULTURAL DEPLETIONS 449 386 622 809 926 -270 2663 5925 4896 4693 4121 2187 27406

1. Municipal and industrial surface and groundwater diversions as in item 25 above.

M&I SURFACE DIVERSIONS 9 0 0 0 0 0 24 78 104 102 78 61 457

M&I GROUNDWATER DIVERSIONS 322 257 257 257 257 257 436 839 1030 1015 838 713 6476

1. Total of the two lines in item 50.

M&I TOTAL DIVERSIONS 331 257 257 257 257 257 460 918 1134 1117 916 775 6934

1. Total municipal and industrial depletions as in item 31 above.

M&I DEPLETIONS 79 20 20 20 20 20 182 535 670 660 534 432 3192

1. Wetland depletions as in item 33 above.

WETLAND DEPLETIONS 59 0 0 0 0 0 115 330 503 643 546 336 2533

1. Subarea yield as in item 38 above.

YIELD 587 406 642 829 946 -250 2959 6791 6070 5996 5201 2955 33131

1. Groundwater mining is the annual groundwater pumping that is in excess of recharge.

GROUNDWATER MINING 31 0 0 0 0 0 102 567 580 646 556 318 2800

1. Yield minus groundwater mining is the basin calculated yield with groundwater mining subtracted.

YIELD MINUS GW MINING 557 406 642 829 946 -250 2857 6223 5490 5350 4645 2636 30331