Monthly Monitoring Data Quality Assurance and Control Procedures

General Information:

- **NOTE ANY CHANGES MADE** in the QAQC Notes column, along with your initials.
- The QA/QC process should be performed MONTHLY for groundwater data, after the checking process is complete, and again at the end of the year. Precipitation, ditch, and USGS river flow data can be proofed annually.
- Conduct the steps of the procedure in the order they are written.

Monthly Groundwater Procedure

1. Ensure all sites are present. If a site is missing, add a line of periods for missing data.
2. Check the comments to ensure that any dry or flooded and unread wells were flagged correctly (orange for dry, blue for flooded), and noted in the QA/QCNotes column
3. If the person checking the data has not already done so, update the individual site graph tabs with the most recent month of data and remove the oldest month of data.
    a. For each site, go to the tab for that site and in the graph right click. Select "Select Data."
    b. If needed, under "Series," click on the month and year from a year ago and select the "Remove" button.
    c. Select the "Add" button. To create the label for the data you just entered, in the "Name" box, write the month and year for the data you are going to graph. For instance, if it's for January 2016, write ="Jan-16" and then click back on the box to the far right of that.
    d. To add your data, click on the far right of "Y values." Click on the data tab in the file and go to the well data for the month and year you want to enter. Select that data. Hit OK.
    e. When a well data point is missing, you will have to delete the "." in the cell; otherwise, Excel will graph the point as '0'

        **If for some reason these graphs are missing or will not display, create new graphs based on the following guidelines: graph the most recent 12 months of data using the casing-height corrected depth, but proof the original non-corrected entry. This is to ensure that you are assessing the relationships between wells without the bias of the differing casing heights (ie, starting at ground level for all wells). However, the pre-casing height (original) entry should be edited as this is the number that would be subjected to error at the reading or entry stage.
4. Compare the new month of data to the past data. Questions to ask:
    a. Does the trend for this month follow the same general trend as in the same month the year before? If not, is there a good reason why not? (e.g., unusually high rainfall or river flow, out of the ordinary diversions from a nearby dam, etc.)

   b. Are the depths for all five wells tending to increase and decrease together? If not, is there an outstanding reason? (e.g., a well that is more strongly influenced by a nearby ditch than other wells, which are more influenced by river flow)
   c. Do the relationships between wells remain consistent over time? (for example, perhaps at a given site, N and S track each other closely, with N generally a bit shallower than S)

5. If a point is questionable, assess for the following common errors:
   a. The point was written down off by one meter
   b. The hash mark on the measuring tape was read as a '1' (common for the first 9 digits after a meter mark, e.g., 119 recorded instead of 109)
   c. Two wells were switched. The most common mistake is W and E, followed by N and S. Also keep an eye out for any two wells whose rows are next to each other on the datasheet (N and E, E and C, C and S, S and W)
   d. Numbers were transposed within a reading (e.g., 149 was recorded when the correct reading was 194)
   e. 9's were read upside down as 6's, and vice versa- this is most common for 99/66.
   f. After a meter mark, the first 9 cm were given a tens value rather than a ones value (e.g., 190 was recorded when the correct reading was 109)
6. If any of the above scenarios resolve a questionable point, make the appropriate change and note it in the QA/QC column. Be sure to include the original entry, the suspected error, the new value, and your initials.
7. If none of the above scenarios resolves a questionable point:
   a. If the point follows the same trend as the other wells but is exaggerated compared to the rest (e.g., 30-40cm deeper than other wells), flag the point in red text but leave it in place. In the QA/QC column, note the reason for the flag and your initials.
   b. If the point does not follow the same trend as the other wells (e.g., a well that is declining while the other four wells are increasing), and is >20cm off track from the other wells' trend, remove the point. In the QA/QC column, note the original entry and your initials.

Annual QA/QC Procedure: Groundwater, Precipitation, Ditch, and USGS Riverflow

As above, perform these steps in the order written.

<u>All Datasets</u>

1. Since the presence of each site is checked monthly during the groundwater QA/QC, you do not need to re-verify the presence of all sites for each month

Groundwater

1. In a separate document, graph the most recent year's worth of casing-height corrected data against the previous year.
2. Use the same general process as with the monthly data to QA/QC the entire year of data

Ditch

1. Add a filter to the dataset. Scroll to the bottom of the list of values to ensure that there are no non-numeric values apart from "." for missing data. Fill any blank cells with "."
2. Search the water related comments for 'ditch.' Ensure that only "." was recorded when the ditch was noted to be dry. Remove the reading if necessary and put it in the QA/QC comments and flag the cell in orange. Similarly, if the ditch was flooded and not read, flag it in blue and note it in the QA/QC comments.

Precipitation

1. Use the filter from step 1 of the ditch protocol to scroll to the bottom of the list of values for the open and canopy gauges to ensure that there are no non-numeric values apart from "." for missing data. Fill any blank cells with "."
2. Search the water-related comments for "trace" precipitation. Ensure that any trace precipitation is entered as 0.05 mm

USGS Riverflow Data

1. Use the filter to scroll to the bottom of the list of values for the riverflow data. Check the past year of data against the downloaded values. Write a comment in blue for the month after the last checked month that says "USGS riverflow data checked to here"

This procedure document has been approved by _____Kim Eichhorst_____

Date _____7/6/20_____