



# Shale Network: Making Knowledge from Numbers

Impoundment of water for hydrofracturing in the Pennsylvania landscape



## Hydrodesktop Demo 5-20-13

Shale Network Team with special thanks to  
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[www.hydrodesktop.org](http://www.hydrodesktop.org)

# Where can I get HydroDesktop when I go back home?

- It can be downloaded from <http://www.hydrodesktop.org/> (click on the "Download" tab and download the latest version of Hydrodesktop and install it on a Windows machine.
- There is no Mac version; however, this version works on a Mac running the Windows operating system.

# What we'll do today

- Open HydroDesktop
- Discuss the overall approach
- Run searches together:
  - Search the metadata catalog for the data we want
  - Download data of interest
  - Use built-in tools to do simple analysis
- Just learning HD: 1) compare Br and Ba in different PA counties
- More advanced HD: (1) and (2) compare Br along river reaches in southwest PA

**If your computer is not turned on, go ahead and turn it on by moving the mouse or touching a key...**



Press CTRL + ALT + DELETE to log on



Type in the info  
we gave you to  
go online to the  
Penn State  
system



xyz123|

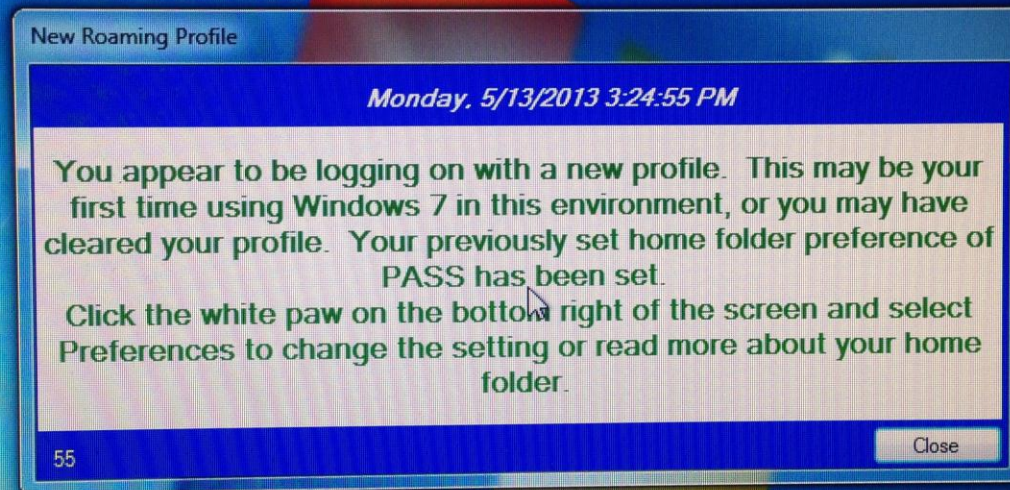
●●●●●●●●



Log on to: [dce.psu.edu](http://dce.psu.edu)  
[How do I log on to another domain?](#)

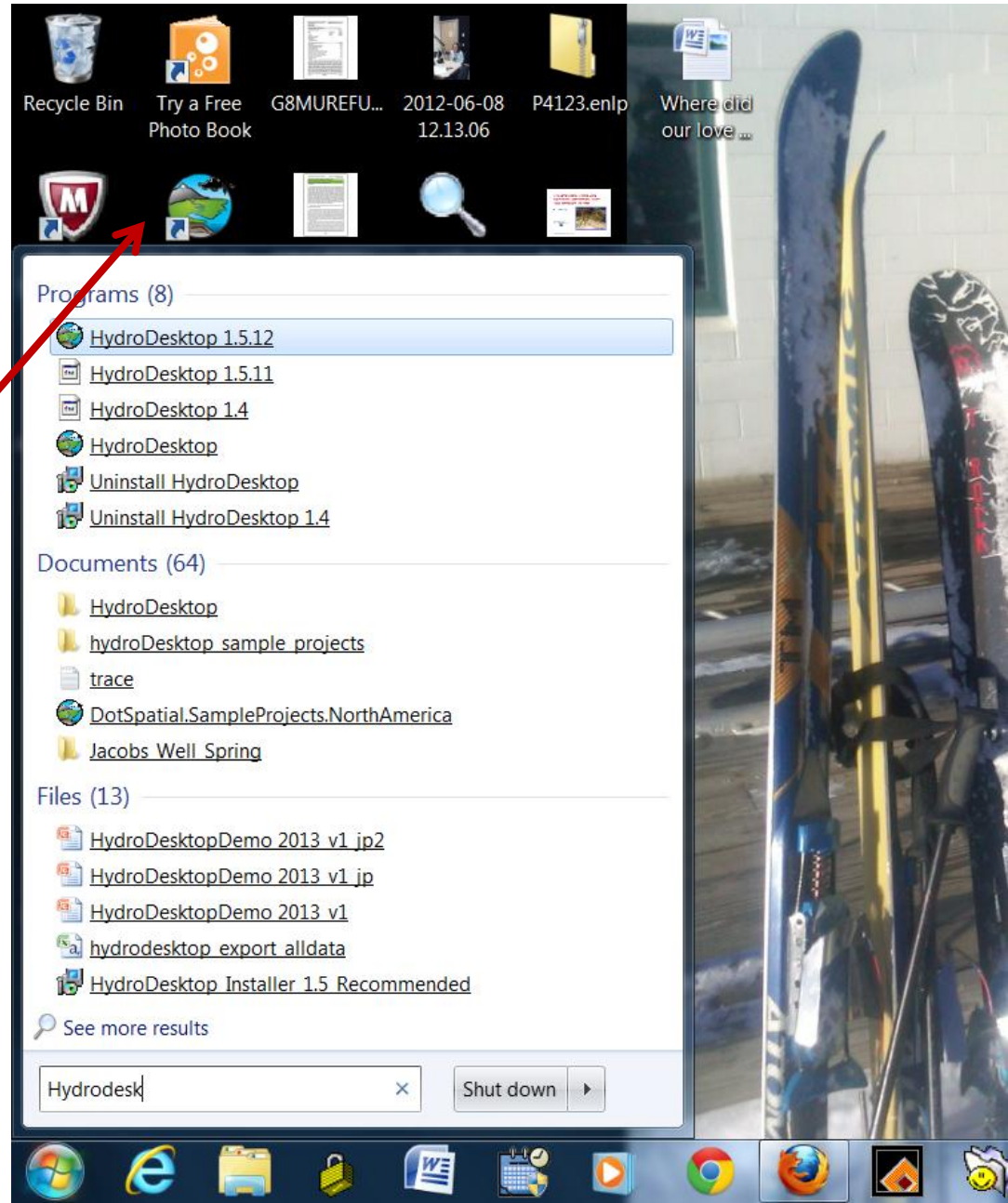
Cancel

If you get this screen, hit **Enter**



Find HydroDesktop-  
top by clicking on  
the **Start Button**  
(**FourSquare-  
Globe thing**) in  
the lower left  
corner, or by  
typing  
HydroDesktop  
into the blank, or  
by finding the  
HydroDesktop  
icon on the  
desktop and  
clicking on it...

**It opens slowly!**





When HydroDesktop opens this is the screen you see...hit **OK**...then wait (it is slow to open)

CUAHSI HydroDesktop \*  
File Map Search Table Graph Edit HydroR Help

Add Layer... Remove Layer  
Layers

Pan  
View

In Out To Extents Previous Next Zoom To Layer  
Zoom

Select Deselect All Identify View Attribute Table  
Map Tool

None  
Opacity: 100  
Online Basemap

Delineate  
EPA Tool

Legend  
Map Layers

Welcome to HydroDesktop

HydroDesktop  
CUAHSI HydroDesktop 1.5.12.9  
[Getting Started with HydroDesktop](#)  
[View HydroDesktop help file](#)

Create New Project From Template

- DotSpatial.SampleProjects.NorthAmerica
- DotSpatial.SampleProjects.World
- elbe
- Jacob's Well Spring

Open Existing Project

DotSpatial.SampleProjects.NorthAmerica

Create New Empty Project

“Create New Project from Template”

“North America”

Click OK

Legend time series | Map Table Graph Edit HydroR

Longitude: 567°82'15"E, Latitude: 234°58'13"N  
Go to the extension manager to find additional extensions!

5:18 AM  
5/13/2013

# Every member of Shale Network or Penn State --

Please raise your hand.. please ask for help  
from any of these folks for help before you get  
lost! If you fear you will need lots of help,  
please stand up and we will move a Penn Stater  
or Shale Networker right next to you

# First screen you see: Map Interface



Each “thing” listed in the legend is a **layer** and corresponds to a shape file –the file that has the info that is plotted on the map

# If you ever lose this layout...

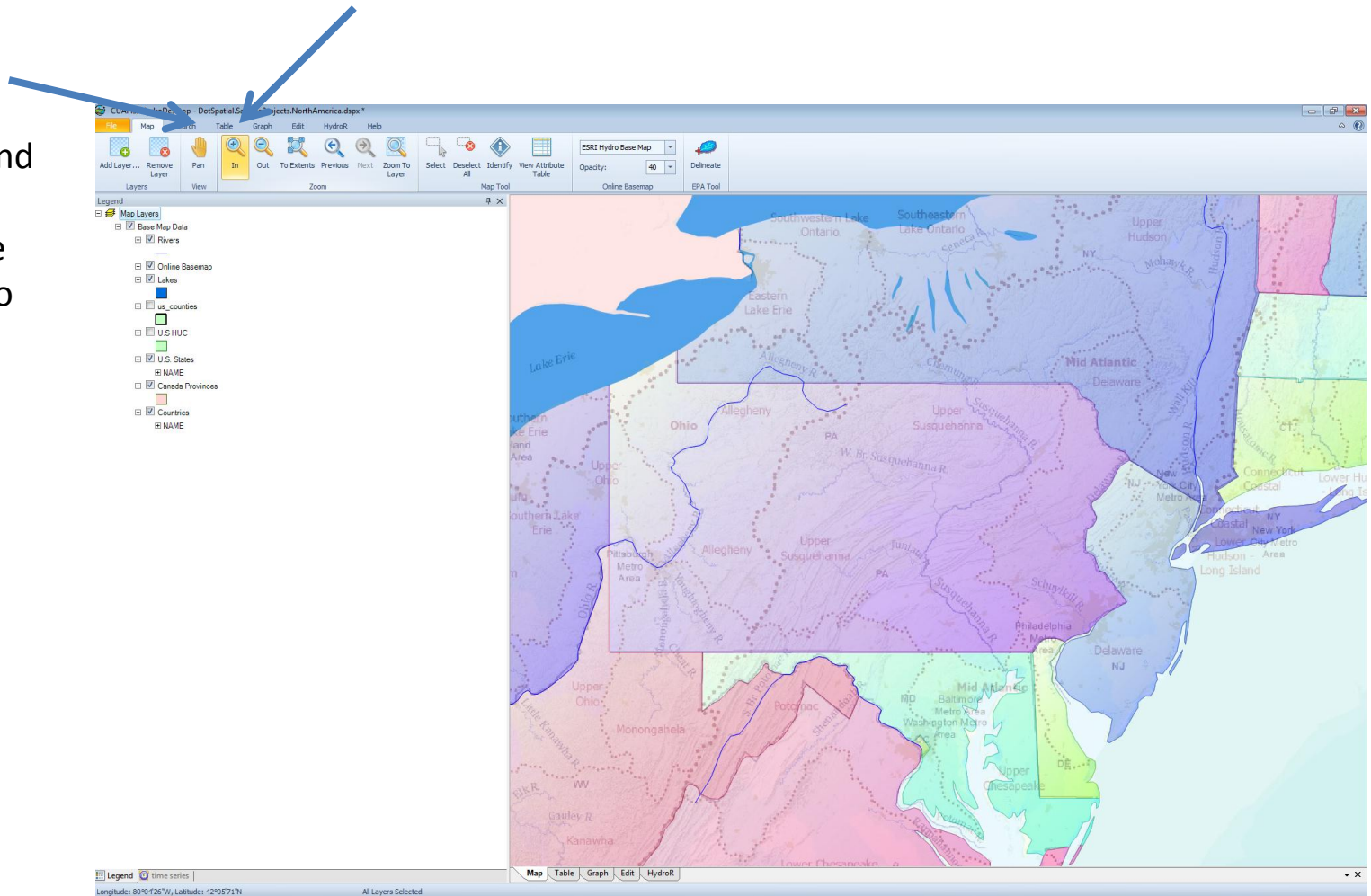


Click File and choose **Reset Window Layout**

This is an amazing piece of software and it is under active development by scientists around the country. This is a collaborative effort. Unfortunately, there are glitches and you will most likely discover some of them.

To play, you can choose the **Pan “Hand”** and move to PA, and choose (**Magnifying glass +**) to expand (it works like Google Maps)

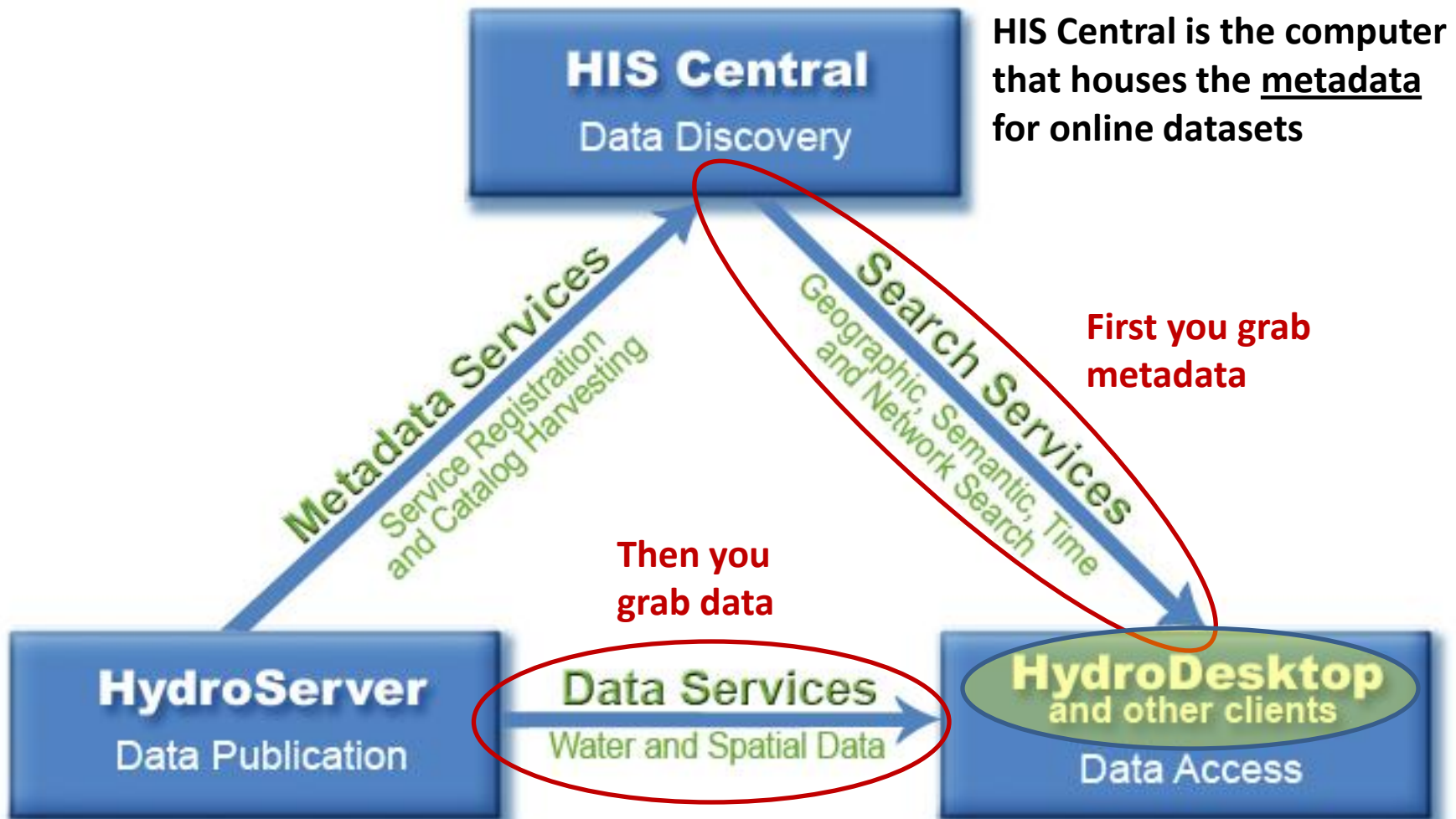
Use the Pan and Zoom tools, located on the map ribbon, to navigate to Pennsylvania.



# We will try one or two different searches (or more in Advanced room?)

- (1) Each person in the room will pick a different county in PA or WV (your choice) and we will look at Br, then Ba, in the surface waters in that county...We will ask, **do we see differences?** We will write the high values for each county on board
- (2) Each person will look at Br in rivers in southwestern PA to assess variations in Br concentrations along the reach, and as a function of discharge

# What is the Hydrologic Information System?



HIS Central is the computer that houses the metadata for online datasets

First you grab metadata

Then you grab data

Hydroservers are computers around world that post online data



HydroDesktop is the computer program that helps you pull the metadata and data onto your home computer

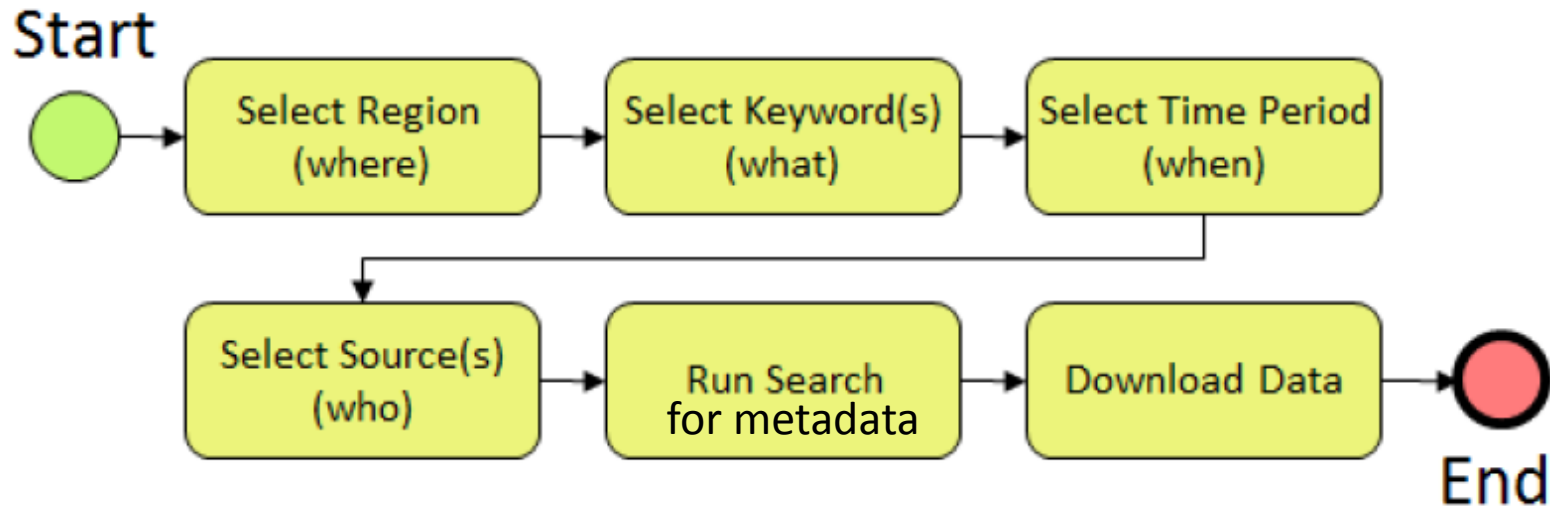
# I can't remember the difference between data and metadata



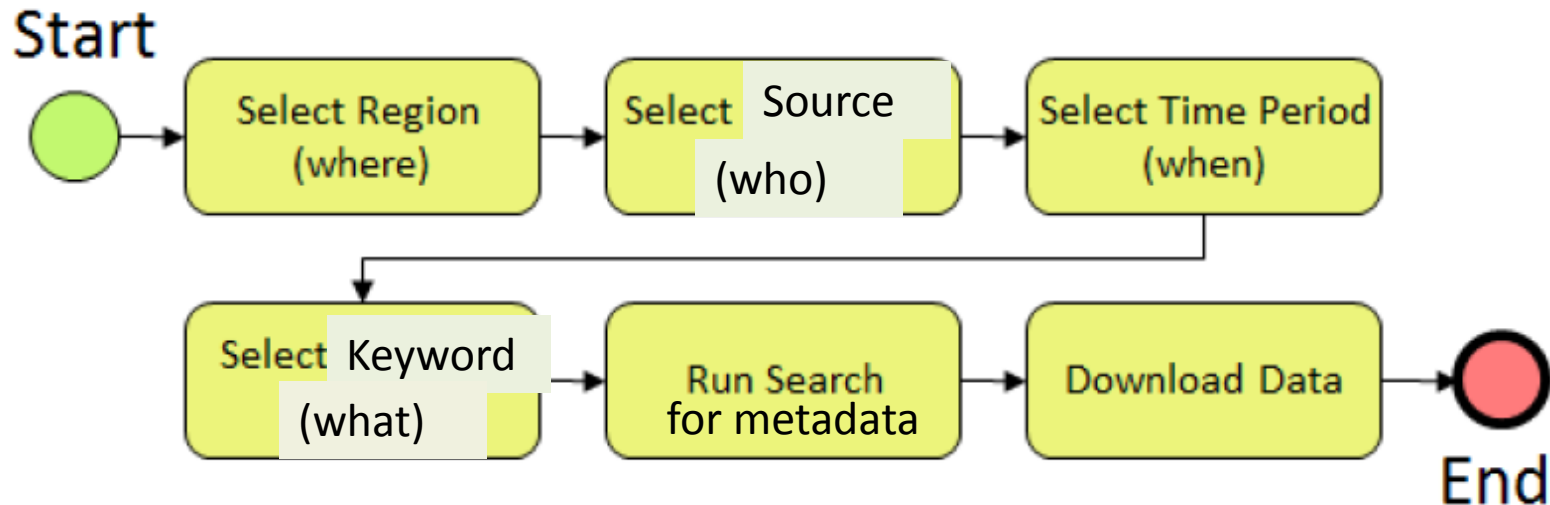
- The **data** is the number that was measured (concentration, flow rate, etc.)
- **Metadata** is all the other stuff you need to know to understand how to think about that number (how the sample was taken, what type sensor was used, where measurement was made, units, time, quality information, analytical technique, etc.)
- Metadata answers all the questions, **Who? What? Where? When? How?**
- **Metadata is why this data system seems so complicated – if we just stored the data values alone, that would not be so hard**



# This is the standard approach to finding data

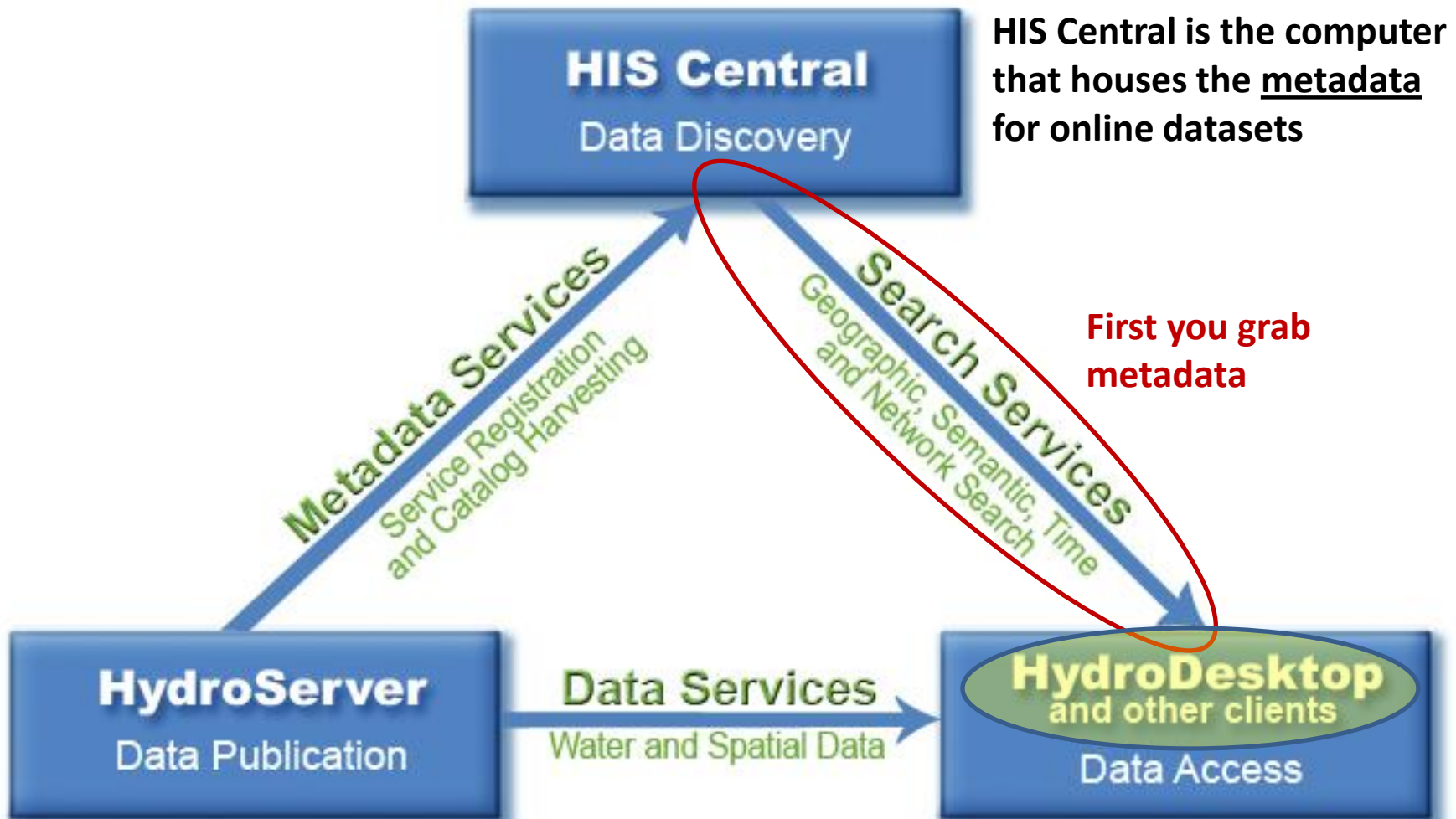


# To avoid a glitch, this is how we will proceed



This is an amazing piece of software and it is under active development by scientists around the country. This is a collaborative effort. Unfortunately, there are glitches and you will most likely discover some of them.

# What is the Hydrologic Information System?

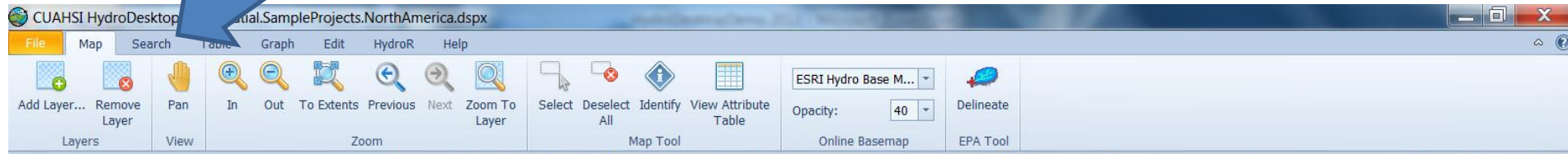
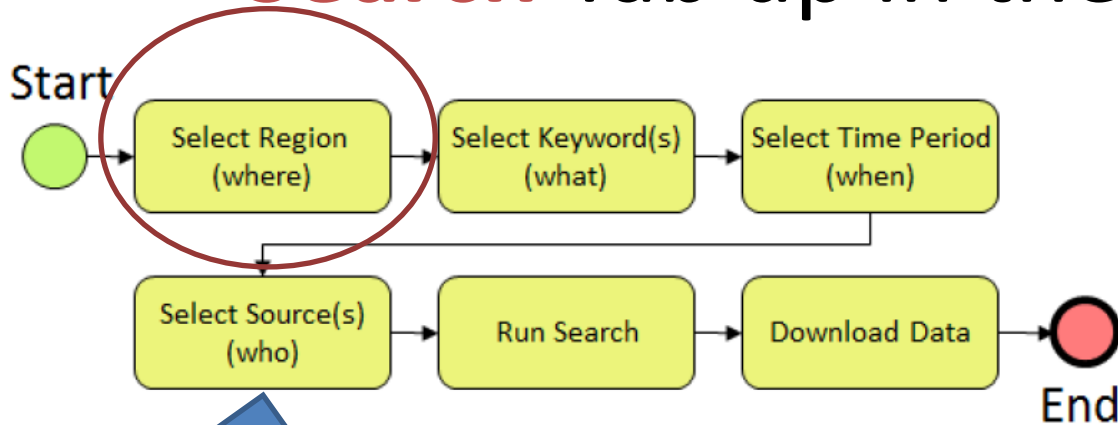


Hydroservers are computers around world that post online data



HydroDesktop is the computer program that helps you pull the metadata and data onto your home computer

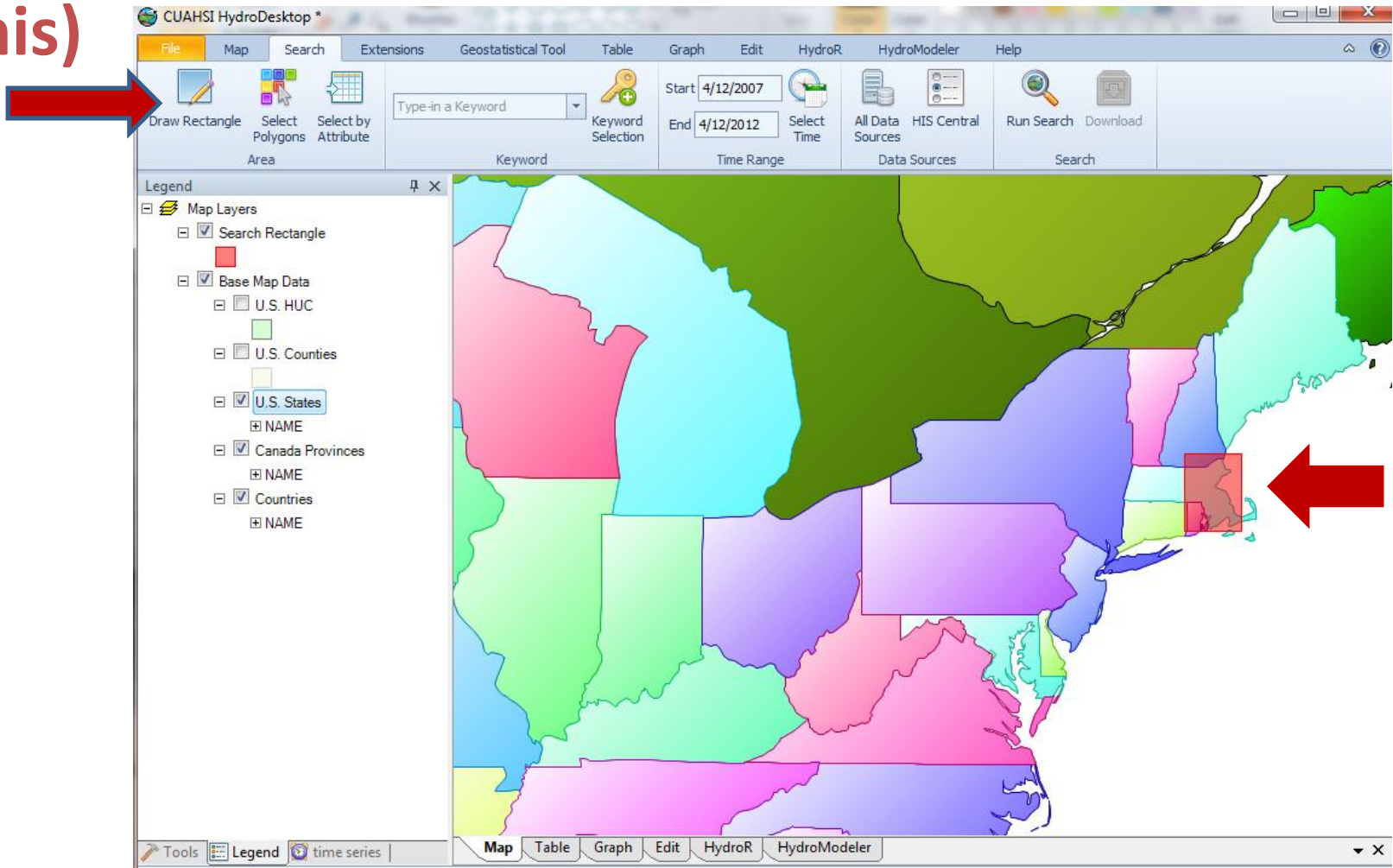
# To start the search for Data...Open **Search** Tab up in the **Ribbon**



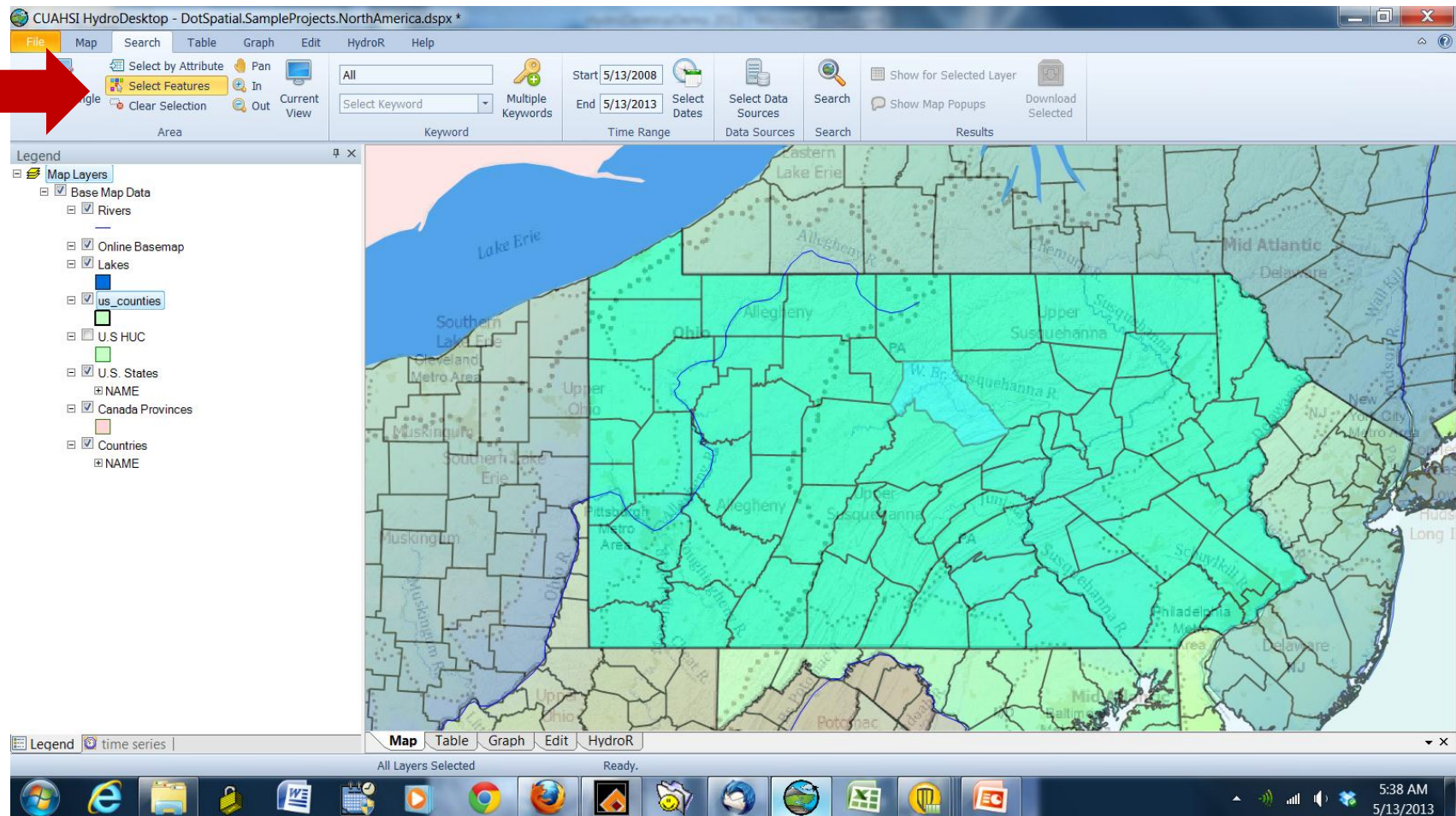
There are four ways to set the region to search

The first way (**don't do this**) to set a region under the Search Tab:

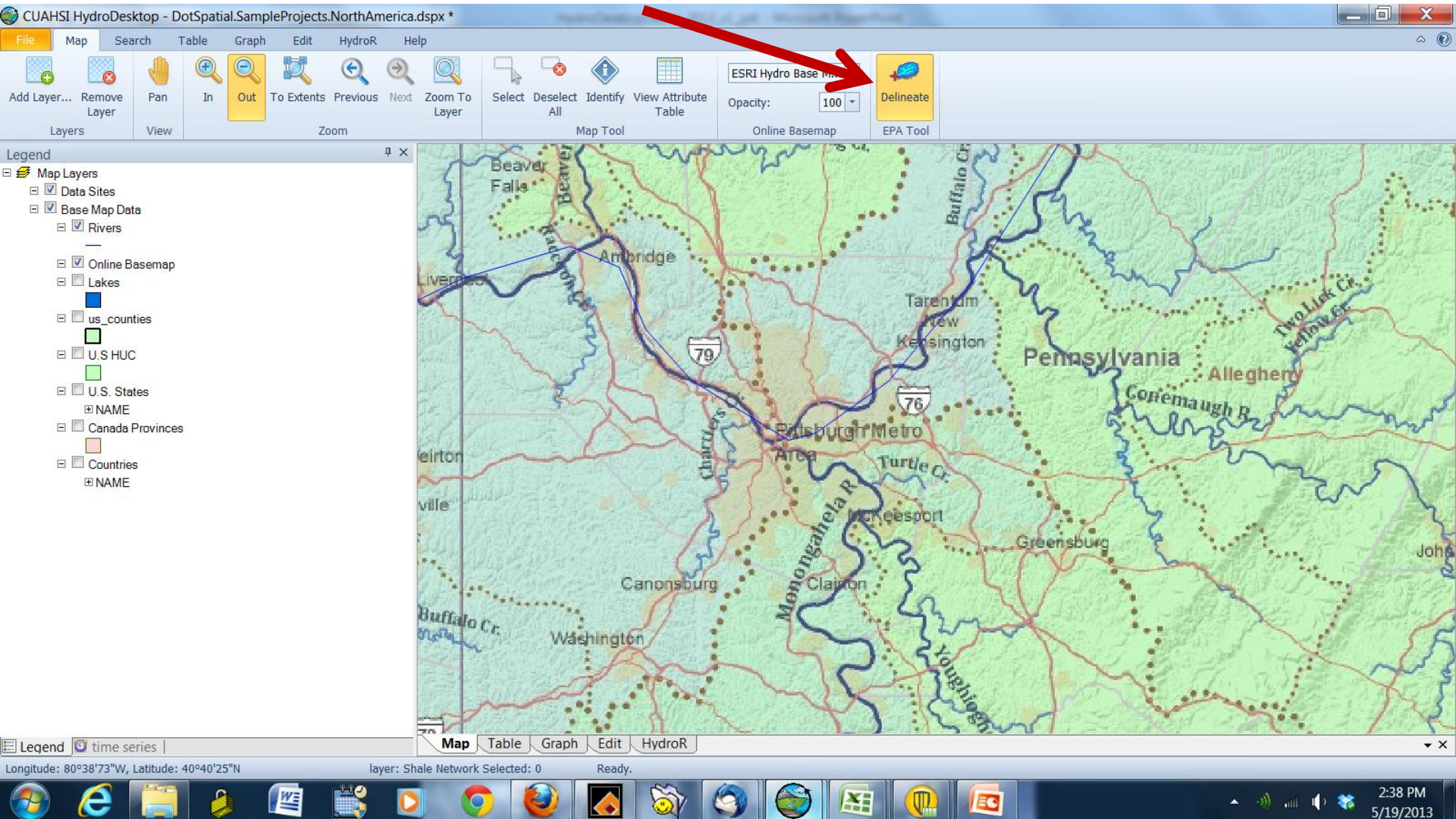
- Draw Rectangle to define a search (**don't do this**)



The second way (**don't do this**) to delineate a region under the **Search Tab: Select Features** and click on a polygon on the map



The 3<sup>rd</sup> way to do this is to choose a watershed using the delineate tool by clicking **Delineate** and then touching one spot on a river (**don't do this**)



# Delineating the upper part of the Conemaugh River watershed

CUAHSI HydroDesktop - DotSpatial.SampleProjects.NorthAmerica.dspix \*

File Map Search Table Graph Edit HydroR Help

Add Layer... Remove Layer Pan In Out To Extents Previous Next Zoom To Layer Select Deselect All Identify View Attribute Table ESRI Hydro Base M... Opacity: 100 Delineate

Layers View Zoom Map Tool Online Basemap EPA Tool

Legend

- Map Layers
  - Data Sites
  - Watershed Point 1
  - Reaches 1
  - Watershed 1
  - Watershed Point
  - Reaches
  - Watershed
  - Base Map Data
    - Rivers
  - Online Basemap
  - Lakes
  - us\_counties
  - U.S HUC
  - U.S. States
  - NAME
  - Canada Provinces
  - Countries
  - NAME

Longitude: 80°56'74"W, Latitude: 40°47'22"N layer: Reaches 1 Selected: 0

2:40 PM 5/19/2013



# The 4th way to delineate a region under the Search Tab: Please do this!

- Select by **Attribute** (i.e. County)..this is how you will choose your county. Please choose your home county or a favorite county with unconventional gas wells

For **Active Layer**: choose us\_counties

**Don't touch "Field"**

Type in name of county under **"Value: type in..."**

Here are the number of wells and CWTs per well..write down the number of each for your county!

	wells	CWTs
ALLEGHENY	22	
ARMSTRONG	145	1
BEAVER	23	
BEDFORD	1	
BLAIR	6	
BRADFORD	1107	
BUTLER	174	
CAMBRIA	5	
CAMERON	14	
CENTRE	63	
CLARION	29	1
CLEARFIELD	149	
CLINTON	84	
COLUMBIA	2	
CRAWFORD	2	
ELK	59	
ERIE	1	
FAYETTE	231	1
FOREST	18	
GREENE	517	
HUNTINGDON	1	
INDIANA	42	1
JEFFERSON	40	
LACKAWANNA	1	
LANCASTER	0	1
LAWRENCE	19	1
LYCOMING	659	3
MCKEAN	59	2
MERCER	3	
POTTER	65	
SOMERSET	20	
SULLIVAN	68	
SUSQUEHANNA	642	1
TIOGA	808	1
VENANGO	4	
WARREN	4	
WASHINGTON	725	
WAYNE	5	
WESTMORELAND	228	1
WYOMING	110	
	6155	

# Waterways impacted by larger spills

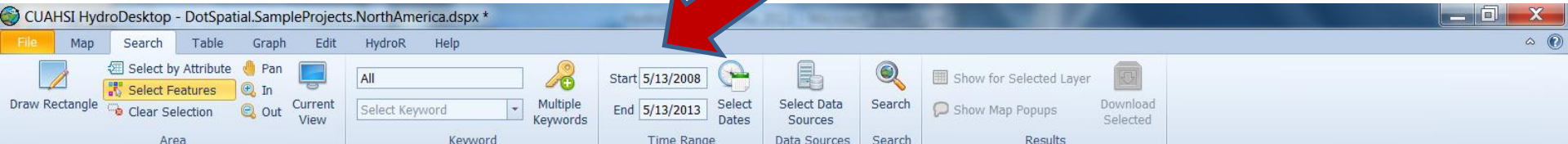
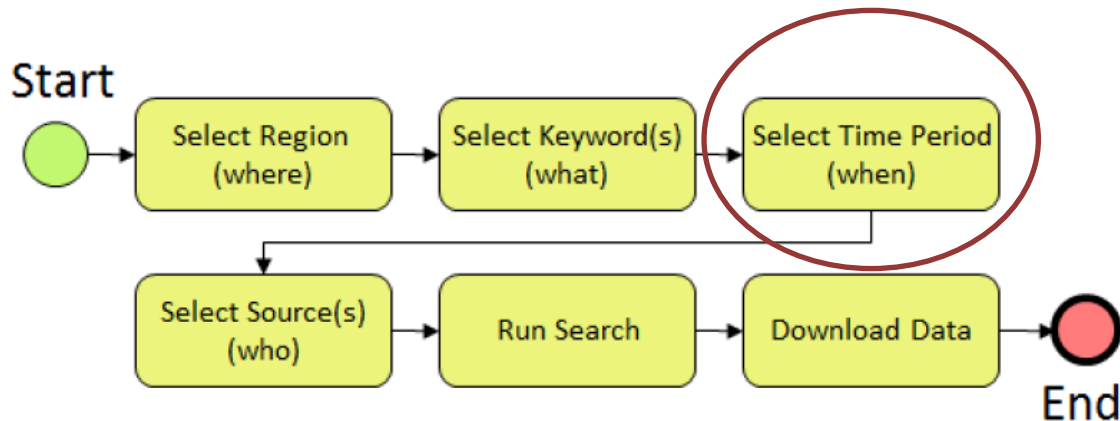
## 2008 to 2011, spills > 400 gallons

- Pine creek (Lycoming, Airfoam)
- Stevens creek (Susquehanna, flowback)
- Brush run (Washington, flowback)
- Little Laurel creek (Clearfield, flowback)
- Dunkle creek (Hopewell, frack fluid)
- Towanda creek (flowback)
- Ten mile creek tributary (Washington, mud)

## Sept 2012-March 2013 (all < 400 gallons)

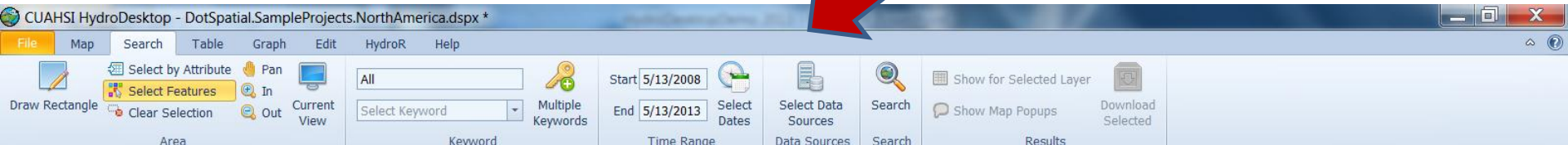
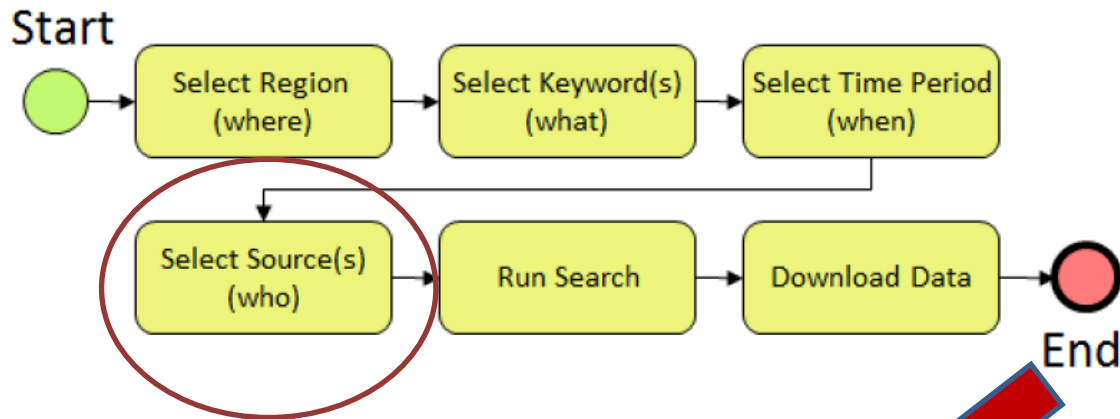
- Harts Run (Sullivan, bentonite)
- Jacobs creek (Westmoreland, drilling mud)
- Mill creek (Sullivan, sediment)
- Black Water run (Sullivan, turbid discharge)
- Slack run tributary (Lycoming, sediment)
- Blacklick creek (Indiana, bentonite)
- Muncy creek (Lycoming, sediment)
- Thorn creek (Butler, drilling fluids)
- Wellmans creek, Salt Lick creek (Sullivan, discharge)
- Brion creek (Lycoming, hydrostatic test water and sediment)
- Big Bottom run (Sullivan, sediment)

# Search for Data by setting Time Range



Use the default value or type in a different range of interest..we suggest 1/1/1960 to today

# Search for Data Source...click on Select Data Sources



This is where you choose  
what computer around  
the country you will  
search for Data

After clicking “Select Data Sources” in the Search ribbon, you get a pop up window: choose **Select None ...** then check **Shale Network** and **Ok**

The screenshot shows the CUAHSI HydroDesktop interface. The main window displays a map of the Pittsburgh Metro Area with a cyan-colored region highlighted. The 'Search' ribbon is active, and the 'Select Data Sources' button is circled in blue. A blue arrow points from this button to the 'Data Sources' dialog box. The dialog box has a 'Refresh' button, 'Select All' and 'Select None' buttons, and a list of data sources. The 'Shale Network' checkbox is checked. The 'OK' and 'Cancel' buttons are at the bottom of the dialog.

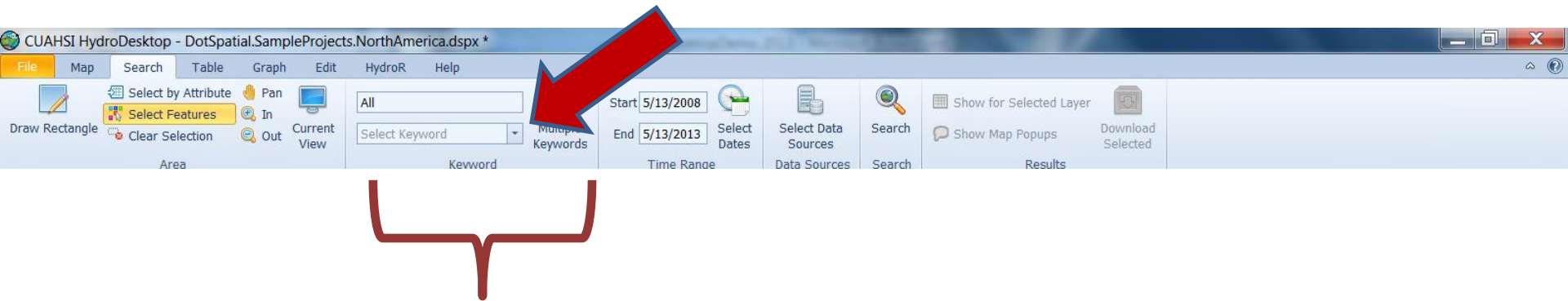
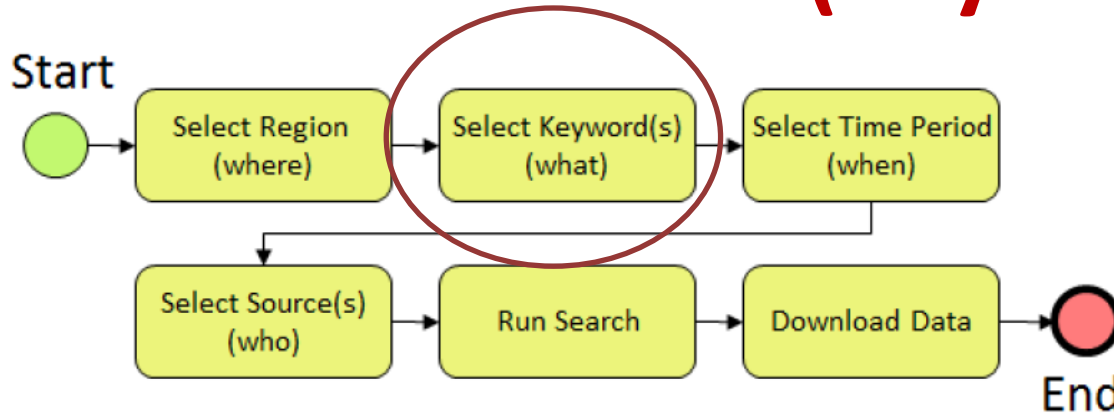
**Data Sources**

Refresh Select All Select None

- [Santa Fe Basin, Florida CTD Sondes](#)
- [Santa Fe Basin, Florida Daily Rain Tipping Bucket](#)
- [Santa Fe Basin, Florida SRWMD select river gauges](#)
- [Santa Fe Ground Water Level SRWMD](#)
- [Santa Fe MICROWAVECITRA](#)
- [Santa Fe, Southwest Florida Water Management District](#)
- [Santa Fe, STORET](#)
- [Shale Hills Susquehanna CZO](#)
- [Shale Network](#)
- [Snake River Basin, Modeled Streamflow](#)
- [Southern Sierra Critical Zone Observatory](#)
- [Storet Phosph and Nitr in Surf water](#)
- [Susquehanna River Basin Hydrologic Observatory](#)
- [TCEQ Surface Water Quality Monitoring \(SWQM\)](#)
- [Texas Instream Flow, Lower Sabine](#)
- [Texas Instream Flow, Lower San Antonio](#)
- [TWDB Wind](#)
- [TWDB Sondes](#)
- [USACE Hourly Reservoir Discharges values](#)
- [USACE River Gauges](#)
- [Weiherbach catchment long-Term monitoring data](#)
- [WRRC Acid Rain Monitoring Project](#)

OK Cancel

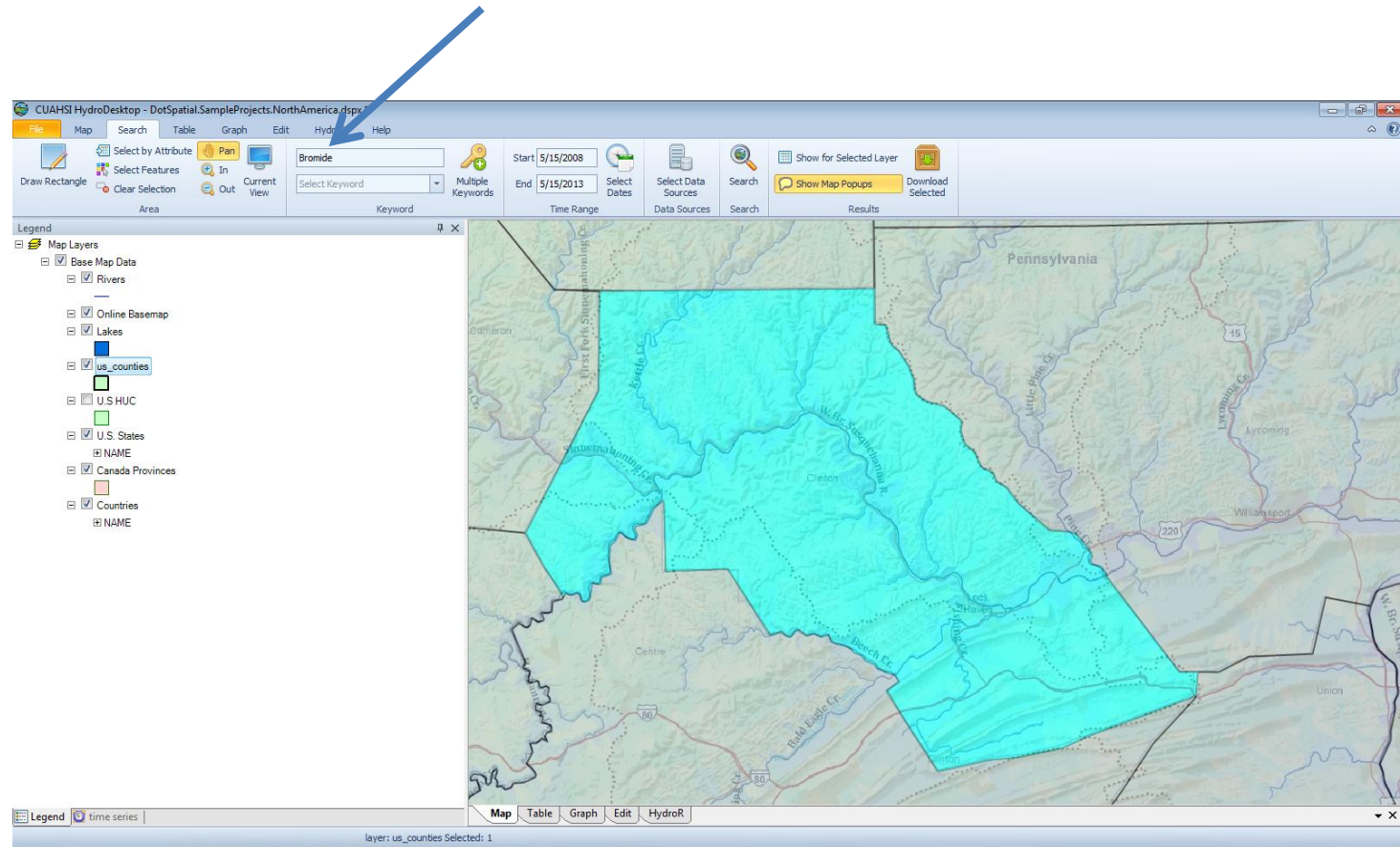
# NEXT Search for the Parameter of Interest (Keyword)



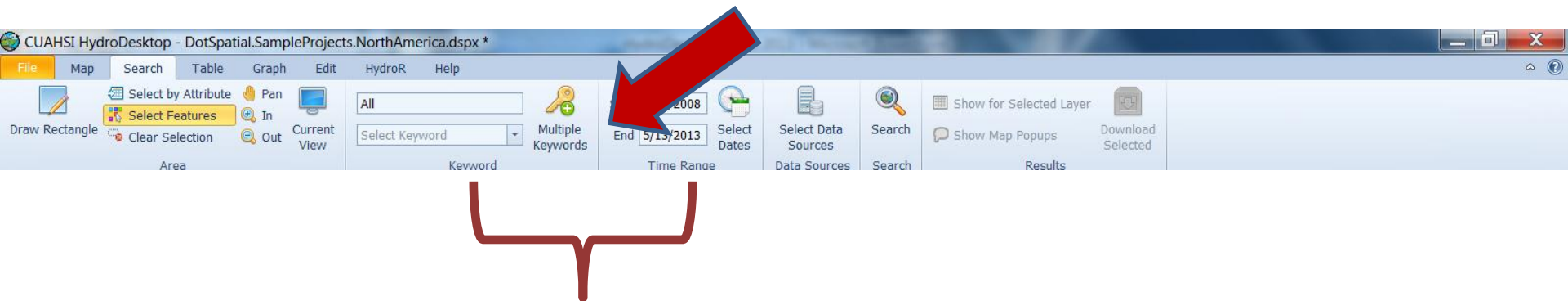
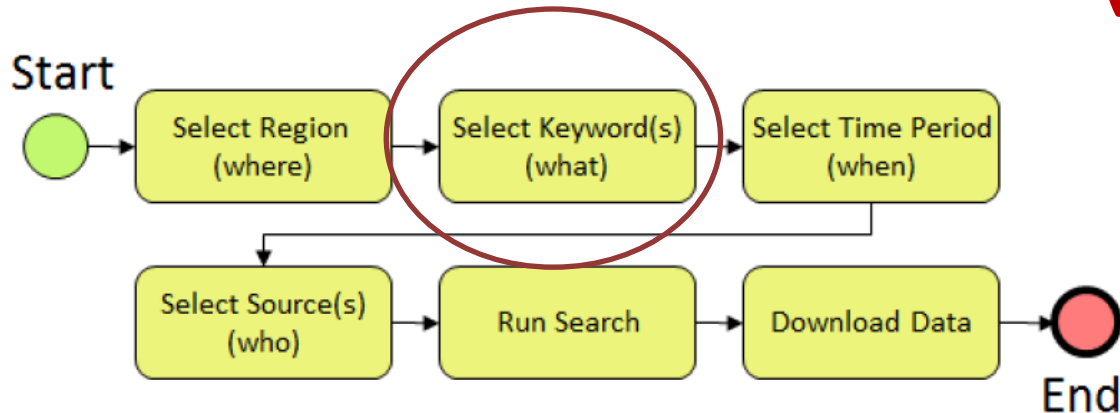
If you don't know how to describe an analyte (keyword) you can use the drop down menu to find parameters that have been measured that you are interested in

# Type “Bromide” in the top search box.

Please note that before running any search, always check the keyword...I find that Keyword resets sometimes to “All.” If you search on All, you look for all analytes for the region and time of interest



# Another way to search for the Parameter of Interest (Keyword)



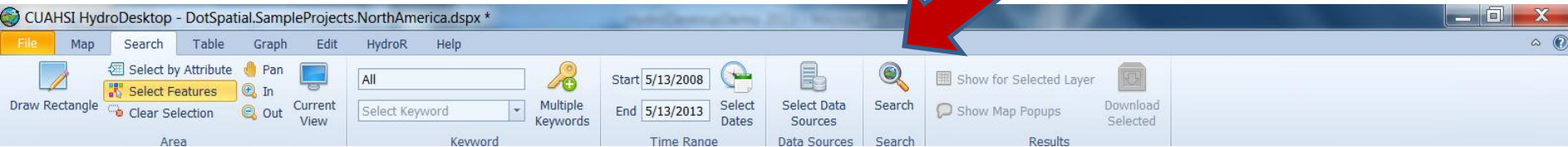
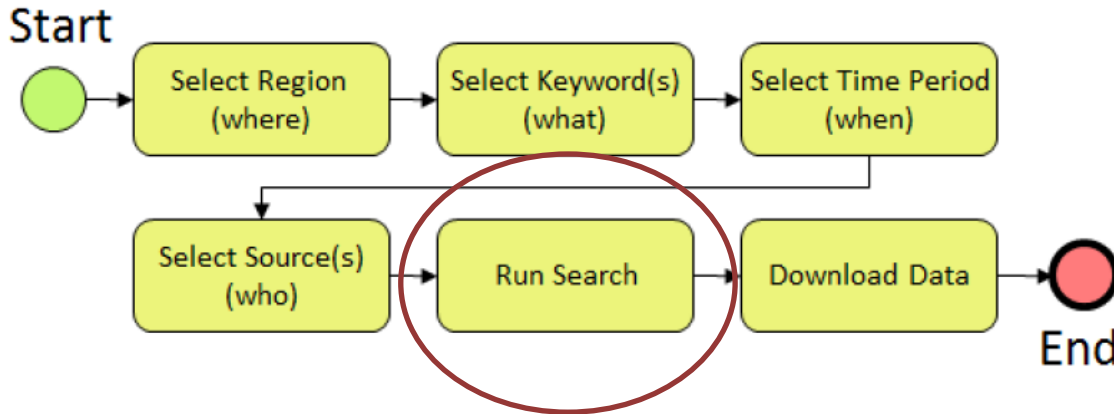
Later (not now) when you get better at it, use the multiple keywords pull down menu, and type in your variable choice. In the pull-down you can see all the different types of data



Before you run Search, check back to see that you only have **Bromide** checked!

We are trying to avoid the glitch where HD reverts back to “All”

# Click the **Search** button...this grabs the metadata

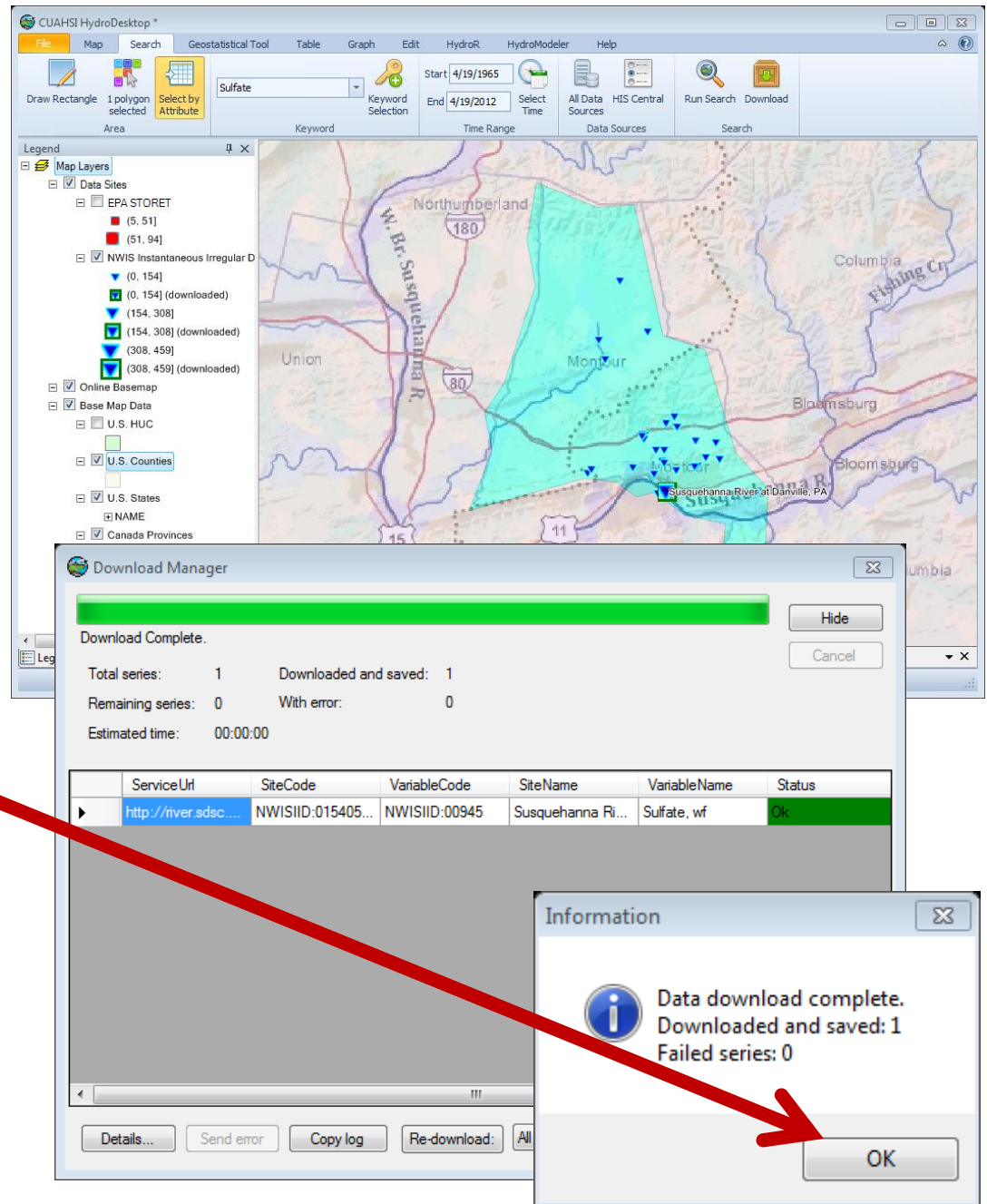


**Beware:** if you try to download too much metadata in this classroom the program might get hung up. That is why we suggest you search for Bromide in a single county

Screenshot from downloading the data...

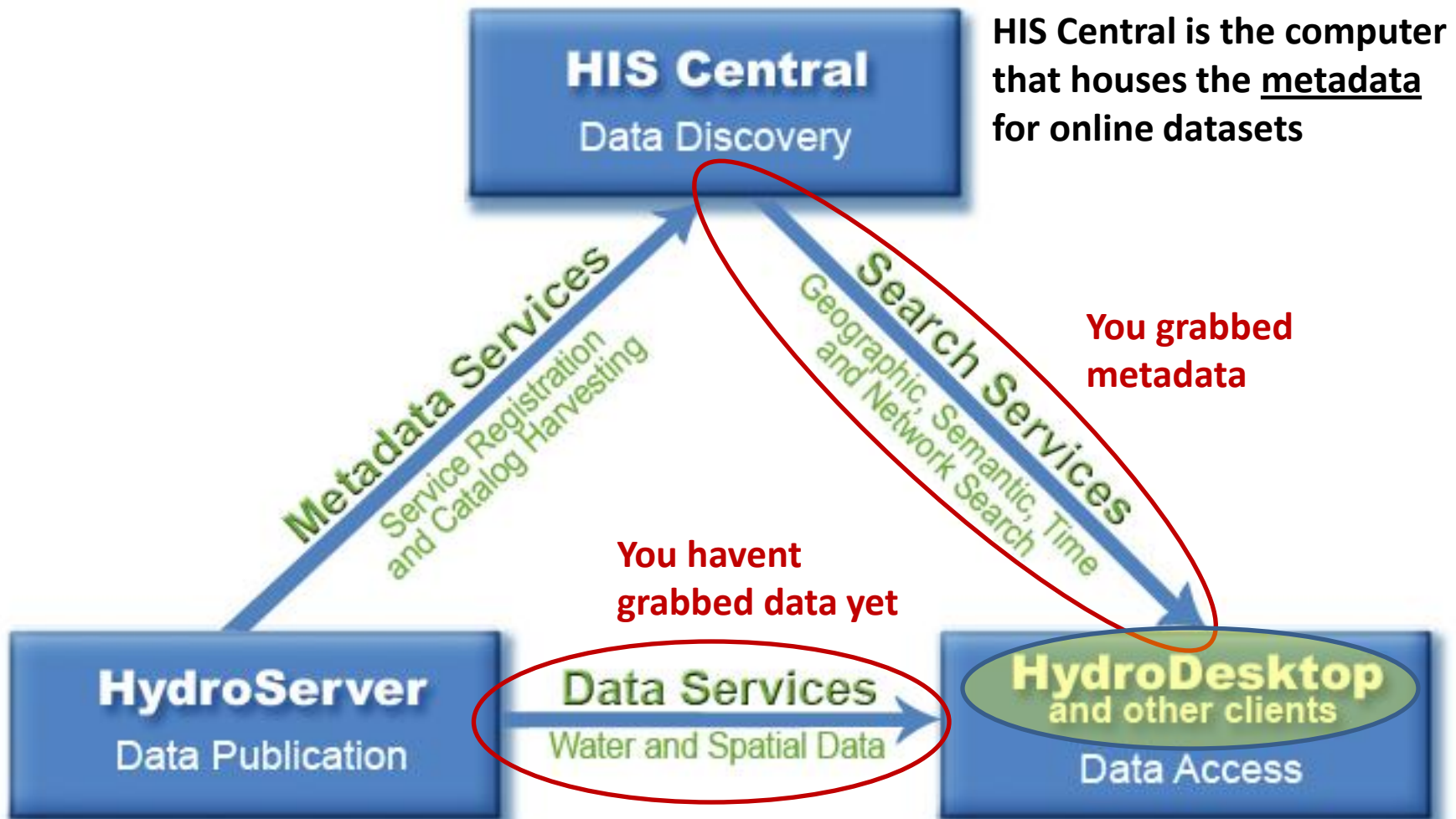
Click **OK**

and then click **Hide** to hide the Download window (you may get a few errors, don't worry). If you get all errors, try it again.





# You just went out to other computers and grabbed metadata



HIS Central is the computer that houses the metadata for online datasets

You grabbed metadata

You havent grabbed data yet

Hydroservers are computers around world that post online data

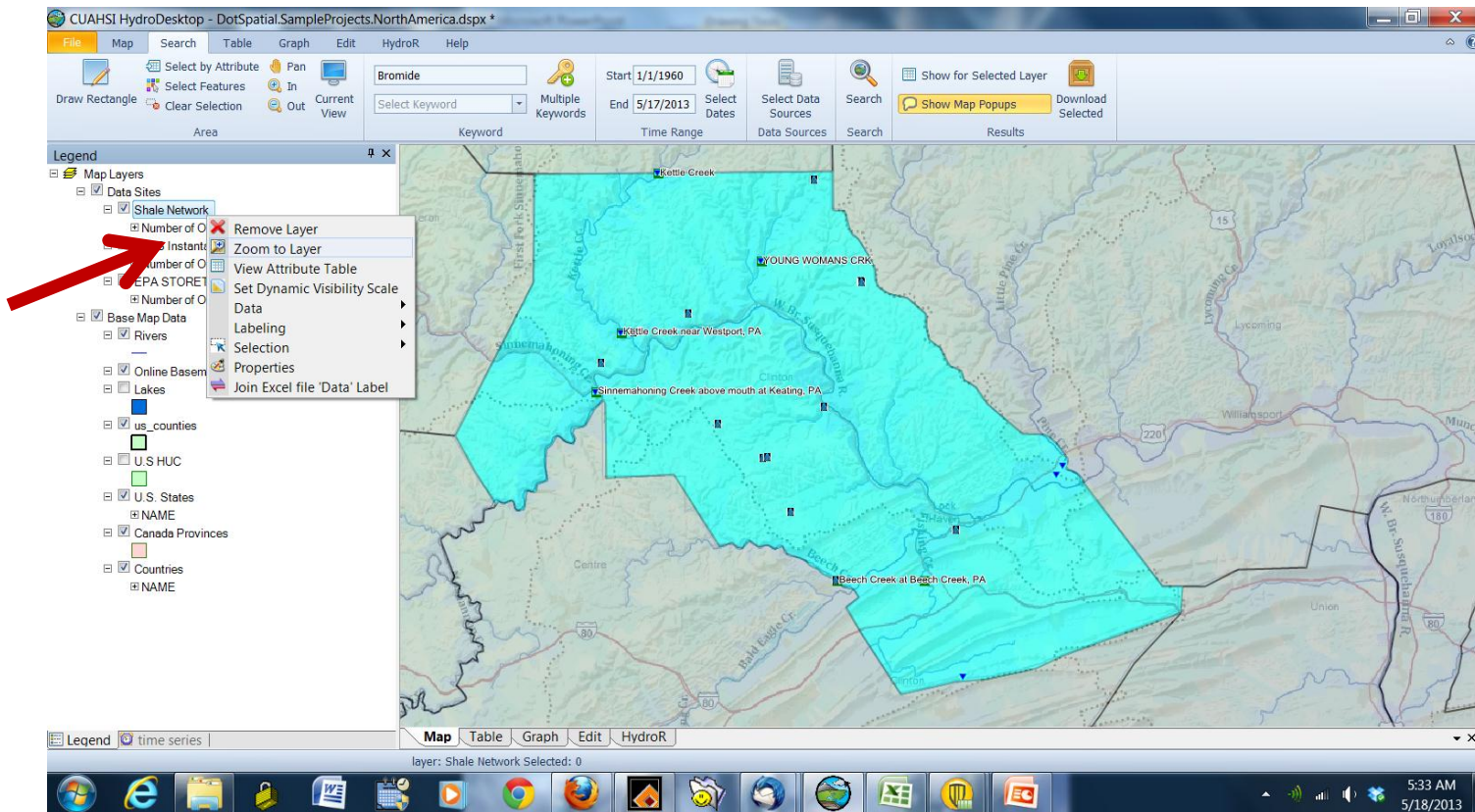


HydroDesktop is the computer program that helps you pull the metadata and data onto your home computer

# You might need to re-center your map

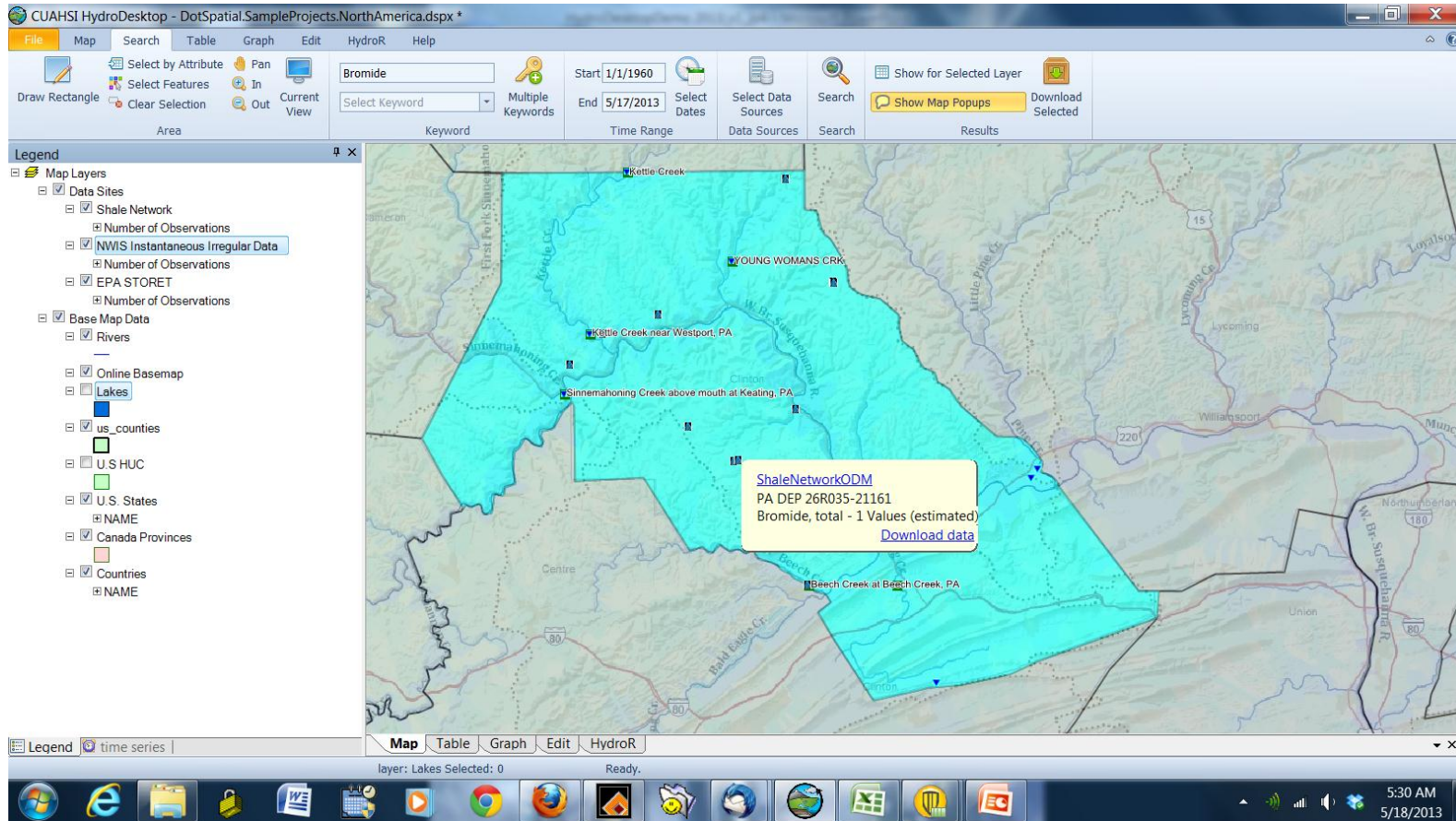
Right click on  
**Shale Network**  
in Legend and  
choose

“Zoom to  
Layer”



But before downloading data, let's hover over data sites and look at metadata a bit. Point mouse to a symbol and hover...

You can hover over a site location and a popup will tell you about that data point. You could even download data for that point, but we won't do this because it is tedious to do all data points this way



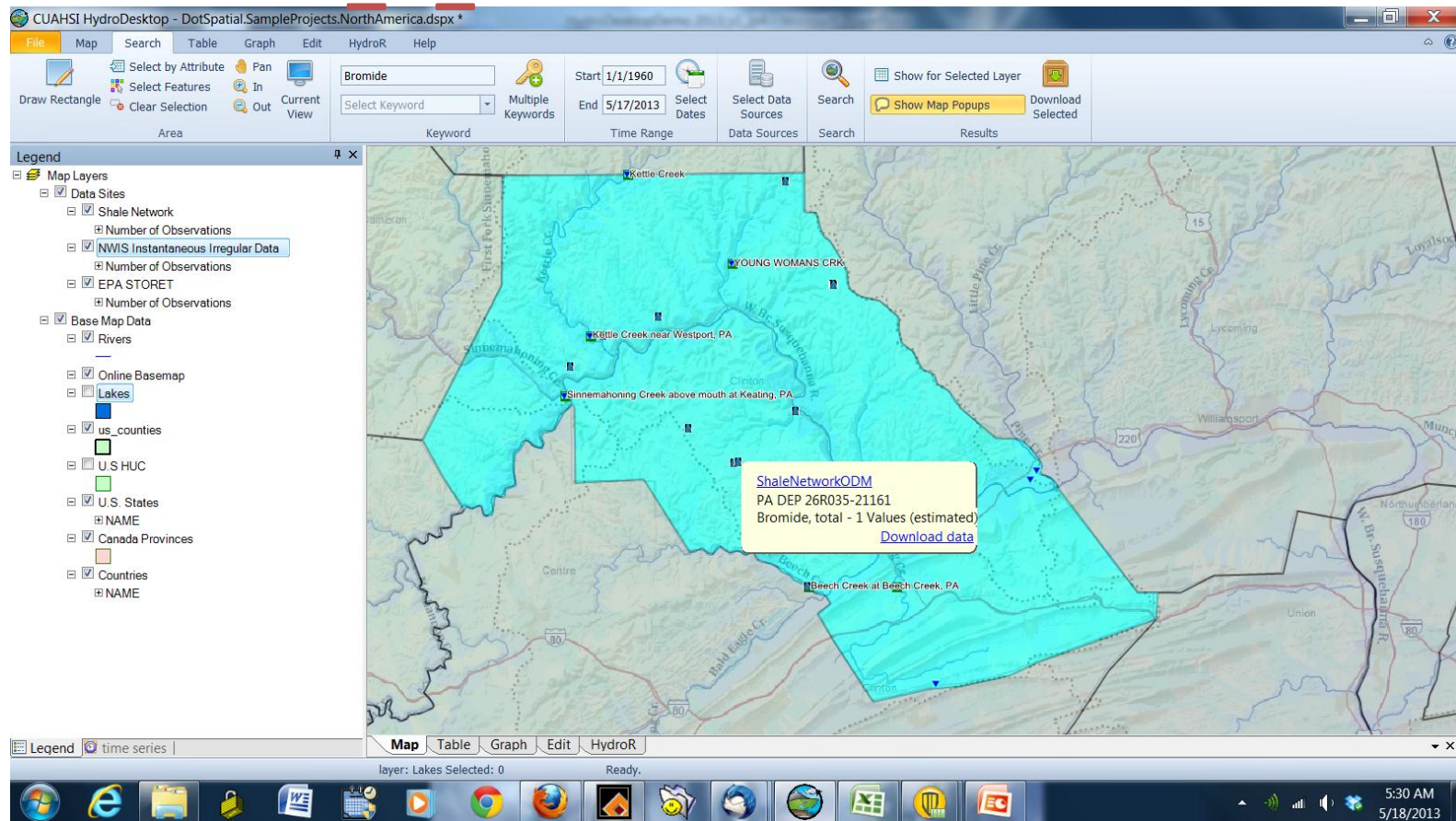
# You might see metadata in the popup that looks like this

- **ShaleNetwork:PA\_DEP\_26R**...these are data that Carl Kirby and students harvested from PA DEP 26R forms. **THIS IS FLOWBACK/PRODUCTION WATER DATA**
- **ShaleNetwork: ALLARM\_xxx**..these are data collected by ALLARM volunteers
- **ShaleNetwork: DEP\_SAC046\_ "name"** ...these are data from the PA DEP using their SAC 46 analyses
- **ShaleNetwork:SRBC**...data from SRBC
- **ShaleNetwork:LHU**...data from Dr. K and the Senior Environmental Corps
- **ShaleNetwork:COP Tract 653 101H\_Well**...data from Haluszczak 2011 **THIS IS FLOWBACK/PRODUCTION WATERDATA**
- **ShaleNetwork:Tioga County P1 Gas Well Production water**...**THIS IS PRODUCTION WATER**



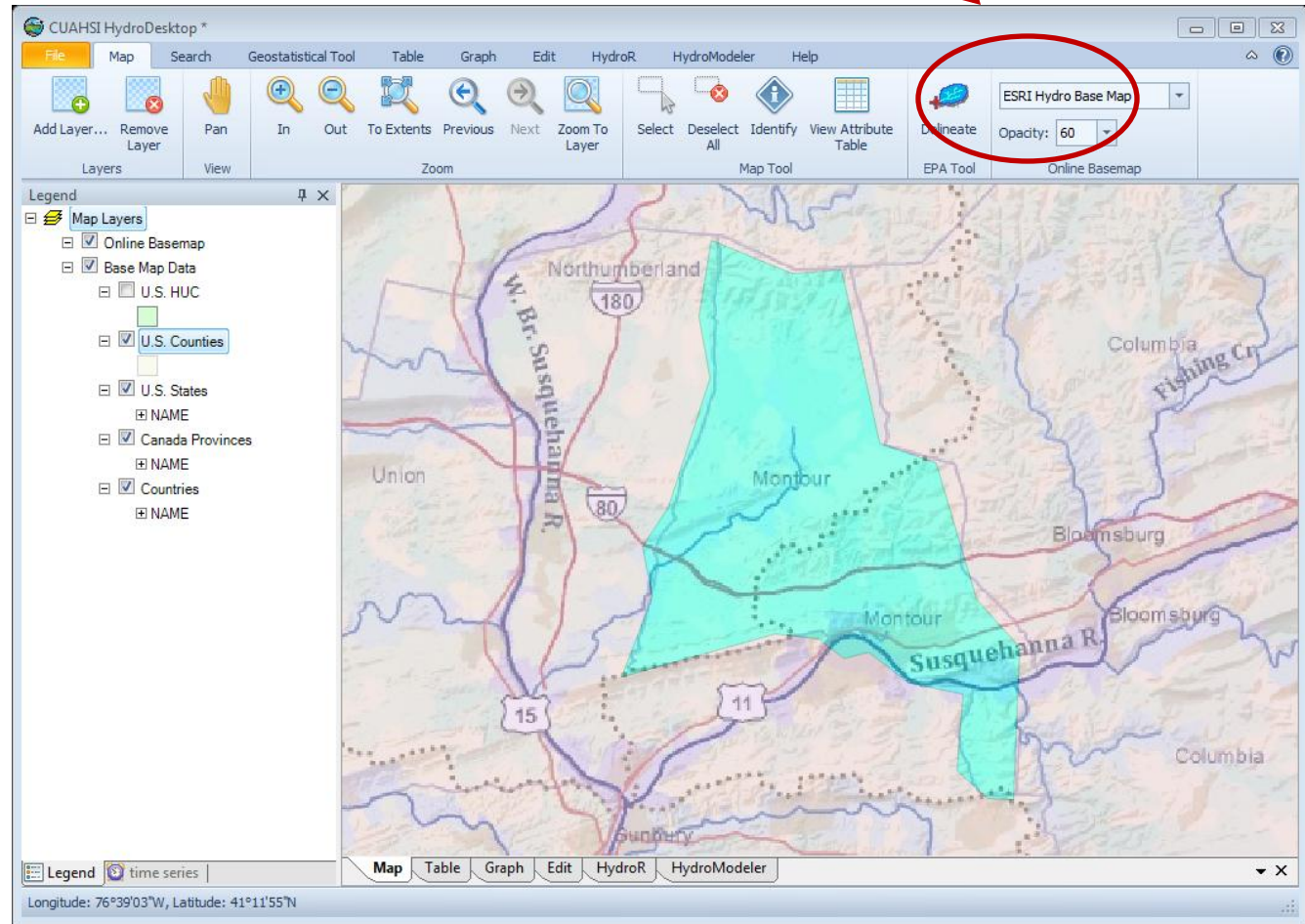
# Can you find a location with production/flowback water chem... i.e. one that has **“PADEP 26Rxxx”** or **...COP Tract 653 xxx.xx** ...or...**Br\_D\_fw** or **...Location I...**

Hover over site locations and look at popup windows looking for a well with production water chemistry (we are just playing)



Let's change the **base map** to look at a well. Put in **Google Satellite** under Map Tab (at the right) and look for wells

Change your base map layer here (it may take time)

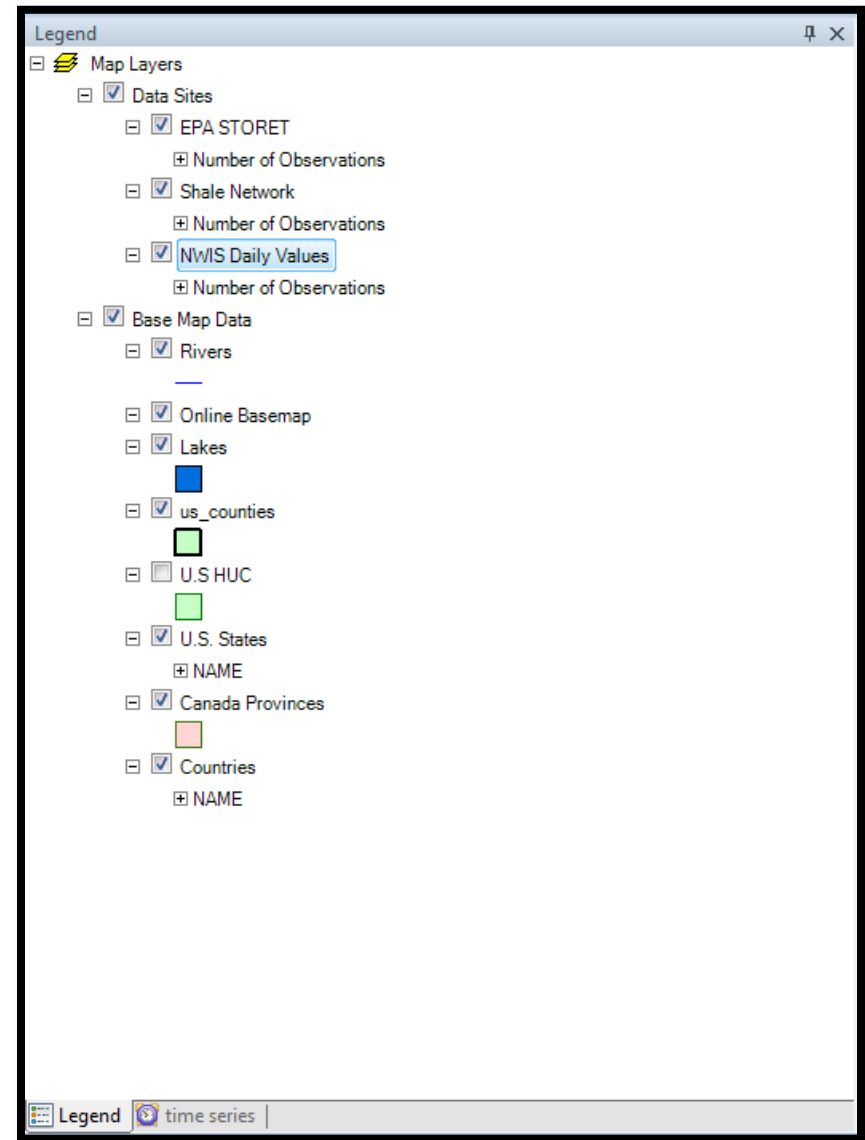


- ESRI Hydro Base Map
- ESRI Topo
- Street Map (Bing, Google, ESRI, Yahoo)
- Satellite Imagery (Bing, ESRI, Google, Yahoo)

# If you change the base map but don't see anything...

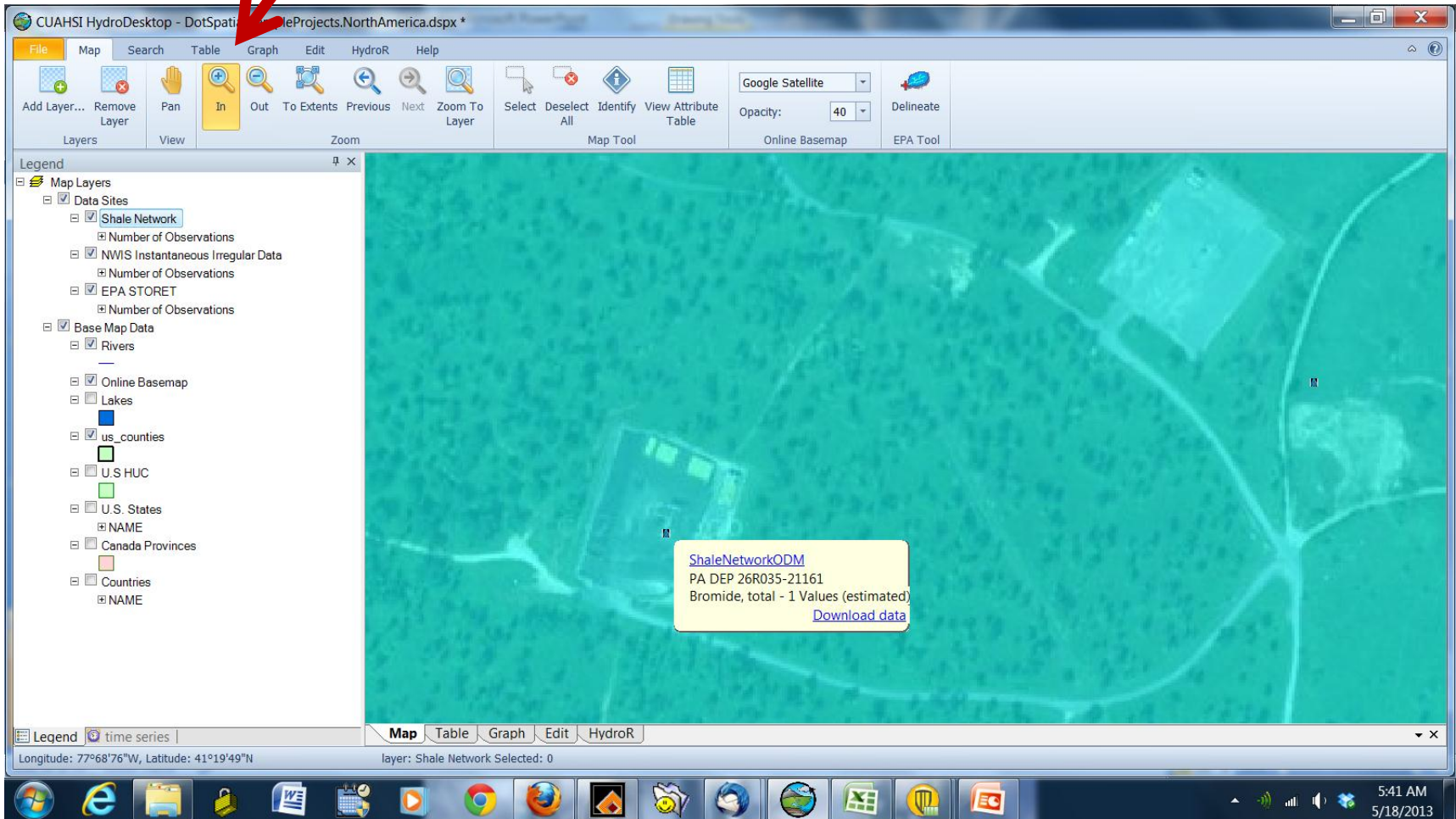
The Legend is a hierarchy. Whatever layer is listed on top in the Legend, will appear “on top” in the map. This means if a layer is opaque, it may be hiding layers underneath.

Try unclicking some of the layers (Countries; Canada Provinces; U.S. States; ) and this may help you see the Google Satellite map



# Zoom in and look at the well on Google Satellite!

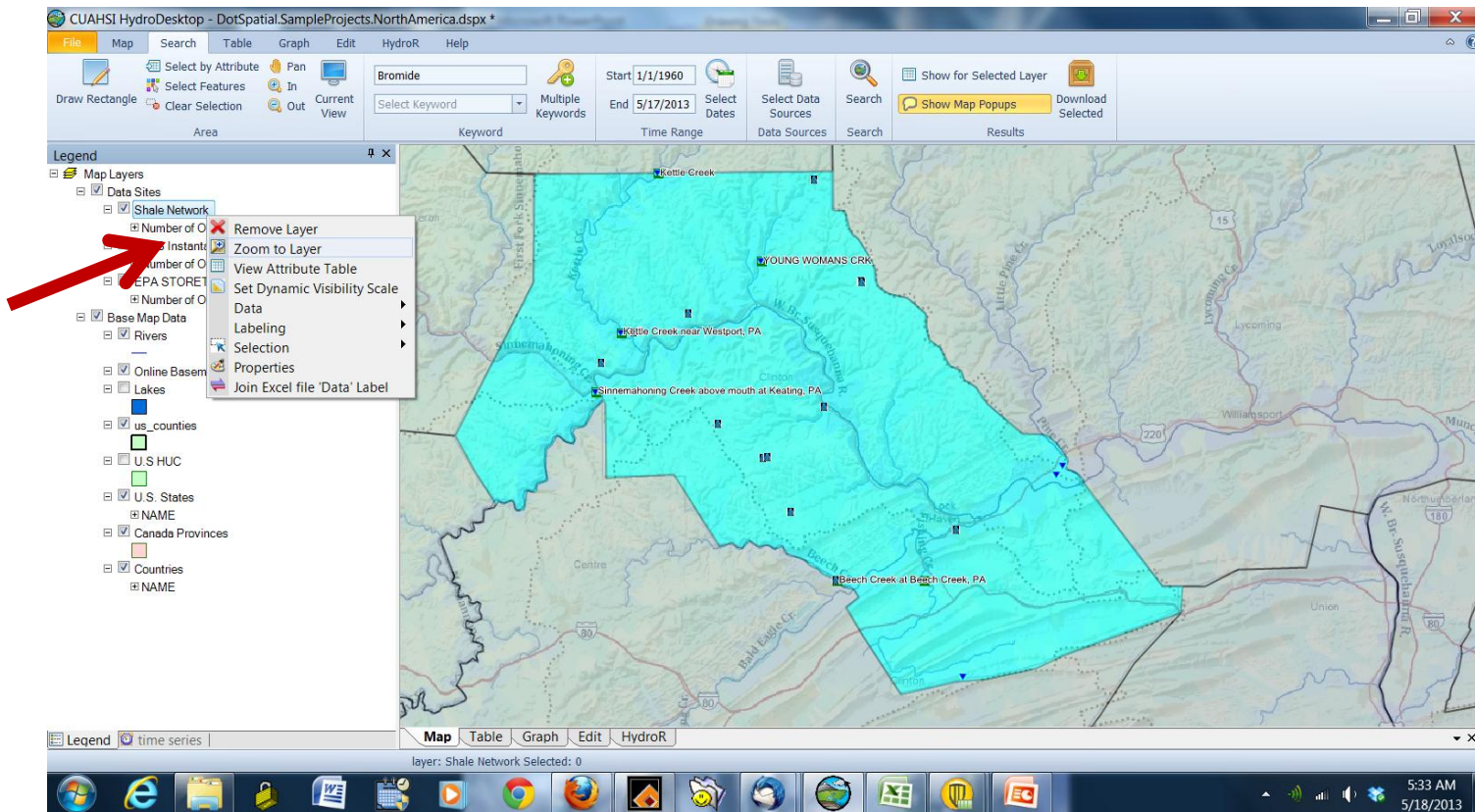
You can adjust opacity of base map on Map Ribbon



# Re-center your map

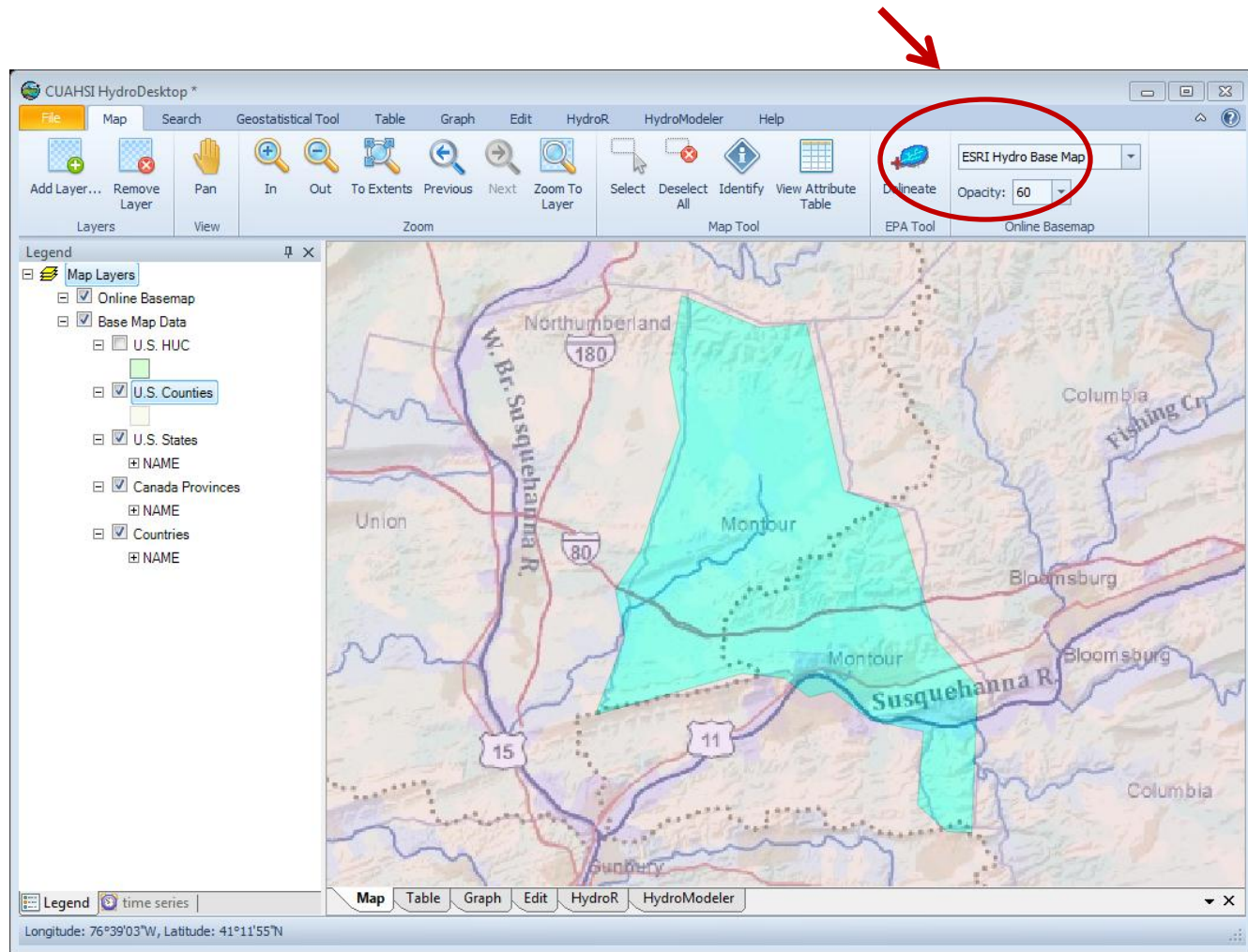
Right click on  
**Shale Network**  
in Legend and  
choose

“Zoom to  
Layer”



Let's change the **base map** now to ESRI World Topo under Map Tab (at the right)

Change your base map layer here (it may take time)



- ESRI Hydro Base Map
- ESRI Topo
- Street Map (Bing, Google, ESRI, Yahoo)
- Satellite Imagery (Bing, ESRI, Google, Yahoo)

Let's explore all your metadata.. right click on the data source of interest in the Legend (ShaleNetwork) and click **View Attribute Table** to explore the metadata

The screenshot displays the CUAHSI HydroDesktop application window. The title bar reads "CUAHSI HydroDesktop - DotSpatial.SampleProjects.NorthAmerica.dsp". The interface includes a menu bar (File, Map, Search, Table, Graph, Edit, HydroR, Help) and a toolbar with various tools like "Draw Rectangle", "Select by Attribute", "Pan", "In", "Out", "Current View", "Multiple Keywords", "Select Dates", "Select Data Sources", "Search", "Show for Selected Layer", and "Download Selected".

The Legend panel on the left shows a tree view of map layers. The "Shale Network" layer is selected, and a context menu is open over it. The menu items are: "Remove Layer", "Zoom to Layer", "View Attribute Table", "Set Dynamic Visibility Scale", "Data", "Labeling", "Selection", "Properties", and "Join Excel file 'Data' Label". A red arrow points to the "View Attribute Table" option.

The main map area shows a hydrological network in Pennsylvania, with various rivers and counties labeled. The "Shale Network" layer is highlighted in blue. The status bar at the bottom indicates "layer: Shale Network Selected: 0".

The Windows taskbar at the bottom shows the system tray with the date and time: "5:56 AM 5/13/2013".

The text box at the bottom left states: "The Attribute Table gives you the metadata."





# The attribute table displays numerous fields including **Data Source, Site Name, Variable, Start and End Dates, Sample Medium, and Units.**

Site Name

Sample medium

	Data Source	Site Name	Var Name	Site Code	Var Code	Keyword	Valu...	Start Date	End Date	Service URL	Service Code	Data Type	Value...	Sample Med	Time ...	Time...	Latitude	Longitude	Is Regular	Units
	ShaleNetworkKODM	Baker Run near Gen...	Specific conductance	ShaleNetwor...	ShaleNetwork:Cond2	Specific co...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day		1 41.24565506	-77.608161926	<input type="checkbox"/>	microsiemens per centimeter
	ShaleNetworkKODM	Baker Run near Gen...	Oxygen, dissolved	ShaleNetwor...	ShaleNetwork:DO	Oxygen, d...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day		0 41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	Baker Run near Gen...	pH	ShaleNetwor...	ShaleNetwork:pH	pH		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day		0 41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
	ShaleNetworkKODM	Baker Run near Gen...	Temperature	ShaleNetwor...	ShaleNetwork:T_C	Temperat...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Continuous	Field Observation	Surface Water	day		0 41.24565506	-77.608161926	<input checked="" type="checkbox"/>	degree celsius
	ShaleNetworkKODM	Baker Run near Gen...	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk2	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day		0 41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Benzene	ShaleNetwor...	ShaleNetwork:benzene_fw	Benzene		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	pH Unit
	ShaleNetworkKODM	PA DEP 26R035-21161	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	pH Unit
	ShaleNetworkKODM	Baker Run near Gen...	pH	ShaleNetwor...	ShaleNetwork:pH2	pH		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day		0 41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
	ShaleNetworkKODM	PA DEP 26R035-21156	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Toluene	ShaleNetwor...	ShaleNetwork:toluene_fw	Toluene		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	Acidity, total acidity	ShaleNetwor...	ShaleNetwork:Acidity_fw	Acidity		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Acidity, total acidity	ShaleNetwor...	ShaleNetwork:Acidity_fw	Acidity		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	Baker Run near Gen...	Alkalinity, bicarbo...	ShaleNetwor...	ShaleNetwork:Alk_CHO3...	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day		0 41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	Baker Run near Gen...	Alkalinity, carbonate	ShaleNetwor...	ShaleNetwork:Alk_CO3...	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day		0 41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21156	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	PA DEP 26R035-21161	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day		0 41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
	ShaleNetworkKODM	Baker Run near Gen...	Gross alpha radion...	ShaleNetwor...	ShaleNetwork:Alpha_F_p...	Alpha radi...		1 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day		0 41.24565506	-77.608161926	<input type="checkbox"/>	picocuries per liter

The Attribute Table is one way to explore the metadata

# But...let's only select surface waters in the Attribute Table

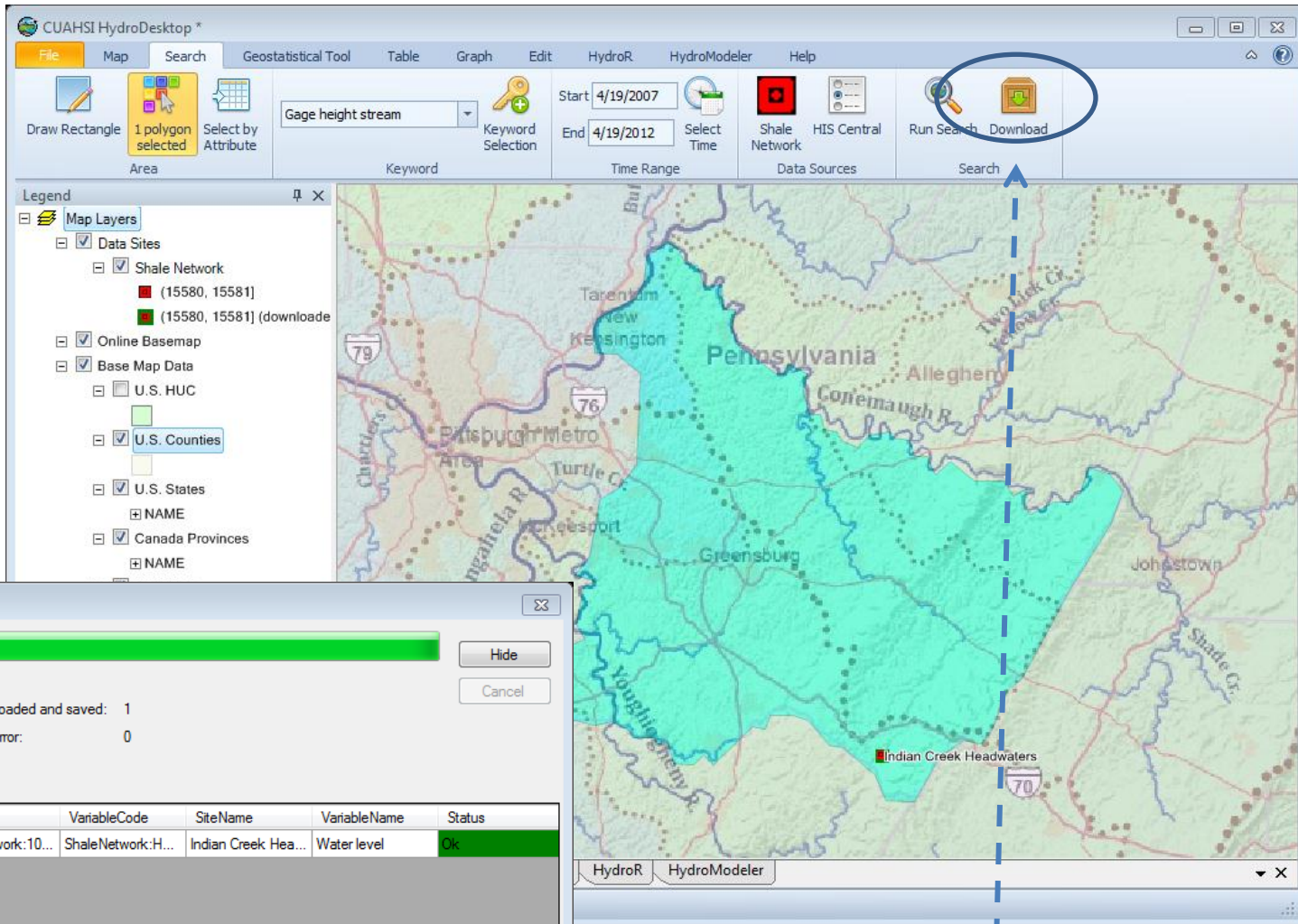
Site Name

Type "Surface water" here under sample medium

Data Source	Site Name	Var Name	Site Code	Var Code	Keyword	Valu...	Start Date	End Date	Service URL	Service Code	Data Type	Value Type	Sample Med	Time ...	Time...	Latitude	Longitude	Is Regular	Units
ShaleNetworkKODM	Baker Run near Glen...	Specific conductance	ShaleNetwor...	ShaleNetwork:Cond2	Specific co...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	1	41.24565506	-77.608161926	<input type="checkbox"/>	microsiemens per centimeter
ShaleNetworkKODM	Baker Run near Glen...	Oxygen, dissolved	ShaleNetwor...	ShaleNetwork:DO	Oxygen, d...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	pH	ShaleNetwor...	ShaleNetwork:pH	pH		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	Baker Run near Glen...	Temperature	ShaleNetwor...	ShaleNetwork:T_C	Temperat...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Continuous	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input checked="" type="checkbox"/>	degree celsius
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk2	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Benzene	ShaleNetwor...	ShaleNetwork:benzene_fw	Benzene		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	PA DEP 26R035-21161	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	Baker Run near Glen...	pH	ShaleNetwor...	ShaleNetwork:pH2	pH		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	PA DEP 26R035-21156	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Toluene	ShaleNetwor...	ShaleNetwork:toluene_fw	Toluene		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Acidity, total acidity	ShaleNetwor...	ShaleNetwork:Acidity_fw	Acidity		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Acidity, total acidity	ShaleNetwor...	ShaleNetwork:Acidity_fw	Acidity		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, bicarbo...	ShaleNetwor...	ShaleNetwork:Alk_CHO3...	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, carbonate	ShaleNetwor...	ShaleNetwork:Alk_CO3...	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Gross alpha radion...	ShaleNetwor...	ShaleNetwork:Alpha_F_p...	Alpha radl...		1 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	picouries per liter

When you type in **Surface Water** at the top, this filters out everything but surface water. Select all surface waters: Now click on a line and drag your mouse down over all the lines. All the surface water data should be highlighted.

Then in the Ribbon, click **"Download Selected"**



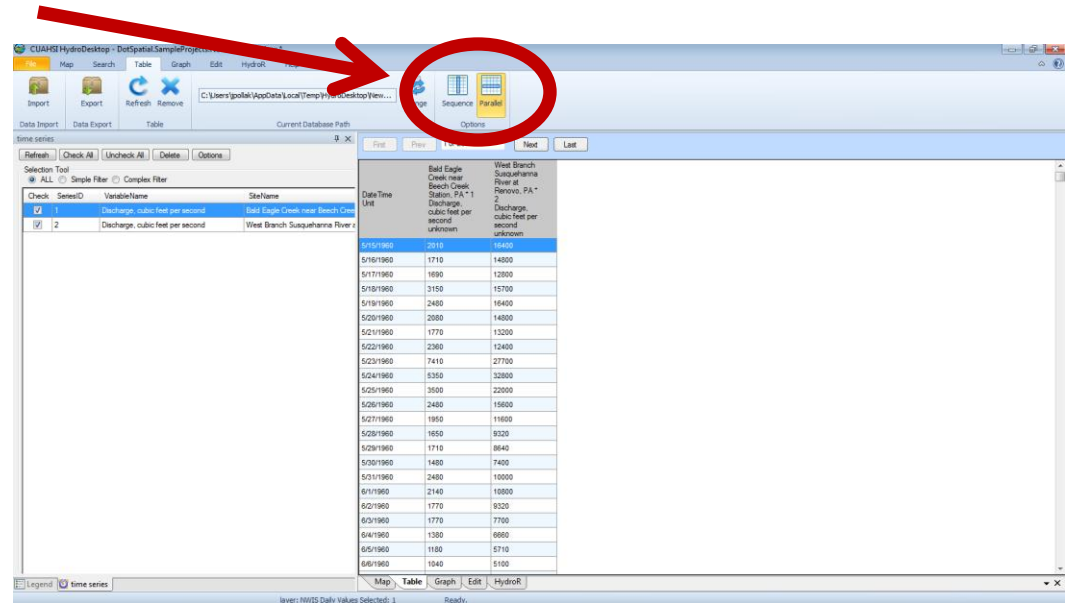
Close this window when it is complete (you might get a few errors – just ignore)

**Download selected data**

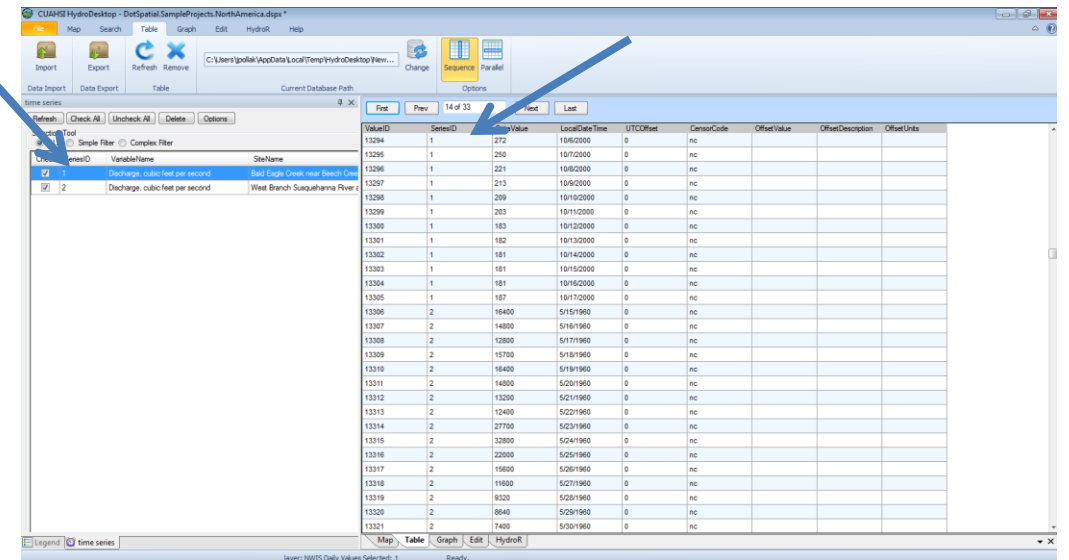


# Sequence vs. Parallel

Parallel allows you to view multiple time series side by side



Sequence view shows all values of one time series followed by all values of the next time series. Note the SeriesID



# Explore the Data using the **Graph Tab**

time series

Selection Tool  
 ALL  Simple Fil  Complex Filter

Check	SeriesID	VariableName	SiteName
<input checked="" type="checkbox"/>	1	Barium, dissolved	DrakeHollowRi
<input checked="" type="checkbox"/>	3	Barium, dissolved	E_Branch_up
<input checked="" type="checkbox"/>	4	Barium, dissolved	HallRunBurney
<input checked="" type="checkbox"/>	2	Barium, dissolved	SRenovoWell

Downloaded datasets

Barium, dissolved - milligrams per liter

Timeseries that are checked at left show up as graph (you can only do about 8)

Var Name	Site Code	Var Code
Oxygen, dissolved	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:t
Electrical conductivity	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:t
Copper, dissolved	ShaleNetwork:LHU_DiamondRockHo...	ShaleNetwork:t
Oxygen, dissolved	ShaleNetwork:LHU_DiamondRockHo...	ShaleNetwork:t
Electrical conductivity	ShaleNetwork:LHU_DiamondRockHo...	ShaleNetwork:t
Solids, total dissolved	ShaleNetwork:LHU_DiamondRockHo...	ShaleNetwork:t
Carbon, total organic	ShaleNetwork:LHU_DiamondRockHo...	ShaleNetwork:t
Copper, dissolved	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:t
Oxygen, dissolved	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:t
Electrical conductivity	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:t
Solids, total dissolved	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:t
Carbon, total organic	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:t
Copper, dissolved	ShaleNetwork:LHU_E_Branch_up	ShaleNetwork:t
Oxygen, dissolved	ShaleNetwork:LHU_E_Branch_up	ShaleNetwork:t
Electrical conductivity	ShaleNetwork:LHU_E_Branch_up	ShaleNetwork:t
Solids, total dissolved	ShaleNetwork:LHU_E_Branch_up	ShaleNetwork:t
Carbon, total organic	ShaleNetwork:LHU_SRenovoReservoir	ShaleNetwork:t
Solids, total dissolved	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:t
Carbon, total organic	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:t
Copper, dissolved	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:t
Oxygen, dissolved	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:t
Electrical conductivity	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:t
Solids, total dissolved	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:t
Carbon, total organic	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:t
Copper, dissolved	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:t
Oxygen, dissolved	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:t
Electrical conductivity	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:t

Legend time series

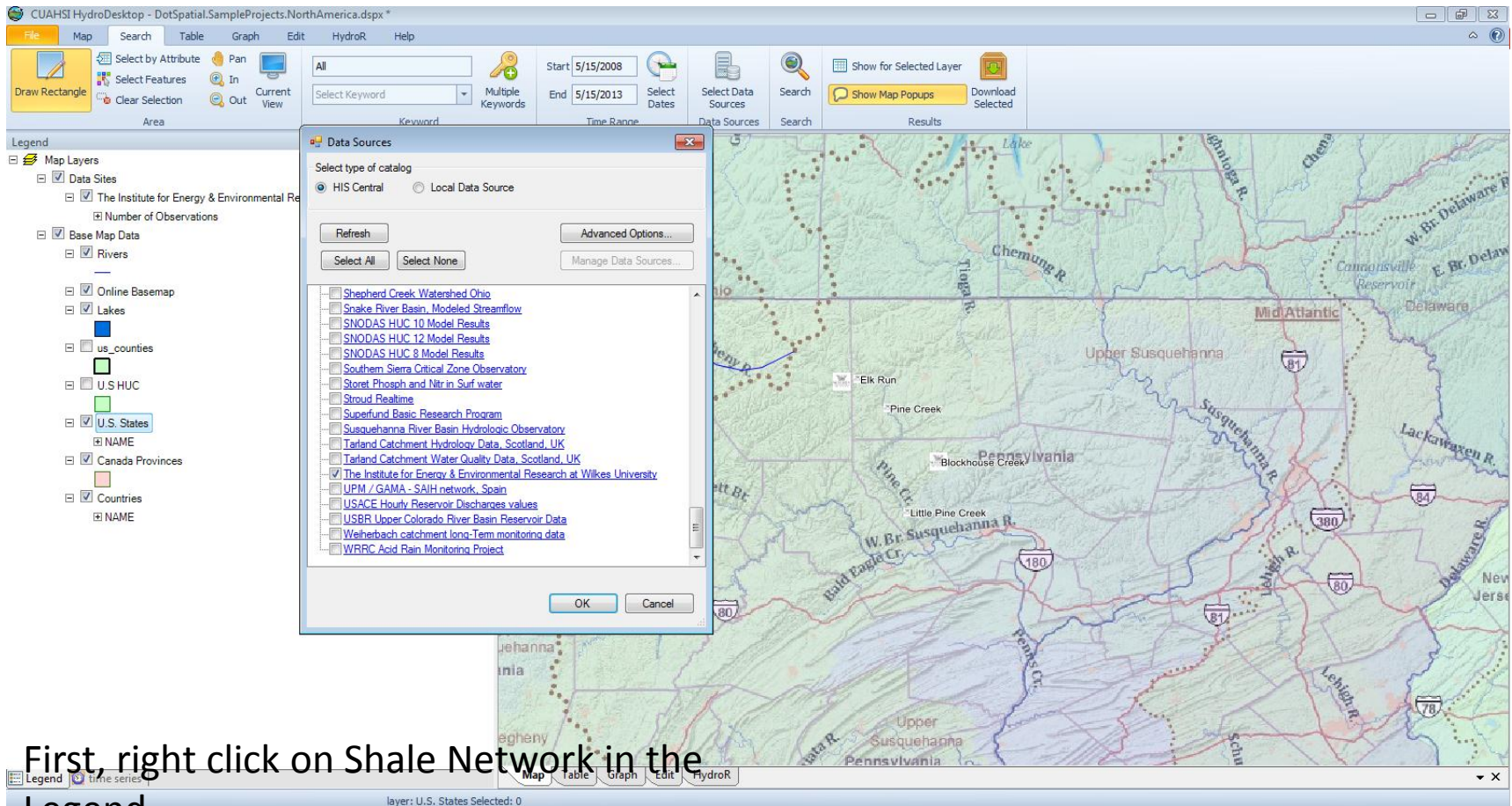
Graph Edit HydroR

layer: Shale Network Selected: 4

Inbox - sxb7@psu.edu - Mozilla Thunderbird

6:05 AM 5/13/2013

Repeat...pull **EPA Storet, NWIS Instantaneous Irregular Data**. You can also pull data from **The Institute for Energy & Environmental Research at Wilkes University** (they have uploaded SRBC data)



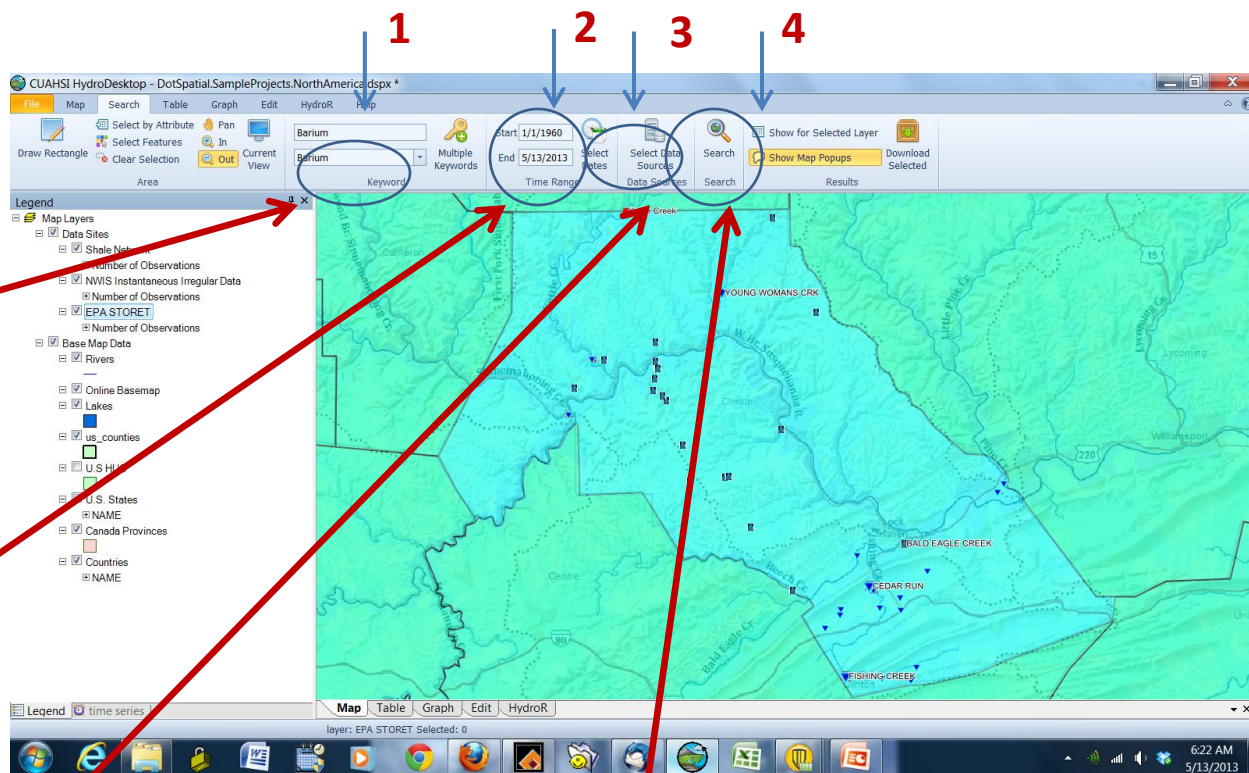
First, right click on Shale Network in the Legend

We want to repeat the whole search

1. Chose keyword: bromide

2. Started in 1960 and ended in 2013

3. We searched Shale Network (now we will deselect SN and select both EPA Storet and NWIS Instantaneous Irregular Values in Data Services pop up)



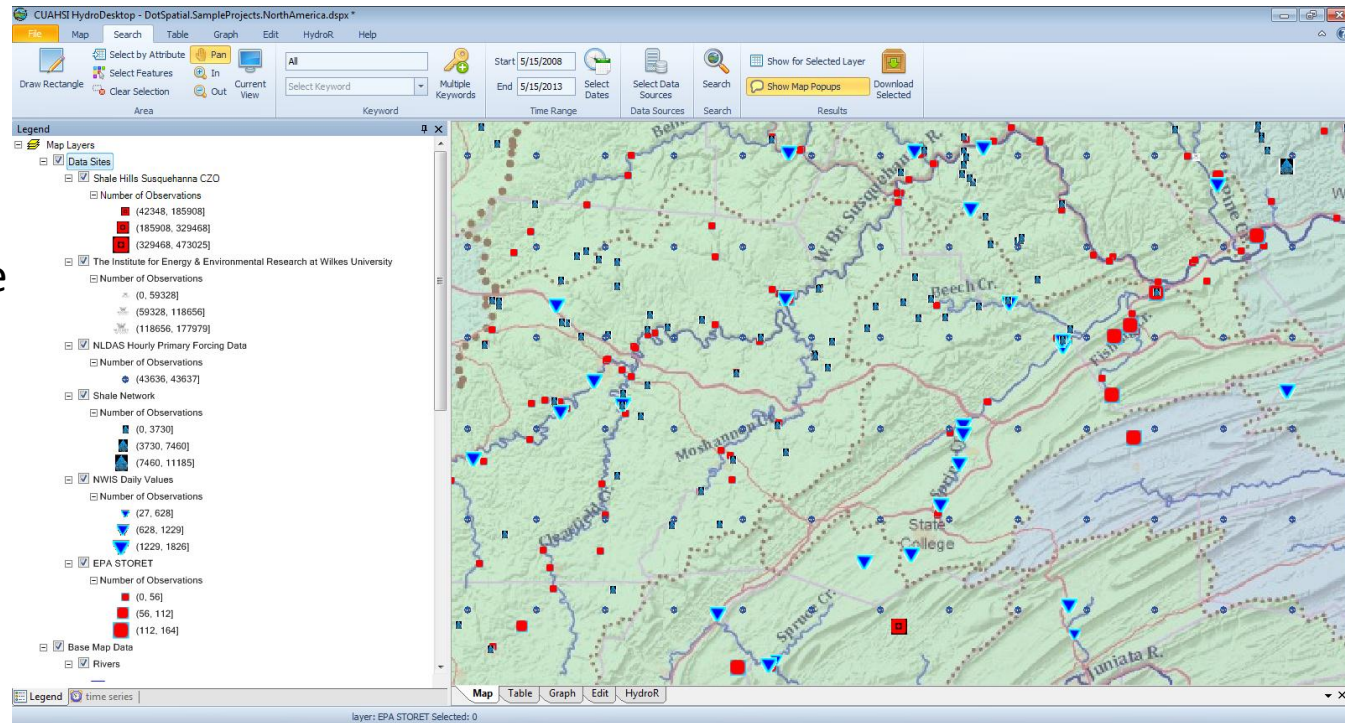
4. Click Search to find the Metadata



# When you return metadata, you should get multiple symbols on the map this time

Symbols are provided by each data publisher. They are typically logos of the organization. The size of the symbol depends on the number of observations at an individual site.

EPA red square  
USGS NWIS blue triangle  
ShaleNetwork blue water drop

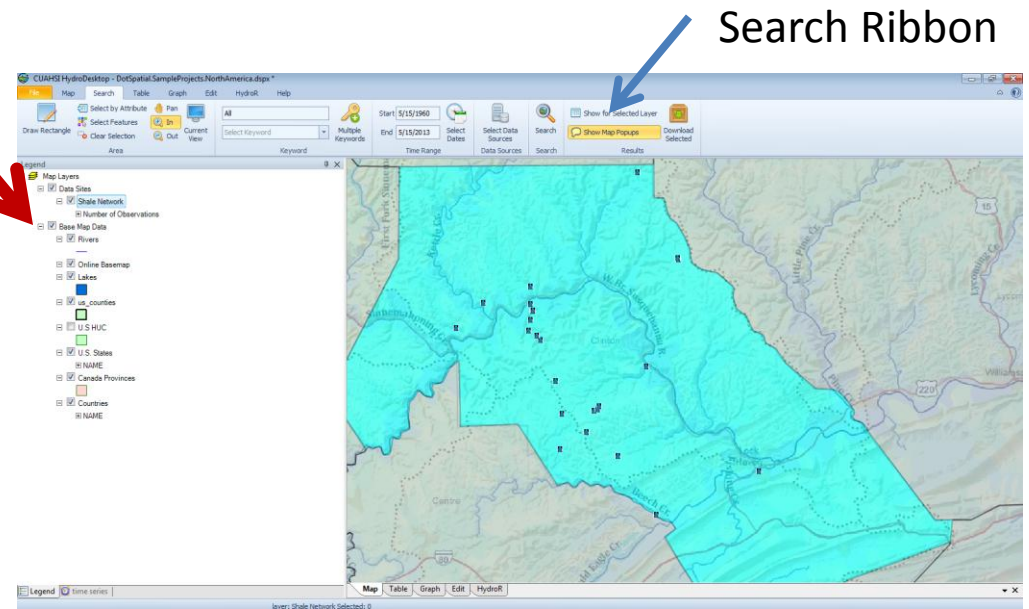
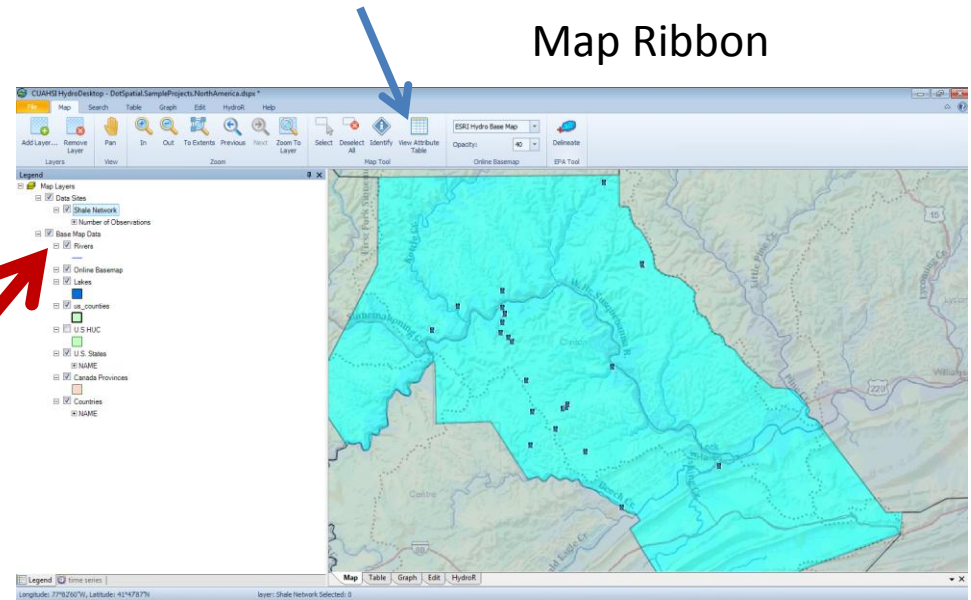


If you don't see all the data services, be sure that there is a check mark by the Data layer in the Legend. If you don't see any Data layers, look for the little boxes and toggle between – and +

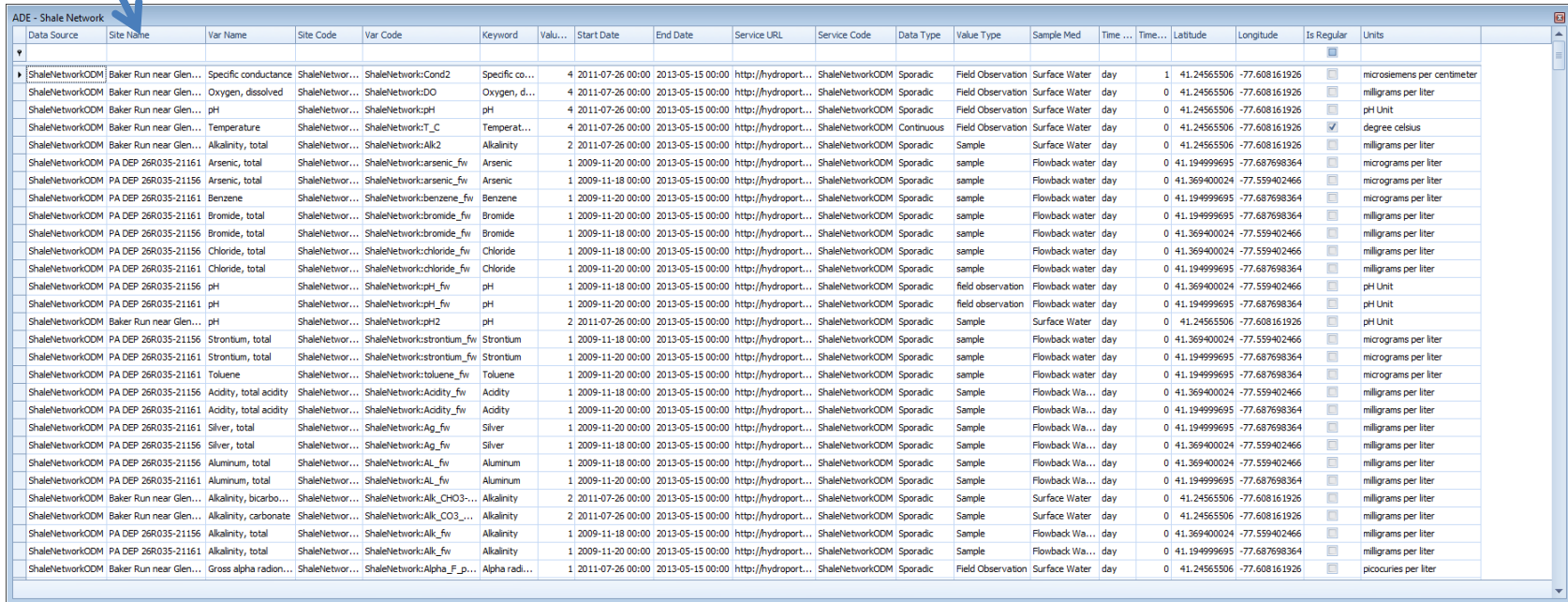
You still need to get the data for each layer of data. To do this, right click the Data Service data layer in the Legend and get the Attribute Table

Or access the **Attribute Table** on the Map ribbon (**Show Attribute Table**) or on the Search ribbon (**Show for Selected Layer**).

Or alternately, right click on data layer in Legend, then choose **View Attribute Table** from popup



# Please click and get the Attribute Table for EPA data first



The screenshot shows a data table with the following columns: Data Source, Site Name, Var Name, Site Code, Var Code, Keyword, Value, Start Date, End Date, Service URL, Service Code, Data Type, Value Type, Sample Med, Time, Time, Latitude, Longitude, Is Regular, and Units. The table contains 30 rows of data, each representing a different environmental parameter measured at the Baker Run near Glen... site. A blue arrow points to the first row, which is highlighted in blue.

Data Source	Site Name	Var Name	Site Code	Var Code	Keyword	Value	Start Date	End Date	Service URL	Service Code	Data Type	Value Type	Sample Med	Time	Time	Latitude	Longitude	Is Regular	Units
ShaleNetworkKODM	Baker Run near Glen...	Specific conductance	ShaleNetwor...	ShaleNetwork:Cond2	Specific co...	4	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	1	41.24565506	-77.608161926	<input type="checkbox"/>	microsiemens per centimeter
ShaleNetworkKODM	Baker Run near Glen...	Oxygen, dissolved	ShaleNetwor...	ShaleNetwork:DO	Oxygen, d...	4	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	pH	ShaleNetwor...	ShaleNetwork:pH	pH	4	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	Baker Run near Glen...	Temperature	ShaleNetwor...	ShaleNetwork:T_C	Temperat...	4	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Continuous	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input checked="" type="checkbox"/>	degree celsius
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk2	Alkalinity	2	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Benzene	ShaleNetwor...	ShaleNetwork:benzene_fw	Benzene	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	PA DEP 26R035-21161	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	Baker Run near Glen...	pH	ShaleNetwor...	ShaleNetwork:pH2	pH	2	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	PA DEP 26R035-21156	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Toluene	ShaleNetwor...	ShaleNetwork:toluene_fw	Toluene	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Acidity, total acidity	ShaleNetwor...	ShaleNetwork:Acidity_fw	Acidity	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Acidity, total acidity	ShaleNetwor...	ShaleNetwork:Acidity_fw	Acidity	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, bicarbo...	ShaleNetwor...	ShaleNetwork:Alk_CHO3...	Alkalinity	2	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, carbonate	ShaleNetwor...	ShaleNetwork:Alk_CO3...	Alkalinity	2	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity	1	2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity	1	2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Gross alpha radion...	ShaleNetwor...	ShaleNetwork:Alpha_F_p...	Alpha radi...	1	2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	picocuries per liter

Choose all the EPA data (these data are all surface water)

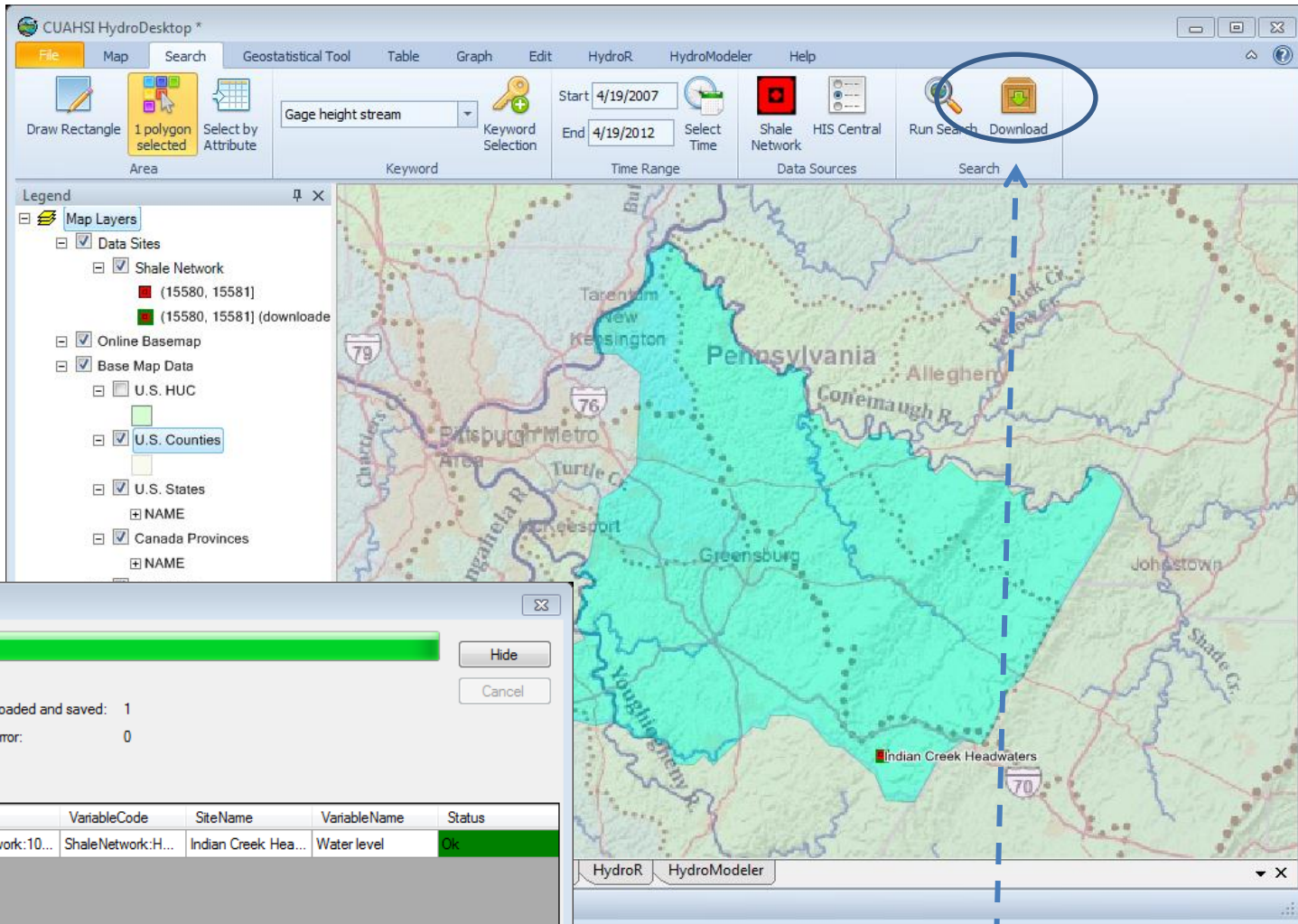
To download EPA data, you must highlight the appropriate lines in the attribute table

**Hold Shift and click all lines (or drag the mouse over all lines) to select all contiguous entries.**



The screenshot displays the CUAHSI HydroDesktop software interface. The top menu bar includes File, Map, Search, Table, Graph, Edit, HydroR, and Help. The toolbar contains various icons for map manipulation and data handling. The main window is divided into three panes: a Legend on the left, a Map in the center, and an Attribute Table on the right. The Legend pane shows a tree view of map layers, with 'Shale Network' selected. The Map pane shows a topographic map with a blue-shaded area representing the Shale Network. The Attribute Table pane, titled 'ADE - Shale Network', displays a table with columns for 'Var Name', 'Site Code', and 'Var Code'. The table contains multiple rows of data, with several rows highlighted in blue. A red arrow points from the text above to the attribute table, and another red arrow points to a specific row in the table.

Var Name	Site Code	Var Code
Temperature	ShaleNetwork:LHU_DiamondRockHo...	ShaleNetwork:1
Barium, dissolved	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:1
Hardness, carbonate	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:1
pH	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:1
Sulfate, dissolved	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:1
Temperature	ShaleNetwork:LHU_DrakeHollowRun...	ShaleNetwork:1
Barium, dissolved	ShaleNetwork:LHU_E_Branch_up	ShaleNetwork:1
Hardness, carbonate	ShaleNetwork:LHU_SRenovoReservoir	ShaleNetwork:1
Temperature	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:1
Barium, dissolved	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:1
Hardness, carbonate	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:1
pH	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:1
Sulfate, dissolved	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:1
Temperature	ShaleNetwork:LHU_HallRunBurneysRd	ShaleNetwork:1
Barium, dissolved	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:1
Hardness, carbonate	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:1
pH	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:1
Sulfate, dissolved	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:1
Temperature	ShaleNetwork:LHU_SRenovoWell	ShaleNetwork:1
Barium, dissolved	ShaleNetwork:LHU_StinkHollow144	ShaleNetwork:1
Hardness, carbonate	ShaleNetwork:LHU_StinkHollow144	ShaleNetwork:1
pH	ShaleNetwork:LHU_StinkHollow144	ShaleNetwork:1
Sulfate, dissolved	ShaleNetwork:LHU_StinkHollow144	ShaleNetwork:1
Temperature	ShaleNetwork:LHU_StinkHollow144	ShaleNetwork:1
Copper, dissolved	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:1
Oxygen, dissolved	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:1
Electrical conductivity	ShaleNetwork:LHU_HallRun_Headw...	ShaleNetwork:1



Close this window when it is complete (you might get a few errors – just ignore)

**Download selected data**

# Next get Attribute Table for NWIS data (right click NWIS on the Legend, choose “Show Attribute Table”)

Hold down the Control key and click on lines one by one. But please check Site Name..do not select any that say “Well” or HU xxx or LY xxx...these are boreholes in each County. Hold down Control key on keyboard and Click on every data line you want to include



Data Source	Site Name	Var Name	Site Code	Var Code	Keyword	Valu...	Start Date	End Date	Service URL	Service Code	Data Type	Value Type	Sample Med	Time ...	Time...	Latitude	Longitude	Is Regular	Units
ShaleNetworkKODM	Baker Run near Glen...	Specific conductance	ShaleNetwor...	ShaleNetwork:Cond2	Specific co...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	1	41.24565506	-77.608161926	<input type="checkbox"/>	microsiemens per centimeter
ShaleNetworkKODM	Baker Run near Glen...	Oxygen, dissolved	ShaleNetwor...	ShaleNetwork:DO	Oxygen, d...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	pH	ShaleNetwor...	ShaleNetwork:pH	pH		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	Baker Run near Glen...	Temperature	ShaleNetwor...	ShaleNetwork:T_C	Temperat...		4 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Continuous	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input checked="" type="checkbox"/>	degree celsius
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk2	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Arsenic, total	ShaleNetwor...	ShaleNetwork:arsenic_fw	Arsenic		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Benzene	ShaleNetwor...	ShaleNetwork:benzene_fw	Benzene		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Bromide, total	ShaleNetwor...	ShaleNetwork:bromide_fw	Bromide		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Chloride, total	ShaleNetwor...	ShaleNetwork:chloride_fw	Chloride		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	PA DEP 26R035-21161	pH	ShaleNetwor...	ShaleNetwork:pH_fw	pH		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	field observation	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	Baker Run near Glen...	pH	ShaleNetwor...	ShaleNetwork:pH2	pH		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	pH Unit
ShaleNetworkKODM	PA DEP 26R035-21156	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Strontium, total	ShaleNetwor...	ShaleNetwork:strontium_fw	Strontium		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Toluene	ShaleNetwor...	ShaleNetwork:toluene_fw	Toluene		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	sample	Flowback water	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	micrograms per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Addity, total addity	ShaleNetwor...	ShaleNetwork:Addity_fw	Addity		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Addity, total addity	ShaleNetwor...	ShaleNetwork:Addity_fw	Addity		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Silver, total	ShaleNetwor...	ShaleNetwork:Ag_fw	Silver		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Aluminum, total	ShaleNetwor...	ShaleNetwork:Al_fw	Aluminum		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, bicarbo...	ShaleNetwor...	ShaleNetwork:Alk_CHO3...	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Alkalinity, carbonate	ShaleNetwor...	ShaleNetwork:Alk_CO3...	Alkalinity		2 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21156	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity		1 2009-11-18 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.369400024	-77.559402466	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	PA DEP 26R035-21161	Alkalinity, total	ShaleNetwor...	ShaleNetwork:Alk_fw	Alkalinity		1 2009-11-20 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Sample	Flowback Wa...	day	0	41.194999695	-77.687698364	<input type="checkbox"/>	milligrams per liter
ShaleNetworkKODM	Baker Run near Glen...	Gross alpha radion...	ShaleNetwor...	ShaleNetwork:Alpha_F_p...	Alpha radi...		1 2011-07-26 00:00	2013-05-15 00:00	http://hydroport...	ShaleNetworkKODM	Sporadic	Field Observation	Surface Water	day	0	41.24565506	-77.608161926	<input type="checkbox"/>	picocuries per liter

NWIS data that starts with two letters (HU, CE, LY for example) and followed by three numbers are observation wells. The two letters are the first two letters of the county. Do not choose these data lines.

# Let's compare Br values county by county

	wells	CWTs
ALLEGHENY	22	
ARMSTRONG	145	1
BEAVER	23	
BEDFORD	1	
BLAIR	6	
BRADFORD	1107	
BUTLER	174	
CAMBRIA	5	
CAMERON	14	
CENTRE	63	
CLARION	29	1
CLEARFIELD	149	
CLINTON	84	
COLUMBIA	2	
CRAWFORD	2	
ELK	59	
ERIE	1	
FAYETTE	231	1
FOREST	18	
GREENE	517	
HUNTINGDON	1	
INDIANA	42	1
JEFFERSON	40	
LACKAWANNA	1	
LANCASTER	0	1
LAWRENCE	19	1
LYCOMING	659	3
MCKEAN	59	2
MERCER	3	
POTTER	65	
SOMERSET	20	
SULLIVAN	68	
SUSQUEHANNA	642	1
TIOGA	808	1
VENANGO	4	
WARREN	4	
WASHINGTON	725	
WAYNE	5	
WESTMORELAND	228	1
WYOMING	110	
	6155	

- Please take some notes about the range of highest values you see for Bromide in SURFACE WATER for your county. We will compare the high values by writing them on the board for each county.
- Units are different for different Data Services. **We will compare everything in parts per million -- written as ppm (= mg/L= µg/mL). If data is presented as µg/L, divide it by 1000 to report it in ppm.**
- Rather look at data in Excel? From **Table Tab, Choose Export → Select a Delimiter (Tab) → Specify Output File (Browse → Desktop → any name for a file you want)**
- Most natural PA samples are in range of 0.01 mg/L and lower. Most analytical labs only can detect to 0.2-0.6 mg/L. EPA recommendation is 6 mg/L but there is no MCL. If you see much higher values, are you sure it is Surface water? What is it? Censored data means that the measured value was less than detection
- **Do we see higher Br concentrations in counties with wells or with counties with Commercial Water Treatment (CWT) plants that are permitted to discharge waste from conventional Oil and Gas wells?**

# Let's now do the same thing for Ba...first get rid of Br data

- Go back to **Search** tab
- Under **Legend/Map Layers/Shale Network**..right click on **Shale Network** and choose **Remove layers**. Wait until layer is gone. If symbols remain on map, zoom in and then zoom out and the symbols should disappear.
- Under **Table** tab, click the **Check** button (to check all downloaded time series) and select **Delete**. Or delete them one at a time.
- If things get messed up (glitch), you may have to close down HydroDesktop and start it up again

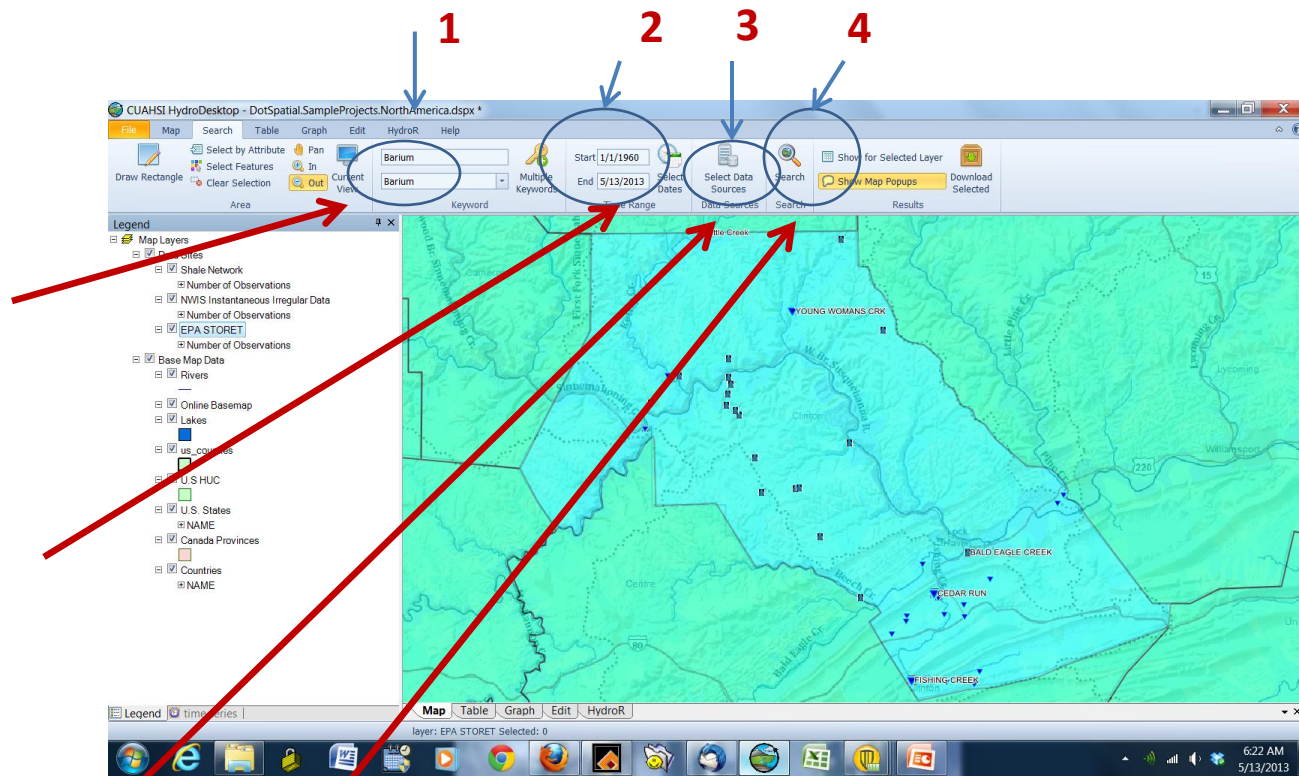


1. Choose **keyword:**  
**Barium**

2. Start in **1960** and  
end today

3. Search **Shale  
Network, EPA Storet  
and NWIS Daily  
Irregular Values**

4. Click **Run Search**



# Explore Barium data

- Right click on each Data service in Legend and choose “Show Attribute Table”
- In Attribute Table depress Control key and click on metadata lines that are surface waters (for Shale Network you might go to Sample Medium and type in Surface water in field at the top; for NWIS data avoid boreholes and anything like CE 242, HU 333, etc.; get all EPA data)
- After highlighting data for a Data Service, click Download Selected...you have to download data separately for each Data Service layer
- Explore data in Table tab
- Units are different for different Data Services. **We will compare everything in parts per million -- written as ppm (= mg/L=  $\mu\text{g}/\text{mL}$ ). If data is presented as  $\mu\text{g}/\text{L}$ , divide it by 1000 to report it in ppm.**
- Maximum contaminant level (MCL) for Ba is 2 mg/L (ppm).
- What is the range of Ba in your county?

# Olmstead et al., 2013

Concern has been raised in the scientific literature about the environmental implications of extracting natural gas from deep shale formations, and published studies suggest that shale gas development may affect local groundwater quality. The potential for surface water quality degradation has been discussed in prior work, although no empirical analysis of this issue has been published. The potential for large-scale surface water quality degradation has affected regulatory approaches to shale gas development in some US states, despite the dearth of evidence. This paper conducts a large-scale examination of the extent to which shale gas development activities affect surface water quality. Focusing on the Marcellus Shale in Pennsylvania, we estimate the effect of shale gas wells and the release of treated shale gas waste by permitted treatment facilities on observed downstream concentrations of chloride ( $\text{Cl}^-$ ) and total suspended solids (TSS), controlling for other factors. Results suggest that (i) the treatment of shale gas waste by treatment plants in a watershed raises downstream  $\text{Cl}^-$  concentrations but not TSS concentrations, and (ii) the presence of shale gas wells in a watershed raises downstream TSS concentrations but not  $\text{Cl}^-$  concentrations. These results can inform future voluntary measures taken by shale gas operators and policy approaches taken by regulators to protect surface water quality as the scale of this economically important activity increases.

Example 2. Let's look at one  
analyte in one river

# First get rid of Br data for your chosen county

- Go back to **Search** tab
- Under **Legend/Map Layers/Shale Network**..right click on **Shale Network** and choose **Remove layers** (sometimes it is slow)
- Under **Table** tab, click the **Check button** and then **Delete** to delete the downloaded time series.

# De-select the county you had been looking at

- Go to **Search tab**
- Choose **Clear Selection**
- Zoom to southwest PA (or wherever you want to look)
- **Change base map to ESRI Hydro Base Map (unclick other layers and change opacity as necessary)**
- **Under map choose Draw Rectangle and draw rectangle around a small part of southwest PA, focussing on one river...set Bromide (or analyte of choice), Streamflow and pull data. You may want to limit to data since 2005**
- You can also search using the **Delineate Watershed** Tool from the Map ribbon. This tool will delineate a watershed polygon for any point you choose, which you can then select using **Select Features** from the **Search Ribbon** to define your search area as you would any other layer in HydroDesktop

# For example...you could explore upper Conemaugh River (contains Blacklick Creek)

The screenshot displays the CUAHSI HydroDesktop software interface. The title bar reads "CUAHSI HydroDesktop - DotSpatial.SampleProjects.NorthAmerica.dspix \*". The main menu includes File, Map, Search, Table, Graph, Edit, HydroR, and Help. The toolbar contains various tools such as Draw Rectangle, Select by Attribute, Select Features, Clear Selection, Pan, In, Out, Current View, Bromide; Discharge, stream, Multiple Keywords, Start (1/1/1960), End (5/17/2013), Select Dates, Select Data Sources, Data Sources, Search, Show for Selected Layer, Show Map Popups, and Download Selected. The Legend panel on the left shows a tree view of Map Layers, including Data Sites, Shale Network, Watershed Point 1, Reaches 1, Watershed 1, Watershed Point, Reaches, Watershed, and Base Map Data. The map area shows a topographic view of the Conemaugh River watershed in Pennsylvania, with the watershed boundary highlighted in cyan. Key features labeled on the map include Conemaugh River - Conemaugh Dam Trail, Blacklick Creek - Newport Rd. Bridge, Blacklick Creek - Route 56 Bridge Armagh, Conemaugh River - Seward Bridge, Conemaugh River - Johnstown Railroad Bridge, and Conemaugh River - Route 56 Bridge Johnstown. The map also shows the state boundary between Pennsylvania and West Virginia, and nearby towns like Greensburg, Latrobe, and Loyalhan. The bottom status bar indicates "layer: Shale Network Selected: 0". The Windows taskbar at the bottom shows the system tray with the date and time: 3:27 PM, 5/19/2013.

# Waterways impacted by larger spills

## 2008 to 2011, spills > 400 gallons

- Pine creek (Lycoming, Airfoam)
- Stevens creek (Susquehanna, flowback)
- Brush run (Washington, flowback)
- Little Laurel creek (Clearfield, flowback)
- Dunkle creek (Hopewell, frack fluid)
- Towanda creek (flowback)
- Ten mile creek tributary (Washington, mud)

## Sept 2012-March 2013 (all < 400 gallons)

- Harts Run (Sullivan, bentonite)
- Jacobs creek (Westmoreland, drilling mud)
- Mill creek (Sullivan, sediment)
- Black Water run (Sullivan, turbid discharge)
- Slack run tributary (Lycoming, sediment)
- Blacklick creek (Indiana, bentonite)
- Muncy creek (Lycoming, sediment)
- Thorn creek (Butler, drilling fluids)
- Wellmans creek, Salt Lick creek (Sullivan, discharge)
- Brion creek (Lycoming, hydrostatic test water and sediment)
- Big Bottom run (Sullivan, sediment)



	wells	CWTs
ALLEGHENY	22	
ARMSTRONG	145	1
BEAVER	23	
BEDFORD	1	
BLAIR	6	
BRADFORD	1107	
BUTLER	174	
CAMBRIA	5	
CAMERON	14	
CENTRE	63	
CLARION	29	1
CLEARFIELD	149	
CLINTON	84	
COLUMBIA	2	
CRAWFORD	2	
ELK	59	
ERIE	1	
FAYETTE	231	1
FOREST	18	
GREENE	517	
HUNTINGDON	1	
INDIANA	42	1
JEFFERSON	40	
LACKAWANNA	1	
LANCASTER	0	1
LAWRENCE	19	1
LYCOMING	659	3
MCKEAN	59	2
MERCER	3	
POTTER	65	
SOMERSET	20	
SULLIVAN	68	
SUSQUEHANNA	642	1
TIOGA	808	1
VENANGO	4	
WARREN	4	
WASHINGTON	725	
WAYNE	5	
WESTMORELAND	228	1
WYOMING	110	
	6155	

Wells in each  
county, CWTs in  
each county

# Find bromide data and discharge data for points on the river

- Use the attribute table to distinguish/browse for each variable. If you highlight a time series in the attribute table, the corresponding site will be highlighted on the map.
- Hover your cursor over the Data sites on the map and find a site that has observations for both variables or 2 sites measuring one variable each to download data
- Explore data in Table and Graph tabs

Select the **Table tab** in the ribbon to view the data in tabular format.

Make sure you check the series box

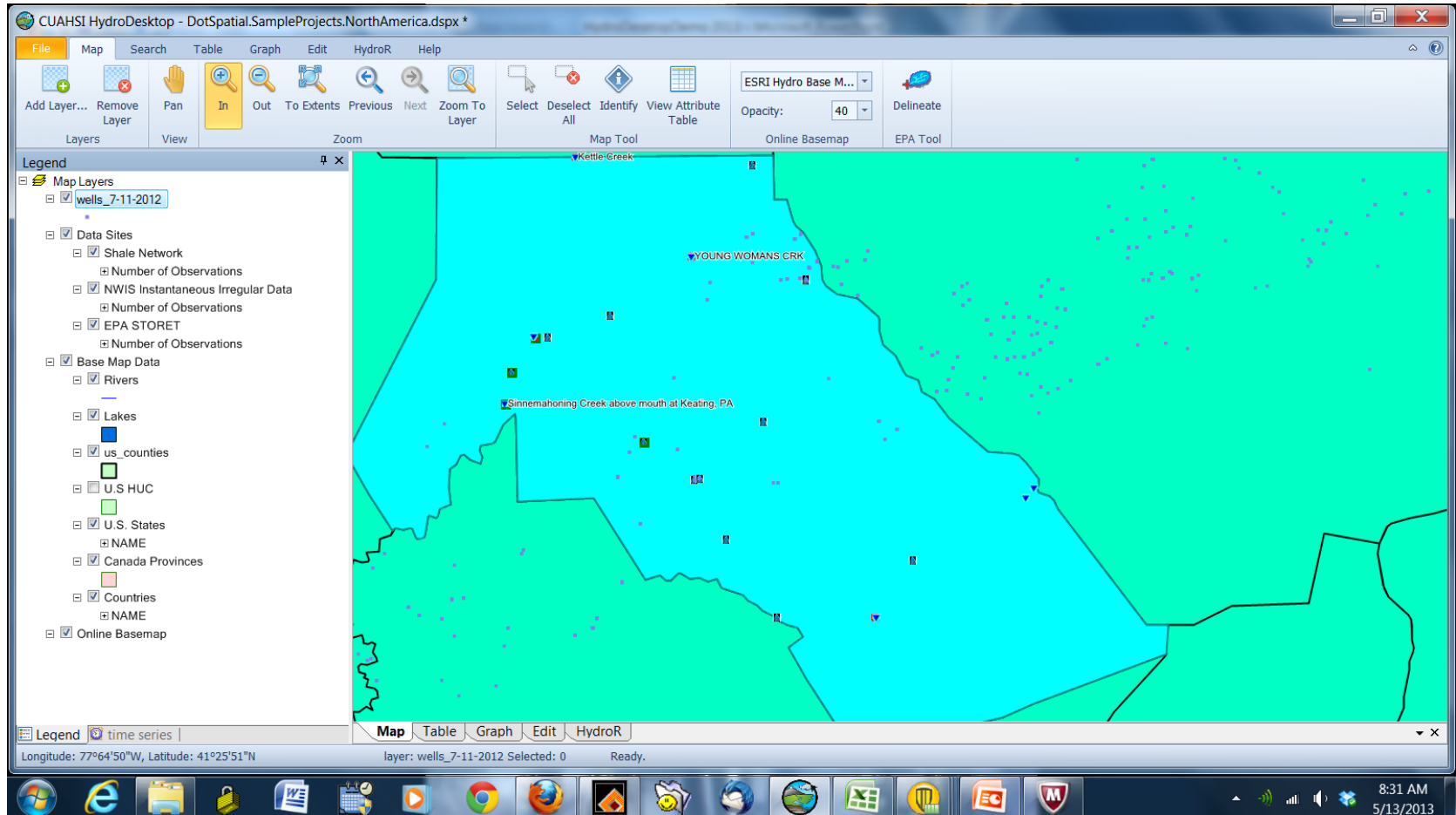
Remember to click the **Parallel** option if you want to see the data with units

The screenshot shows the CUAHSI HydroDesktop software interface. The 'Table' tab is selected in the ribbon, and the 'Parallel' option is also selected. The data table is displayed with the following columns: ValueID, SeriesID, DataValue, LocalDate Time, UTCOffset, and CensorCode. The data is filtered to show 24 rows, with the first row selected. The 'Selection Tool' on the left shows 'ALL' selected, and the 'SeriesID' column is checked.

ValueID	SeriesID	DataValue	LocalDate Time	UTCOffset	CensorCode
1	1	212.72	3/25/2011 4:00 PM	-5	nc
2	1	212.83	3/25/2011 4:15 PM	-5	nc
3	1	212.16	3/25/2011 4:30 PM	-5	nc
4	1	211.55	3/25/2011 4:45 PM	-5	nc
5	1	211.99	3/25/2011 5:00 PM	-5	nc
6	1	211.96	3/25/2011 5:15 PM	-5	nc
7	1	211.06	3/25/2011 5:30 PM	-5	nc
8	1	211.31	3/25/2011 5:45 PM	-5	nc
9	1	210.57	3/25/2011 6:00 PM	-5	nc
10	1	210.65	3/25/2011 6:15 PM	-5	nc
11	1	210.43	3/25/2011 6:30 PM	-5	nc
12	1	210.75	3/25/2011 6:45 PM	-5	nc
13	1	210.59	3/25/2011 7:00 PM	-5	nc
14	1	210.04	3/25/2011 7:15 PM	-5	nc
15	1	210.44	3/25/2011 7:30 PM	-5	nc
16	1	210.41	3/25/2011 7:45 PM	-5	nc
17	1	210.38	3/25/2011 8:00 PM	-5	nc
18	1	210.33	3/25/2011 8:15 PM	-5	nc
19	1	209.82	3/25/2011 8:30 PM	-5	nc
20	1	209.79	3/25/2011 8:45 PM	-5	nc
21	1	209.31	3/25/2011 9:00 PM	-5	nc
22	1	208.83	3/25/2011 9:15 PM	-5	nc

# Advanced Topics

# Advanced topic: Show the gas wells on top of the sample sites



# Upload the shape file for wells

- Hover over a site with ShaleNetwork data
- Click on ShaleNetwork in pop up window...this takes you to [www.cuahsi.org](http://www.cuahsi.org)
- Click on ShaleNetwork...this takes you to [www.shalenetwork.org](http://www.shalenetwork.org)
- Click on **Databases** then **Hydrodesktop**. At this site there is a version of HydroDesktop with the well shape file
- You can either run this version of HydroDesktop or extract the shape file and add it to your current version of HydroDesktop by choosing **Add layer** under **Map tab**

# Jon Pollak and Dan Ames are building a customized HD for Shale Network

- The Shale Data Search tool (for searching “any/or” of specific keywords like discharge, bromide, strontium, etc.)
- Buttons added for links to: [shalenetwork.org](http://shalenetwork.org) and [shalenetwork.org/contact](http://shalenetwork.org/contact)
- Measuring tool for both distance and area
- Shape files for maps of wells, mines, CWTs, NOV's

# Searching for data, using and/or

The screenshot displays the CUAHSI HydroDesktop interface. The main window shows a map of North America with various data layers overlaid. A dialog box titled "ShaleData" is open, allowing users to search for data sites. The dialog box has two radio buttons: "Find sites with ALL selected variables" (selected) and "Find sites with ANY selected variables". Below these are ten checkboxes labeled "Keyword1" through "Keyword10". At the bottom of the dialog are "OK" and "Cancel" buttons.

The software interface includes a menu bar (File, Map, Shale Network, Table, Graph, Edit, HydroR, HydroModeler, Help) and a toolbar with various tools like "Draw Rectangle", "Select by Attribute", "Pan", "In", "Out", "Shale Data", "Contact SN", "Select Data Sources", "Search", "Show for Selected Layer", "Show Map Popups", and "Download Selected". The "Legend" panel on the left shows a list of map layers, including "Base Map Data", "Rivers", "Online Basemap", "Lakes", "us\_counties", "U.S HUC", "U.S. States", "Canada Provinces", and "Countries". The "Map" panel at the bottom shows "Legend" and "time series" tabs, and the status bar indicates "All Layers Selected".



# Measuring lengths or areas

CUAHSI HydroDesktop - DotSpatial.SampleProjects.NorthAmerica.dspx \*

File Map Shale Network Table Graph Edit HydroR HydroModeler Help

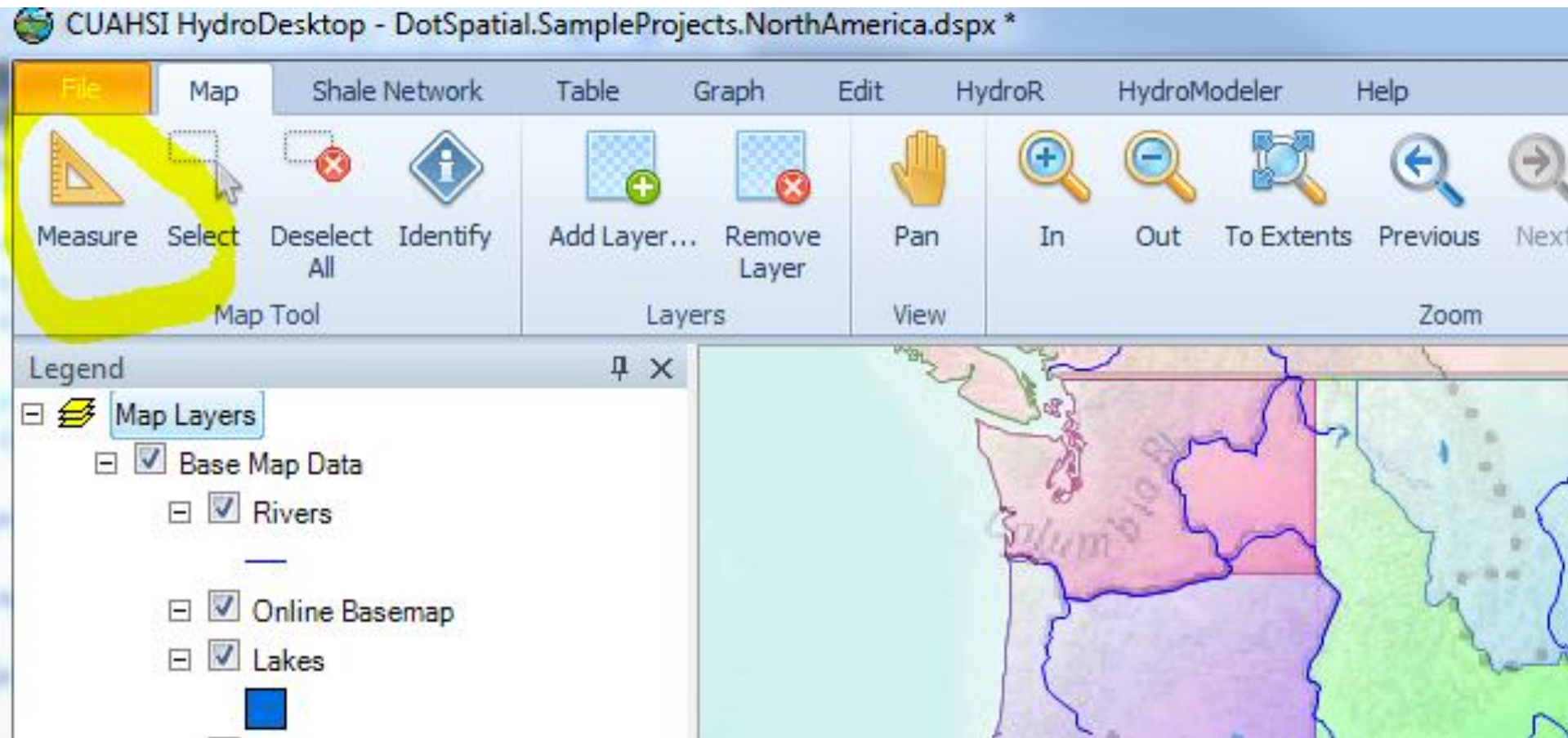
Measure Select Deselect All Identify Add Layer... Remove Layer Pan In Out To Extents Previous Next

Map Tool Layers View Zoom

Legend

Map Layers

- Base Map Data
  - Rivers
- Online Basemap
- Lakes



Lunch is at 12 30 back at Atherton  
Hotel

See you back there!