BEST PRACTICES FOR DETERMINING CROP HISTORICAL CONSUMPTIVE USE

Historical consumptive use (HCU) should be quantified month-by-month by comparing the monthly irrigation water requirement (IWR) against the same month’s diversion records for every month in the study period. The IWR can be calculated from approved methods, such as the commonly used Modified Blaney-Criddle Method. As part of the HCU analysis, the portion of the flow that is not consumed (a.k.a. return flows) must also be evaluated.

Modified Blaney-Criddle Method Models used to determine the IWR need monthly temperature and precipitation values for the field site. The weather data are obtained from climate stations throughout Colorado; however, the temperature and precipitation values should be corrected for the field site in the following situations. If the elevation of the site is different than the climate station, the temperature values from the climate station should be corrected. A temperature adjustment of 3.6 degrees cooler per 1000 feet of elevation gain is typically accepted if no other data exists. For precipitation value comparisons, a statewide map of the long-term average annual precipitation values (1951-1980) can be obtained from both the Colorado’s Decision Support Systems (CDSS) and the Division of Water Resources (DWR) websites – the GIS coverages can be downloaded by Division. The weather station long-term average should be compared against the statewide map value for the field site so that a precipitation correction factor can be applied to the weather station data for use at the field site as needed.

The StateCU Program, available for free download from the CDSS website, can be used to compute the historical consumptive use in a month-by-month analysis. The program has an “orographic adjustment” feature that can be used to apply the long-term climate correction factors in the analysis and also has a feature that can weight the data from different climate stations instead of using the orographic adjustment. The weighted average feature should only be used if the resulting weighted long-term average precipitation matches the long-term average precipitation map. Water storage into the soil moisture profile is another component that may be used in the analysis and is a feature available in the StateCU program. In addition, this CDSS website provides statewide diversion record information from HydroBase, the State’s central water resources database.

The portion of the diversion that is not consumed is called the historical return flow, and properly computing this component is an essential part of the analysis. The portion of the historical return flow that was surface flow is typically considered to have returned in the same month as the diversion; further, the portion of the historical return flow that seeped into the ground should be timed or lagged back to the stream. The lagged timing may be computed using an analytical method such as Glover or a numerical model such as MODFLOW. The diversion minus the lagged historical return flow for each month is called the “net historical depletion”. The final monthly average net historical depletion for all of the 12 months in a year is obtained by averaging the monthly net historical depletion in the study period. Since the historical return flow typically has a lagging factor, a return flow obligation after the end of the diversion season is normally required to also be computed and maintained with the change of water right.

In many water right change cases, it is appropriate to determine the monthly percentage of historical net depletions from the monthly historical average diversion and apply that percentage to the future diversions to determine the amount of credit obtained in a given future month. Under this approach, it is appropriate to determine maximum monthly credits, maximum annual credits, and a long-term annual average that may not be exceeded.

Applicable State Internet Products
StateCU download and water database (HydroBase) website: http://cdss.state.co.us
Precipitation Map:
  AquaMap: http://water.state.co.us/DataMaps/GISandMaps/AquaMap/Pages/default.aspx
  MapViewer: http://cdss.state.co.us/onlineTools/Pages/MapViewer.aspx
  GIS Geodatabases: http://cdss.state.co.us/GIS/Pages/DataByCategory.aspx

1. Note: A simplified analysis of obtaining an average long-term monthly diversion and comparing once against a long-term monthly IWR, instead of performing a month-by-month analysis, will result in an incorrect historical consumptive use value because the water short months will be moderated by the water long months to incorrectly show consumption when irrigation water was not available by diversion or from soil moisture.

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