**Excel sheet changes done by Alex Giberson**

For simplicity, the original excel sheet from Ethan will be called the v5 sheet and the excel sheet I have made is called v6

The basic logic of the v6 sheet is to find what the highest demand for 170 can be that is able to produce flows that is able to satisfy Canadian entitlement and allow the US to use any additional flow. The final demand values may look extremely volatile but this is by design as the realistic demand is not being calculated as goal of the credit system is to make sure Canada receives enough water and the US is able to use whatever extra is sent.   
  
The first and second set of changes was adjusting the dates. The v5 sheet had the days starting on Jan 01, which is not correct as WRMM first set of data is the weekly average from Jan 01 to Jan 07. This error had the side effect of shifting the date handling of Oct 28th to Nov 4th as the date handling was being done from Nov 4th to Nov 11th. The Second change was done to how the date handling was being calculated. The v5 sheet did not reset the credits properly as the Nov 4th week was still referring to the previous week data. You can view the changes under the “US CREDIT (Only Cum Positives for Cap) AC.FT” section (row 200) in the v6 sheet. Essentially the Oct 28th week includes 3/7th of the Nov 4th flow to account for Oct 19th,30th, and 31st while the Nov 4th week only includes 4/7th of the Nov 4th flow to exclude those October dates.

The next set of changes was to how the logic of the excel sheet works. I will write out the logic here to help with understanding the changes I did, I will refer to the sections by name and include the row number as to where the section in located within the v6 sheet.

1. “Actual Surplus of flow ((Outsim 170) - (OutID170))-Surplus Delivery above share (CMS)” (Row 431)

The biggest change was to this section as before it was supposed to be the prev run flows at NATCHL 170. This was done by importing the outid for 170. The issue with how v5 handled “prev flow” was the assumption that outid contained flow data. Outid is the ideal demand for a specific component and what was actually being imported was the demand that produced the flows in outsim 170 for that run. Because the purpose of the excel sheet is to recalculate the demand for NATCHL 170 and generate demand for NATCHL 982, this section was changes to find what the surplus flow was from the current demand.   
  
The formula looks at “SURPLUS DELIVERIES Above Entitlement (cms) - Outsim 170 - Canadian Entitlement” (Row 124) to see if there is a positive surplus of flow above Canadian entitlement. If there is, then the outsim 170 is subtracted by the outid 170 in order to find how much flow was delivered above what the demand requested. If there was not surplus then the value is whatever the deficit is.

1. “SURPLUS DELIVERIES Above Share AC.FT” (Row 162)

This section calculates the surplus deliveries that the US sends to Canada along the St Mary River in AC.FT. This section uses the values calculated in “Actual Surplus of flow ((Outsim 170) - (OutID170))-Surplus Delivery above share (CMS)” (Row 431) instead of the values in the Row 124 section as the actual surplus is whatever the difference what the demand specified and the flow that was simulated.

1. “Intermediate Demand Calc (Prev run + (entitle - prev run))” (Row 545)

This section is meant to calculate what the new demand would be before any checks are done. The formula starts with the difference between demand and entitlement (E471), then adds an adjustment if there’s a credit overshoot (choosing the bigger of the overshoot or surplus-minus-credit-needed) and finally adds the external demand value from the outid.csv file. The result is the “new demand before checks,” rounded to 3 decimals.

1. “Excess Take (cms) - Credit that was taken when there was no credit to take” (Row 697)

This section is the final check to make sure the new demand is taking into account if the “Intermediate Demand Calc..” (which uses the outid for 170) is not demanding more water than what is being allowed by the allowable use (row 659).

1. “New Entitlement -> HBDF CAN STM” (Row 736)

This section is what the new demand is for 170. Essentially it takes the “Intermediate Demand Calc…” section as the new demand but if the current week is using credit that is not available its subtracts the new demand by how much extra is being taken.

1. “New US Take -> HBDF File NATCH982” (Row 775)

This is a new section that is the Allowable Use (Row 659) which is what the US can take from its surplus they send to Canada.