

How Did Conductivity Vary Along the Wichita River from April 2003 – November 2003?



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GEO 327 G
December 7, 2017

Problem

The Wichita River has some of the best striped bass fishing in the United States, it is a multimillion dollar industry. Striped bass thrive off these saline waters. However, for many residents and city planners, potable use of the water is more important. Efforts have been made by the Army Corps of Engineers to remove thousands of tons of salt water. The USGS has stream gauging stations where precipitation, conductivity, and discharge rates are measured. These values can tell us more about the conductivity of the river and give us a better understanding of how to solve the saline water issue.

Goal

The goal of my project is to produce a graph showing the conductivity at different locations along the Wichita from April 2002 to October 2002, as well as one location on the Red River for reference. This will also help with trace element research by ICP-MS that I am currently conducting over the same time interval.

Data Collection

USGS National Water Information System

https://waterdata.usgs.gov/tx/nwis/current?type=flow&group_key=NONE

Data.Gov

<https://catalog.data.gov/dataset/tiger-line-shapefile-2013-state-texas-current-county-subdivision-state-based>

Secrets of the West by Steffen Synnatschke

<http://www.synnatschke.de/geo-tools/coordinate-converter.php>

Geo-class folder >> GEO-327g_386g >> 2017_Lab_data >> Lab_1_data >>
Texas_data >> USGS_Geology

Method:

1. Obtaining the Data From Online

In order to download the Conductivity data you must go to the Nation Water Information System's Web Interface.

(https://waterdata.usgs.gov/tx/nwis/current?type=flow&group_key=NONE)

Once there, select our gaging station: N Wichita Rv nr Truscott, TX (Station Number 07311700).

The screenshot shows the USGS National Water Information System Web Interface. It displays a list of current conditions for Texas streamflow, with 590 sites found. The table below is a representation of the data shown in the screenshot.

Station Number	Station name	Date/Time	Gage height, feet	Discharge, cfs	Flow, cfs	Term
07272400	Cramer Cr at US Hwy 54 nr Bullhart, TX	12/08 15:30 CST	3.18	0.00	0.00	
07272400	Canadian Rv nr Amarillo, TX	12/08 15:15 CST	1.25	6.8	17.0	
07272800	Big Bend Cr nr Pithco, TX	12/08 15:15 CST	0.43	0.02	2.80	
07282600	Canadian Rv nr Canadian, TX	12/08 14:45 CST	1.49	58.7	41.0	
07283200	Palo Duro Cr nr Spearman, TX	12/08 14:30 CST	2.51	0.00	.20	
07283500	Wolf Cr at Lipscomb, TX	12/08 14:45 CST	0.36	0.02	2.20	
07292400	Herra Blanco Cr abv Buffalo Lk nr Umbarger, TX	12/08 15:00 CST	0.50	0.00	.25	
07292900	Pr Dog Iwn Fk Red Rv nr Weysside, TX	12/08 15:00 CST	3.90	10.6	4.30	
07293200	Pr Dog Iwn Fk Red Rv nr Epico, TX	12/08 15:00 CST	4.77	8.40	.30	
07293240	Pr Dog Iwn Fk Red Rv nr Childress, TX	12/08 14:45 CST	8.21	21.2	11.0	
07293500	Greenback Cr at SR 6 nr Quamah, TX	12/08 15:00 CST	6.88	17.0	4.80	
07293900	Lalla Lk Cr bl Bell Cr nr Hedley, TX	12/08 14:45 CST	3.37	0.98	1.70	
07300000	Salt Fk Red Rv nr Wellington, TX	12/08 15:00 CST	2.74	11.8	20.0	
07311300	N Fk Red Rv nr Shinerock, TX	12/08 14:45 CST	5.63	41.7	18.0	
07311440	Sweetwater Cr nr Kellon, TX	12/08 14:45 CST	6.51	2.99	9.30	
07311700	Pease Rv nr Vernon, TX	12/08 15:00 CST	5.05	24.0	13.0	
07312600	Red Rv nr Burkburnett, TX	12/08 14:30 CST	6.60	6.60	21.7	
07311700	N Wichita Rv nr Truscott, TX	12/08 14:45 CST	6.52	14.0	19.0	
07311800	S Wichita Rv nr Benjamin, TX	12/08 14:45 CST	7.48	0.00	3.90	
07311900	Wichita Rv nr Seymour, TX	12/08 15:15 CST	6.58	6.17	23.0	
07312100	Wichita Rv nr Malvern, TX	12/08 14:45 CST	1.34	0.04	1.10	

Once the first station has been chosen, specify the time range for the data. Choose the table of data output.

The screenshot shows the USGS data retrieval interface for station 07311700. It includes a table for the period of record and various options for choosing the output format.

USGS 07311700 N Wichita Rv nr Truscott, TX

Available data for this site:

Knox County, Texas
 Latitude: 33°09'14" Longitude: 99°17'10" NAD27
 Gage datum 1,351.78 feet above NGVD29
 Site Type: Stream

Period of record

Begin Date	End Date	Samples
1965-07-08	2011-08-24	576

Choose Output Format

Retrieve Water-Quality Samples for Selected Sites
 Choose one of the following options for displaying data for the sites meeting the criteria above:

- Parameter Group Period of Record table
- Inventory of water-quality data
- Tab-separated inventory of water-quality data

Retrieve data from: to: (YYYY-MM-DD -- Blank = all data)

Retrieve sample time and time zone: as stored in UTC

Retrieve samples for specified parameter values: (Parameter Code) (Maximum:)

Samples and parameters to include:

- Samples that include only above parameter selection criteria (Count: 0)
- Samples that include above selection criteria and all associated parameters
- Samples that include above selection criteria plus one or more of these parameter codes separated by a comma (Limit: 200 codes):
- Samples that include above selection criteria plus one or more of these parameters in a file. Enter the full pathname of a file containing parameter codes. (Limit: 200 codes):

Table of data:

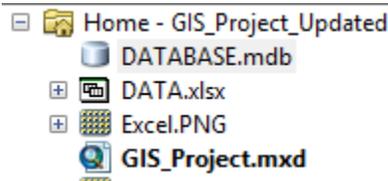
Tab-separated data: One sample per row with remark codes combined with values.

In my case, I have the data arranged in an excel sheet. Over 5 localities from April of 2003 – November 2003.

Location	County	Latitude NAD27	Longitude NAD27	Drainage Area (sq. miles)	Area (sq. NGVD29)	ID#	Date	Discharge (ft ³ /sec)	Temperature Water °C	Conductance @ 25°C (uS/cm)
SOUTH WICHITA RIVER NR BENJAMIN, TX	Knox	33°38'39"	99°48'02"	584	1334.23	7111800	4/15/2003	1.5	30	23300
SOUTH WICHITA RIVER NR BENJAMIN, TX	Knox	33°38'39"	99°48'02"	584	1334.23	7111800	7/16/2003	0.39	11.6	13600
SOUTH WICHITA RIVER NR BENJAMIN, TX	Knox	33°38'39"	99°48'02"	584	1334.23	7111800	9/11/2003	1750	20.7	693
SOUTH WICHITA RIVER NR BENJAMIN, TX	Knox	33°38'39"	99°48'02"	584	1334.23	7111800	10/2/2003	0.31	19.5	9200
NORTH WICHITA RIVER NR TRUSCOTT, TX	Knox	33°49'14"	99°47'10"	937	1351.78	7111700	4/23/2003	52	16.2	8750
NORTH WICHITA RIVER NR TRUSCOTT, TX	Knox	33°49'14"	99°47'10"	937	1351.78	7111700	7/22/2003	2.4	30	26200
NORTH WICHITA RIVER NR TRUSCOTT, TX	Knox	33°49'14"	99°47'10"	937	1351.78	7111700	8/13/2003	7	29.7	30900
NORTH WICHITA RIVER NR TRUSCOTT, TX	Knox	33°49'14"	99°47'10"	937	1351.78	7111700	10/10/2003	13	21.9	6640
WICHITA RIVER NR MABELLE, TX	Baylor	33°45'36"	99°08'33"	2086	1062.72	7112100	4/9/2003	143	14.8	4230
WICHITA RIVER NR MABELLE, TX	Baylor	33°45'36"	99°08'33"	2086	1062.72	7112100	5/7/2003	140	21.8	4400
WICHITA RIVER NR MABELLE, TX	Baylor	33°45'36"	99°08'33"	2086	1062.72	7112100	6/18/2003	1.4	27.1	4750
WICHITA RIVER NR MABELLE, TX	Baylor	33°45'36"	99°08'33"	2086	1062.72	7112100	7/29/2003	255	28.1	4620
WICHITA RIVER NR MABELLE, TX	Baylor	33°45'36"	99°08'33"	2086	1062.72	7112100	8/22/2003	243	27.7	4660
WICHITA RIVER NR MABELLE, TX	Baylor	33°45'36"	99°08'33"	2086	1062.72	7112100	9/22/2003	0.33	22.4	4910
WICHITA RIVER NR MABELLE, TX	Baylor	33°45'36"	99°08'33"	2086	1062.72	7112100	10/29/2003	1.32	18.5	4760
WICHITA RIVER NR SEYMOUR, TX	Baylor	33°42'01"	99°23'18"	1874	1152.7	7111900	4/2/2003	18	24.6	17700
WICHITA RIVER NR SEYMOUR, TX	Baylor	33°42'01"	99°23'18"	1874	1152.7	7111900	6/17/2003	39	26.3	8150
WICHITA RIVER NR SEYMOUR, TX	Baylor	33°42'01"	99°23'18"	1874	1152.7	7111900	7/17/2003	2.4	28.3	12000
WICHITA RIVER NR SEYMOUR, TX	Baylor	33°42'01"	99°23'18"	1874	1152.7	7111900	10/7/2003	2.6	21.9	12000
RED RIVER NR BURKBURNETT, TX	Wichita	34°06'36"	98°31'53"	20570	952.57	7308500	4/14/2003	134	18.5	9760
RED RIVER NR BURKBURNETT, TX	Wichita	34°06'36"	98°31'53"	20570	952.57	7308500	6/27/2003	1920	23.1	6330
RED RIVER NR BURKBURNETT, TX	Wichita	34°06'36"	98°31'53"	20570	952.57	7308500	8/19/2003	32	29.4	6950
RED RIVER NR BURKBURNETT, TX	Wichita	34°06'36"	98°31'53"	20570	952.57	7308500	9/24/2003	156	22.6	7920
RED RIVER NR BURKBURNETT, TX	Wichita	34°06'36"	98°31'53"	20570	952.57	7308500	10/23/2003	32	22.5	10200

2. Linking the Data Within ArcMap

Next, open a blank ArcMap and select the Catalog window icon. Right click the folder you are working with and select New>> Personal Geodatabase.



It should look something like this.

From that Database, right click, select New >> Feature Dataset. Set the coordinate system to NAD 1927 and NGVD 1929 as the vertical coordinates, as that is the CS used by the USGS for their measurements.

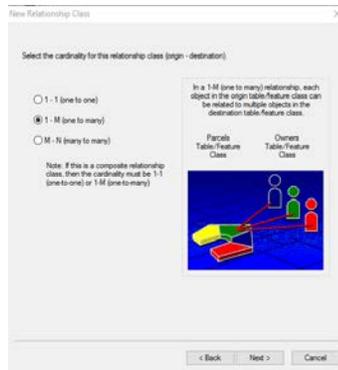
From the Dataset, right click, select New>> Feature Class. Name the feature class *Station*, select Point Features for the 'Type of features stored in this feature class'. Select Next. Fill out the fields, we want our station identification number, label it *ID*, latitude, longitude, drainage area, and conductivity. Then select finish.



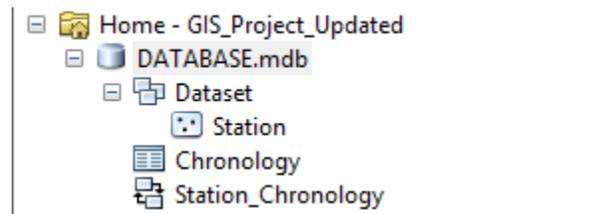
Now, make an empty table in the DATABASE.mdb. Right click DATABASE.mdb, select New>>Table. Name it *Chronology*, select next and fill it out as follows before selecting Finish.



Next, make a relationship class by linking the Station feature class with the Chronology table. Right click the Database.mdb, select New>> Relationship Class. Name the Relationship Class *Station_Chronology*. For the Origin feature class, Select *Station* and Select *Chronology* as the destination. >>Next. Select *Simple (peer to peer) relationship*, this relationship allows two or more objects in the database to exist independent of each other; meaning, if the object(s) in the original table are deleted, the object(s) in the destination table will not also be deleted. Select Next until coming to the cardinality window.



Select 1 –M (one to many), this allows each object in our origin to be related to multiple objects in the destination. Next select, *No, I do not want to add attributes to this relationship class*. In the following window, select *ID* as the Primary key field in the origin and similarly *ID* as the Foreign key field in the destination that refers to the primary. This ultimately allows for the linkage between the Station feature class and the Chronology table. Follow the default and select Finish. Ensure that step 2 was followed correctly, seeing that the DATABASE.mdb looks as follows.



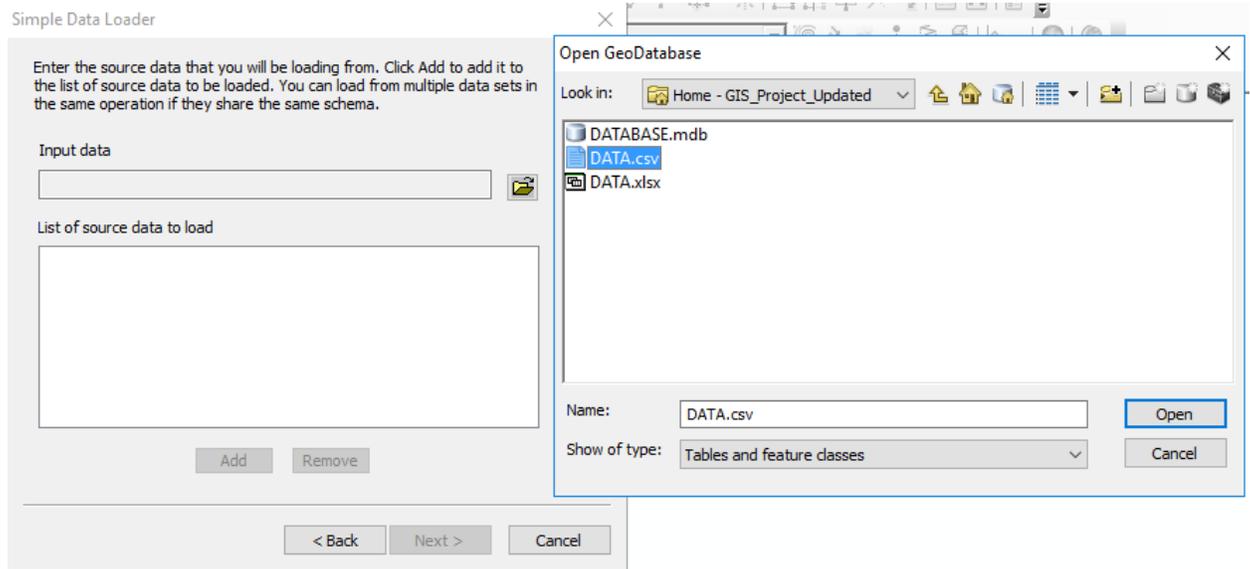
3. Loading Data

Now, convert the Microsoft Excel sheet into a CSV file.

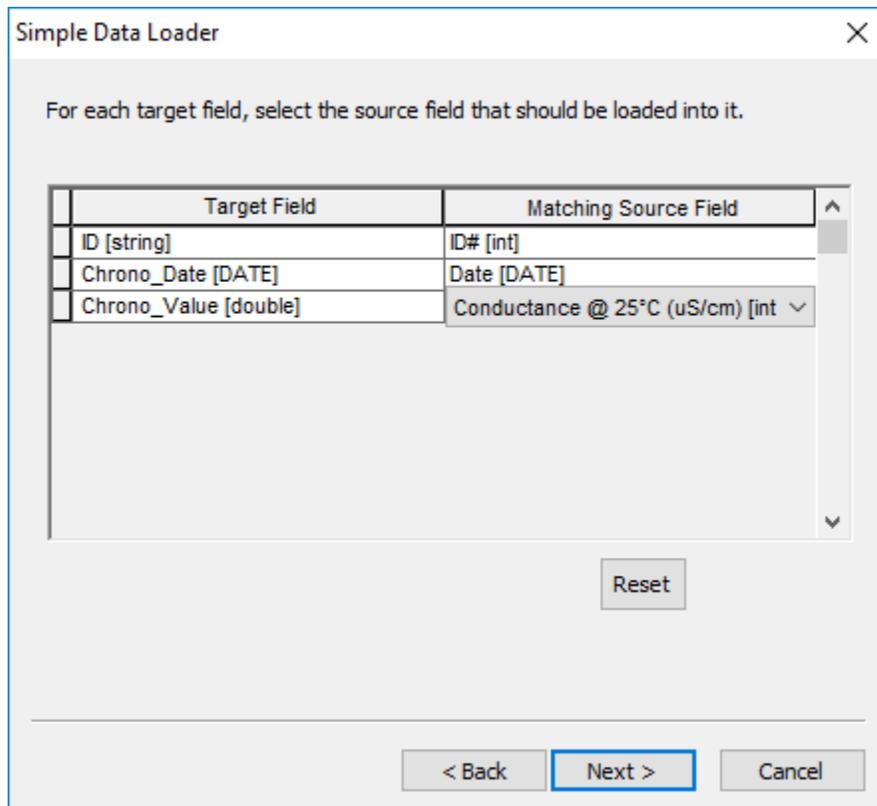
From the Microsoft Excel spreadsheet, Select File >> Save as >> File Format CSV (Comma delimited) >> Save it to the file you are working on

Next, right click Chronology >> Select Load >> Load Data...

Under Input data select the DATA.csv file.

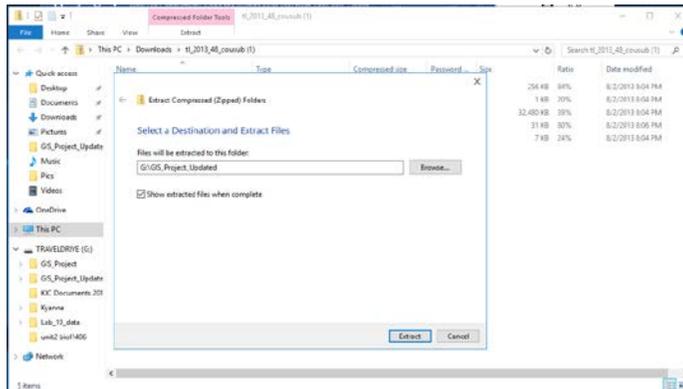


Select next, then *I do not want to load all rows into a subtype.* >> Fill Out the Table as follows:

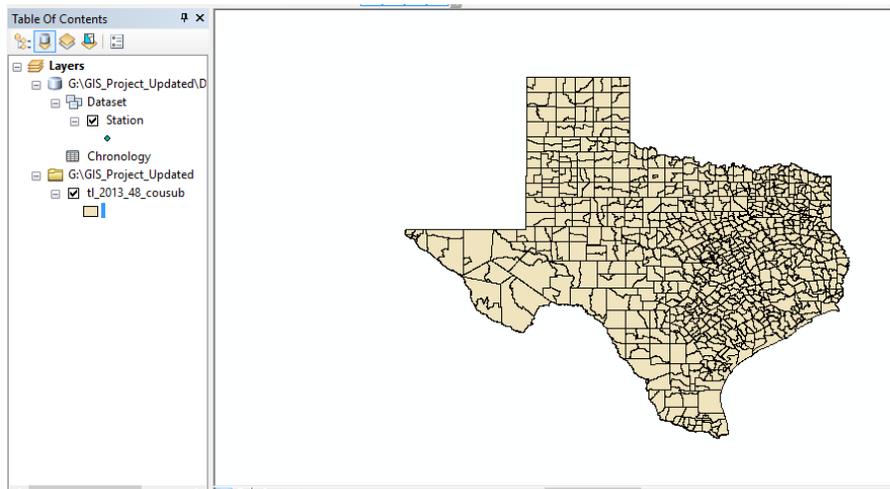


Select Next >> *Load all of the source data* >> Finish

- Next ensure the coordinate system for the mxd is NAD 1927. Then we may add a map of Texas. Obtain the map of Texas from Data.gov titled TIGER/Line Shapefile, 2013, state, Texas, Current County Subdivision State-based. Download the zip file and use the Extract all tool and select your folder as the destination.



Before adding Texas into ArcMap, set the file's coordinate system by right clicking the file in ArcCatalog>Properties>XY Coordinate System>Geographic Coordinate Systems>North America>NAD 1927. Then drag it to the table of contents.



- Station Data

We will enable the *Editor tool* and select *Start Editing*. Use the *Create Features tool*, >> Station >> Point >> Hover over the map of Texas >> F6 >> Enter the decimal degrees values for the longitude and latitude. Select enter and repeat for each of our 5 points. In between points, open the attribute table and fill in the ID, Lat, Long, and Drainage Area as these points are consistent for each locality.

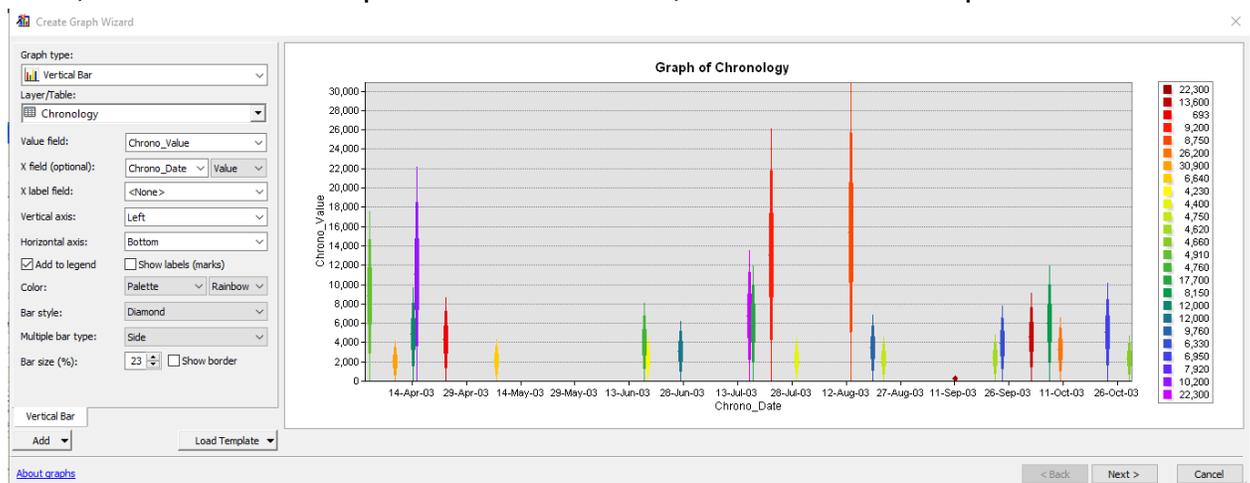
NOTE: Use a negative sign for longitude as we are working in the Western Hemisphere. A quick way to perform the conversions is by going to Secrets of the West: Geographic Tools :: Coordinate Conversion / Datum Transformation. <http://www.synnatschke.de/geo-tools/coordinate-converter.php>

Be sure to Save your edits in the Editor drop down menu, then select Stop editing.

6. Plot

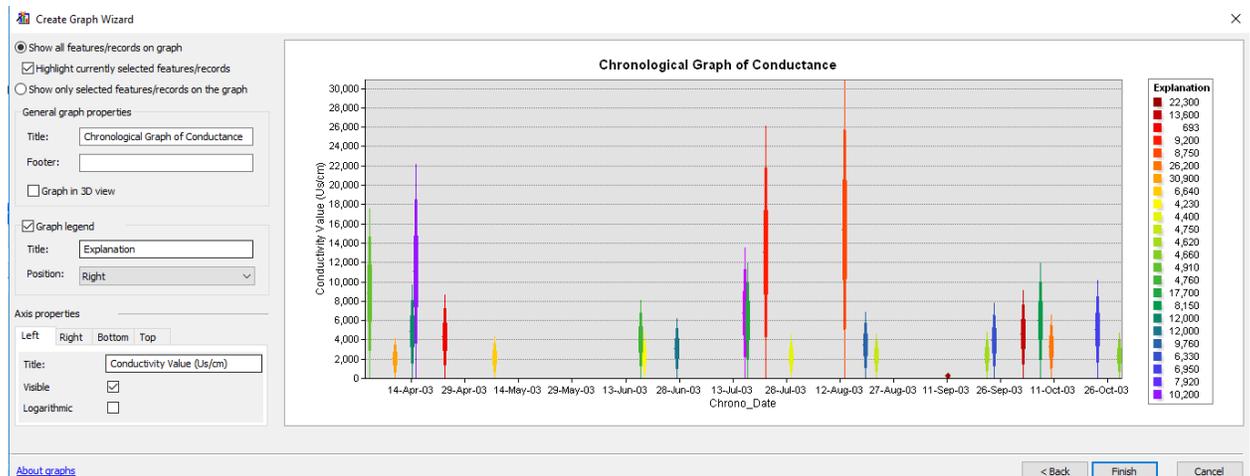
Next, right click the Stations in the Layers menu on the Table of contents >> Select Attribute table >> Related Table button >> Table Options >> Create Graph.

Now, fill the Create Graph Wizard as follows, or customize it as preferred.

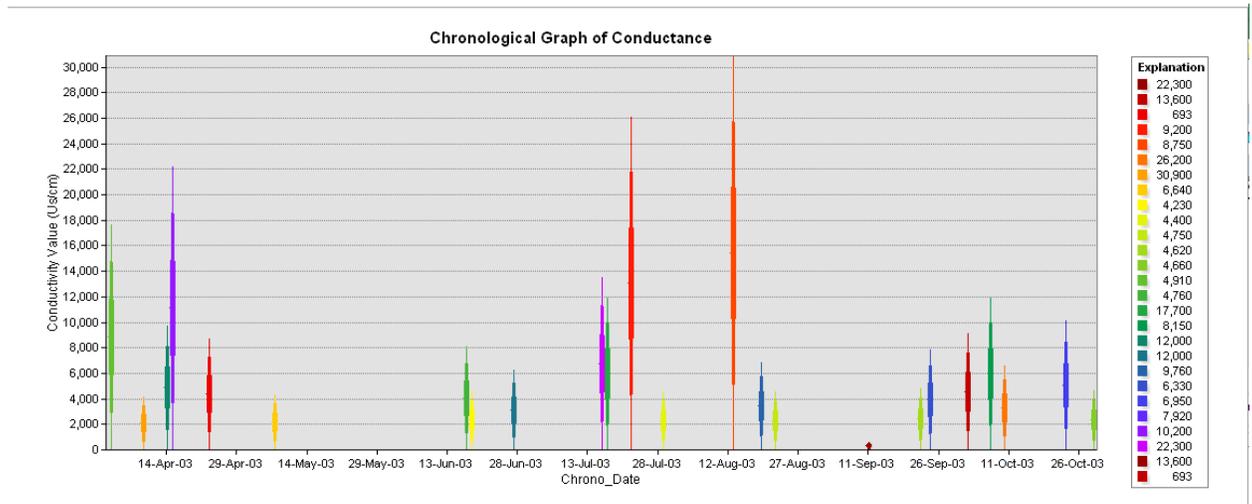


Select Next.

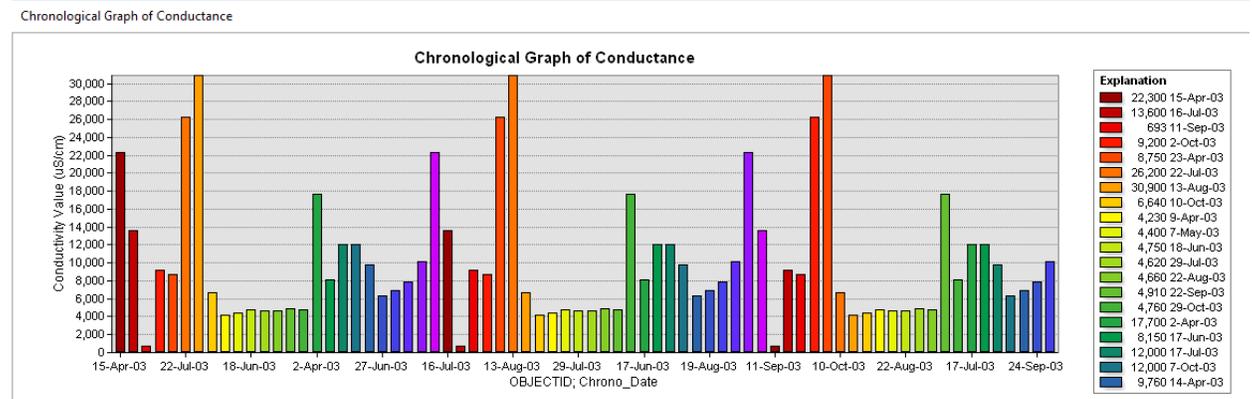
Again, fill the Create Graph Wizard as follows, or customize it as preferred.



The final product should look like follows.



Changing a few parameters can give you a better graph. Such as the following:



Conclusion:

This allows us to interpret how Conductivity values change over time by location. It is important to note that salinity values are decreasing as we move east. If we could focus efforts to desalinate headwaters, the perhaps breakthroughs can be made in making water potable downstream.