AGWRAP – Water Needs Assessment Tool

Introduction

This spreadsheet- based tool is designed to aid in the determination of water needs (demands) of irrigated cropland and livestock consumption. It also predicts monthly runoff and by cumulating supply (runoff) and demand estimates the required capacity of a farm pond.

The tool uses Excel and Visual Basic for Applications (VBA) for user input screens, output screens, and to access help files.

Main Page

The main page is used to help the user navigate to the desired input screens and to view output. The user may also navigate the workbook by clicking on the desired worksheet tab. Buttons that are light green are those that require user input. The button that activates help documentation is orange.

Clear Data

This button will clear acreage data associated with cropland, watershed, and livestock. It is not necessary to clear data prior to the evaluation if all pertinent data is entered and pre-existing data is cleared via the checkboxes in the respective data entry pages.

Input Location, Crop and Irrigation System Information

Click this button to move to the data entry page for these items.

Input Watershed Information

Click this button to navigate to the data entry page to enter watershed information such as soils, cover, and area. The user will select between a “simple method” and a curve number approach to estimating watershed runoff.

Input Livestock Information

Click this button to move to the workbook page to enter livestock type and head numbers. This information will be used to estimate monthly livestock water demand.

Summary Output

Click this button to view a table of monthly output. Information includes crop and livestock water demand, cumulative demand and supply (runoff) and required pond capacity.

Plots

Monthly rainfall, runoff and cumulative supply and demand curves will be shown when this button is clicked.

Pond Operation

Click this button after reviewing the Summary Output page to operate the pond system. This allows the user to check the "best estimate" of required pond storage in the summary output. The user can change the pond capacity and starting volume to see the effect on water supply adequacy.

Irrigation Requirements Only

Click this button to view monthly reference ET for the selected site; and monthly crop coefficients, effective precipitation, net irrigation requirements, and gross irrigation requirements for the crops selected.

Help

Clicking on this button accesses the help files (such as this).

Location, Crop and Irrigation System Input Screen

County

Enter the county for which you will be doing the assessment. This will be used to access the appropriate weather station for rainfall and temperature.

Crop Information

The user can specify up to 3 crops that would be grown in a 12 month period. Click the check boxes above crop1, crop2 or crop3 to enter data or to omit data (uncheck) if fewer than 3 crops are to be evaluated. Note that when a check box is checked, the list boxes below are visible and enabled; if the box is unchecked, nothing can be entered in the associated crop information boxes below. Select the crop from the list box using the scroll bar if necessary. For any crops that are selected, the associated acreage is entered in the box below the crop selection box and a planting date is chosen using the list box below the acreage data. Click on the desired entry to highlight and select it.

A double crop option if given for the first two crops. If double-cropping is planned, click the far left double crop check box and enter the acreage to be double-cropped. The double-crop check box and acreage for crop 2 will automatically be checked and filled with the same acreage as crop 1.

Irrigation System Information

For each crop selected, choose the associated irrigation system. Selection of a particular irrigation system will determine the irrigation efficiency for all types except “custom”. If “custom” is selected, the user can enter the desired irrigation efficiency.

Once all desired information is entered, click on the “home” button in the upper –left corner to return to the main menu.

Help

Help files can be accessed by clicking on the help button from any input or output page.

Livestock Information

If livestock water requirements are to be considered - assumed source is farm pond and grazing animals – but the requirements should be valid for any water source - enter data on this page

Up to 4 livestock types and associated numbers (head) can be entered. The user should uncheck types that will not be used for cases of fewer than 4 livestock types

Watershed input

This page is used to enter the information required to estimate monthly runoff.

Estimation methodology

Select either the “use simple method” or “use cover type” to select the method used in the NRCS document “Ponds-Planning, Design and Construction” or the NRCS curve number method to estimate runoff into a proposed farm pond.

Simple-Method

The method used a “acres required to produce one acre-foot annually” map found in the NRCS Pond Planning publication. Runoff is distributed monthly using the proportion of monthly to annual runoff from the rainfall station associated with the respective county. The user must enter the total number of acres for the watershed that would drain to the proposed pond. This methodl tend to be the more conservative method (predict less runoff than the curve number method) for soils in hydrologic groups C and D and for good land cover. If watershed cover and soils are unknown, this is the preferred method.

Cover-Type

If land cover and associated acreage are known, the SCS curve number method can be used. This method computes excess precipitation (runoff) from monthly precipitation, the average number of

rainfall events of 0.5 in. or more, and cover type. The user can select up to three different watershed cover types and associated acreage for each cover type. If selecting fewer than three cover types, be sure to "uncheck" the other entries. The user must also select the predominant soil in the watershed. This will determine the hydrologic soil group used to estimate the curve number for the cover types.

For agricultural practices, the following key applies for interpretation of the input form:

CR = crop residue

SR = straight row

C = Contoured

T = Terraced

The user can click on the home button to return to the main page or click on the help button to access help files (such as this one).

Summary Output

This page provides a monthly output table of water demands and water supply. The "deficit" column is greater than 0 when demand exceeds the supply for the month. The font will turn to red to alert the user of the condition. If annual supply exceeds annual demand, pond storage can satisfy the months with deficits. The third- and second-last columns of the table list cumulative supply (runoff) and total demand (irrigation and livestock). The last column just outside the shaded portion of the table shows the difference (cumulative runoff – cumulative demand) by month. The largest deficit (negative value) in the last column would be the required pond storage. If the total annual runoff is less than the total annual demand, then no amount of pond capacity will be able to fully supply water needs in a normal year.

The required pond storage is shown beneath the table along with targeted error messages.

Pond Operation

This page is used to operate a pond, usually started with a pond of about the same capacity recommended at the bottom of the summary output table. The user can change pond capacity and pond beginning storage to see the effect on water supply adequacy. The blue areas of the table in the worksheet are related to operation and are subject to change as the blue input cells, i.e., pond capacity and beginning storage, and the operation mode are changed.

Operation Mode

Click on the cell below the label "operation mode" to select the mode which determines the order of operation in the pond operation model. Two options are available; "inflow first" or "demand first". Selecting "inflow first" means that monthly inflow will be placed in the pond first, subject to pond

capacity. This is the more conservative of operation order as it potentially leaves less water for water demand and results in more “spill”. Selecting “demand first” assumes that all demand will be satisfied first from the beginning month pond volume allowing “space” for inflow.

The monthly “spill” and “deficit” columns are subject to the operation mode.

The “notes” below the table provide guidance to meet total water demand by either reducing acreage or by increasing storage, based upon runoff, and operational spills and deficits.